Exelon Generation

PROPRIETARY INFORMATION – WITHHOLD UNDER 10 CFR 2.390

10 CFR 50.90
10 CFR 2.390

September 4, 2014

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Subject: License Amendment Request - Maximum Extended Load Line Limit Analysis Plus

In accordance with 10 CFR 50.90, Exelon Generation Company, LLC (EGC) requests an amendment to Renewed Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3, respectively. Specifically, the proposed changes would revise the Renewed Operating Licenses to allow operation in the expanded Maximum Extended Load Line Limit Analysis Plus (MELLLA+) domain and use of the Detect and Suppress Solution – Confirmation Density (DSS-CD) stability solution.

Attachments 1 through 6 include a description of the proposed changes and the supporting documentation as follows:

Attachment 1 Provides a description and evaluation of the proposed changes that require NRC approval, and a No Significant Hazards Consideration (NSHC) analysis.

Attachment 2 Provides a markup of the Operating Licenses and affected Technical Specifications (TS) pages indicating the proposed changes for MELLLA+ and use of DSS-CD.

Attachment 3 Provides a markup of the affected TS Bases pages. These marked-up pages are provided for information only and do not require NRC approval.

Attachment 4 Provides a proprietary version of the GE Hitachi Nuclear Energy Americas LLC (GEH) report documented in NEDC-33720P, "Safety Analysis Report for Peach Bottom Atomic Power Station Units 2 & 3 Maximum Extended Load Line Limit Analysis Plus" (M+SAR).

Attachment 4 contains Proprietary Information.
When separated from Attachment 4, this document is decontrolled.

This report summarizes the results of all significant safety evaluations (SEs) performed that justify expansion of the core flow operating domain for PBAPS Units 2 & 3. The proposed changes expand the operating domain in the region of operation with less than rated core flow, but do not increase the licensed power level. The MELLLA+ core operating domain expansion does not require major plant system modifications but involves changes to the operating power/core flow map, application of the detect and suppress solution - confirmation density (DSS-CD) stability solution, and changes to a small number of instrument setpoints.

Portions of the information provided in Attachment 4 of this proposed license amendment request are considered to be proprietary and, therefore, exempt from public disclosure pursuant to 10 CFR 2.390.

Attachment 5 Provides a non-proprietary version of the M+SAR.

Attachment 6 Contains affidavits for withholding information executed by GEH and Electric Power Research Institute (EPRI). On behalf of GEH and EPRI, EGC requests to withhold Attachment 4 from public disclosure in accordance with 10 CFR 2.390(b)(1).

EGC requests approval of the proposed amendment by September 9, 2015. Once approved, the amendment will be implemented within 30 days for Unit 2 and prior to startup from refueling outage P3R20 for Unit 3.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), EGC is notifying the Commonwealth of Pennsylvania and the State of Maryland of this application by transmitting a copy of this letter along with the attachments to the designated State Officials.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this letter, please contact Mr. David Neff at (610) 765-5631.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 4th day of September 2014.

Respectfully,

Kevin F. Borton
Manager, Licensing – Power Uprate
Exelon Generation Company, LLC

Attachments:

1. Evaluation of Proposed Changes
2. Markup of Proposed Operating License and Technical Specifications Pages
3. Markup of Proposed Technical Specifications Bases (provided for information only)
4. NEDC-33720P, Safety Analysis Report for Peach Bottom Atomic Power Station Units 2 & 3 Maximum Extended Load Line Limit Analysis Plus (Proprietary)
5. NEDC-33720, Safety Analysis Report for Peach Bottom Atomic Power Station Units 2 & 3 Maximum Extended Load Line Limit Analysis Plus (Non-proprietary)
6. GEH and EPRI Affidavits Supporting Withholding Information in NEDC-33720P

cc:	USNRC Region I, Regional Administrator	w/attachments
	USNRC Senior Resident Inspector, PBAPS	w/attachments
	USNRC Project Manager, PBAPS	w/attachments
	R. R. Janati, Commonwealth of Pennsylvania	w/o proprietary attachment
	S. T. Gray, State of Maryland	w/o proprietary attachment

ATTACHMENT 1

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. 50-277 and 50-278

MELLLA+ License Amendment Request

Evaluation of Proposed Changes

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1.0 SUMMARY DESCRIPTION

Pursuant to 10 CFR 50.90, Exelon Generation Company, LLC (EGC) proposes to revise the Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3 Renewed Facility Operating License (FOL) and Technical Specifications (TS) to allow plant operation in the expanded Maximum Extended Load Line Limit Analysis Plus (MELLLA+) domain with the Detect and Suppress Solution – Confirmation Density (DSS-CD) long-term reactor core thermal-hydraulic stability solution.

Proposed FOL and TS changes include:

- Prohibiting operation in the MELLLA+ domain when operating in the following plant configurations:
    - Reactor Recirculation System Single Loop Operation (SLO)
    - A feedwater heater out of service resulting in more than a 10°F reduction in feedwater temperature below the design feedwater temperature

- Replacing TS 3.3.1.1 Conditions/Required Actions/Completion Times for Conditions I and J with new Conditions/Required Actions/Completion Times I, J, and K. due to implementation of DSS-CD stability solution

- Eliminating Surveillance Requirement (SR) 3.3.1.1.19, which is no longer required by the proposed DSS-CD stability solution

- Revising TS Table 3.3.1.1-1 Function 2.b to change the Allowable Value for APRM Simulated Thermal Power – High trip function and to add a new note due to implementation of DSS-CD stability solution

- Revising TS Table 3.3.1.1-1 Function 2.f to set the new operability power level for OPRM Upscale and to add a new note due to implementation of the DSS-CD stability solution

- Adding new Condition B and corresponding Required Action B.1 and a Completion Time to TS 3.4.1 to reflect the fact that Single Loop Operation (SLO) is prohibited in the MELLLA+ region and to require immediate action required when the MELLLA+ domain is entered with one recirculation loop in operation. The previous Condition B regarding no recirculation loops in operation was re-designated as Condition C.

- Revising TS Administrative Section 5.6.5.a to require certain content in the Core Operating Limits Report (COLR) and updating the applicable references in Subsection 5.6.5.b. due to implementation of DSS-CD stability solution

- Adding new TS Administrative Section 5.6.8, which specifies the contents of a new report required by new TS 3.3.1.1 REQUIRED ACTION I.3

This MELLLA+ license amendment request (LAR) is based on the following General Electric – Hitachi (GEH) licensing topical reports (LTRs):

- NEDC-33006P-A, Revision 3, Maximum Extended Load Line Limit Analysis Plus (M+LTR), (Reference 1)

- NEDC-33075P-A, Revision 8, General Electric Boiling Water Reactor Detect and Suppress Solution - Confirmation Density (DSS-CD LTR), (Reference 2)

- NEDE-33147P-A, Revision 4 DSS-CD TRACG Application (TRACG LTR), (Reference 3)

- NEDC-33173P-A, Revision 4, Applicability of GE Methods to Expanded Operating Domains (Methods LTR) (Reference 4)

- NEDE-32906P, Revision 3, TRACG Applications for Anticipated Operational Occurrences (AOO) Transient Analyses (TRACG Applications LTR), and its Supplements 1-A and 3-A (References 5, 6 and 7)

The marked-up FOL and TS pages for the proposed changes are provided in Attachment 2. Associated changes to the TS Bases are provided in Attachment 3 for information only. Attachment 4 contains GEH Report NEDC-33720P, Revision 0, Safety Analysis Report for Peach Bottom Atomic Power Station – Maximum Extended Load Line Limit Analysis Plus (M+SAR), which provides the technical bases for this request and contains an integrated summary of the results of the underlying safety analyses and evaluations performed specifically for PBAPS. The M+SAR follows the guidelines contained in the M+LTR (Reference 1). The NRC has specified limitations and conditions for the Methods LTR (Reference 4), M+LTR (Reference 1), the DSS-CD LTR (Reference 2), and the TRACG Applications LTR and its Supplements (References 5, 6 and 7). These are addressed in Appendices A, B, C and D of the M+SAR, respectively.

The specific proposed FOL and TS changes (described in Section 2.0, below) are consistent with the M+LTR.

2.0 DETAILED DESCRIPTION

2.1 Background

PBAPS Units 2 and 3 were each originally licensed to operate at a maximum power level of 3293 MWt. A rerate implemented in 1994 and 1995 increased the licensed thermal power by approximately 5% to 3458 MWt. A Measurement Uncertainty Uprate (MUR) in 2002 increased the maximum power level to 3514 MWt and an Extended Power Uprate (EPU) approved on August 25, 2014, (Reference 8) increased the maximum power level to the Current Licensed Thermal Power (CLTP) of 3951 MWt.

Operation of BWRs requires that reactivity balance be maintained to accommodate fuel burn-up. BWR operators have typically two methods to maintain this reactivity balance that include (1) control rod movements, and (2) reactor recirculation core flow adjustments.

Because of strong void reactivity feedback and its distributed effect through the reactor core, recirculation flow adjustments are the preferred reactivity control method. Operating at low core flow conditions at rated power level also increases the fuel capacity factor through spectral shift. In addition, an increased flow region compensates for reactivity reduction due to fuel depletion during the operating cycle.

EPUs are implemented by extending the MELLLA operating domain up to EPU rated thermal power (RTP) levels. However, this reduces the available core flow window at these levels. In addition, the increased core pressure drop limits recirculation flow capability. Consequently, EPU plants generally operate with a greatly reduced core flow window and compensate for reactivity loss with control rod movement.

MELLLA+ increases the operating boundary to permit PBAPS operation at a CLTP of 3951 MWt with a core flow as low as 83% thus adding a 16% flow-control window. The entire MELLLA+ domain is shown in Figure 1-1 of the M+SAR (Attachment 4). By operating in the MELLLA+ domain, a significantly lesser number of control rod manipulations are required than is currently required in the present operating domain. Lessening the number of rod manipulations represents a significant improvement in operating flexibility as well as providing safer plant operation. Specifically, this minimizes the likelihood of fuel failures and reduces the likelihood of events initiated by reactor maneuvers required to achieve an operating condition where control rods can be withdrawn.

The MELLLA+ core operating domain expansion does not require major plant system modifications. It involves changes to the operating power/core flow map, changes to a small number of instrument setpoints included in the proposed TS changes, and application of the DSS-CD stability solution.

2.2 Renewed Facility Operating License (FOL) and Technical Specifications (TS) Changes

The following FOL and TS sections are affected by this change:

- FOL Section 2.C added new Item (16) to limit feedwater temperature reductions as a result of a feedwater heater being out of service
- TS 3.3.1.1, Reactor Protection System (RPS) Instrumentation
- TS 3.4.1, Recirculation Loops Operating
- TS 5.6.5, Core Operating Limits Report (COLR)
- TS 5.6.8, Oscillation Power Range Monitor (OPRM) Report (new section)

2.3 Stability Solution

PBAPS currently operates with the Option III stability solution. The NRC Safety Evaluation for the M+LTR (Reference 1) requires that plants implementing MELLLA+ change from the Option III solution to the DSS-CD stability solution.

The DSS-CD solution being implemented at PBAPS is designed to identify the power oscillation upon inception and initiate control rod insertion (scram) to terminate the oscillations prior to any significant amplitude growth. DSS-CD is based on the same hardware design as Option III. However, it introduces an enhanced detection algorithm that detects the inception of power oscillations and generates an early power suppression trip signal based on successive period confirmation recognition and an amplitude component. The existing Option III algorithms are retained (with generic setpoints) to provide defense-in-depth protection for unanticipated reactor instability events.

The DSS-CD solution algorithm, licensing basis, and application procedures are generically described in NEDC-33075P-A (Reference 2) and NEDE-33147P-A (Reference 3), and are applicable to PBAPS, including any limitations and condition associated with their use and approval.

2.4 Technical Specification Task Force (TSTF)-493 Applicability

This LAR proposes changes to two TS Reactor Protection System (RPS) functions: (1) the Oscillation Power Range Monitor (OPRM) Upscale; and (2) the Average Power Range Monitor (APRM) Simulated Thermal Power (STP) – High. Application of TSTF-493 is not required for OPRM and the requirements of TSTF-493 were applied to APRM STP-High with issuance of the EPU License Amendments (Reference 8); therefore, no further actions are required

3.0 TECHNICAL EVALUATION

The technical analyses and justifications for the proposed changes are provided in the M+SAR (Attachment 4). The M+SAR summarizes the results of the significant safety evaluations performed that justify:

(1) Implementing the MELLLA+ expanded operating domain;

(2) Changing the PBAPS stability solution from Option III to DSS-CD; and

(3) Applying the GEH TRACG04 analysis code to DSS-CD and the ATWS overpressure analysis.

As stated in Section 1.0, above, the M+SAR is based on the M+LTR (Reference 1), the DSS-CD LTR (Reference 2), the TRACG LTR (Reference 3), and the Methods LTR (Reference 4). The evaluations contained in the M+SAR demonstrate that PBAPS can safely operate in the MELLLA+ expanded operating domain using the DSS-CD stability solution in adherence to the requirements of these LTRs.

The DSS-CD stability solution is required by the SER for the M+LTR (Reference 1) and is being implemented at PBAPS using the guidelines contained in the DSS-CD LTR (Reference 2). The use of TRACG04 is being implemented using the guidelines contained in the TRACG LTR (Reference 3). The results of the DSS-CD evaluation and the use of TRACG04 are provided in M+SAR Section 2.4.

Table 1, below, identifies the FOL and TS sections being changed, a description of the change, the M+SAR section that justifies the change, and any pertinent comments.

Table 1
Renewed Facility Operating License and Technical Specifications Changes

FOL/TS Section	Description of Change	M+SAR Section	Comments
FOL Section 2.C			
2.C (16) (new)	Implement a new license condition that prohibits operation of the facility within the MELLLA+ operating domain with a feedwater heater out of service resulting in more than a 10° F reduction in feedwater temperature below the design feedwater temperature.	1.2.4 2.4.4	The NRC has stated that any plant-specific application intending to operate with FWHOOS must provide the bases in the plant-specific application (Reference 1 page B-39). The bases for the proposed license condition are provided in M+SAR Sections 1.2.4 and 2.4.4 which satisfies the M+ LTR Safety Evaluation Report Limitation and Condition 12.5.b). Prohibiting a FW temperature reduction of greater than 10°F includes prohibiting use of the FWHOOS and FFWTR operating flexibility options.
TS 2.0, Safety Limits			
TS 2.1	The SLMCPR values for two loop operation (TLO) and single loop operation (SLO) are expected to change to a single value to support MELLLA+ operation. The actual value will be determined in the reload licensing evaluation for the cycle that implements MELLLA+ operation.	2.2.1	For Information Only - No corresponding change provided in Attachment 2.
TS 3.3.1.1, Reactor Protection System (RPS) Instrumentation			
TS 3.3.1.1 Condition I	Replace REQUIRED ACTIONS I.1 and I.2 with new REQUIRED ACTIONS I.1, I.2, and I.3 to implement DSS-CD for the Oscillation Power Range Monitor (OPRM), as follows: I.1. Initiate action to implement the Manual Backup Stability Protection (BSP) Regions defined in the COLR. AND	2.4.3	This change is discussed in Sections 7.2 and 7.4, and Table 8-1 of the DSS-CD LTR (Reference 2).

FOL/TS Section	Description of Change	M+SAR Section	Comments
	I.2 Implement the Automated BSP Scram Region using the modified APRM Simulated Thermal Power – High scram setpoints defined in the COLR. AND I.3 Initiate action to submit an OPRM report in accordance with Specification 5.6.8. The COMPLETION TIME for each is as follows: I.1: Immediately I.2: 12 hours I.3: Immediately		
TS 3.3.1.1 Condition J	Replace REQUIRED ACTION J.1 with new REQUIRED ACTIONS J.1, J.2, and J.3 to implement DSS-CD for the OPRM, as follows: J.1 Initiate action to implement the Manual BSP Regions defined in the COLR. AND J.2 Reduce operation to below the BSP Boundary defined in the COLR. <u>AND</u> J.3 -------NOTE--------------------- LCO 3.0.4 is not applicable ------------------------------------- Restore required channel to OPERABLE. The COMPLETION TIME for each is as follows: J.1: Immediately J.2: 12 hours J.3: 120 days	2.4.3	This change is discussed in Sections 7.2 and 7.4, and Table 8-1 of the DSS-CD LTR (Reference 2).

FOL/TS Section	Description of Change	M+SAR Section	Comments
TS 3.3.1.1 Condition K (new)	Insert new CONDITION K and REQUIRED ACTION K.1 to implement DSS-CD for the OPRM, as follows: CONDITION: K. Required Action and associated Completion Time of Condition J not met. REQUIRED ACTION K.1 Reduce Thermal Power to less than 18% RTP. The COMPLETION TIME for K.1 is 4 hours.	2.4.2	Section 3.5 of the DSS-CD LTR (Reference 2) requires DSS-CD to be operable above a power level set at 5% below the lower boundary of the Armed Region defined by the MCPR monitoring threshold level, which is 23% for PBAPS (see M+SAR Section 2.4.2). Therefore, DSS-CD must be operable at 18% (23% - 5%). This change is also specified in Table 8-1 of the DSS-CD LTR.
SR 3.3.1.1.19	Delete this SR. Because the DSS-CD automatically arms, this surveillance requirement (which verifies the OPRM is not bypassed) is no longer necessary and is being deleted.	2.4.1	Deleting this SR is specified in Table 8-1 of the DSS-CD LTR.
Table 3.3.1.1-1, Reactor Protection System Instrumentation			
Function 2b	Revised the Allowable Value (AV) of the Average Power Range Monitors (APRM) Simulated Thermal Power - High to ≤ 0.61W + 67.1% RTP.	5.3.1	The change is made to maintain the margin between the operating domain and the current trip during two loop operation.
Function 2b	Add new Note (g) in the "Allowable Value" column due to implementation of DSS-CD.	2.4.3	Section 7.4 of the DSS-CD LTR discusses this action. See also Table 8-1 of the DSS-CD LTR.
Function 2f	Change the value in the APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS column from "≥ 23%" to "≥ 18%"	2.4.3	Section 3.5 of the DSS-CD LTR (Reference 2) requires DSS-CD to be operable above a power level set at 5% below the lower boundary of the Armed Region defined by the MCPR threshold power level, which is 23% for PBAPS (see M+SAR Section 2.4.2).

FOL/TS Section	Description of Change	M+SAR Section	Comments
			Therefore, DSS-CD must be operable at 18% (23% - 5%). This change is also specified in Table 8-1 of the DSS-CD LTR.
Function 2f	Add new Note (h) in the APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS column due to implementation of DSS-CD.	2.4	This change is discussed in Sections 2.2 and 7.4, and Table 8-1 of the DSS-CD LTR.
Function 2f	Delete SR 3.3.1.1.8 and SR 3.3.1.1.19 due to implementation of DSS-CD.	2.4	This change is discussed in Sections 2.2 and 7.4, and Table 8-1 of the DSS-CD LTR. SR 3.3.1.1.8 to calibrate the Low Power Range Monitors is not included in the corresponding SRs assigned to Function 2f as shown in Table 8-1 of the DSS-CD LTR.
Function 2f	Delete Note (d) due to implementation of DSS-CD.	2.4	Section 7.5 of the DSS-CD LTR discusses and justifies this deletion. See also Table 8-1 of the DSS-CD LTR.
TS 3.4.1, Recirculation Loops Operating			
TS 3.4.1	Revise LCO to state that operation in the MELLLA+ domain with a single loop in operation is prohibited and add new ACTION B with corresponding REQUIRED ACTION B.1 and a COMPLETION TIME to reflect the immediate action required when the MELLLA+ domain is entered with a single recirculation loop in operation. The previous Condition B was re-designated as Condition C.	1.2.4	SLO is prohibited while operating in the MELLLA+ domain in accordance with Limitation and Condition 12.5.a of the M+LTR safety evaluation (Reference 1).
TS 3.4.1 b.	The SLMCPR values for two loop operation (TLO) and single loop operation (SLO) are expected to change to a single value to support MELLLA+ operation. The actual value will be determined in the reload licensing evaluation for the cycle that implements MELLLA+ operation.	2.2.1	For Information Only - No corresponding change provided in Attachment 2.

FOL/TS Section	Description of Change	M+SAR Section	Comments
TS Section 5.6.5, Core Operating Limits Report (COLR)			
TS 5.6.5	To reflect implementation of DSS-CD, replace Subsection a.5. with the following: "The Manual Backup Stability Protection (BSP) Scram Region (Region I), the Manual BSP Controlled Entry Region (Region II), the modified APRM Simulated Thermal Power – High scram setpoints used in the Automated BSP Scram Region, and the BSP Boundary for Specification 3.3.1.1"	2.4.3	Section 7.5 of the DSS-CD LTR discusses and justifies this addition. See also Table 8-1 of the DSS-CD LTR.
TS 5.6.5	Replaced document listed in Item 9 to Subsection b) with NEDC-33075P-A Revision 8 due to implementation of DSS-CD.	2.4.1.1	NEDC-33075P-A Revision 8 provides the generic licensing basis for DSS-CD applications to GE BWR/3-6 product lines, GE14 fuel designs, and operating envelopes up to and including MELLLA+.
TS Section 5.6.8, Oscillation Power Range Monitoring (OPRM) Report (new)			
TS 5.6.8	Add new Section 5.6.8 as follows: "5.6.8 <u>OPRM Report</u> When an OPRM report is required by CONDITION I of LCO 3.3.1.1, "RPS Instrumentation," the report shall be submitted within the following 90 days. The report shall outline the preplanned means to provide backup stability protection, the cause of the inoperability, and the plans and schedule for restoring the required instrumentation channels to OPERABLE status."	2.4.3	Section 7.5.2 of the DSS-CD LTR discusses and justifies this addition. See also Table 8-1 of the DSS-CD LTR.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

10 CFR 50.36 (c)(2)(ii) Criterion 2 requires TS Limiting Conditions for Operations (LCO) to include process variables, design features, and operating restrictions that are initial conditions of design basis accident analysis. Compliance with TS ensures that system performance parameters are maintained within the values assumed in the safety analyses. The proposed

FOL and TS changes are supported by the safety analyses and continue to provide a level of protection comparable to the current TS. Applicable regulatory requirements and significant safety evaluations performed in support of the proposed changes are described in the M+SAR (Attachment 4).

4.2 Precedent

This application addresses the applicable limitations and conditions described in the NRC Safety Evaluation Reports for the following GEH LTRs as documented in the indicated M+SAR (Attachment 4) Appendices.

- NEDC-33173P-A (Methods LTR), Revision 4 and its associated safety evaluation report (Reference 4); (Appendix A to M+SAR)

- NEDC-33006P-A (M+LTR), Revision 3 and its associated safety evaluation report (Reference 1); (Appendix B to M+SAR)

- NEDE-32906P-A Revision 3 including Supplements 1-A and 3-A and their associated safety evaluation reports (References 5, 6 and 7); (Appendix D to M+SAR)

In accordance with Limitation and Condition 12.2 of the NRC SER for the M+LTR, PBAPS will also implement the DSS-CD solution, with limitations and conditions as identified in NEDC-33075P-A (DSS-CD LTR), Revision 8 (Reference 2) as documented in Appendix C to the M+SAR. The purpose and content of the NRC SER for NEDE-33147P-A (TRACG LTR) Revision 4 (Reference 3) has also been implemented to address M+LTR SER Limitation and Condition 12.2.

The NRC has issued Amendment 180 to the Renewed Facility Operating License for the Monticello Nuclear Generating Plant allowing operation in the expanded MELLLA+ operating domain and changing the stability solution from Option III to DSS-CD (ADAMS Accession No. ML14035A248).

4.3 No Significant Hazards Consideration

In accordance with the requirements of 10 CFR 50.90, EGC requests an amendment to Renewed Facility Operating License Nos. DPR-44 and DPR-56 for the PBAPS, Units 2 and 3. This license amendment request proposes revisions to the PBAPS FOL and TS to allow operating in the expanded MELLLA+ domain.

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

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

Response: No. The proposed operation in the MELLLA+ operating domain does not significantly increase the probability or consequences of an accident previously evaluated. The probability (frequency of occurrence) of Design Basis Accidents (DBAs) occurring is not affected by the MELLLA+ operating domain because PBAPS continues

to comply with the regulatory and design basis criteria established for plant equipment. There is no change in consequences of postulated accidents when operating in the MELLLA+ operating domain compared to the operating domain previously evaluated. The results of accident evaluations remain within the NRC approved acceptance limits.

The spectrum of postulated transients has been investigated and is shown to meet the plant's currently licensed regulatory criteria. Continued compliance with the Safety Limit Minimum Critical Power Ratio (SLMCPR) will be confirmed on a cycle-specific basis consistent with the criteria accepted by the NRC.

Challenges to the reactor coolant pressure boundary were evaluated for the MELLLA+ operating domain conditions (pressure, temperature, flow, and radiation) and were found to meet their acceptance criteria for allowable stresses and overpressure margin.

Challenges to the containment were evaluated and the containment and its associated cooling systems continue to meet the current licensing basis. The calculated post-Loss-of-Coolant Accident (LOCA) suppression pool temperature remains acceptable.

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

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

Response: No. The proposed operation in the MELLLA+ operating domain does not create the possibility of a new or different kind of accident from any previously evaluated.

Equipment that could be affected by the MELLLA+ operating domain has been evaluated. No new operating mode, safety-related equipment lineup, accident scenario, or equipment failure mode was identified. The full spectrum of accident considerations has been evaluated and no new or different kind of accident has been identified. The MELLLA+ operating domain uses developed technology, and applies it within the capabilities of existing plant safety-related equipment in accordance with the regulatory criteria (including NRC-approved codes, standards and methods). No new accident or event precursor has been identified.

Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

Response: No. The proposed operation in the MELLLA+ domain does not involve a significant reduction in the margin of safety.

The MELLLA+ operating domain affects only design and operational margins. Challenges to the fuel, reactor coolant pressure boundary, and containment were evaluated for the MELLLA+ operating domain conditions. Fuel integrity is maintained by meeting existing design and regulatory limits. The calculated loads on affected structures, systems, and components, including the reactor coolant pressure boundary, will remain within their design allowables for design basis event categories. No NRC

acceptance criterion is exceeded. The PBAPS configuration and responses to transients and postulated accidents do not result in exceeding the presently approved NRC acceptance limits.

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

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

4.4 Conclusion

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

5.0 ENVIRONMENTAL CONSIDERATION

The environmental effects of MELLLA+ operating domain expansion are controlled at the same limits as the current analyses. None of the present limits for plant environmental releases are increased as a consequence of MELLLA+ operating domain expansion. MELLLA+ has no effect on the non-radiological elements of concern, and the plant will be operated in an environmentally acceptable manner as documented by the Environmental Assessment for PBAPS's current licensed operating domain. Existing Federal, State and local regulatory permits presently in effect accommodate the MELLLA+ operating domain expansion without modification.

The evaluation of the effects of MELLLA+ operating domain expansion on normal radiological effluents is included in Section 8.0 of the M+SAR (Attachment 4). There will be no change in the radiological effluents released to the environment due to the MELLLA+ operating domain expansion. The normal effluents and doses remain well within the 10 CFR 20 limits and the 10 CFR 50, Appendix I guidance. There is no change to the predicted doses from postulated accidents and the 10 CFR 50.67 dose criteria continue to be met. In addition, the quantity of spent fuel does not increase as a result of MELLLA+ operating domain expansion.

EGC has determined that operation with the proposed MELLLA+ license amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or a significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed license amendment meets the eligibility criterion for categorical exclusion as set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed license amendment.

6.0 REFERENCES

1. GEH NEDC-33006P-A, "General Electric Boiling Water Reactor Maximum Extended Load Line Limit Analysis Plus," (M+LTR), Revision 3, June 2009.

2. GEH NEDC-33075P-A, "General Electric Boiling Water Reactor Detect and Suppress Solution - Confirmation Density," (DSS-CD LTR), Revision 8, November 2013.

3. GEH NEDE-33147P-A, "DSS-CD TRACG Application," (TRACG LTR), Revision 4, August 2013.

4. GEH NEDC-33173P-A, "Applicability of GE Methods to Expanded Operating Domains," (Methods LTR), Revision 4, November 2012.

5. GEH NEDE-32906P-A, "TRACG Applications for Anticipated Operational Occurrences (AOO) Transient Analyses," (TRACG Applications LTR), Revision 3, September 2006.

6. GEH NEDE-32906P-A Supplement 1-A, "TRACG Application for Anticipated Transient Without Scram Overpressure Transient Analysis," November 2003.

7. GEH NEDE-32906P-A, Supplement 3-A, "Migration to TRACG04 / PANAC11 from TRACG02 / PANAC10 for TRACG AOO and ATWS Overpressure Transients," Revision 1, April 2010.

8. Letter from USNRC to Exelon Nuclear, Peach Bottom Atomic Power Station, Units 2 and 3 - Issuance of Amendment RE: Extended Power Uprate (TAC NOS. ME9631 and ME9632), dated August 25, 2014.

ATTACHMENT 2

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. 50-277 and 50-278

MELLLA+ License Amendment Request

Markup of Renewed Facility Operating License and Technical Specifications Pages

Revised Facility Operating License Pages

Unit 2 and Unit 3
7g

Revised Technical Specifications Pages

Units 2 and 3
3.3-3
3.3-6a
3.3-7
3.4-1
3.4-3
5.0-21
5.0-22

2. Level 1 performance criteria.

3. The methodology for establishing the RSD strain limits used for the Level 1 and Level 2 performance.

(e) The results of the power ascension testing to verify the continued structural integrity of the steam dryer shall be submitted to the NRC staff in a report in accordance with 10 CFR 50.4. The report shall include a final load definition and stress report of the steam dryer, including the results of a complete re-analysis using the end-to-end B/Us determined at EPU conditions and a comparison of predicted and measured pressures and strains (RMS levels and spectra) on the RSD. The report shall be submitted within 90 days of the completion of EPU power ascension testing for Peach Bottom Unit 2.

(f) During the first two scheduled refueling outages after reaching EPU conditions, a visual inspection shall be conducted of the steam dryer as described in the inspection guidelines contained in WCAP-17635-P.

(g) The results of the visual inspections of the steam dryer shall be submitted to the NRC staff in a report in accordance with 10 CFR 50.4. The report shall be submitted within 90 days following startup from each of the first two respective refueling outages.

(h) Within 6 months following completion of the second refueling outage, after the implementation of the EPU, the licensee shall submit a long-term steam dryer inspection plan based on industry operating experience along with the baseline inspection results.

The license condition described above shall expire: (1) upon satisfaction of the requirements in paragraphs (f) and (g), provided that a visual inspection of the steam dryer does not reveal any new unacceptable flaw(s) or unacceptable flaw growth that is due to fatigue, and; (2) upon satisfaction of the requirements specified in paragraph (h).

Insert License Condition 16

Insert License Condition 16 for Renewed Facility Operating License Unit 2

(16) Maximum Extended Load Line Limit Analysis Plus (MELLLA+) Special Consideration

The licensee shall not operate the facility within the MELLLA+ operating domain with a feedwater heater out of service resulting in more than a 10°F reduction in feedwater temperature below the design feedwater temperature.

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~~ See Insert A for changes to Actions I and J, and the addition of Action K
	~~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 < 23% RTP.~~	~~4 hours~~

TS 3. 3. 1. 1 Insert A

I. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	I.1 Initiate action to implement the Manual Backup Stability Protection (BSP) Regions defined in the COLR. AND	Immediately
	I.2 Implement the Automated BSP Scram Region using the modified APRM Simulated Thermal Power - High scram setpoints defined in the COLR. AND	12 hours
	I.3 Initiate action to submit an OPRM report in accordance with Specification 5.6.8.	Immediately
J. Required Action and associated Completion Time of Condition I not met.	J.1 Initiate action to implement the Manual BSP Regions defined in the COLR. AND	Immediately
	J.2 Reduce operation to below the BSP Boundary defined in the COLR. AND	12 hours
	J.3 -------NOTE----------- LCO 3.0.4 is not applicable ---------------------- Restore required channel to OPERABLE.	120 days
K. Required Action and associated Completion Time of Condition J not met.	K.1 Reduce Thermal Power to less than 18% RTP.	4 hours

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.16	Calibrate each radiation detector.	In accordance with the Surveillance Frequency Control Program.
SR 3.3.1.1.17	Perform LOGIC SYSTEM FUNCTIONAL TEST.	In accordance with the Surveillance Frequency Control Program.
SR 3.3.1.1.18	Verify the RPS RESPONSE TIME is within limits.	In accordance with the Surveillance Frequency Control Program.
SR 3.3.1.1.19 Deleted	~~Verify OPRM is not bypassed when APRM Simulated Thermal Power is ≥ 26.2% and recirculation drive flow is <60%.~~	~~In accordance with the Surveillance Frequency Control Program.~~

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 See Insert B for Note (g)	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				0.61W + 67.1%	
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[e],[f]	≤ ~~0.55 W + 63.3%~~ RTP[b] (g) and ≤ 118.0% RTP
c. See Insert B for Note (h)	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	≥18% (h) ~~≥ 23%~~ 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~~	~~(d)~~ NA

(continued)

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

(b) 0.55 (W - ΔW) + 61.5% 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.

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

(e) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(f) The instrument channel set point shall be reset to a value that is within the Leave Alone Zone (LAZ) around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided the as-found tolerance and LAZ apply to the actual setpoint implemented in the Surveillance procedures to confirm channel performance. The NTSP methodologies used to determine the as-found tolerance and the LAZ are specified in the Bases associated with the specified function.

TS T3. 3. 1. 1- 1 Insert B

(g) With OPRM Upscale (Function 2.f) inoperable, the Automated BSP Scram Region setpoints are implemented in accordance with Action I of this Specification.

(h) Following Detect and Suppress Solution – Confirmation Density (DSS-CD) implementation, DSS-CD is not required to be armed while in the DSS-CD Armed Region during the first reactor startup and during the first controlled shutdown that passes completely through the DSS-CD Armed Region. However, DSS-CD is considered OPERABLE and shall be maintained OPERABLE and capable of automatically arming for operation at recirculation drive flow rates above the DSS-CD Armed Region.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 Recirculation Loops Operating

LCO 3.4.1 Two recirculation loops with matched flows shall be in operation.

<u>OR</u>

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

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

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

c. LCO 3.2.3, "LINEAR HEAT GENERATION RATE (LHGR)," single loop operation limits specified in the COLR; and

d. 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.

----------------------------NOTE----------------------------
Single recirculation loop operation is prohibited in the MELLLA+ domain.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of the LCO not met.	A.1 Satisfy the requirements of the LCO.	24 hours
~~B.~~ C. No recirculation loops in operation. OR Required Action and associated Completion Time of Condition A or B not met.	~~B.1~~ C.1 Be in MODE 3.	12 hours
B. Operation in the MELLLA+ domain with a single recirculation loop in operation.	B.1 Initiate action to exit the MELLLA+ domain.	Immediately

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;

4. The Control Rod Block Instrumentation for Specification 3.3.2.1; and

See Insert C for Item 5

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)

TS 5.6.5.a Insert C

5. The Manual Backup Stability Protection (BSP) Scram Region (Region I), the Manual BSP Controlled Entry Region (Region II), the modified APRM Simulated Thermal Power – High scram setpoints used in the Automated BSP Scram Region and the BSP Boundary for Specification 3.3.1.1.

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";

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

See Insert C1 for new document 9

9. ~~NEDO-32465-A, "Reactor 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.

5.6.7 Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

a. RCS pressure and temperature limits for heatup, cooldown, low temperature operation, criticality, and hydrostatic testing as well as heatup and cooldown rates shall be established and documented in the PTLR for the following:

i) Limiting Conditions for Operation Section 3.4.9, "RCS Pressure and Temperature (P/T) Limits"

ii) Surveillance Requirements Section 3.4.9, "RCS Pressure and Temperature (P/T) Limits"

See Insert D for added 5.6.8

(continued)

TS 5.6 Insert C1

9. NEDC-33075P-A, “GE Hitachi Boiling Water Reactor, Detect and Suppress Solution – Confirmation Density,” Revision 8, November 2013.

TS 5.6 Insert D

5.6.8 OPRM Report

When an OPRM report is required by CONDITION I of LCO 3.3.1.1, "RPS Instrumentation," the report shall be submitted within the following 90 days. The report shall outline the preplanned means to provide backup stability protection, the cause of the inoperability, and the plans and schedule for restoring the required instrumentation channels to OPERABLE status.

(e) The results of the power ascension testing to verify the continued structural integrity of the steam dryer shall be submitted to the NRC staff in a report in accordance with 10 CFR 50.4. The report shall include a final load definition and stress report of the steam dryer, including the results of a complete re-analysis using the end-to-end B/Us from Peach Bottom Unit 2 benchmarking at EPU conditions. The report shall be submitted within 90 days of the completion of EPU power ascension testing for Peach Bottom Unit 3.

(f) During the first two scheduled refueling outages after reaching EPU conditions, a visual inspection shall be conducted of the steam dryer as described in the inspection guidelines contained in WCAP-17635-P.

(g) The results of the visual inspections of the steam dryer shall be submitted to the NRC staff in a report in accordance with 10 CFR 50.4. The report shall be submitted within 90 days following startup from each of the first two respective refueling outages.

(h) Within 6 months following completion of the second refueling outage, after the implementation of the EPU, the licensee shall submit a long-term steam dryer inspection plan based on industry operating experience along with the baseline inspection results.

The license condition described above shall expire: (1) upon satisfaction of the requirements in paragraphs (f) and (g), provided that a visual inspection of the steam dryer does not reveal any new unacceptable flaw(s) or unacceptable flaw growth that is due to fatigue, and; (2) upon satisfaction of the requirements specified in paragraph (h).

Insert License Condition 16

3. This renewed license is subject to the following conditions for the protection of the environment:

A. To the extent matters related to thermal discharges are treated therein, operation of Peach Bottom Atomic Power Station, Unit No. 3, will be governed by NPDES Permit No. PA 0009733, as now in effect and as hereafter amended. Questions pertaining to conformance thereto shall be referred to and shall be determined by the NPDES Permit issuing or enforcement authority, as appropriate.

B. In the event of any modification of the NPDES Permit related to thermal discharges or the establishment (or amendment) of alternative effluent limitations established pursuant to Section 316 of the Federal Water Pollution Control Act, the Exelon Generation Company shall inform the NRC and analyze any associated changes in or to the Station, its components, its operation or in the discharge of effluents therefrom. If such change would entail any modification to

Insert License Condition 16 for Renewed Facility Operating License Unit 3

(16) Maximum Extended Load Line Limit Analysis Plus (MELLLA+) Special Consideration

The licensee shall not operate the facility within the MELLLA+ operating domain with a feedwater heater out of service resulting in more than a 10°F reduction in feedwater temperature below the design feedwater temperature.

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 <23% RTP.~~	~~4 hours~~

See Insert A for changes to Actions I and J, and the addition of Action K

I. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	I.1 Initiate action to implement the Manual Backup Stability Protection (BSP) Regions defined in the COLR. AND I.2 Implement the Automated BSP Scram Region using the modified APRM Simulated Thermal Power - High scram setpoints defined in the COLR. AND I.3 Initiate action to submit an OPRM report in accordance with Specification 5.6.8.	Immediately 12 hours Immediately
J. Required Action and associated Completion Time of Condition I not met.	J.1 Initiate action to implement the Manual BSP Regions defined in the COLR. AND J.2 Reduce operation to below the BSP Boundary defined in the COLR. AND J.3 -------NOTE----------- LCO 3.0.4 is not applicable ---------------------- Restore required channel to OPERABLE.	Immediately 12 hours 120 days
K. Required Action and associated Completion Time of Condition J not met.	K.1 Reduce Thermal Power to less than 18% RTP.	4 hours

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.16	Calibrate each radiation detector.	In accordance with the Surveillance Frequency Control Program.
SR 3.3.1.1.17	Perform LOGIC SYSTEM FUNCTIONAL TEST.	In accordance with the Surveillance Frequency Control Program.
SR 3.3.1.1.18	Verify the RPS RESPONSE TIME is within limits.	In accordance with the Surveillance Frequency Control Program.
SR 3.3.1.1.19 Deleted	~~Verify OPRM is not bypassed when APRM Simulated Thermal Power is ≥ 26.2% and recirculation drive flow is <60%.~~	~~In accordance with the Surveillance Frequency Control Program.~~

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 (e),(f)	≤ ~~0.55 W + 63.3%~~ 0.61W + 67.1% RTP(b) (g) 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	~~≥23%~~ ≥18%(h) 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~~	~~(d)~~ NA

See Insert B for Note (g)

See Insert B for Note (h)

(continued)

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

(b) 0.55 (W - ΔW) + 61.5% 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.

Deleted

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

(e) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(f) The instrument channel set point shall be reset to a value that is within the Leave Alone Zone (LAZ) around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided the as-found tolerance and LAZ apply to the actual setpoint implemented in the Surveillance procedures to confirm channel performance. The NTSP methodologies used to determine the as-found tolerance and the LAZ are specified in the Bases associated with the specified function.

TS T3. 3. 1. 1- 1 Insert B

(g) With OPRM Upscale (Function 2.f) inoperable, the Automated BSP Scram Region setpoints are implemented in accordance with Action I of this Specification.

(h) Following Detect and Suppress Solution – Confirmation Density (DSS-CD) implementation, DSS-CD is not required to be armed while in the DSS-CD Armed Region during the first reactor startup and during the first controlled shutdown that passes completely through the DSS-CD Armed Region. However, DSS-CD is considered OPERABLE and shall be maintained OPERABLE and capable of automatically arming for operation at recirculation drive flow rates above the DSS-CD Armed Region.

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.

OR

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

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

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

c. LCO 3.2.3, "LINEAR HEAT GENERATION RATE (LHGR)," single loop operation limits specified in the COLR; and

d. 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.

----------------------------NOTE----------------------------
Single recirculation loop operation is prohibited in the MELLLA+ domain
----

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of the LCO not met.	A.1 Satisfy the requirements of the LCO.	24 hours
~~B.~~ C. No recirculation loops in operation. OR Required Action and associated Completion Time of Condition A or B not met.	~~B.1~~ C.1 Be in MODE 3.	12 hours
B. Operation in the MELLLA+ domain with a single recirculation loop in operation	B.1 Initiate action to exit the MELLLA+ domain.	Immediately

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;

4. The Control Rod Block Instrumentation for Specification 3.3.2.1; and

See Insert C for Item 5

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)

TS 5.6.5.a Insert C

5. The Manual Backup Stability Protection (BSP) Scram Region (Region I), the Manual BSP Controlled Entry Region (Region II), the modified APRM Simulated Thermal Power – High scram setpoints used in the Automated BSP Scram Region and the BSP Boundary for Specification 3.3.1.1.

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";

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

See Insert C1 for new document 9

9. ~~NEDO-32465-A, "Reactor 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.

5.6.7 Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

a. RCS pressure and temperature limits for heatup, cooldown, low temperature operation, criticality, and hydrostatic testing as well as heatup and cooldown rates shall be established and documented in the PTLR for the following:

i) Limiting Conditions for Operation Section 3.4.9, "RCS Pressure and Temperature (P/T) Limits"

ii) Surveillance Requirements Section 3.4.9, "RCS Pressure and Temperature (P/T) Limits"

See Insert D for added 5.6.8

TS 5.6 Insert C1

9. NEDC-33075P-A, “GE Hitachi Boiling Water Reactor, Detect and Suppress Solution – Confirmation Density,” Revision 8, November 2013.

TS 5.6 Insert D

5.6.8 OPRM Report

When an OPRM report is required by CONDITION I of LCO 3.3.1.1, "RPS Instrumentation," the report shall be submitted within the following 90 days. The report shall outline the preplanned means to provide backup stability protection, the cause of the inoperability, and the plans and schedule for restoring the required instrumentation channels to OPERABLE status.

ATTACHMENT 3

Peach Bottom Atomic Power Station Units 2 and 3

NRC Docket Nos. 50-277 and 50-278

MELLLA+ License Amendment Request

Markup of Technical Specifications Bases Pages

Revised Technical Specifications Bases Pages

Units 2	**Unit 3**
B 3.3-12a	B 3.3-12a
B 3.3-12b	B 3.3-12b
B 3.3-27	B 3.3-27
B 3.3-27a	B 3.3-27a
B 3.3-35a	B 3.3-36
B 3.3-35b	B 3.3-36a
B 3.4-3	B 3.4-3
B 3.4-5	B 3.4-5
B 3.4-7	B 3.4-7
B 3.4-8	B 3.4-8
B 3.4-9	B 3.4-9
B 3.4-10	B 3.4-10

BASES

See Insert E for replacement of 2.f

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 (PBDA), the amplitude based algorithm (ABA), and the growth rate algorithm (GRA). All three are implemented in the OPRM Upscale Function, but the safety analysis takes credit only for the PBDA. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM Upscale Function OPERABILITY for Technical Specifications purposes is based only on the PBDA.~~

~~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 ≥ 26.2% 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 OPRM Upscale Function is required to be OPERABLE when the plant is at ≥ 23% RTP. The 23% RTP level is selected to provide margin in the unlikely event that a reactor power increase transient occurring while the plant is operating below 26.2% RTP causes a power increase to or beyond the 26.2% 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.~~

~~(continued)~~

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

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

An OPRM Upscale trip is issued from an APRM channel when the PBDA 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 GRA or ABA detects 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 APRM Simulated Thermal Power (26.2%) and drive flow (60%); b) PBDA confirmation count and amplitude setpoints; c) PBDA tuning parameters; and d) GRA and 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 without the application of setpoint methodology per Reference 18. The settings, 26.2% 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 Technical Specifications 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, 15 and 16, are established as nominal values only, and are controlled by PBAPS procedures.

(continued)

TSB 3.3.1.1 Insert E

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.

Reference 21 describes the Detect and Suppress - Confirmation Density (DSS-CD) long-term stability solution and the licensing basis Confirmation Density Algorithm (CDA). Reference 21 also describes the DSS-CD Armed Region and the three additional algorithms for detecting thermal-hydraulic instability related neutron flux oscillations: the period based detection algorithm (PBDA), the amplitude based algorithm (ABA), and the growth rate algorithm (GRA). All four algorithms are implemented in the OPRM Upscale Function, but the safety analysis takes credit only for the CDA. The remaining three algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM Upscale Function OPERABILITY is based only on the CDA.

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.

DSS-CD operability requires at least 8 responsive OPRM cells per channel. The DSS-CD software includes a self-check for the responsive OPRM cells; therefore, no SR is necessary.

The OPRM Upscale Function is required to be OPERABLE when the plant is ≥ 18% RTP, which is established as a power level that is greater than or equal to 5% below the lower boundary of the Armed Region. This requirement is designed to encompass the region of power-flow operation where anticipated events could lead to thermal-hydraulic instability and related neutron flux oscillations. The OPRM Upscale Function is automatically trip-enabled when THERMAL POWER, as indicated by the APRM Simulated Thermal Power, is ≥23% RTP corresponding to the MCPR monitoring threshold and reactor recirculation drive flow, is less than 75% of rated flow. This region is the OPRM Armed Region. Note (h) allows for entry into the DSS-CD Armed Region without automatic arming of DSS-CD prior to completely passing through the DSS-CD Armed Region during the first startup and the first shutdown following DSS-CD implementation.

As described in Reference 21 and 23, the RTP values for the OPRM Upscale function to be OPERABLE (≥18% RTP) and for the OPRM Upscale function to be auto-enabled (≥23% RTP) are sufficiently conservative for protection of the plant against thermal-hydraulic instabilities. The basis for the 5% RTP difference between the OPRM Upscale OPERABLE (18% RPT) and OPRM Upscale auto-enable value (23% RTP) is to ensure that no credible event, e.g. loss of feed water heating, could result in a plant power excursion where an INOPERABLE OPRM channel entered into the OPRM ARMED region. Peach Bottom plant specific analyses performed at these low power levels (Ref. 23) have demonstrated that any power excursion resulting from credible events is bounded by 5% RTP. In addition, both the core-wide and channel decay ratios at the OPRM Upscale auto-enabled values are extremely low as documented in Ref. 21, which demonstrates the low possibility of thermal hydraulic instabilities at low power and confirms the conservatisms in the OPRM Upscale function auto-enable RTP value. The conservatisms in the determination of the values for OPRM Upscale function OPERABLE and the OPRM Upscale function auto enabled sufficiently compensate for possible inaccuracy of the APRM simulated thermal power signal versus actual core thermal power at power levels < 23% RTP. Therefore, there is no need to perform any calibration of the APRM simulated thermal power signal to calculated

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

power with RTP < 23% in order to determine the OPRM Upscale function OPERABLE.

If any OPRM auto-enable setpoint is in a non-conservative condition, i.e. the OPRM Upscale is not auto-enabled with RTP ≥ 23% and reactor recirculation drive flow ≤ 75% of rated, the associated channel is considered inoperative for the OPRM Upscale function. Alternatively, the auto-enable set point may be adjusted to place the channel in a conservative condition (armed). If placed in the armed condition, the channel is considered OPERABLE.

Note (h) reflects the need for plant data collection in order to test the DSS-CD equipment. Testing the DSS-CD equipment ensures its proper operation and prevents spurious reactor trips. Entry into the DSS-CD Armed Region without automatic arming of DSS-CD during this initial testing phase also allows for changes in plant operations to address maintenance or other operational needs. However, during this initial testing period, the OPRM upscale function is OPERABLE and DSS-CD operability and capability to automatically arm shall be maintained at recirculation drive flow rates above the DSS-CD Armed Region flow boundary.

An OPRM Upscale trip is issued from an OPRM channel when the confirmation density algorithm in that channel detects oscillatory changes in the neutron flux, indicated by periodic confirmations and amplitude exceeding specified setpoints for a specified number of OPRM cells in the channel. An OPRM Upscale trip is also issued from the channel if any of the defense-in-depth algorithms (PBDA, ABA, GRA) exceed their trip condition for one or more cells in that channel.

Three of the four channels are required to be operable. Each channel is capable of detecting thermal-hydraulic instabilities, by detecting the related neutron flux oscillations, and issuing a trip signal before the SLMCPR is exceeded. There is no Allowable Value for this function.

The OPRM Upscale Function is not LSSS SL-related (Reference 21) and Reference 22 confirms that the OPRM Upscale Function settings based on DSS-CD also do not have traditional instrumentation setpoints determined under an instrument setpoint methodology.

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~~

See Insert F for modified I.1 and I.2, and for added I.3, J.1, J.2, J.3, and K.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 hour duration is judged to be reasonable.~~

~~The 12 hour Completion Time of I.1 is provided to establish the alternate detect and suppress method regardless of whether the 120 day Completion Time of I.2 applies. If the inoperable condition is such that action I.2 does not apply, then Condition J is entered once Required Action I.1 has been completed or once the Completion Time of Required Action I.1 has expired.~~

(continued)

BASES

See Insert F for modified I.1 and I.2, and for added I.3, J.1, J.2, J.3, and K.1

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.~~

~~The 12 hour Completion Time of I.1 is provided to establish the alternate detect and suppress method regardless of whether the 120 day Completion Time of I.2 applies. If the inoperable condition is such that action I.2 does not apply, then Condition J is entered once Required Action I.1 has been completed or once the Completion Time of Required Action I.1 has expired.~~

~~A note is provided to indicate that LCO 3.0.4 is not applicable. The intent of that note is to allow plant startup while operating 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)

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

ACTIONS

I.1

If OPRM Upscale trip capability is not maintained, Condition I exists and Backup Stability Protection (BSP) is required. The Manual BSP Regions are described in Reference 21. The Manual BSP Regions are procedurally established consistent with the guidelines identified in Reference 21 and require specified manual operator actions if certain predefined operational conditions occur.

The Completion Time of immediate is based on the importance of limiting the period of time during which no automatic or alternate detect and suppress trip capability is in place.

I.2 and I.3

Actions I.2 and I.3 are both required to be taken in conjunction with Action I.1 if OPRM Upscale trip capability is not maintained. As described in Section 7.4 of Reference 21, the Automated BSP Scram Region is designed to avoid reactor instability by automatically preventing entry into the region of the power and flow-operating map that is susceptible to reactor instability. The reactor trip would be initiated by the modified APRM Simulated Thermal Power-High scram setpoints for flow reduction events that would have terminated in the Manual BSP Region I. The Automated BSP Scram Region ensures an early scram and SLMCPR protection.

The Completion Time of 12 hours to complete the specified actions is reasonable, based on operational experience, and based on the importance of restoring an automatic reactor trip for thermal hydraulic instability events.

Backup Stability Protection is intended as a temporary means to protect against thermal-hydraulic instability events. The action should be initiated immediately to document the situation and prepare the report. The reporting requirements of Specification 5.6.8 document the corrective actions and schedule to restore the required channels to an OPERABLE status. The Completion Time of 90 days shown in Specification 5.6.8 is adequate to allow time to evaluate the cause of the inoperability and to determine the appropriate corrective actions and schedule to restore the required channels to OPERABLE status.

J.1

If the Required Action I is not completed within the associated Completion Time, then Action J is required. The Bases for the Manual BSP Regions and associated Completion Time is addressed in the Bases for I.1. The Manual BSP Regions are required in conjunction with the BSP Boundary.

J.2

The BSP Boundary, as described in Section 7.3 of Reference 21, defines an operating domain where potential instability events can be effectively addressed by the specified BSP manual operator actions. The BSP Boundary is constructed such that a flow reduction event initiated from this boundary and terminated at the core natural circulation line (NCL) would not exceed the Manual BSP Region I stability criterion. Potential instabilities would develop slowly as a result of the feedwater temperature transient (Reference 21).

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

The Completion Time of 12 hours to complete the specified actions is reasonable, based on operational experience, to reach the specific condition from full power conditions in an orderly manner and without challenging plant system.

J.3

Backup Stability Protection (BSP) is a temporary means for protection against thermal-hydraulic instability events. An extended period of inoperability without automatic trip capability is not justified. Consequently, the required channels are required to be restored to OPERABLE status within 120 days.

Based on engineering judgment, the likelihood of an instability event that could not be adequately handled by the use of the BSP Regions (See Action J.1) and the BSP Boundary (See J.2) during a 120-day period is negligibly small. The 120-day period is intended to allow for the case where limited 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 Conditions A and B.

A Note is provided to indicate that LCO 3.0.4 is not applicable. The intent of the note is to allow plant startup while operating within the 120 day Completion Time for Required Action J.3. 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.

K.1

If the required channels are not restored to OPERABLE status and the Required Actions of J are not met within the associated Completion Times, then the plant must be placed in an operating condition in which the LCO does not apply. To achieve this status, the plant must be brought to less than 18% RTP within 4 hours. The allowed Completion Time is reasonable, based on operating experience, to reach the specified operating power level from full power conditions in an orderly manner and without challenging plant systems.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.1.19 — Deleted

~~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.~~

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

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-33566P, "Safety Analysis Report for Exelon Peach Bottom Atomic Power Station Units 2 and 3, Constant Pressure Power Uprate," Revision 0.

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.

(continued)

BASES

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.

Deleted

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

Deleted

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

Deleted

16. ~~NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology And Reload Applications," August 1996.~~

Deleted

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

Deleted

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.

20. Setpoint Methodology for Peach Bottom Atomic Power Station and Limerick Generating Station, CC-MA-103-2001.

See Insert G for added references

TSB 3.3.1.1 Insert G

References

21. GE Hitachi Nuclear Energy, “GE Hitachi Boiling Water Reactor, Detect and Suppress Solution – Confirmation Density,” NEDC-33075P-A, Revision 8, November 2013.

22. GEH letter to NRC, "NEDC-33075P-A, Detect and Suppress Solution - Confirmation Density (DSS-CD) Analytical Limit (TAC No. MD0277)," October 29, 2008. (ADAMS Accession No. ML083040052)

23. 000N7936-R0, “Project Task Report – Exelon Generation Company LLC, Peach Bottom Atomic Power Station Unit 2 & 3 MELLLA+, Task T0202: Thermal-Hydraulic Stability,” April 2014.

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, 4, 7 and 8).

"The Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operating domain has not been analyzed for single recirculation loop operation. Therefore, single loop operation is prohibited in the MELLLA+ operating domain (Ref. 7)."

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."

(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.

"Single loop operation is prohibited in the MELLLA+ operating domain per Reference 7."

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

ACTIONS
(continued)

A.1

With the requirements of the LCO not met, 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.

"Note that single loop operation is prohibited in the MELLLA+ operating domain per Reference 7."

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~~ C.1

With no recirculation loops in operation or the Required Action and associated Completion Time of Condition A or B 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.

"B.1

The Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operating domain is not analyzed for single recirculation loop operation. Therefore, single loop operation is prohibited in the MELLLA+ operating domain (Ref. 7). Action shall be taken to immediately exit the MELLLA + domain in order to return to operation at an analyzed condition. However, it is expected that plant design limitations will preclude operation in the MELLLA+ domain with a single recirculation loop."

(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 the specified Frequency after both loops are in operation. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

"and operation in the MELLLA+ domain is prohibited per Reference 7"

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. NEDC-33566P, "Safety Analysis Report for Exelon Peach Bottom Atomic Power Station Units 2 and 3, Constant Pressure power Uprate," Revision 0.

7. NEDC-33006P-A, "Maximum Extended Load Line Limit Analysis Plus Licensing Topical Report," Revision 3, June 2009.

BASES

See Insert E for replacement of 2.f

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 (PBDA), the amplitude based algorithm (ABA), and the growth rate algorithm (GRA). All three are implemented in the OPRM Upscale Function, but the safety analysis takes credit only for the PBDA. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM Upscale Function OPERABILITY for Technical Specifications purposes is based only on the PBDA.

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 ≥ 26.2% 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 OPRM Upscale Function is required to be OPERABLE when the plant is at ≥ 23% RTP. The 23% RTP level is selected to provide margin in the unlikely event that a reactor power increase transient occurring while the plant is operating below 26.2% RTP causes a power increase to or beyond the 26.2% 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.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

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

~~An OPRM Upscale trip is issued from an APRM channel when the PBDA 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 GRA or ABA detects 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 APRM Simulated Thermal Power (26.2%) and drive flow (60%); b) PBDA confirmation count and amplitude setpoints; c) PBDA tuning parameters; and d) GRA and 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 without the application of setpoint methodology per Reference 18. The settings, 26.2% 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 Technical Specifications 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, 15, and 16, are established as nominal values only, and are controlled by PBAPS procedures.~~

(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.

Reference 21 describes the Detect and Suppress - Confirmation Density (DSS-CD) long-term stability solution and the licensing basis Confirmation Density Algorithm (CDA). Reference 21 also describes the DSS-CD Armed Region and the three additional algorithms for detecting thermal-hydraulic instability related neutron flux oscillations: the period based detection algorithm (PBDA), the amplitude based algorithm (ABA), and the growth rate algorithm (GRA). All four algorithms are implemented in the OPRM Upscale Function, but the safety analysis takes credit only for the CDA. The remaining three algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM Upscale Function OPERABILITY is based only on the CDA.

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.

DSS-CD operability requires at least 8 responsive OPRM cells per channel. The DSS-CD software includes a self-check for the responsive OPRM cells; therefore, no SR is necessary.

The OPRM Upscale Function is required to be OPERABLE when the plant is ≥ 18% RTP, which is established as a power level that is greater than or equal to 5% below the lower boundary of the Armed Region. This requirement is designed to encompass the region of power-flow operation where anticipated events could lead to thermal-hydraulic instability and related neutron flux oscillations. The OPRM Upscale Function is automatically trip-enabled when THERMAL POWER, as indicated by the APRM Simulated Thermal Power, is ≥23% RTP corresponding to the MCPR monitoring threshold and reactor recirculation drive flow, is less than 75% of rated flow. This region is the OPRM Armed Region. Note (h) allows for entry into the DSS-CD Armed Region without automatic arming of DSS-CD prior to completely passing through the DSS-CD Armed Region during the first startup and the first shutdown following DSS-CD implementation.

As described in Reference 21 and 23, the RTP values for the OPRM Upscale function to be OPERABLE (≥18% RTP) and for the OPRM Upscale function to be auto-enabled (≥23% RTP) are sufficiently conservative for protection of the plant against thermal-hydraulic instabilities. The basis for the 5% RTP difference between the OPRM Upscale OPERABLE (18% RPT) and OPRM Upscale auto-enable value (23% RTP) is to ensure that no credible event, e.g. loss of feed water heating, could result in a plant power excursion where an INOPERABLE OPRM channel entered into the OPRM ARMED region. Peach Bottom plant specific analyses performed at these low power levels (Ref. 23) have demonstrated that any power excursion resulting from credible events is bounded by 5% RTP. In addition, both the core-wide and channel decay ratios at the OPRM Upscale auto-enabled values are extremely low as documented in Ref. 21, which demonstrates the low possibility of thermal hydraulic instabilities at low power and confirms the conservatisms in the OPRM Upscale function auto-enable RTP value. The conservatisms in the determination of the values for OPRM Upscale function OPERABLE and the OPRM Upscale function auto enabled sufficiently compensate for possible inaccuracy of the APRM simulated thermal power signal versus actual core thermal power at power levels < 23% RTP. Therefore, there is no need to perform any calibration of the APRM simulated thermal power signal to calculated

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

power with RTP < 23% in order to determine the OPRM Upscale function OPERABLE.

If any OPRM auto-enable setpoint is in a non-conservative condition, i.e. the OPRM Upscale is not auto-enabled with RTP ≥ 23% and reactor recirculation drive flow ≤ 75% of rated, the associated channel is considered inoperative for the OPRM Upscale function. Alternatively, the auto-enable set point may be adjusted to place the channel in a conservative condition (armed). If placed in the armed condition, the channel is considered OPERABLE.

Note (h) reflects the need for plant data collection in order to test the DSS-CD equipment. Testing the DSS-CD equipment ensures its proper operation and prevents spurious reactor trips. Entry into the DSS-CD Armed Region without automatic arming of DSS-CD during this initial testing phase also allows for changes in plant operations to address maintenance or other operational needs. However, during this initial testing period, the OPRM upscale function is OPERABLE and DSS-CD operability and capability to automatically arm shall be maintained at recirculation drive flow rates above the DSS-CD Armed Region flow boundary.

An OPRM Upscale trip is issued from an OPRM channel when the confirmation density algorithm in that channel detects oscillatory changes in the neutron flux, indicated by periodic confirmations and amplitude exceeding specified setpoints for a specified number of OPRM cells in the channel. An OPRM Upscale trip is also issued from the channel if any of the defense-in-depth algorithms (PBDA, ABA, GRA) exceed their trip condition for one or more cells in that channel.

Three of the four channels are required to be operable. Each channel is capable of detecting thermal-hydraulic instabilities, by detecting the related neutron flux oscillations, and issuing a trip signal before the SLMCPR is exceeded. There is no Allowable Value for this function.

The OPRM Upscale Function is not LSSS SL-related (Reference 21) and Reference 22 confirms that the OPRM Upscale Function settings based on DSS-CD also do not have traditional instrumentation setpoints determined under an instrument setpoint methodology.

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~~

See Insert F for modified I.1 and I.2, and for added I.3, J.1, J.2, J.3, and K.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 hour duration is judged to be reasonable.~~

~~The 12 hour Completion Time of I.1 is provided to establish the alternate detect and suppress method regardless of whether the 120 day Completion time of I.2 applies. If the inoperable condition is such that action I.2 does not apply, then Condition J is entered once Required Action I.1 has been completed or once the Completion Time of Required Action I.1 has expired.~~

(continued)

BASES

See Insert F for modified I.1 and I.2, and for added I.3, J.1, J.2, J.3, and K.1

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.

The 12 hour Completion Time of I.1 is provided to establish the alternate detect and suppress method regardless of whether the 120 day Completion time of I.2 applies. If the inoperable condition is such that action I.2 does not apply, then Condition J is entered once Required Action I.1 has been completed or once the Completion Time of Required Action I.1 has expired.

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)

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

ACTIONS

I.1

If OPRM Upscale trip capability is not maintained, Condition I exists and Backup Stability Protection (BSP) is required. The Manual BSP Regions are described in Reference 21. The Manual BSP Regions are procedurally established consistent with the guidelines identified in Reference 21 and require specified manual operator actions if certain predefined operational conditions occur.

The Completion Time of immediate is based on the importance of limiting the period of time during which no automatic or alternate detect and suppress trip capability is in place.

I.2 and I.3

Actions I.2 and I.3 are both required to be taken in conjunction with Action I.1 if OPRM Upscale trip capability is not maintained. As described in Section 7.4 of Reference 21, the Automated BSP Scram Region is designed to avoid reactor instability by automatically preventing entry into the region of the power and flow-operating map that is susceptible to reactor instability. The reactor trip would be initiated by the modified APRM Simulated Thermal Power-High scram setpoints for flow reduction events that would have terminated in the Manual BSP Region I. The Automated BSP Scram Region ensures an early scram and SLMCPR protection.

The Completion Time of 12 hours to complete the specified actions is reasonable, based on operational experience, and based on the importance of restoring an automatic reactor trip for thermal hydraulic instability events.

Backup Stability Protection is intended as a temporary means to protect against thermal-hydraulic instability events. The action should be initiated immediately to document the situation and prepare the report. The reporting requirements of Specification 5.6.8 document the corrective actions and schedule to restore the required channels to an OPERABLE status. The Completion Time of 90 days shown in Specification 5.6.8 is adequate to allow time to evaluate the cause of the inoperability and to determine the appropriate corrective actions and schedule to restore the required channels to OPERABLE status.

J.1

If the Required Action I is not completed within the associated Completion Time, then Action J is required. The Bases for the Manual BSP Regions and associated Completion Time is addressed in the Bases for I.1. The Manual BSP Regions are required in conjunction with the BSP Boundary.

J.2

The BSP Boundary, as described in Section 7.3 of Reference 21, defines an operating domain where potential instability events can be effectively addressed by the specified BSP manual operator actions. The BSP Boundary is constructed such that a flow reduction event initiated from this boundary and terminated at the core natural circulation line (NCL) would not exceed the Manual BSP Region I stability criterion. Potential instabilities would develop slowly as a result of the feedwater temperature transient (Reference 21).

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

The Completion Time of 12 hours to complete the specified actions is reasonable, based on operational experience, to reach the specific condition from full power conditions in an orderly manner and without challenging plant system.

J.3

Backup Stability Protection (BSP) is a temporary means for protection against thermal-hydraulic instability events. An extended period of inoperability without automatic trip capability is not justified. Consequently, the required channels are required to be restored to OPERABLE status within 120 days.

Based on engineering judgment, the likelihood of an instability event that could not be adequately handled by the use of the BSP Regions (See Action J.1) and the BSP Boundary (See J.2) during a 120-day period is negligibly small. The 120-day period is intended to allow for the case where limited 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 Conditions A and B.

A Note is provided to indicate that LCO 3.0.4 is not applicable. The intent of the note is to allow plant startup while operating within the 120 day Completion Time for Required Action J.3. 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.

K.1

If the required channels are not restored to OPERABLE status and the Required Actions of J are not met within the associated Completion Times, then the plant must be placed in an operating condition in which the LCO does not apply. To achieve this status, the plant must be brought to less than 18% RTP within 4 hours. The allowed Completion Time is reasonable, based on operating experience, to reach the specified operating power level from full power conditions in an orderly manner and without challenging plant systems.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.1.19

Deleted

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.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

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-33566P, "Safety Analysis Report for Exelon Peach Bottom Atomic Power Station Units 2 and 3, Constant Pressure Power Uprate," Revision 0.

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.

(continued)

BASES

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.

Deleted

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

Deleted

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

Deleted

16. ~~NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology And Reload Applications," August 1996.~~

Deleted

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

Deleted

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.

20. Setpoint Methodology for Peach Bottom Atomic Power Station and Limerick Generating Station, CC-MA-103-2001.

See Insert G for added references

TSB 3.3.1.1 Insert G

References

21. GE Hitachi Nuclear Energy, “GE Hitachi Boiling Water Reactor, Detect and Suppress Solution – Confirmation Density,” NEDC-33075P-A, Revision 8, November 2013.

22. GEH letter to NRC, "NEDC-33075P-A, Detect and Suppress Solution - Confirmation Density (DSS-CD) Analytical Limit (TAC No. MD0277)," October 29, 2008. (ADAMS Accession No. ML083040052)

23. 000N7936-R0, “Project Task Report – Exelon Generation Company LLC, Peach Bottom Atomic Power Station Unit 2 & 3 MELLLA+, Task T0202: Thermal-Hydraulic Stability,” April 2014.

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 Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operating domain has not been analyzed for single recirculation loop operation. Therefore, single loop operation is prohibited in the MELLLA+ operating domain (Ref. 7)."

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."

(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.

"Single loop operation is prohibited in the MELLLA+ operating domain per Reference 7."

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

ACTIONS
(continued)

A.1

With the requirements of the LCO not met, 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.

"Note that single loop operation is prohibited in the MELLLA+ operating domain per Reference 7."

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~~ C.1

With no recirculation loops in operation or the Required Action and associated Completion Time of Condition A or B 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.

"B.1

The Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operating domain is not analyzed for single recirculation loop operation. Therefore, single loop operation is prohibited in the MELLLA+ operating domain (Ref. 7). Action shall be taken to immediately exit the MELLLA+ domain in order to return to operation at an analyzed condition. However, it is expected that plan design limitations will preclude operation in the MELLLA+ domain with a single recirculation loop."

(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 the specified Frequency after both loops are in operation. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

"and operation in the MELLLA+ domain is prohibited per Reference 7"

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.

6. NEDC-33566P, "Safety Analysis Report for Exelon Peach Bottom Atomic Power Station Units 2 and 3, Constant Pressure Power Uprate," Revision 0.

7. NEDC-33006P-A, "Maximum Extended Load Line Limit Analysis Plus Licensing Topical Report," Revision 3, June 2009.

ATTACHMENT 5

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. 50-277 and 50-278

MELLLA+ License Amendment Request

<u>NEDC-33720, Safety Analysis Report for Peach Bottom Atomic Power Station Units 2 & 3 Maximum Extended Load Line Limit Analysis Plus (Non-proprietary)</u>

GE Hitachi Nuclear Energy

NEDO-33720
Revision 0
September 2014

Non-Proprietary Information – Class I (Public)

SAFETY ANALYSIS REPORT
FOR
PEACH BOTTOM ATOMIC POWER STATION
UNITS 2 & 3
MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS

INFORMATION NOTICE

This is a non-proprietary version of the document NEDC-33720P, Revision 0, which has the proprietary information removed. Portions of the document that have been removed are indicated by an open and closed bracket as shown here [[ ]].

IMPORTANT NOTICE REGARDING CONTENTS OF THIS REPORT

Please Read Carefully

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EXECUTIVE SUMMARY

This report summarizes the results of all significant safety evaluations (SEs) performed that justify the expansion of the core flow (CF) operating domain for the Peach Bottom Atomic Power Station Units 2 and 3 (PBAPS). The changes expand the operating domain in the region of operation with less than rated core flow (RCF), but do not increase the licensed power level or the maximum CF. The expanded operating domain is identified as maximum extended load line limit analysis plus (MELLLA+).

The scope of evaluations required to support the expansion of the CF operating domain to the MELLLA+ boundary is contained in the licensing topical report (LTR) NEDC-33006P-A, “Maximum Extended Load Line Limit Analysis Plus,” referred to as the M+LTR (Reference 1). This report provides a systematic disposition of the M+LTR subjects applied to PBAPS, including performance of plant-specific assessments and confirmation of the applicability of generic assessments to support a MELLLA+ CF operating domain expansion.

It is not the intent of this report to address all the details of the analyses and evaluations reported herein. Only previously Nuclear Regulatory Commission (NRC)-approved or industry-accepted methods were used for the analyses of accidents and transients. Therefore, because the safety analysis methods have been previously addressed, the details of the methods are not presented for review and approval in this report. Also, event and analysis descriptions that are already provided in other licensing reports or the Updated Final Safety Analysis Report (UFSAR) are not repeated within this report.

The MELLLA+ operating domain expansion is applied as an incremental expansion of the operating boundary without changing the maximum licensed power or CF, or the current plant vessel dome pressure. This report supports operation of PBAPS at a licensed thermal power (LTP) of 3,951 MWt with CF as low as 83% of RCF. The MELLLA+ core operating domain expansion does not require major plant system modifications. The core operating domain expansion involves changes to the operating power/CF map, application of the Detect and Suppress Solution - Confirmation Density (DSS-CD) stability solution, and changes to a small number of instrument setpoints. Because there are no increases in the operating pressure, power, steam flow rate, and feedwater (FW) flow rate, there are no significant effects on the plant systems outside of the nuclear steam supply system (NSSS). There is a potential increase in the steam moisture content at certain times while operating in the MELLLA+ operating domain. The effects of the potential increase in moisture content on plant systems have been evaluated and determined to be acceptable. The MELLLA+ operating domain expansion does not cause additional requirements to be imposed on any of the safety, balance-of-plant (BOP), electrical, or auxiliary systems. No changes to the power generation and electrical distribution systems are required as a result of the MELLLA+ operating domain expansion.

Evaluations of the reactor, engineered safety features (ESFs), power conversion, emergency power, support systems, environmental issues, and design basis accidents (DBAs) were performed. The following conclusions summarize the results of the evaluations presented in this report.

- All safety aspects of the plant that are affected by MELLLA+ operating domain expansion were evaluated.
- There is no change in the existing design basis and licensing basis acceptance criteria of the plant.
- Evaluations were performed using NRC-approved or industry-accepted analytical methods.
- No major hardware modifications to safety-related equipment are required to support MELLLA+ operating domain expansion.
- Systems and components affected by MELLLA+ were reviewed to ensure that there is no significant challenge to any safety system.
- Potentially affected commitments to the NRC were reviewed.

This report summarizes the results of the SEs needed to justify a licensing amendment to allow the MELLLA+ operating domain expansion to a minimum CF rate of 83% of RCF at 100% current licensed thermal power (CLTP). These SEs demonstrate that the MELLLA+ operating domain expansion can be accommodated:

- without a significant increase in the probability or consequences of an accident previously evaluated;
- without creating the possibility of a new or different kind of accident from any accident previously evaluated; and
- without exceeding any presently existing regulatory limits or acceptance criteria applicable to the plant that might cause a reduction in a margin of safety.

Therefore, the requested MELLLA+ operating domain expansion does not involve a significant hazards consideration.

ACRONYMS

Term	Definition
1RPT	One Recirculation Pump Trip
2RPT	Two Recirculation Pump Trip
ABSP	Automated Backup Stability Protection
AC	Alternating Current
ADS	Automatic Depressurization System
AL	Analytical Limit
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
AOO	Anticipated Operational Occurrence
AOP	Abnormal Operating Procedure
APRM	Average Power Range Monitor
ARI	Alternate Rod Insertion
ART	Adjusted Reference Temperature
ARTS	APRM / RBM / Technical Specifications
ASME	American Society of Mechanical Engineers
AST	Alternate Source Term
ATWS	Anticipated Transient Without Scram
ATWSI	ATWS With Instability
AV	Allowable Value
BOC	Beginning of Cycle
BOP	Balance-of-Plant
BSP	Backup Stability Protection
BTP	Branch Technical Position
BTU/lbm	BTU per Pounds Mass
BWR	Boiling Water Reactor
BWROG	BWR Owners' Group
BWRVIP	Boiling Water Reactor Vessel Internals Project
CAP	Containment Accident Pressure
CCF	Common Cause Failure
CDA	Confirmation Density Algorithm
CDF	Core Damage Frequency
CF	Core Flow
CFFF	Condensate Full Flow Filtration

Term	Definition
cfm	Cubic Feet per Minute
CFR	Code of Federal Regulations
CLTP	Current Licensed Thermal Power
CO	Condensation Oscillation
COLR	Core Operating Limits Report
CPR	Critical Power Ratio
ΔCPR	Change in Critical Power Ratio
CRD	Control Rod Drive
CRDA	Control Rod Drop Accident
CRGT	Control Rod Guide Tube
CS	Core Spray
CST	Condensate Storage Tank
DBA	Design Basis Accident
DC	Direct Current
DIR	Design Input Request
DOR	Division of Responsibility
DP	Differential Pressure
DSS-CD	Detect and Suppress Solution – Confirmation Density
DSS-CD LTR	DSS-CD Licensing Topical Report (NEDC-33075P-A Revision 8)
DTR	Draft Task Report
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
EFPY	Effective Full Power Years
EMA	Equivalent Margin Analysis
EOC	End of Cycle
EOOS	Equipment Out-of-Service
EOP	Emergency Operating Procedure
EOR	End of Rated
EPRI	Electric Power Research Institute
EPU	Extended Power Uprate
EQ	Environmental Qualification
ESF	Engineered Safety Feature
°F	Degrees Fahrenheit
FAC	Flow-Accelerated Corrosion
FCV	Flow Control Valve

Term	Definition
FFWTR	Final Feedwater Temperature Reduction
FHA	Fuel Handling Accident
FIV	Flow-Induced Vibration
FTR	Final Task Report
FW	Feedwater
FWCF	Feedwater Controller Failure (Maximum Demand)
FWHOOS	Feedwater Heater(s) Out-of-Service
GEH	GE-Hitachi Nuclear Energy Americas LLC
GESTAR	General Electric Standard Application for Reactor Fuel
GNF	Global Nuclear Fuel – Americas, LLC
gpm	Gallons per Minute
GSF	Generic Shape Function
GWd/ST	Gigawatt Days per Short Ton
HCTL	Heat Capacity Temperature Limit
HELB	High Energy Line Break
HFCL	High Flow Control Line
HPCI	High Pressure Coolant Injection
HPCIL8	Inadvertent HPCI Start with Level 8 Trip
HSBW	Hot Shutdown Boron Weight
HVAC	Heating, Ventilation, and Air Conditioning
HWC	Hydrogen Water Chemistry
IASCC	Irradiation Assisted Stress Corrosion Cracking
ICF	Increased Core Flow
ICPR	Initial Critical Power Ratio
ID	Internal Diameter
IGSCC	Intergranular Stress Corrosion Cracking
ILBA	Instrument Line Break Accident
IPE	Individual Plant Examination
IRM	Intermediate Range Monitor
ISI	In-Service Inspection
ISP	Integrated Surveillance Program
IST	In-Service Testing
JPSL	Jet Pump Sensing Line
K_f	Flow Dependent Power Limit
LAR	License Amendment Request

Term	Definition
LCO	Limiting Condition for Operation
LDR	Load Definition Report
LERF	Large Early Release Frequency
LFWH	Loss of Feedwater Heating
LHGR	Linear Heat Generation Rate
$LHGRFAC_f$	Linear Heat Generation Rate Flow Factor
LOCA	Loss-of-Coolant Accident
LOFW	Loss of Feedwater
LOOP	Loss of Off-Site Power
LPCI	Low Pressure Coolant Injection
LPRM	Local Power Range Monitor
LRNBP	Generator Load Rejection Without Bypass
LTP	Licensed Thermal Power
LTR	Licensing Topical Report
MAPLHGR	Maximum Average Planar Linear Heat Generation Rate
MCO	Moisture Carryover
MCPR	Minimum Critical Power Ratio
$MCPR_f$	Minimum Critical Power Ratio Flow Factor
$MCPR_p$	Minimum Critical Power Ratio Power Factor
MCR	Main Control Room
MELB	Moderate Energy Line Break
MELLLA	Maximum Extended Load Line Limit Analysis
MELLLA+	Maximum Extended Load Line Limit Analysis Plus
MFLCPR	Maximum Fraction of Limiting Critical Power Ratio
MFLPD	Maximum Fraction of Limiting Power Density
MIP	MCPR Importance Parameter
Mlb/hr	Millions of Pounds per Hour
Mlbm/hr	Millions of Pounds Mass per Hour
M+LTR	MELLLA+ Licensing Topical Report (NEDC-33006P-A Revision 3)
MOC	Middle of Cycle
MOP	Mechanical Overpower
MOV	Motor-Operated Valve
MPS	Minimum Recirculation Pump Speed
MS	Main Steam
M+SAR	MELLLA+ Safety Analysis Report (NEDC-33720P Revision 0)

Term	Definition
MSF	Modified Shape Function
MSIV	Main Steam Isolation Valve
MSIVC	Main Steam Isolation Valve Closure
MSIVF	Main Steam Isolation Valve Closure with Scram on High Flux
MSL	Main Steam Line
MSLBA	Main Steam Line Break Accident
MWd/ST	Megawatt Days per Short Ton
MWt	Megawatt-Thermal
NCL	Natural Circulation Line
NMCA	Noble Metal Chemical Addition
NPSH	Net Positive Suction Head
NPSHA	Net Positive Suction Head Available
NPSHR	Net Positive Suction Head Required
NRC	Nuclear Regulatory Commission
NSDC	Normal Shutdown Cooling Function
NSRB	Nuclear Safety Review Board
NSSS	Nuclear Steam Supply System
NTSP	Nominal Trip Setpoint
NUMAC	Nuclear Measurement Analysis and Control
OLMCPR	Operating Limit Minimum Critical Power Ratio
OLTP	Original Licensed Thermal Power
OOS	Out-of-Service
OPRM	Oscillation Power Range Monitor
PB	Integrated Bundle Power
PBAPS	Peach Bottom Atomic Power Station Units 2 and 3
PBDA	Period Based Detection Algorithm
PCT	Peak Cladding Temperature
PLM	Product Lifecycle Management
PORC	Plant Operations Review Committee
ppm	Parts per Million
PRA	Probabilistic Risk Assessment
PRFO	Pressure Regulator Failure - Open
PRNM	Power Range Neutron Monitor
PRNMS	Power Range Neutron Monitoring System
psi	Pounds per Square Inch

Term	Definition
psia	Pounds per Square Inch - Absolute
psid	Pounds per Square Inch - Differential
psig	Pounds per Square Inch - Gauge
PWP	Project Work Plan
QAP	Quality Assurance Program
RAI	Request for Additional Information
RBM	Rod Block Monitor
RCF	Rated Core Flow
RCIC	Reactor Core Isolation Cooling
RCPB	Reactor Coolant Pressure Boundary
RE	Responsible Engineer
RG	Regulatory Guide
RHR	Residual Heat Removal
RIPD	Reactor Internal Pressure Difference
RMCS	Reactor Manual Control System
RPIS	Rod Position Information System
RPT	Recirculation Pump Trip
RPTOOS	Recirculation Pump Trip Out-of-Service
RPV	Reactor Pressure Vessel
RRS	Reactor Recirculation System
RSD	Replacement Steam Dryer
RSLB	Recirculation Suction Line Break
RT_{NDT}	Reference Temperature of Nil-Ductility Transition
RWCU	Reactor Water Cleanup
RWE	Rod Withdrawal Error
RWM	Rod Worth Minimizer
S_{AD}	Amplitude Discriminator Setpoint
SBO	Station Blackout
SDC	Shutdown Cooling
SE	Safety Evaluation
SER	Safety Evaluation Report
SFP	Spent Fuel Pool
SGTS	Standby Gas Treatment System
SLC	Standby Liquid Control
SLCS	Standby Liquid Control System

Term	Definition
SLMCPR	Safety Limit Minimum Critical Power Ratio
SLO	Single Loop Operation
SORV	Stuck Open Relief Valve
SPC	Suppression Pool Cooling
SPDS	Safety Parameter Display System
SRLR	Supplemental Reload Licensing Report
SRM	Source Range Monitor
SRO	Strong Rod Out
SRP	Standard Review Plan
SRV	Safety Relief Valve
SRVDL	Safety Relief Valve Discharge Line
SRVOOS	Safety Relief Valve – Out-of-Service
SSV	Spring Safety Valve
SSW	Sacrificial Shield Wall
STP	Simulated Thermal Power
TAF	Top of Active Fuel
TBVOOS	Turbine Bypass Valves Out-of-Service
T_{FW}	Feedwater Temperature
THI	Thermal Hydraulic Instability
TIP	Traversing Incore Probe
TLO	Two-Loop Operation
T-M	Thermal-Mechanical
T_{min}	Minimum Stable Film Boiling Temperature
TOP	Thermal Overpower
TR	Task Report
TS	Technical Specification(s)
TSD	Task Scoping Document
TSV	Turbine Stop Valve
TTNBP	Turbine Trip Without Bypass
TTWBP	Turbine Trip With Bypass
UHS	Ultimate Heat Sink
UFSAR	Updated Final Safety Analysis Report
USE	Upper Shelf Energy
V&V	Verification and Validation
VFC	Bundle Average In-Channel Void Fraction

Term	Definition
VPF	Vane Passing Frequency
WRNM	Wide Range Neutron Monitoring
wt %	Percent by Weight

1.0 INTRODUCTION

This report summarizes the results of all significant SEs performed that justify the expansion of the operating boundary that would permit PBAPS operation at a CLTP of 3,951 MWt and with a CF as low as 83% of RCF. The changes expand the operating domain in the region of operation with less than RCF, but do not increase the licensed power level or the maximum CF. The expanded operating domain is identified as MELLLA+.

The scope of evaluations required to support the expansion of the CF operating domain to the MELLLA+ boundary is contained in the LTR NEDC-33006P-A, "Maximum Extended Load Line Limit Analysis Plus," referred to as the M+LTR (Reference 1). This report provides a systematic disposition of the M+LTR subjects applied to PBAPS, including performance of plant-specific assessments and confirmation of the applicability of generic assessments to support a MELLLA+ CF operating domain expansion.

The MELLLA+ core operating domain expansion does not require major plant hardware modifications. In accordance with Limitation and Condition 12.2 of the NRC safety evaluation report (SER) for MELLLA+ (Reference 1), referred to as the M+LTR SER, PBAPS will implement the DSS-CD solution, with limitations and conditions as identified in the DSS-CD LTR SER (Reference 2). The purpose and content of the NRC SER for NEDE-33147P-A Revision 4 (Reference 3) has also been implemented to address M+LTR SER Limitation and Condition 12.2. DSS-CD requires a revision to the existing stability solution software. The operating domain expansion involves changes to the operating power/CF map and changes to a small number of instrument setpoints. Because there are no increases in the operating pressure, power, steam flow rate, and FW flow rate, there are no significant effects on the plant hardware outside of the NSSS. There is a potential increase in the steam moisture content at certain times while operating in the MELLLA+ operating domain. The effects of the potential increase in moisture content on plant hardware have been evaluated and determined to be acceptable. The MELLLA+ operating domain expansion does not cause additional requirements to be imposed on any of the safety, BOP, electrical, or auxiliary systems. No changes to the power generation and electrical distribution systems are required due to the introduction of MELLLA+.

This report also addresses applicable limitations and conditions as described in the M+LTR SER, the NRC SER for the GE-Hitachi Nuclear Energy Americas LLC (GEH) LTR NEDC-33173P-A, "Applicability of GE Methods to Expanded Operating Domains," referred to as the Methods LTR (Reference 4), and in the NRC SER for the GEH LTR NEDE 32906P, Supplement 3-A, "Migration to TRACG04 / PANAC11 from TRACG02 / PANAC10 for TRACG AOO and ATWS Overpressure Transients" (Reference 5).

The disposition of each applicable limitation and condition is discussed along with the relevant section of this report. A complete listing of the required M+LTR SER, Methods LTR SER, DSS-CD LTR SER, and Migration to TRACG04 / PANAC11 from TRACG02 / PANAC10 for TRACG AOO and ATWS Overpressure Transients LTR SER limitations and conditions, and

the sections of this report which address them, is presented in Appendices A, B, C, and D, respectively.

1.1 REPORT APPROACH

The evaluations provided in this report demonstrate that the MELLLA+ operating domain expansion can be accomplished within the applicable safety design criteria. Many of the SEs and equipment assessments previously performed for the PBAPS extended power uprate (EPU) are unaffected because the MELLLA+ operating domain expansion effects are limited to the NSSS system.

This PBAPS MELLLA+ safety analysis report (M+SAR) follows the same structure and content as the M+LTR (Reference 1). Two dispositions of the evaluation topics are used to characterize the MELLLA+ evaluation scope. Topics are dispositioned as either "Generic" or "Plant Specific" as described in Sections 1.1.1 and 1.1.2, respectively.

1.1.1 Generic Assessments

Generic assessments are those SEs that can be dispositioned by:

- Providing or referencing a bounding analysis for the limiting conditions;
- Demonstrating that there is a negligible effect due to MELLLA+;
- Identifying the portions of the plant that are unaffected by the MELLLA+ power/flow map operating domain expansion; or
- Demonstrating that the sensitivity to MELLLA+ is small enough that the required plant cycle-specific reload analysis process is sufficient and appropriate for establishing the MELLLA+ licensing basis in accordance with M+LTR SER Limitation and Condition 12.3.c and as defined in General Electric Standard Application for Reactor Fuel (GESTAR) (Reference 6).

  As per M+LTR SER Limitation and Condition 12.4, the plant-specific MELLLA+ application shall provide the plant-specific thermal limits assessment and transient analysis results. Considering the timing requirements to support the reload, the fuel and cycle-dependent analyses including the plant-specific thermal limits assessment may be submitted by supplementing the initial M+SAR. Additionally, the Supplemental Reload Licensing Report (SRLR) for the initial MELLLA+ implementation cycle shall be submitted for NRC staff confirmation.

  Some of the SEs affected by MELLLA+ are fuel operating cycle (reload) dependent. Reload dependent evaluations require that the reload fuel design, core loading pattern, and operational plan be established so that analyses can be performed to establish core operating limits. The reload analysis demonstrates that the core design for MELLLA+ meets the applicable NRC evaluation criteria and limits documented in Reference 6. [[

]] No plant can enter the MELLLA+ domain unless the appropriate reload core analysis is performed and all criteria and limits documented in Reference 6 are satisfied. Otherwise, the plant would be in an unanalyzed condition. Based on current requirements, the reload analysis results are documented in the SRLR, and the applicable core operating limits are documented in the plant-specific Core Operating Limits Report (COLR).

As required by M+LTR SER Limitation and Condition 12.3.b, the applicability of the generic assessments to PBAPS is identified and confirmed in the applicable sections. In the event that the generic assessment presented in the M+LTR is not applicable to PBAPS, a plant-specific evaluation per Section 1.1.2 is completed to demonstrate the acceptability of the MELLLA+ operating domain expansion.

1.1.2 Plant-Specific Evaluation

A PBAPS-specific evaluation is provided for SEs not categorized as Generic. Where applicable, the assessment methodology in References 1, 6, 7, 8, or 9 is referenced. As required by M+LTR SER Limitation and Condition 12.3.a, the plant-specific evaluations are reported consistent with the content, structure, and level of detail indicated in the M+LTR.

The plant-specific evaluations performed and reported in this document use plant-specific values to model the actual plant systems, transient response, and operating conditions.

1.1.3 Computer Codes and Methods

NRC-approved or industry-accepted computer codes and calculational techniques are used in the evaluations for the MELLLA+ operating domain. The primary computer codes used for PBAPS evaluations are listed in Table 1-1. The application of these codes complies with the limitations, restrictions, and conditions specified in the approving NRC SER. Exceptions to the use of the code or special conditions of the applicable SER are included as notes to Table 1-1.

The Methods LTR NEDC-33173P-A (Reference 4) documents all analyses supporting the conclusions in this section that the application ranges of GEH codes and methods are adequate in the MELLLA+ operating domain. In accordance with the M+LTR SER Limitation and Condition 12.1, the range of mass fluxes and power/flow ratios in the GEXL database covers the intended MELLLA+ operating domain. The database includes low flow, high qualities, and void fractions. There are no restrictions on the application of the GEXL-PLUS correlation in the MELLLA+ operating domain.

As required by M+LTR SER Limitation and Condition 12.23.2, the PBAPS-specific ODYN and TRACG calculation parameters are provided in Table 9-2.

As discussed in Section 1.0, consistent with M+LTR SER Limitation and Condition 12.2, the specific limitations and conditions associated with the M+LTR, Methods LTR, DSS-CD LTR, and Migration to TRACG04 / PANAC11 from TRACG02 / PANAC10 for TRACG AOO and ATWS Overpressure Transients LTR are discussed along with the relevant section of this report. A summary of the required M+LTR SER, Methods LTR SER, DSS-CD LTR SER, and Migration to TRACG04 / PANAC11 from TRACG02 / PANAC10 for TRACG AOO and ATWS Overpressure Transients LTR SER limitations and conditions and the sections of this report which address them is presented in Appendices A, B, C, and D, respectively.

1.1.4 Scope of Evaluations

Sections 2.0 through 11.0 provide evaluations of the MELLLA+ operating domain expansion on the respective topics. The scope of the evaluations is summarized in the following sections.

Section 2.0, Reactor Core and Fuel Performance: The plant specific (cycle independent) equilibrium core and fuel performance is demonstrated to show the effects of MELLLA+ on thermal margins, reactivity margins, and stability with the GNF2 fuel product line. The cycle specific evaluations for each reload are evaluated and documented in the SRLR and COLR for each fuel cycle that implements the MELLLA+ operating domain.

Section 3.0, Reactor Coolant and Connected Systems: Evaluations of the NSSS components and systems are performed in the MELLLA+ operating domain. Because the reactor operating pressure and the CF are not increased by MELLLA+, the effects on the reactor coolant and connected systems are minor. These evaluations confirm the acceptability of the MELLLA+ changes to process variables in the NSSS.

Section 4.0, Engineered Safety Features: The effects of MELLLA+ operating domain expansion on the containment, emergency core cooling systems (ECCS), standby gas treatment system (SGTS), and other ESFs are evaluated. The operating pressure for ESF equipment is not increased because operating pressure and safety relief valve (SRV) setpoints are unchanged as a result of MELLLA+.

Section 5.0, Instrumentation and Control: The instrumentation and control systems and analytical limits (ALs) for setpoints are evaluated to establish the effects of MELLLA+ operating domain expansion on process parameters. The scope of MELLLA+ effects on the controls and setpoints is limited because the MELLLA+ parameter variations are limited to the core.

Section 6.0, Electrical Power and Auxiliary Systems: Because the power level is not changed by MELLLA+, the electrical power and distribution systems are not affected. The auxillary systems have been previously evaluated to ensure they are capable of supporting safe plant operation at CLTP, which is unchanged by MELLLA+ operating domain expansion.

Section 7.0, Power Conversion Systems: Because the pressure, steam flow, and FW flow do not change as a result of MELLLA+ operating domain expansion, the power conversion systems are not affected by MELLLA+.

Section 8.0, Radwaste Systems and Radiation Sources: The liquid and gaseous waste management systems are not affected by the MELLLA+ operating domain changes.

Section 9.0, Reactor Safety Performance Evaluations: The UFSAR anticipated operational occurrences (AOOs), DBAs, and special events are reviewed as part of the MELLLA+ evaluation.

Section 10.0, Other Evaluations: High energy line break (HELB) and environmental qualification (EQ) evaluations for the MELLLA+ domain are confirmed to demonstrate the operability of plant equipment at MELLLA+ conditions. The effects on the individual plant examination (IPE) are evaluated to demonstrate there is no significant change to the PBAPS vulnerability to severe accidents.

Section 11.0, Licensing Evaluations: The effect on Technical Specifications (TS), the Environmental Assessment, and the No Significant Hazards Consideration are provided as a part of the accompanying license amendment request (LAR).

1.1.5 Product Line Applicability

The M+LTR describes processes, evaluations, and dispositions applicable to GE boiling water reactor (BWR) product lines BWR/3, BWR/4, BWR/5, and BWR/6. As such, the M+LTR process is applicable to PBAPS, a BWR/4.

1.1.6 Report Generation and Review Process

GEH Scope

This M+SAR represents several years of project planning activities, engineering analysis, technical verification, and technical review. The final stages of the M+SAR preparation include M+SAR integration, additional review, on-site safety review committee review, and submittal to NRC. The PBAPS MELLLA+ project relied on the generic M+LTR submitted to and approved by the NRC (Reference 1).

The project began with the respective GEH and Exelon project managers creating a project work plan (PWP). This PWP, developed in accordance with GEH engineering procedures, was used to define the plant-specific work scope, inputs and outputs required for project activities. A division of responsibility (DOR) between Exelon and GEH was used to further develop the work scope and assign responsible engineers (REs) from each organization. A task scoping document (TSD) applicable for each GEH task was created, reviewed, and approved by Exelon prior to any technical work being performed. Each GEH task RE submitted a design input request (DIR) to the Exelon task RE interface to define the correct plant information for use in the GEH task analysis and evaluation. Additional DIRs were submitted as the project continued. A plant-specific M+SAR "shell" was created that contains the appropriate depth of information expected in the final M+SAR.

All pertinent information is captured in an individual task product lifecycle management (PLM) specification maintained by the GEH RE with oversight by the respective engineering manager. Each specification contains the quality assurance records applicable to the task, which includes evidence of design verification.

A draft task report (DTR) was created for every GEH task. The DTR includes a description of the analysis performed, inputs, methods applied, results obtained and includes input to the applicable M+SAR section(s). The DTR with M+SAR input was verified, in accordance with the GEH quality assurance program (QAP), by a GEH technical verifier and a GEH Regulatory Affairs verifier, with oversight by the responsible GEH technical manager and GEH Project Manager. The DTR with M+SAR input was transmitted by the GEH Project Manager to Exelon and reviewed by the Exelon RE and other Exelon engineers, as appropriate. Subsequent comments were resolved between the GEH and the Exelon REs and a final task report (FTR) with M+SAR input was developed. The FTR with M+SAR input was again verified (whether or not there were changes to the document), in accordance with the GEH QAP, by a GEH technical verifier and a GEH Regulatory Affairs verifier, with oversight by the responsible GEH technical manager and GEH Project Manager. The GEH Project Manager transmitted the FTR with M+SAR input to the Exelon Project Manager.

For the PBAPS MELLLA+ project, Exelon personnel:

1. Conducted multidisciplinary technical reviews of GEH evaluation reports (DTRs with M+SAR input and FTRs with M+SAR input) to ensure:
    i. Appropriate use of design inputs;
    ii. Consistency with the M+LTR; and
    iii. Design basis and licensing basis requirements were addressed.
2. Provided technical review results, in the form of detailed comments, to GEH performers;
3. Participated in discussions with GEH REs to address and resolve comments; and
4. Controlled the application of the Exelon off-site services process to GEH.

The Regulatory Affairs RE integrated the individual M+SAR sections creating a draft M+SAR that was verified, in accordance with the GEH QAP, by another GEH Regulatory Affairs engineer, with oversight by the GEH Regulatory Affairs New Plant Projects / Services Licensing Manager and the GEH Project Manager. The GEH Project Manager transmitted the verified draft M+SAR to Exelon where it received another complete review by Exelon's technical personnel, project staff, and Licensing staff.

Exelon personnel generated questions and comments, which were responded to by GEH's technical and Regulatory Affairs personnel. The M+SAR was then presented to Exelon's on-site safety review committee (i.e., plant operations review committee (PORC)) and to the off-site safety review committee (i.e., nuclear safety review board (NSRB)). After resolution of any final comments, the Final M+SAR was submitted to the NRC.

1.1.7 Report Generation and Review Process

Exelon Scope

As noted in Section 1.1.6 above, a DOR between Exelon and GEH was used to further develop the work scope and assign REs from each organization. Tasks assigned to Exelon REs were performed under the Exelon 10 Code of Federal Regulations (CFR) 50, Appendix B QAP,

where applicable. The Exelon assigned tasks were performed internally by Exelon engineers or contracted out to engineering consulting firms on the Exelon approved supplier list. Where applicable, the contractors applied a 10 CFR 50, Appendix B QAP.

Exelon internal tasks were prepared, reviewed, and approved in accordance with applicable procedures.

For contracted tasks, a TSD applicable for each task was created, reviewed, and approved by Exelon prior to any technical work being performed. This work scope formed the basis for the MELLLA+ task. The design inputs were then collected, reviewed, and forwarded to the engineering consultant, in accordance with applicable procedures.

FTRs, and other engineering products, when issued, are processed through the Exelon engineering change process as a final verification of acceptability and retained as quality records in the Exelon nuclear records management system.

1.2 OPERATING CONDITIONS AND CONSTRAINTS

1.2.1 Power/Flow Map

The PBAPS power/flow map including the MELLLA+ operating domain expansion is shown in Figure 1-1. [[

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All lines on the power/flow map in Figure 1-1, other than those associated with the MELLLA+ operating domain expansion, are unchanged by MELLLA+.

In accordance with M+LTR SER Limitation and Condition 12.5.c, PBAPS will include the power/flow map in the COLR once the MELLLA+ operating domain expansion is approved.

The MELLLA+ domain extends from 55% RCF at 78.8% of CLTP to 83% RCF at 100% of CLTP. Normal core performance characteristics for plant power/flow maneuvers at near full power can be accomplished above 55% RCF. Due to stability considerations at high power and low CF, the MELLLA+ domain was not extended below 55% RCF. The reactor operating conditions following an unplanned event could stabilize at a power/flow point outside the allowed operating domain. If this occurs, plant procedures will direct the operators to place the plant back into the allowed operating domain.

The steady state core thermal power to CF ratio for the statepoints that define the MELLLA+ domain are listed in Table 1-3. Each point listed is in compliance with the Methods LTR SER Limitation and Condition 9.3 of 50 MWt/Mlbm/hr with the exception of one point on Figure 1-1: the point of low flow / high power, point 'K' (55% of RCF / 78.8% of CLTP). Extended periods of continuous operation above the threshold 50 MWt/Mlbm/hr power-to-flow ratio is unlikely. Because the limitation is not intended to place operational restrictions on the plant (Reference 4), the PBAPS MELLLA+ power/flow map shall remain as shown in Figure 1-1.

As PBAPS exceeds the power-to-flow ratio of 50 MWt/Mlbm/hr at 55% RCF, an assessment of the limitation with respect to the conservatism of the power distribution uncertainties is performed. The results of this assessment are provided in Section 2.2.5.

1.2.2 Reactor Heat Balance

The nominal rated reactor heat balance is not affected by MELLLA+. The changes in the reactor heat balance resulting from the MELLLA+ operating range expansion are only those that are a result of the decrease in recirculation pump heat and the decrease in core inlet enthalpy as a result of the lower operating domain.

1.2.3 Core and Reactor Conditions

As mentioned previously, the MELLLA+ operating domain expansion results in changes to the core and reactor.

Table 1-2 compares maximum extended load line limit analysis (MELLLA) and MELLLA+ thermal-hydraulic operating conditions for PBAPS. The differences shown in Table 1-2 are typical of other BWR plants analyzed for MELLLA+ operating domain expansion, and the core operating conditions listed in Table 1-3 represent the maximum allowed power-to-flow ratio statepoints within the boundaries of the MELLLA+ operating domain.

The decay heat is principally a function of the reactor power level and the irradiation time. The MELLLA+ operating domain expansion does not alter either of these two parameters, and therefore, there is no first order effect on decay heat. Enrichment, exposure, void fraction, power history, cycle length, and refueling batch fraction have a second order effect on decay heat. [[

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M+LTR SER Limitation and Condition 12.23.5 states that the conclusion of the LTR and associated SE are limited to reactors operating with a power density lower than 52.5 MW/Mlbm/hr for operation at minimum allowable CF at 120% original licensed thermal power (OLTP). PBAPS is licensed for operation at 120% of OLTP. At this power level, the power density is 46.4 MW/Mlbm/hr, which satisfies this requirement.

1.2.4 Operational Enhancements

The following table provides the performance improvement and/or equipment out-of-service (EOOS) features applicable to PBAPS and whether they are allowed in the MELLLA+ operating domain. The table also dispositions other operational enhancements that were discussed in the M+LTR (Reference 1).

Operational Enhancements	MELLLA+	PBAPS M+SAR
Increased Core Flow (ICF)	Allowed	Included
Final Feedwater Temperature Reduction (FFWTR)	Not Allowed	Not Included
Feedwater Heater Out-of-Service (OOS) with a License Condition	Allowed	Included
Single Loop Operation (SLO)	Not Allowed	Not Included
Safety Relief Valves – Out-of-Service (SRVOOS) (1 valve)	Allowed	Included
Turbine Bypass Valves Out-of-Service (TBVOOS)	Allowed	Included
End of Cycle (EOC) Recirculation Pump Trip Out-of-Service (RPTOOS)	Allowed	Included
24 Month Cycle	Allowed	Included

The evaluations performed in support of MELLLA+ operating domain expansion consider each of the operational enhancements listed as "Allowed". Because the operational enhancements are considered as a part of the design inputs for evaluations performed in support of MELLLA+ operating domain expansion, these operational enhancements are evaluated across the scope of this M+SAR and are therefore not dispositioned in a specific section.

The PBAPS MELLLA+ LAR includes a proposed license condition that 1) restricts operation in the MELLLA+ domain to FW temperatures within 10 degrees of the design and 2) prohibits FFWTR within the MELLLA+ domain. The effects from this license condition were evaluated, and the results were found to be acceptable. This license condition satisfies M+LTR SER Limitation and Condition 12.5.b.

SLO in the MELLLA+ domain is not allowed. As required by M+LTR SER Limitation and Condition 12.5.a, TS 3.4.1 is being modified as shown in the Exelon MELLLA+ LAR package to specify that SLO operation is prohibited in the MELLLA+ operating domain. The present licensing basis for SLO will remain available per plant TS.

1.3 Summary and Conclusions

This M+SAR documents the results of analyses necessary to expand the operating domain of the PBAPS plant to include the MELLLA+ domain. This document conforms to the scope, content and structure described in the M+LTR, which the NRC has determined "is acceptable for referencing in licensing applications for GE-designated boiling water reactors to the extent

specified and under the limitations and conditions delineated in the TR [task report] and in the enclosed final SE [safety evaluation]."

Table 1-1 Computer Codes Used in the M+SAR Evaluations

Task	Computer Code*	Version or Revision	NRC Approved	Comments
Reactor Heat Balance	ISCOR	09	Y(1)	NEDE-24011P Rev. 0 SER
Reactor Core and Fuel Performance	TGBLA PANAC ISCOR	06 11 09	Y(2) Y(2) Y(1)	NEDE-30130P-A NEDE-30130P-A NEDE-24011P Rev. 0 SER
Thermal Hydraulic Stability	ODYSY ISCOR PANAC TRACG	05 09 11 04	Y Y(1) Y(3) Y(14)	NEDE-33213P-A NEDE-24011P Rev. 0 SER NEDE-30130P-A NEDE-33147P-A, Rev. 4
Reactor Internal Pressure Differences	LAMB TRACG ISCOR	07 02 09	(4) (5) Y(1)	NEDE-20566P-A, September 1986 NRC TAC No. M90270, Sept. 1994 NEDE-24011P Rev. 0 SER
Reactor Recirculation System	BILBO	04V	(8)	NEDE-23504, Feb. 1977
Reactor Pressure Vessel (RPV) Fluence	TGBLA DORTG	06 01	Y N	(2) (11, 12)
Containment System Response	M3CPT LAMB	05 08	Y (4)	NEDM-10320, March 1971 (Reference 10) NEDE-20566-P-A, September 1986 (Reference 11)
Annulus Pressurization Loads	ISCOR	09	Y(1)	NEDE-24011P Rev. 0 SER
ECCS-Loss-of-Coolant Accident (LOCA)	LAMB PRIME SAFER ISCOR TASC	08 03 04 09 03	Y Y(15) Y Y(1) Y	NEDE-20566P-A NEDC-33256P-A Rev. 1, NEDC-33257P-A Rev. 1, NEDC-33258P-A Rev. 1 (9) (10) NEDE-24011P Rev. 0 SER NEDC-32084P-A Rev. 2
Transient Analysis	PANAC ISCOR TRACG	11 09 04	Y(6) Y(1) Y	NEDE-30130P-A NEDE-24011P Rev. 0 SER NEDE-32906-P-A Rev. 3, NEDE-32906P Supp. 3-A, Rev. 1 (6)
Anticipated Transient Without Scram (ATWS)	ODYN STEMP PANAC TASC ISCOR TRACG	10 04 11 03 09 04	Y (7) Y(6) Y Y(1) Y(13)	NEDC-24154P-A, Supplement 1, Vol. 4 (Reference 12) NEDE-30130P-A NEDC-32084P-A Rev. 2 NEDE-24011P Rev. 0 SER NEDE-32906P Supplement 3-A, Revision 1

* The application of these codes to the MELLLA+ analyses complies with the limitations, restrictions, and conditions specified in the approving NRC SER where applicable for each code. The application of the codes also complies with the SERs for the MELLLA+ programs.

Notes for Table 1-1:

(1) The ISCOR code is not approved by name. However, in the SER supporting approval of NEDE-24011P Revision 0 by the May 12, 1978 letter from D. G. Eisenhut (NRC) to R. Gridley (GE), the NRC finds the models and methods acceptable for steady-state thermal-hydraulic analysis, and mentions the use of a digital computer code. The referenced digital computer code is ISCOR. The use of ISCOR to provide core thermal-hydraulic information in reactor internal pressure differences (RIPDs), transient, ATWS, stability, and LOCA applications is consistent with the approved models and methods.

(2) The use of TGBLA Version 06 and PANAC Version 11 was initiated following approval of Amendment 26 of GESTAR II by letter from S. A. Richards (NRC) to G. A. Watford (GE) Subject: "Amendment 26 to GE Licensing Topical Report NEDE-24011P-A, GESTAR II Implementing Improved GE Steady-State Methods," (TAC NO. MA6481), November 10, 1999.

(3) The use of PANAC Version 11 was initiated following approval of Amendment 26 of GESTAR II by letter from S.A. Richards (NRC) to G.A. Watford (GE) Subject: "Amendment 26 to GE Licensing Topical Report NEDE-24011P-A, GESTAR II Implementing Improved GE Steady-State Methods," (TAC NO. MA6481), November 10, 1999.

(4) The LAMB code is approved for use in ECCS-LOCA applications (NEDE-20566-P-A), but no approving SER exists for the use of LAMB for the evaluation of RIPDs or containment system response. The use of LAMB for these applications is consistent with the model description of NEDE-20566-P-A.

(5) NRC has reviewed and accepted the TRACG application for the flow-induced loads on the core shroud as stated in NRC SER TAC No. M90270.

(6) The physics code PANAC provides inputs to the transient codes ODYN and TRACG04. The use of PANAC Version 11 in conjunction with TRACG04 was approved by the NRC SE for NEDE-32906P Supplement 3-A, Revision 1, April 2010.

(7) The STEMP code uses fundamental mass and energy conservation laws to calculate the suppression pool heatup. The use of STEMP was noted in NEDE-24222, "Assessment of BWR Mitigation of ATWS, Volume I & II (NUREG-0460 Alternate No. 3)," December 1, 1979. The code has been used in ATWS applications since that time. There is no formal NRC review and approval of STEMP or the ATWS topical report.

(8) Not a safety analysis code that requires NRC approval. The code application is reviewed and approved by GEH for "Level-2" application and is part of GEH's standard design process. Also, the application of this code has been used in other MELLLA+ and power uprate submittals.

(9) General Electric Company, "SAFER Model for Evaluation of Loss-of-Coolant Accidents for Jet Pump and Non-Jet Pump Plants," NEDE-30996P-A, October 1987.

(10) Letter, Richard E. Kingston (GEH) to NRC, "Transmittal of Revision 1 of NEDC-32950, Compilation of Improvements to GENE's SAFER ECCS-LOCA Evaluation Model," MFN 07-406, July 31, 2007.

(11) CCC-543, "TORT-DORT Two- and Three-Dimensional Discrete Ordinates Transport Version 2.8.14," Radiation Shielding Information Center (RSIC), January 1994.

(12) Letter, H. N. Berkow (NRC) to G. B. Stramback (GE), "Final Safety Evaluation Regarding Removal of Methodology Limitations for NEDC-32983P-A, General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations (TAC No. MC3788)," November 17, 2005.

(13) TRACG04 is approved by the NRC for application to ATWS overpressure transients in NEDE-32906P Supplement 3-A, "Migration to TRACG04 / PANAC11 from TRACG02 / PANAC10 for TRACG AOO and ATWS Overpressure Transients," April 2010. ODYN remains the licensing basis code for ATWS long-term analysis consistent with the NRC SE for NEDC-33006P. The use of TRACG04 for the best-estimate TRACG ATWS with depressurization and ATWS with instability (ATWSI) analysis is required by the NRC SE for NEDC-33006P.

(14) TRACG04 application for DSS-CD is documented in NEDE-33147P-A Revision 4 (Reference 3).

(15) Application of PRIME models and data to downstream methods is approved by NEDO-33173 Supplement 4-A, "Implementation of PRIME Models and Data in Downstream Methods," Revision 1, November 2012 (Reference 4).

Table 1-2 Comparison of Thermal-Hydraulic Parameters

Parameter	MELLLA 100% CLTP, 99% Core Flow	MELLLA 100% CLTP, 99% Core Flow, 90°F Feedwater Temperature Reduction	MELLLA+ 100% CLTP, 83% Core Flow	MELLLA+ 77.8% CLTP, 55% Core Flow
Thermal Power (MWt)	3,951	3,951	3,951	3,113
Dome Pressure (psia)	1,050	1,033	1,050	1,017
Steam Flow Rate (Mlb/hr)	16.169	14.533	16.150	12.347
Feedwater Flow Rate (Mlbm/hr)	16.137	14.501	16.118	12.315
Feedwater Temperature (°F)	381.5	291.5	381.4	359.5
Core Flow (Mlb/hr)	101.475	101.475	85.075	56.375
Core Inlet Enthalpy (BTU/lbm)	521.2	508.9	515.1	500.1
Core Pressure Drop (psi)	24.4	23.7	18.8	13.4
Core Average Void Fraction	0.48	0.44	0.51	0.51
Core Exit Void Fraction	0.71	0.69	0.74	0.76

Table 1-3 Core Thermal Power to Core Flow Ratios

Steady-State Operation	Point on the Power/Flow Map	Core Thermal Power (MWt/%CLTP)	Core Flow (Mlbm/hr/%rated)	Power-to-Flow Ratio (MWt/Mlbm/hr)
Current Operating Domain 99% Rated Core Flow	D	3,951 / 100.0	101.5 / 99.0	38.9
MELLLA+ Operating Domain 83% Rated Core Flow	J	3,951 / 100.0	85.1 / 83.0	46.4
MELLLA+ Operating Domain 55% Rated Core Flow	K	3,113 / 78.8	56.4 / 55.0	55.2

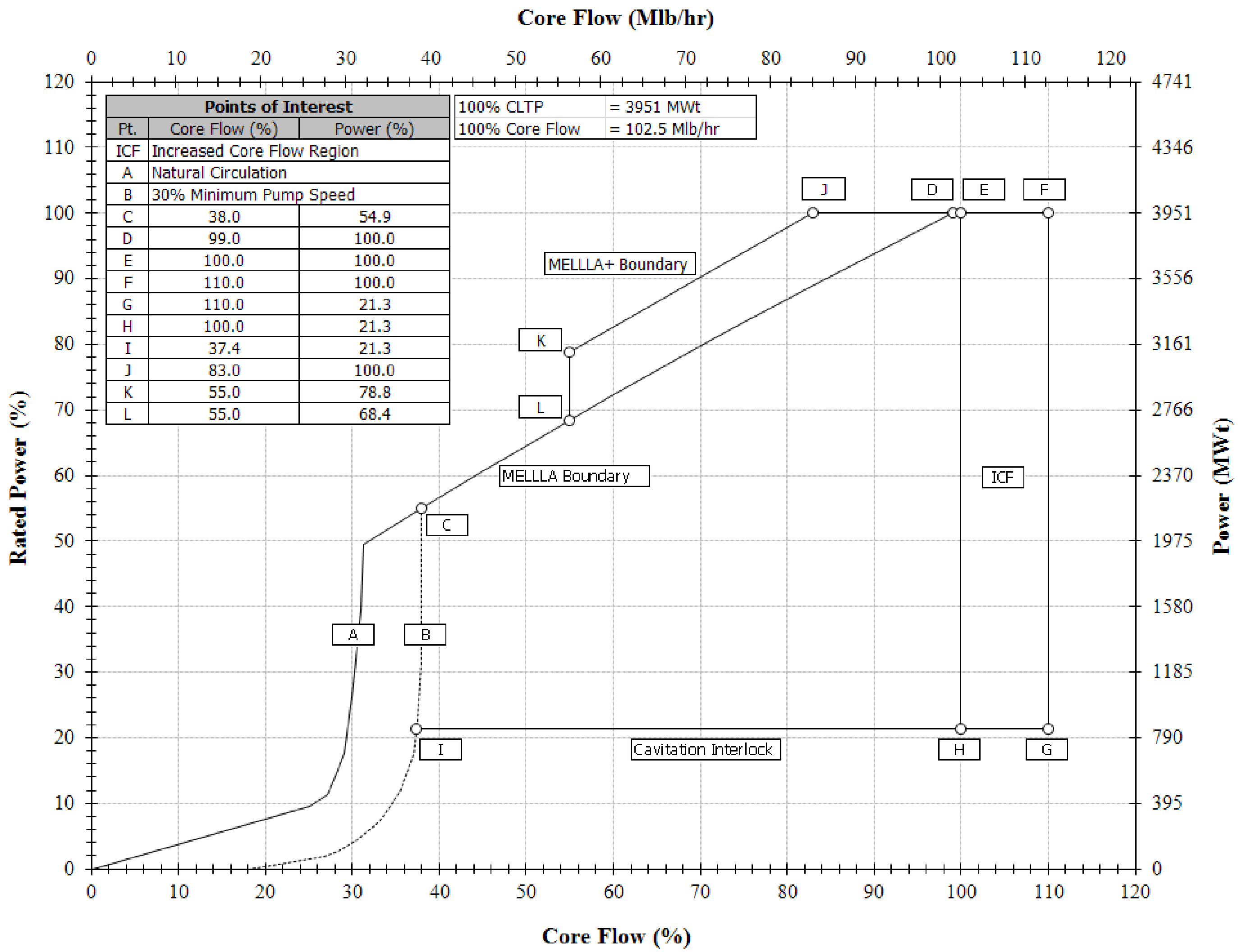

Figure 1-1 Power/Flow Operating Map for MELLLA+

2.0 REACTOR CORE AND FUEL PERFORMANCE

This section addresses the evaluations that are applicable to MELLLA+.

Because PBAPS currently uses GNF2 fuel, the following limitations and conditions from the Methods LTR SER (Reference 4) are not applicable to the PBAPS M+SAR:

Methods LTR SER Limitations and Conditions:

Limitation and Condition 9.13: APPLICATION OF 10 WEIGHT PERCENT GD

Limitation and Condition 9.21: MIXED CORE METHOD 1

Limitation and Condition 9.22: MIXED CORE METHOD 2

2.1 FUEL DESIGN AND OPERATION

The effect of MELLLA+ on the fuel design and operation is described below. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Fuel Product Line Design	Generic	Meets M+LTR Disposition
Core Design	Generic	Meets M+LTR Disposition
Fuel Thermal Margin Monitoring Threshold	Generic	Meets M+LTR Disposition

2.1.1 Fuel Product Line

The fuel design limits are established for all new fuel product line designs as a part of the fuel introduction and reload analyses. The M+LTR establishes that there are no changes in fuel product line design as a consequence of MELLLA+. Because implementation of the MELLLA+ operating domain does not necessitate a new fuel design, no additional fuel and core design evaluation is required.

PBAPS currently operates with Global Nuclear Fuel – Americas, LLC (GNF) fuel. The PBAPS Units 2 and 3 cores at the time of MELLLA+ implementation are expected to consist only of GNF2 fuel. For PBAPS, no new fuel product line design is introduced and there is no change to fuel design limits required by the MELLLA+ introduction at PBAPS. Consistent with M+LTR SER Limitation and Condition 12.3.e, the usage of GNF2 is specifically addressed in the M+SAR. The SRLR will confirm that there are no new fuel products as a result of MELLLA+ and validate the conclusion that no additional fuel and core design evaluation is required for PBAPS.

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2.1.2 Core Design and Fuel Thermal Monitoring Threshold

The M+LTR states that the maximum licensed power level and fuel design do not change as a result of MELLLA+. There is no change to the average power density as a result of MELLLA+ operating domain expansion. Because the maximum licensed power level and fuel product line design do not change as a result of MELLLA+, there is no increase in the average bundle power or in the maximum allowable peak bundle power. Because there is no change in average power density there is no change required to the fuel thermal monitoring threshold.

There are no changes to the PBAPS fuel or fuel design limits as a result of MELLLA+. PBAPS continues to use the GNF2 fuel product line. The LTP with MELLLA+ remains at 3,951 MWt. This validates the conclusion that there are no changes needed to the fuel thermal monitoring threshold.

Furthermore, because the MELLLA+ operating domain allows higher bundle power versus flow conditions, the M+LTR recognizes that the range of void fraction, axial and radial power shape, and rod positions in the core may change slightly. While the change in power distribution in the core is achieved, the individual fuel bundles remain within the allowable thermal limits as defined in the COLR.

Also, per Methods LTR SER Limitation and Condition 9.17, the range of void fraction, axial and radial power shape, and rod positions in the core does change slightly as a result of MELLLA+ operating domain expansion. For PBAPS, the predicted bypass void fraction at the D-Level local power range monitor (LPRM) satisfies the [[ ]] design requirement. The steady-state bypass voiding is demonstrated on the MELLLA+ upper boundary at 100% power in Table 2-2.

The SRLR will validate that the power distribution in the core is achieved while maintaining individual fuel bundles within the allowable thermal limits as defined in the COLR.

As required by Methods LTR SER Limitation and Condition 9.24, the following core design and fuel monitoring parameters are plotted as indicated below in Table 2-1 and Figures 2-1 through 2-6 for each cycle exposure statepoint. The parameters are compared to the experience base reported in Reference 4:

Table 2-1 Peak Nodal Exposures

Figure 2-1 Power of Peak Bundle versus Cycle Exposure

Figure 2-2 Coolant Flow for Peak Bundle versus Cycle Exposure

Figure 2-3 Exit Void Fraction for Peak Power Bundle versus Cycle Exposure

Figure 2-4 Maximum Channel Exit Void Fraction versus Cycle Exposure

Figure 2-5 Core Average Exit Void Fraction versus Cycle Exposure

Figure 2-6 Peak LHGR versus Cycle Exposure

In accordance with M+LTR SER Limitation and Condition 12.24.2, the exit void fraction for peak power bundle versus cycle exposure is provided in Figure 2-3.

Also, quarter core maps with mirror symmetry are plotted in Figure 2-7 through Figure 2-15 showing bundle power, bundle operating linear heat generation rate (LHGR), and minimum critical power ratio (MCPR) for beginning of cycle (BOC) (0 MWd/ST), middle of cycle (MOC) (8,000 MWd/ST), and end of rated (EOR) (16,000 MWd/ST) conditions. The maximum fraction of limiting power density (MFLPD) occurs at 0 MWd/ST (Figure 2-10) and the largest maximum fraction of limiting critical power ratio (MFLCPR) occurs at 10,800 MWd/ST (Figure 2-16) for this core design. In Figure 2-7 through Figure 2-9, the bundle power is dimensionless. To obtain the bundle power in MWt, multiply each number by a factor of 5.17. This factor equals 3,951/764, where 3,951 MWt is the rated thermal power and 764 is the total number of fuel bundles in the core.

Table 2-1 shows that PBAPS's peak nodal exposure is lower than the top two reference plants. Figure 2-1, Figure 2-2, and Figure 2-6 show that the PBAPS MELLLA+ operation is in the expected range as compared to the reference plants. Figures 2-3 through 2-5 shows that exit voiding at PBAPS is higher than other plants. This is because of operating a high power density plant at lower CFs through the entire cycle. Figures 2-7 through 2-9 show the relative bundle power for BOC, MOC, and EOR, respectively. Figures 2-10 through 2-12 show the operating LHGR for BOC, MOC, and EOR, respectively. Figures 2-13 through 2-15 show the MCPR for BOC, MOC, and EOR, respectively. Figures 2-7 through 2-16 show that the general operational conditions for PBAPS in the MELLLA+ operating domain are within expected parameters.

Therefore, PBAPS meets all M+LTR dispositions for core design and the fuel thermal monitoring threshold.

2.2 THERMAL LIMITS ASSESSMENT

The effect of MELLLA+ on the MCPR safety and operating limits, maximum average planar linear heat generation rate (MAPLHGR), and LHGR limits is described below. As required by Methods LTR SER Limitation and Condition 9.6, the GNF2 bundle R-factors generated for this project are consistent with GNF standard design practices, which use an axial void profile shape with 60% average in-channel voids. This is consistent with lattice axial void conditions expected for the hot channel operating state as shown in Figure 2-17.

As required by Methods LTR SER Limitation and Condition 9.15, the nodal void reactivity biases applied in TRACG are applicable to the lattices representative of fuel loaded in the core. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Safety Limit MCPR	Generic	Meets M+LTR Disposition
Operating Limit MCPR	Generic	Meets M+LTR Disposition
MAPLHGR Limit	Generic	Meets M+LTR Disposition
LHGR Limit	Generic	Meets M+LTR Disposition

2.2.1 Safety Limit Minimum Critical Power Ratio

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]] the SLMCPR is calculated based on the actual core loading pattern for each reload core. In the event that the cycle-specific SLMCPR is not bounded by the current PBAPS TS value, PBAPS must implement a license amendment to change the TS.

The SLMCPR analysis for PBAPS reflects the actual plant core loading pattern and is performed for each reload core. The cycle-specific SLMCPR will be determined using the methods defined in Reference 6. As required by M+LTR SER Limitation and Condition 12.6, the SLMCPR will be calculated at the rated statepoint (100.0% of CLTP / 100.0% of CF), the upper left corner of the MELLLA+ upper boundary (100% of CLTP / 83.0% of CF), the lower left corner of the MELLLA+ upper boundary (78.8% of CLTP / 55.0% of CF), and the CLTP at the ICF statepoint (100.0% of CLTP / 110.0% of CF) (i.e., Figure 1-1 Statepoints E, J, K and F, respectively). See Section 1.2.1 for further information on the power-to-flow statepoints. The currently approved off-rated CF uncertainty applied to the SLO operation is used for the minimum CF Statepoint J and at 55.0% of CF Statepoint K. The calculated values will be documented in the SRLR.

As noted in Section 2.2.5 and Table 2-3, there are statepoints where the power-to-flow ratio exceeds 42 MWt/Mlbm/hr. As required by Methods LTR SER Limitation and Condition 9.5, for MELLLA+ operation with a power-to-flow ratio greater than 42 MWt/Mlbm/hr, a +0.02 SLMCPR adder will be added to the cycle-specific SLMCPR determined based on M+LTR SER Limitation and Condition 12.6. The cycle-specific SLMCPR analysis will incorporate a +0.02 SLMCPR adder for MELLLA+ operation. The calculated values will be documented in the SRLR. A TS change will be requested if the current value is not bounding.

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2.2.2 Operating Limit Minimum Critical Power Ratio

The M+LTR states that the operating limit minimum critical power ratio (OLMCPR) is calculated by adding the change in MCPR due to the limiting AOO event to the SLMCPR. [[

]] The OLMCPR is determined on a cycle-specific basis from the results of the reload transient analysis, as described in Reference 6. The cycle-specific analysis results are documented in the SRLR and included in the COLR. The MELLLA+ operating conditions do not change the methods used to determine this limit.

The OLMCPR for PBAPS is calculated by adding the change in MCPR due to the limiting AOO event to the SLMCPR. [[

]] if the Methods LTR SER and M+LTR SER penalties are not applied to PBAPS. The OLMCPR for PBAPS is determined on a cycle-specific basis from the results of the reload transient analysis, as described in Reference 6. The PBAPS cycle-specific analysis results are documented in the SRLR and included in the COLR. The MELLLA+ operating conditions do not change the methods used to determine this limit. With the usage of TRACG-AOO instead of ODYN the +0.01 adder to the resulting OLMCPR as required by Methods LTR SER Limitation and Condition 9.19 is no longer applicable and will not be applied to the OLMCPR.

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2.2.3 Maximum Average Planar Linear Heat Generation Rate Limits

The M+LTR describes that the MAPLHGR limits ensure that the plant does not exceed regulatory limits established in 10 CFR 50.46. Section 4.3, Emergency Core Cooling System Performance, presents the evaluation to demonstrate that plants meet the regulatory limits in the MELLLA+ operating domain. [[

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The PBAPS MAPLHGR limits ensure that PBAPS does not exceed regulatory limits established in 10 CFR 50.46. Section 4.3 of this M+SAR presents the evaluation to demonstrate that PBAPS meets the regulatory limits in the MELLLA+ operating domain. [[

]] The MELLLA+ operating conditions do not change the methods used to determine this limit.

[[

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2.2.4 Linear Heat Generation Rate Limits

The M+LTR describes that LHGR limits ensure that the plant does not exceed fuel thermal-mechanical (T-M) design limits. The LHGR is determined by the fuel rod T-M design and is not

affected by MELLLA+ operating domain expansion. No changes to the fuel rod are required as a part of MELLLA+. [[
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The PBAPS LHGR limits ensure that the plant does not exceed fuel T-M design limits. There are no changes to the PBAPS fuel or fuel design limits as a result of MELLLA+. PBAPS continues to use the GNF2 fuel product line. [[
]] The MELLLA+ operating conditions do not change the methods used to determine this limit.

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2.2.5 Power-to-Flow Ratio

Methods LTR SER Limitation and Condition 9.3 requires that plant-specific EPU and expanded operating domain applications confirm that the core thermal power to CF ratio will not exceed 50 MWt/Mlbm/hr at any statepoint in the allowed operating domain. For plants that exceed the power-to-flow value of 50 MWt/Mlbm/hr, the LAR will include a power distribution assessment to establish that axial and nodal power distribution uncertainties determined via neutronic methods have not increased.

The core thermal power to CF ratio at steady-state and off-rated conditions along the MELLLA+ boundary is reported in Table 2-3. Table 2-3 identifies that the power-to-flow ratio of 50 MWt/Mlbm/hr at 55% RCF is exceeded.

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2.3 REACTIVITY CHARACTERISTICS

The effect of MELLLA+ on hot excess reactivity, strong rod out (SRO) shutdown margin, and standby liquid control system (SLCS) shutdown margin is described below. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Hot Excess Reactivity	Generic	Meets M+LTR Disposition
Strong Rod Out Shutdown Margin	Generic	Meets M+LTR Disposition
SLCS Shutdown Margin	Generic	Meets M+LTR Disposition

2.3.1 Hot Excess Reactivity

The M+LTR describes that operation in the MELLLA+ operating domain may change the hot excess reactivity during the cycle. This change in reactivity does not affect safety and is not expected to significantly affect the ability to manage power distribution through the cycle and to achieve the target power level. [[ ]] The MELLLA+ operating conditions do not change the methods used to evaluate hot excess reactivity.

[[ ]] PBAPS continues to operate on a 24-month cycle length. The MELLLA+ operating conditions do not change the PBAPS methods used to evaluate that sufficient hot excess reactivity exists to match the 24-month cycle conditions.

[[ ]]

2.3.2 Strong Rod Out Shutdown Margin

The M+LTR describes that, for SRO shutdown margin, higher core average void fraction results in higher plutonium production, increased hot reactivity later in the operational cycle, and decreased hot-to-cold reactivity differences. Smaller cold shutdown margins may result from cores designed for operation with the MELLLA+ operating domain expansion. This potential loss in margin is offset through core design to maintain current design and TS cold shutdown margin requirements. All minimum SRO shutdown margin requirements apply to cold most reactive conditions and are maintained without change for MELLLA+ implementation. In order to account for reactivity uncertainties, including the effects of temperature and analysis methods, margin well in excess of the TS limits is included in the design requirements. [[ ]] The MELLLA+ operating conditions do not change the methods used to evaluate SRO shutdown margin.

[[ ]] PBAPS current design and TS cold shutdown margin limits are unchanged by MELLLA+. The MELLLA+ operating conditions do not change the PBAPS methods used to evaluate that SRO shutdown margin meets the current PBAPS design and TS cold shutdown limits.

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2.3.3 SLCS Shutdown Margin

The M+LTR describes that, for the SLCS Shutdown Margin, higher core average void fraction results in higher plutonium production, increased hot reactivity later in the operational cycle, and decreased hot-to-cold reactivity differences. Smaller cold shutdown margins may result from cores designed for operation with the MELLLA+ operating domain expansion. This potential loss in margin is offset through core design to maintain current design and SLCS TS requirements. All minimum SLCS TS requirements apply to most reactive SLCS conditions and are maintained without change for MELLLA+ implementation. In order to account for reactivity uncertainties, including the effects of temperature and analysis methods, margin in excess of the TS limits is included in the design requirements. [[

]] The MELLLA+ operating conditions do not change the methods used to evaluate the SLCS shutdown margin.

[[

]] PBAPS current design and SLCS TS requirements are unchanged by MELLLA+. The MELLLA+ operating conditions do not change the PBAPS methods used to evaluate that SLCS shutdown margin meets the current PBAPS design and SLCS TS requirements.

[[

]]

2.4 STABILITY

The DSS-CD stability solution (Reference 2) has been shown to provide an early trip signal upon instability inception prior to any significant oscillation amplitude growth and MCPR degradation for both core wide and regional mode oscillations. PBAPS Units 2 and 3 will implement the DSS-CD solution consistent with the M+LTR (Reference 1) and DSS-CD LTR (Reference 2). DSS-CD implementation includes any limitations and conditions in the applicable DSS-CD SER (Reference 2). In accordance with DSS-CD LTR SER Limitation and Condition 5.1 (Reference 2), because PBAPS Units 2 and 3 are implementing DSS-CD using the NRC approved GEH Option III platform, a plant-specific review is not required. There were no changes proposed in the bounding uncertainty or in the process to bound the uncertainty in the MCPR documented in Reference 3.

Topic	M+LTR Disposition	PBAPS Result
DSS-CD Setpoints	Generic	Meets M+LTR Disposition
Armed Region	Generic	Meets M+LTR Disposition
Backup Stability Protection (BSP)	Generic	Meets M+LTR Disposition

2.4.1 DSS-CD Setpoints

[[

]] As a part of DSS-CD implementation, the applicability checklist is incorporated into the reload evaluation process and is documented in the SRLR. DSS-CD implementation also includes incorporation of appropriate [[ ]] analyses to be performed if a specific reload analysis [[ ]] DSS-CD is incorporated per the requirements of the DSS-CD LTR. This implementation requires that a process for reviewing the DSS-CD setpoints for each reload analysis is in place. [[ ]] no further review of MELLLA+ is necessary to evaluate the adequacy of the DSS-CD setpoints.

PBAPS Units 2 and 3 will incorporate the DSS-CD solution consistent with the requirements of the DSS-CD LTR. Implementation of DSS-CD in accordance with the DSS-CD LTR ensures that PBAPS Units 2 and 3 incorporates the applicability checklist into the reload evaluation process and documents the results of the applicability checklist review in the SRLR. DSS-CD implementation per the DSS-CD LTR also ensures that PBAPS Units 2 and 3 incorporates appropriate [[ ]] analyses to be performed if a specific reload analysis [[

]]

A plant-specific review has been performed to confirm that the generic DSS-CD licensing basis is applicable to plant-specific designs. If the generic DSS-CD licensing basis is not applicable to a plant-specific design, additional analyses are necessary to demonstrate applicability. The standard plant-specific review process consists of an applicability checklist, confirming that the generic applicability envelope, as defined in Section 4.0 of Reference 2, is not exceeded. The plant-specific applicability checklists are provided in Tables 6-1 and 6-2 of Reference 2 for two-loop operation (TLO) and SLO, respectively. If any checklist criterion is not met as a result of a plant-specific design change that may affect reactor stability performance, the DSS-CD plant-

specific procedures (Tables 6-3 and 6-4 of Reference 2) are performed to demonstrate adequate SLMCPR protection and to extend the DSS-CD applicability envelope.

[[

]]

The plant-specific application demonstrates that the analyses and evaluations supporting the stability method are applicable to the fuel loaded in the core by expanding the DSS-CD Licensing Basis Extended Applicability Envelope for both TLO and SLO for GNF2 fuel. The expansion of the DSS-CD Licensing Basis Extended Applicability Envelope is performed per Reference 2. Therefore, PBAPS MELLLA+ plant-specific stability evaluations comply with M+LTR SER Limitation and Condition 12.3.f.

[[

]]

Methods LTR SER Limitation and Condition 9.18 (Reference 4) for the stability setpoints is not applicable to DSS-CD [[

]]

The CDA setpoint calculation formula and the adjustable parameters values are defined in the DSS-CD LTR (Reference 2). In accordance with DSS-CD LTR SER Limitation and Condition 5.2 (Reference 2), a reference to either the DSS-CD LTR or the GESTAR II LTR that references the latest approved DSS-CD LTR is included in the proposed changes to the PBAPS TS described in Attachment 1 of the PBAPS MELLLA+ LAR.

2.4.1.1 DSS-CD Diversity

The diverse means for the safety trip function performed by the DSS-CD algorithms at PBAPS for a postulated common-mode failure of the nuclear measurement analysis and control (NUMAC) power range neutron monitoring system (PRNMS) is Manual Operator Action. The basis that the diverse means is unlikely to be subject to the same common-mode failure that would disable the DSS-CD safety function is documented below.

The OPRM system (supporting either the DSS-CD or Option III solution) is designed to automatically detect and suppress anticipated power oscillations. The postulated common cause failure (CCF), assumed to result in comprehensive loss of PRNMS functionality, would also disable the OPRM system (i.e., CDA for DSS-CD and period based detection algorithm (PBDA) for Option III). The loss of PRNMS functionality would also disable the automated backup

stability protection (ABSP) function of DSS-CD because the average power range monitor (APRM) system would no longer be available.

As described in Section 7 and in the TS changes documented in the approved DSS-CD LTR NEDC-33075P-A, Revision 8 (Reference 2), if both the OPRM system is inoperable and the ABSP function cannot be implemented or is inoperable, the licensed stability solution becomes the manual BSP regions with the BSP boundary, which is manually implemented through administrative actions. This is essentially the same backup approach utilized in Option III for the PBDA algorithm. In the Option III solution there is only one BSP option, which is provided by the manual BSP regions and associated operator actions.

The postulated CCF in the PRNMS results in the system providing valid indications of plant conditions until the stability transient occurs, at which time they become anomalous. In the case of power oscillations, PRNMS indications of power and flow would track consistently with other plant indicators as they change to a statepoint where the potential exists for high growth-rate power oscillations (i.e., the upper left corner of the power/flow map), but fail to provide any protection when large amplitude oscillations begin to occur.

[[

]]

PBAPS emergency operating procedures (EOPs) require immediate action to reduce reactor power in order to mitigate possible high growth-rate power oscillations following unanticipated CF reduction events, such as [[ ]] Besides the indications that a 2RPT occurred, the operators would know the statepoint because the status of recirculation pumps is provided independent of PRNMS; flow information is available from the recirculation flow system, and power level information is available from either the electrical power output or a core thermal power calculation. Furthermore, the reactor recirculation flow system, rod position information system (RPIS), reactor manual control system (RMCS), and manual scram are unaffected by the CCF. Thus, the plant is able to cope with the CCF because they can determine that defensive steps are necessary and execute those steps via immediate actions (i.e., [[ ]] Because the SLMCPR is not exceeded throughout this event, the acceptance criteria provided in BTP 7-19 are automatically met.

[[

]]

The ABSP is an alternative stability solution in the event that the CDA becomes inoperable. However, ABSP is designed to prevent the core from operating in regions with high potential for THI. Therefore, a postulated CCF of the ABSP would mean that the automatic scram would not occur when the reactor is operating in the BSP Scram region. The procedures for immediate action to scram the reactor as discussed above would apply. The immediate actions provide a diverse and independent method to assure reactor protection in the event of a postulated stability event with an ABSP (or PRNMS) CCF.

In summary, the PBAPS evaluation of the CCF for the PRNMS with DSS-CD was performed to disposition undetected power oscillations using the acceptance criteria provided in BTP 7-19. It was determined that sufficient redundancy and diversity exists so that the plant has the ability to cope with any CCF in the PRNMS with Option III or DSS-CD.

2.4.2 Armed Region

The M+LTR recognizes that the DSS-CD LTR specifies the OPRM Armed Region for MELLLA+ operation. Per the DSS-CD LTR and the M+LTR, the OPRM Armed Region is generically defined as the region on the power/flow map at the MCPR monitoring threshold of 25% OLTP and rated recirculation drive flow ≤ 75% (Reference 2). For a power-uprated plant, the MCPR monitoring threshold may be scaled to a lower percent value. This scaled value defines the Armed Region boundary in this situation (Reference 2). For PBAPS, the MCPR monitoring threshold is 23.0% of EPU. As a result, the OPRM Armed Region for PBAPS is defined as the region on the power/flow map with power ≥ 23.0% of EPU and rated recirculation drive flow ≤ 75%. The OPRM Armed Region for PBAPS is illustrated in Figure 2-18.

The generic boundaries of the OPRM Armed Region are approved as a part of the DSS-CD LTR.
[[

]] no further review of MELLLA+ is necessary to evaluate the adequacy of the OPRM Armed Region.

Because PBAPS Units 2 and 3 are implementing the DSS-CD solution consistent with the DSS-CD LTR, no further review of MELLLA+ is necessary to evaluate the adequacy of the OPRM Armed Region.

2.4.3 Backup Stability Protection

The M+LTR recognizes that the DSS-CD LTR defines the BSP along with a generic process for confirming that the BSP requirements are met in each reload analysis. This BSP may be used when the OPRM system is temporarily inoperable. Implementation of DSS-CD per the DSS-CD LTR requires that the alternate stability protection approach is confirmed on a cycle-specific basis to demonstrate adequacy for each reload cycle. [[

]] no further review of MELLLA+ is necessary to evaluate the adequacy of the BSP.

Implementation of DSS-CD in accordance with the DSS-CD LTR requires that PBAPS Units 2 and 3 confirm that the BSP approach is adequate as a part of the reload analysis. Because PBAPS Units 2 and 3 are implementing the DSS-CD solution consistent with the requirements of the DSS-CD LTR, no further review of the BSP is required.

Reference 2 describes two BSP options that are based on selected elements from three distinct constituents. The three constituents are:

1. BSP Manual Regions that comprise plant-specific Scram (Region I) and Controlled Entry (Region II) regions in the licensed power/flow operating domain and associated manual operator actions (Section 7.2 of Reference 2).
2. BSP Boundary that defines the operating domain portion where potential instability events can be effectively addressed by specific operator actions (Section 7.3 of Reference 2).
3. ABSP Scram Region, which comprises an automatic reactor scram region initiated by the APRM flow-biased scram setpoint (Section 7.4 of Reference 2).

The two BSP options are:

Option 1: Consists of the BSP Manual Regions, BSP Boundary and associated operator actions.

Option 2: Consists of the ABSP Scram Region, as implemented by the APRM flow-biased scram setpoint, Region II and associated operator actions.

[[

]]

The TS changes contained in Reference 2 delineate specific implementation requirements for both BSP Options when the OPRM system is declared inoperable. BSP region statepoints are calculated on the high flow control line (HFCL) and the NCL on a plant- and cycle-specific basis

and are at least as conservative as the Base BSP regions described in Reference 2. The BSP Scram and Controlled Entry region boundaries are developed by connecting the corresponding statepoints on the HFCL and the NCL using the boundary shape function (either generic shape function (GSF) or modified shape function (MSF)) defined in Section 7.2.1 of the DSS-CD LTR (Reference 2). The manual Scram Region forms the basis for the ABSP setpoints. The BSP Manual Regions, BSP boundary, and the ABSP setpoints are confirmed or established on a cycle-specific basis. The application of ABSP complies with M+LTR SE Limitation and Condition 12.7.

The proposed TS changes for implementation of DSS-CD include a revised Action I and a new TS 5.6.8, which would require, in part, submittal of a Special Report within 90 days. The Special Report would include the plans and schedule to restore the required instrument channels to OPERABLE status. If the ABSP is not implemented consistent with proposed Action I, then the proposed Action J would require, in part, restoration of the inoperable channels within 120 days. The above complies with M+LTR SE Limitation and Condition 12.3.g.

The BSP Manual Regions and the BSP Boundary are cycle-specific and are established or confirmed for each reload and the results are documented in the SRLR.

[[

]]

The implementation of the ABSP setpoints for PBAPS Units 2 and 3 DSS-CD is determined per the process described in this section.

2.4.4 M+LTR SER Limitation and Condition 12.5.b

M+LTR SER Limitation and Condition 12.5.b requires that prohibited flexibility options be controlled by a license condition. At PBAPS, operation in the MELLLA+ domain will be restricted to FW temperatures within 10 degrees of the design temperature. The intent of the restriction is to limit the core inlet subcooling and prevent degradation of the stability response in the event of a recirculation pump trip (RPT). As described in Section 2.4.1, the plant-specific stability evaluations support an operational variance for a FW temperature within 10 degrees of the design FW temperature. This LAR includes a proposed license condition that prohibits the facility from operating in the MELLLA+ domain with a FW heating capacity less than that required to produce a FW temperature of 371.5°F at rated steady-state conditions unless analyses supporting such operations are submitted by the licensee and approved by the staff.

2.5 REACTIVITY CONTROL

The control rod drive (CRD) system controls core reactivity by positioning neutron absorbing control rods within the reactor and scramming the reactor by rapidly inserting control rods into the core. No change is made to the control rods or drive system due to MELLLA+. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Scram Time Response	Generic	Meets M+LTR Disposition
CRD Positioning and Cooling	Generic	Meets M+LTR Disposition
CRD Integrity	Generic	Meets M+LTR Disposition

2.5.1 Control Rod Scram

The generic disposition of the Control Rod Scram topic in the M+LTR describes that for BWR/3, BWR/4, and BWR/5 plants the Hydraulic Control Unit accumulators supply the initial scram pressure and, as the scram continues, the reactor becomes the primary source of pressure to complete the scram. [[

]]

Consistent with the generic disposition discussed above, the PBAPS Hydraulic Control Unit accumulators supply the initial scram pressure and, as the scram continues, the reactor becomes the primary source of pressure to complete the scram. The PBAPS reactor dome pressure is 1,050 psia (1,035 psig) and does not change as a result of MELLLA+ operating domain expansion. Therefore, the generic disposition is applicable to PBAPS in that [[

]]

Therefore, PBAPS meets all M+LTR dispositions for CRD system control rod scram.

2.5.2 Control Rod Drive Positioning and Cooling

The generic disposition of the CRD Positioning and Cooling topic in the M+LTR describes that [[

]] As a result of MELLLA+, there is no increase in temperature and [[

]] Therefore, the CRD positioning and cooling functions are not affected by MELLLA+.

Consistent with the generic disposition discussed above, for PBAPS, the reactor coolant temperature does not increase. [[

]]

Therefore, PBAPS meets all M+LTR dispositions for CRD positioning and cooling.

2.5.3 Control Rod Drive Integrity

The generic disposition of the CRD Integrity topic in the M+LTR describes that the postulated abnormal operating conditions for the CRD design assume a failure of the CRD system pressure-regulating valve that applies the maximum pump discharge pressure to the CRD mechanism internal components. This postulated abnormal pressure bounds the American Society of Mechanical Engineers (ASME) reactor overpressure limit. [[

]] Because the postulated abnormal conditions for the CRD design continue to bound the loads and stresses experienced by the CRD system, no further evaluation of CRD integrity is required as result of MELLLA+.

Consistent with the generic disposition discussed above, the PBAPS CRD mechanism has been analyzed for an abnormal pressure operation (the application of the maximum CRD pump discharge pressure) that bounds the ASME RPV overpressure condition. [[
]] Also, as stated in Section 3.1, for the ASME RPV overpressure condition, the peak RPV bottom head pressure remains less than the limit of 1,375 psig. [[
]] and no further evaluation of CRD integrity is required as result of MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for CRD integrity.

2.6 Additional Limitations and Conditions Related to Reactor Core and Fuel Performance

For that subset of limitations and conditions relating to reactor core and fuel design, which did not fit conveniently into the organizational structure of the M+LTR, the required information is presented here. The information is identified by either the M+LTR SER (Reference 1) limitation and condition or the Methods LTR SER (Reference 4) limitation and condition to which it relates.

2.6.1 TGBLA/PANAC Version

In accordance with Methods LTR SER Limitation and Condition 9.1, TGBLA06 and PANAC11 have been used to develop the PBAPS equilibrium core for the MELLLA+ evaluations. Cycle-specific analyses will be performed using these or later approved versions of the neutronic methods.

2.6.2 M+LTR SER Limitation and Condition 12.24.1

M+LTR SER Limitation and Condition 12.24.1 requires that the TRACG supporting analyses use the actual flow conditions. [[

]]

2.6.3 LHGR and Exposure Qualification

Methods LTR SER Limitation and Condition 9.12 states that once the PRIME LTR and its application are approved, future license applications for EPU and MELLLA+ referencing LTR NEDC-33173P-A must utilize the PRIME T-M methods. The PRIME LTR was approved on January 22, 2010 (Reference 15) and implemented in GESTAR II in September 2010 (Reference 6). The PBAPS M+SAR is based on the GNF2 fuel product line, which has a PRIME T-M basis. PRIME fuel parameters will be used in all analyses requiring fuel performance parameters.

The T-M evaluation performed in support of the PBAPS M+SAR was performed using the PRIME T-M methodology.

2.6.4 GEXL-PLUS and Pressure Drop Database

The applicability of the GNF2 experimental GEXL-PLUS and pressure drop database is confirmed for operation in the MELLLA+ domain.

The Methods LTR NEDC-33173P-A (Reference 4) documents all analyses supporting the conclusions in this section that the application ranges of GEH codes and methods are adequate in the MELLLA+ operating domain. In accordance with M+LTR SER Limitation and Condition 12.1, the range of mass fluxes and power/flow ratios in the GEXL-PLUS database covers the intended MELLLA+ operating domain. The database includes low flow, high qualities, and void fractions. There are no restrictions on the application of the GEXL-PLUS correlation in the MELLLA+ operating domain.

Table 2-1 Peak Nodal Exposures

Plant	Cycle	Peak Nodal Exposure (GWd/ST)
A	18	38.849
A	19	43.784
B	9	56.359
B	10	51.544
C	7	53.447
C	8	47.766
D	13	56.660
E	11	55.387
F	EQ - 120% OLTP	51.174
PBAPS PUSAR	EQ - 120% OLTP	55.578
PBAPS M+SAR	EQ - 120% OLTP	55.564

Table 2-2 Steady-State Bypass Voiding

Statepoint on Power/Flow Map	Core Power (% of Rated)	Core Flow (% of Rated)	Hot Channel Void Fraction in Bypass Region at Instrumentation D Level (ISCOR Node 21)
"E"	100.0	100.0	0.00
"D"	100.0	99.0	0.00
"J"	100.0	83.0	0.00

Table 2-3 Core Thermal Power to Core Flow Ratio at Steady-State and Off-Rated Conditions

Statepoint on Power/Flow Map	Core Power MWt (% of rated)	Core Flow Mlbm/hr (% of rated)	Power-to-Flow Ratio (MWt/Mlbm/hr)
"E"	3,951.0 (100.0)	102.500 (100.0)	38.55
"D"	3,951.0 (100.0)	101.475 (99.0)	38.94
"J"	3,951.0 (100.0)	85.075 (83.0)	46.44
"K"	3,113.4 (78.8)	56.375 (55.0)	55.23
"L"	2,702.5 (68.4)	56.375 (55.0)	47.94

Table 2-4 [[ ]]

[[	

]]

Table 2-5 [[ ]]

[[	

]]

Table 2-6 [[ ]]

[[			

]]

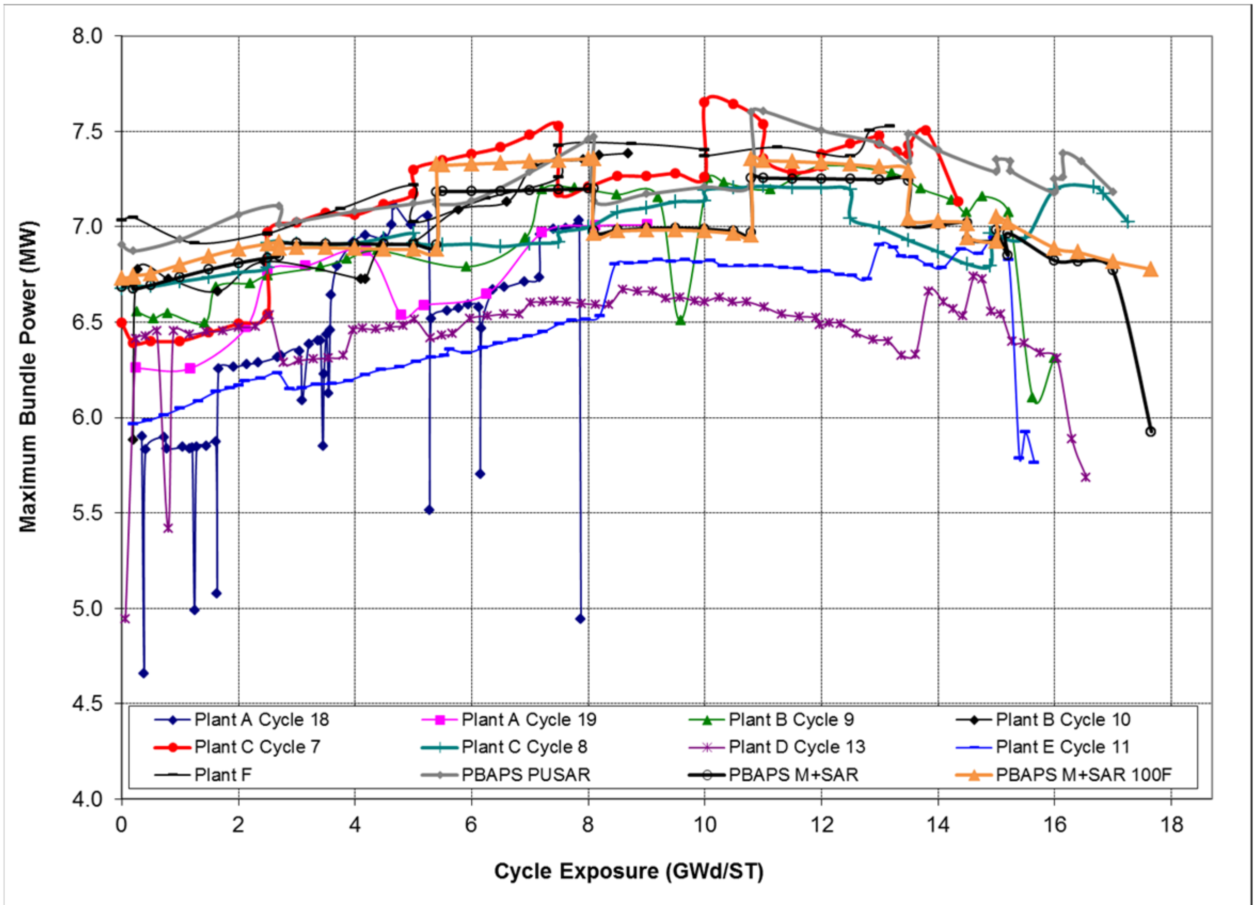


Figure 2-1 Power of Peak Bundle versus Cycle Exposure

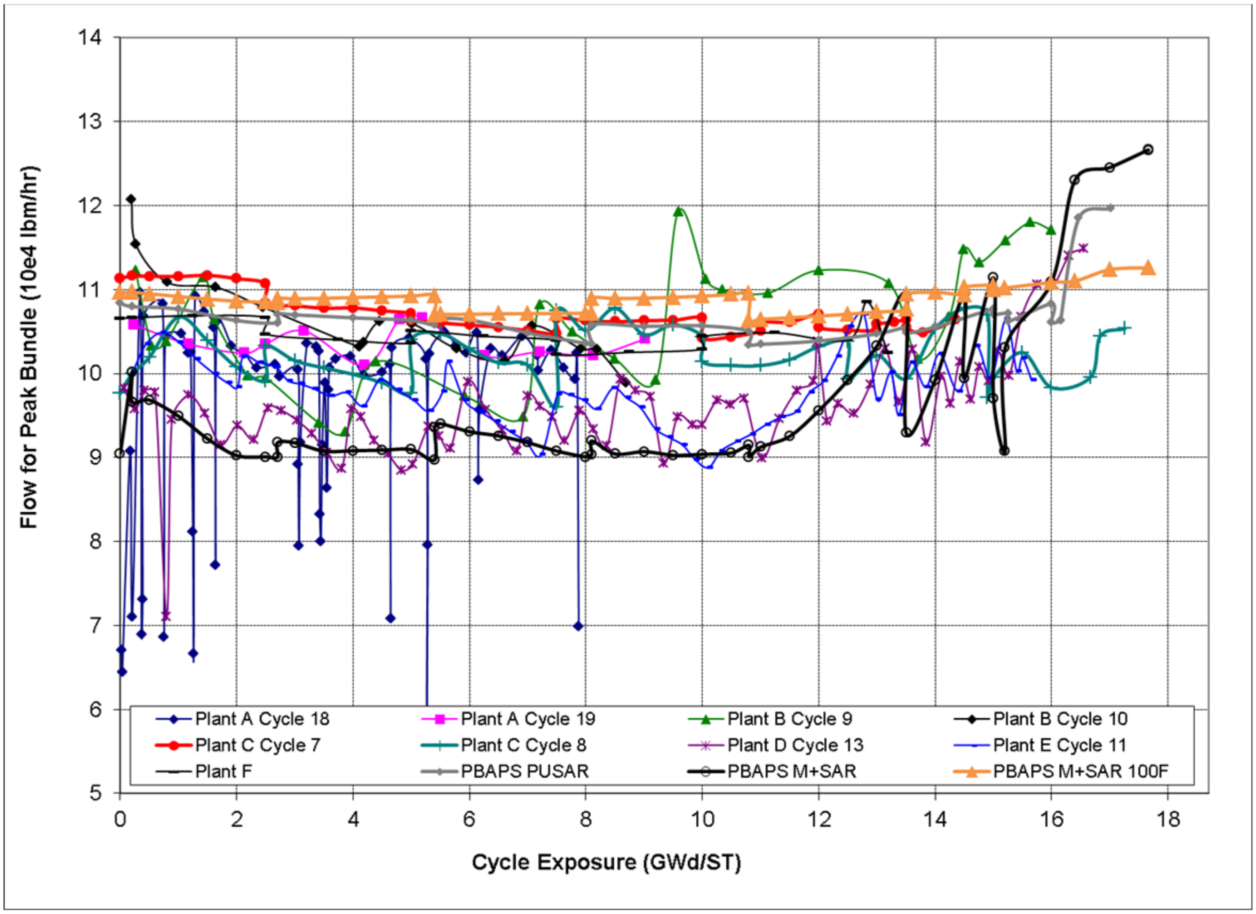


Figure 2-2 Coolant Flow for Peak Bundle versus Cycle Exposure

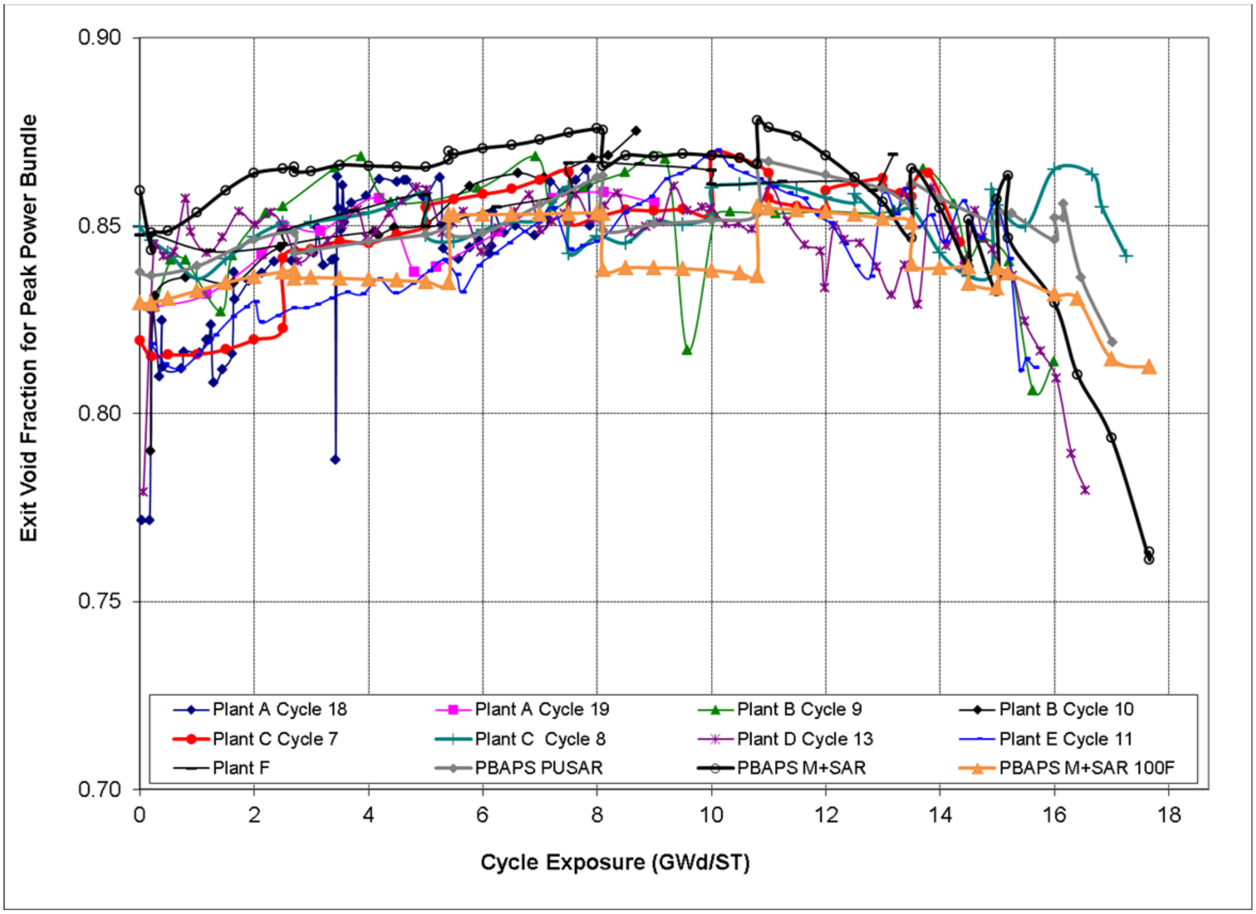


Figure 2-3 Exit Void Fraction for Peak Power Bundle versus Cycle Exposure

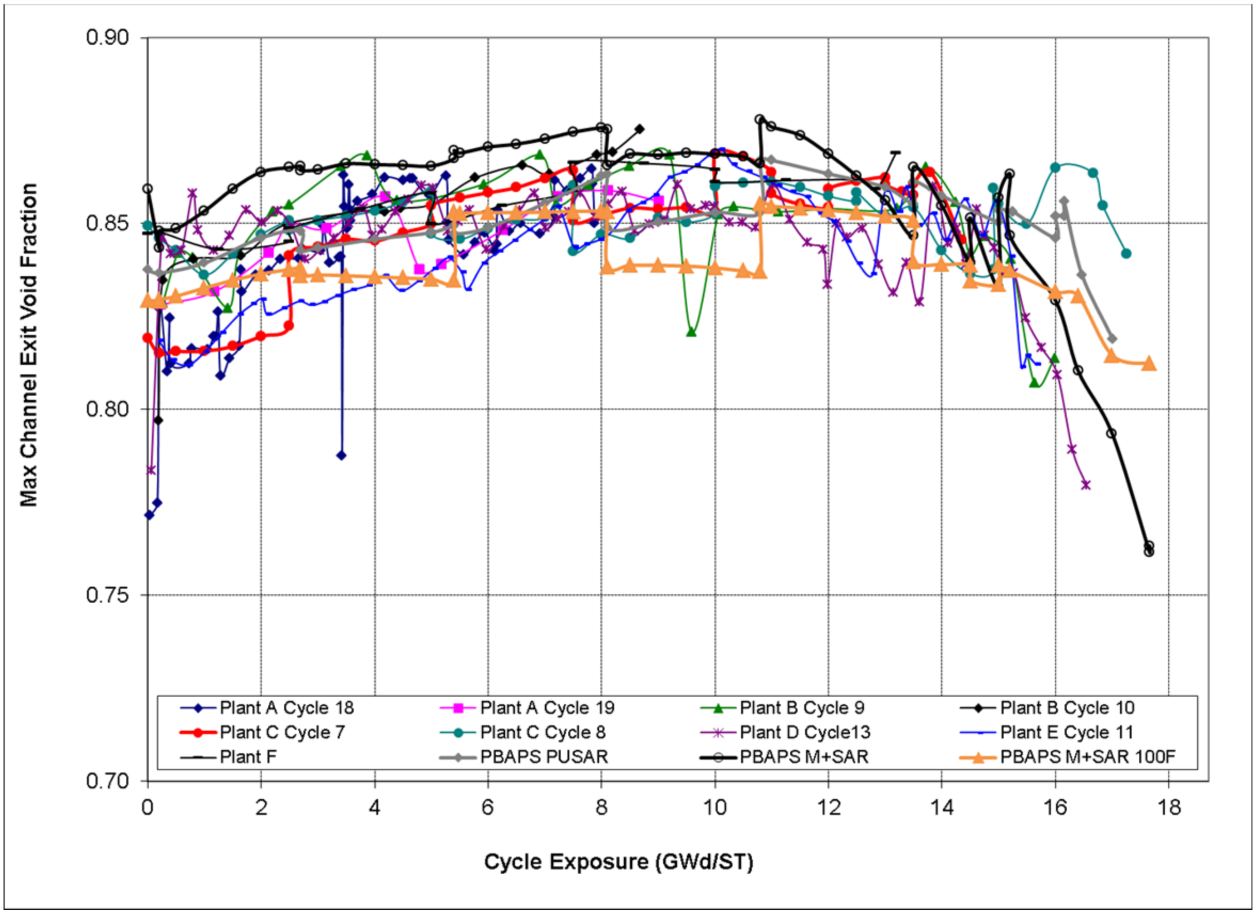


Figure 2-4 Maximum Channel Exit Void Fraction versus Cycle Exposure

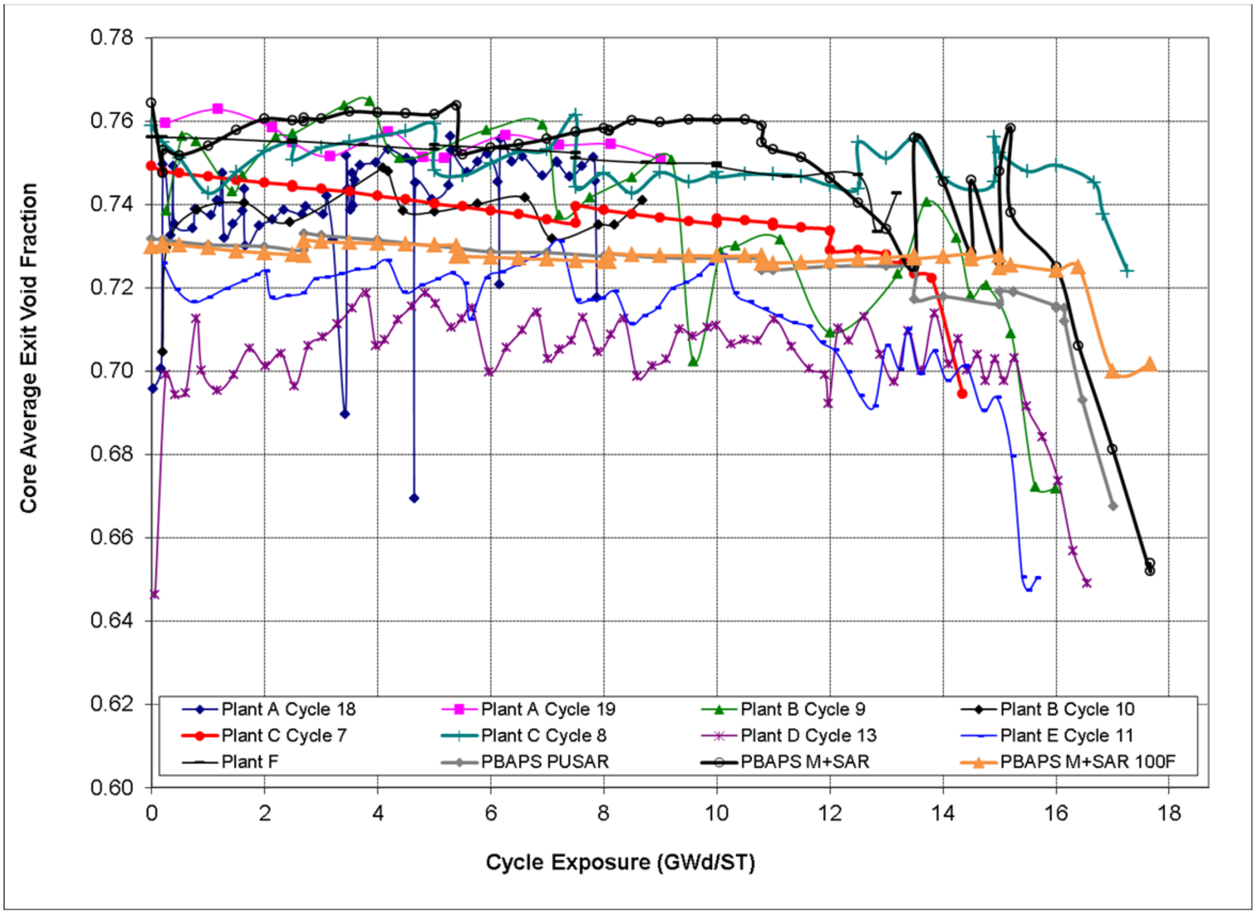


Figure 2-5 Core Average Exit Void Fraction versus Cycle Exposure

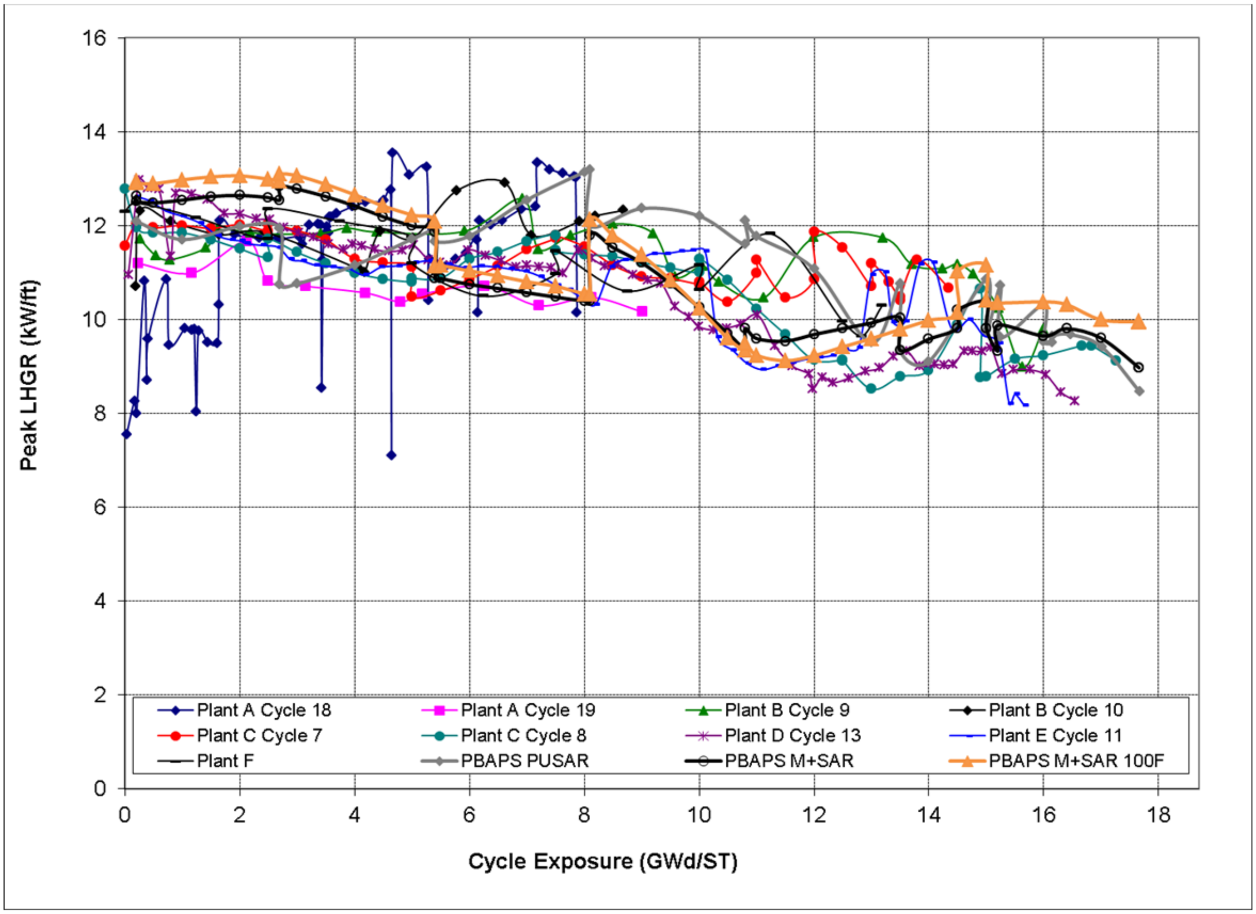


Figure 2-6 Peak LHGR versus Cycle Exposure

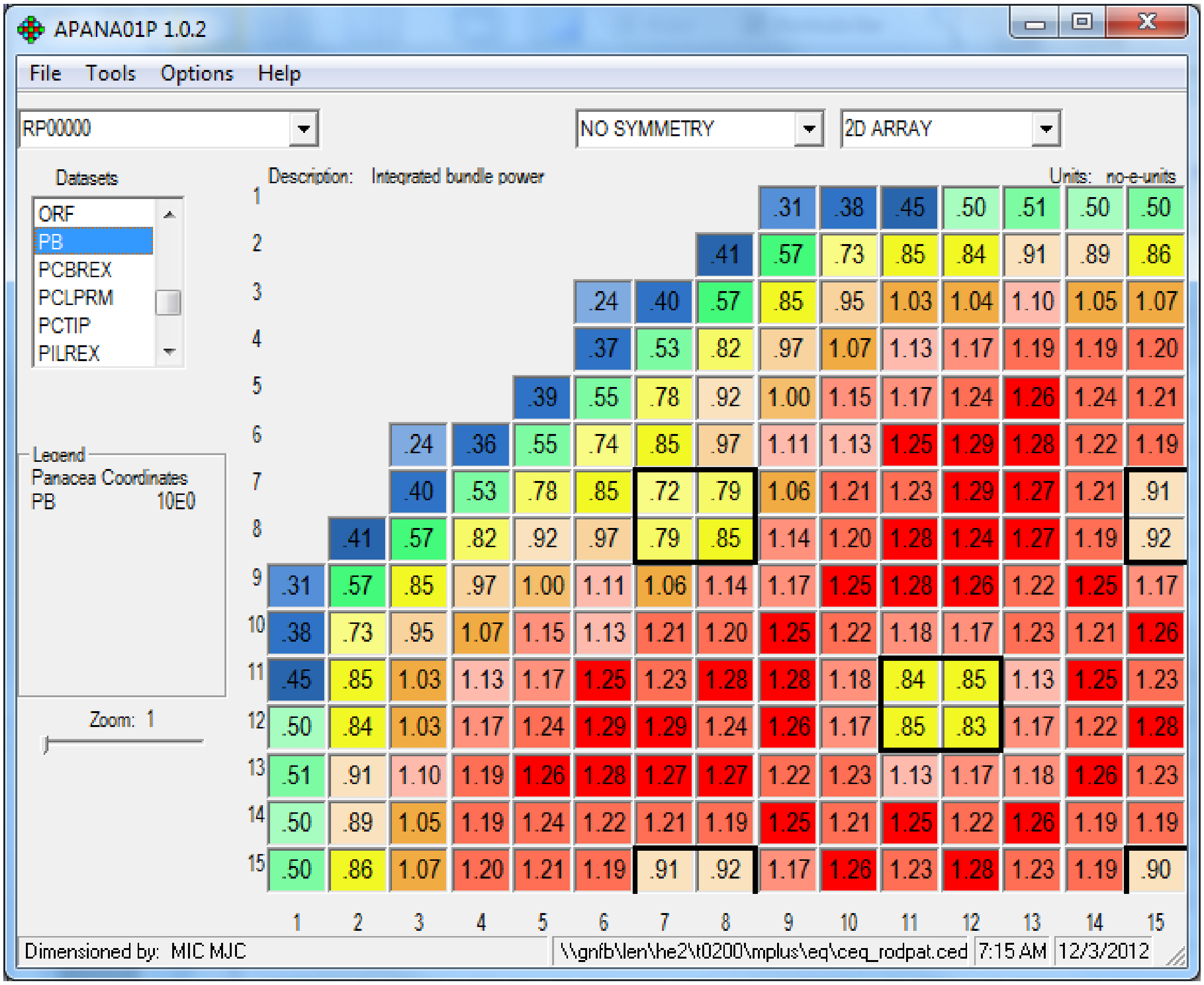
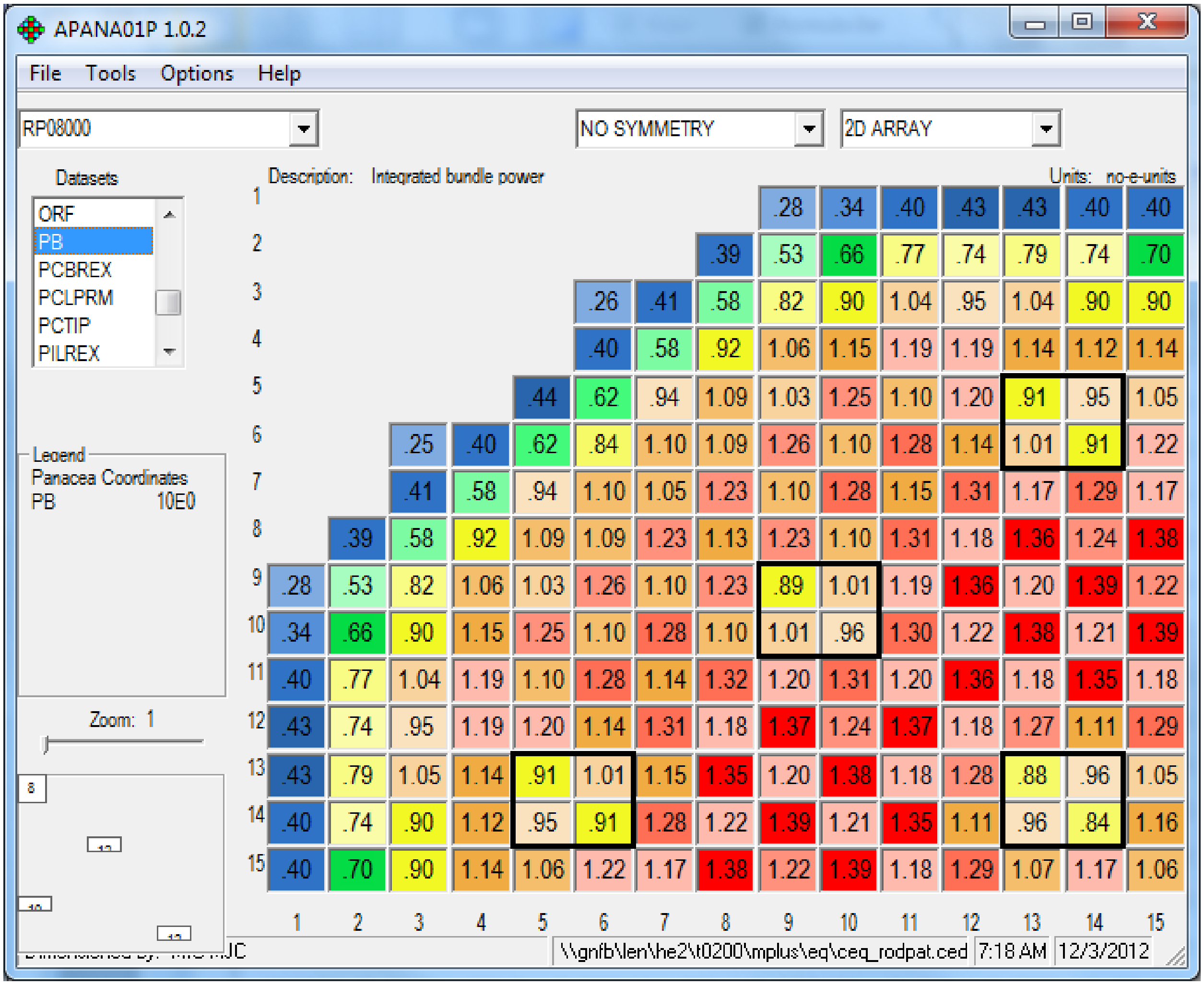
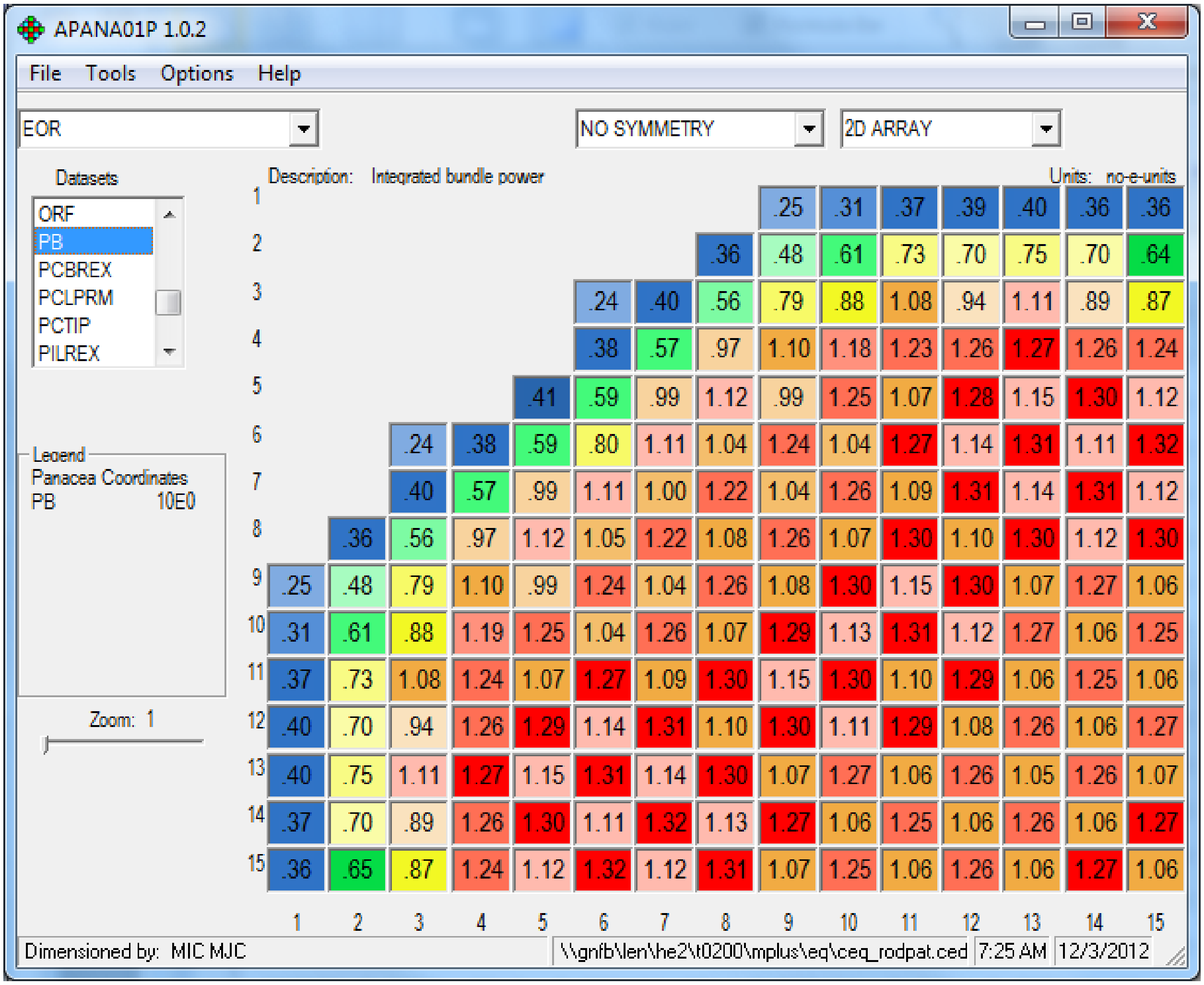


Figure 2-7 Dimensionless Bundle Power at BOC (0 MWd/ST)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1									.28	.34	.40	.43	.43	.40	.40
2								.39	.53	.66	.77	.74	.79	.74	.70
3						.26	.41	.58	.82	.90	1.04	.95	1.04	.90	.90
4						.40	.58	.92	1.06	1.15	1.19	1.19	1.14	1.12	1.14
5					.44	.62	.94	1.09	1.03	1.25	1.10	1.20	.91	.95	1.05
6			.25	.40	.62	.84	1.10	1.09	1.26	1.10	1.28	1.14	1.01	.91	1.22
7			.41	.58	.94	1.10	1.05	1.23	1.10	1.28	1.15	1.31	1.17	1.29	1.17
8		.39	.58	.92	1.09	1.09	1.23	1.13	1.23	1.10	1.31	1.18	1.36	1.24	1.38
9	.28	.53	.82	1.06	1.03	1.26	1.10	1.23	.89	1.01	1.19	1.36	1.20	1.39	1.22
10	.34	.66	.90	1.15	1.25	1.10	1.28	1.10	1.01	.96	1.30	1.22	1.38	1.21	1.39
11	.40	.77	1.04	1.19	1.10	1.28	1.14	1.32	1.20	1.31	1.20	1.36	1.18	1.35	1.18
12	.43	.74	.95	1.19	1.20	1.14	1.31	1.18	1.37	1.24	1.37	1.18	1.27	1.11	1.29
13	.43	.79	1.05	1.14	.91	1.01	1.15	1.35	1.20	1.38	1.18	1.28	.88	.96	1.05
14	.40	.74	.90	1.12	.95	.91	1.28	1.22	1.39	1.21	1.35	1.11	.96	.84	1.16
15	.40	.70	.90	1.14	1.06	1.22	1.17	1.38	1.22	1.39	1.18	1.29	1.07	1.17	1.06

Figure 2-8 Dimensionless Bundle Power at MOC (8,000 MWd/ST)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1									.25	.31	.37	.39	.40	.36	.36
2								.36	.48	.61	.73	.70	.75	.70	.64
3						.24	.40	.56	.79	.88	1.08	.94	1.11	.89	.87
4						.38	.57	.97	1.10	1.18	1.23	1.26	1.27	1.26	1.24
5					.41	.59	.99	1.12	.99	1.25	1.07	1.28	1.15	1.30	1.12
6			.24	.38	.59	.80	1.11	1.04	1.24	1.04	1.27	1.14	1.31	1.11	1.32
7			.40	.57	.99	1.11	1.00	1.22	1.04	1.26	1.09	1.31	1.14	1.31	1.12
8		.36	.56	.97	1.12	1.05	1.22	1.08	1.26	1.07	1.30	1.10	1.30	1.12	1.30
9	.25	.48	.79	1.10	.99	1.24	1.04	1.26	1.08	1.30	1.15	1.30	1.07	1.27	1.06
10	.31	.61	.88	1.19	1.25	1.04	1.26	1.07	1.29	1.13	1.31	1.12	1.27	1.06	1.25
11	.37	.73	1.08	1.24	1.07	1.27	1.09	1.30	1.15	1.30	1.10	1.29	1.06	1.25	1.06
12	.40	.70	.94	1.26	1.29	1.14	1.31	1.10	1.30	1.11	1.29	1.08	1.26	1.06	1.27
13	.40	.75	1.11	1.27	1.15	1.31	1.14	1.30	1.07	1.27	1.06	1.26	1.05	1.26	1.07
14	.37	.70	.89	1.26	1.30	1.11	1.32	1.13	1.27	1.06	1.25	1.06	1.26	1.06	1.27
15	.36	.65	.87	1.24	1.12	1.32	1.12	1.31	1.07	1.25	1.06	1.26	1.06	1.27	1.06

Figure 2-9 Dimensionless Bundle Power at EOR (16,000 MWd/ST)

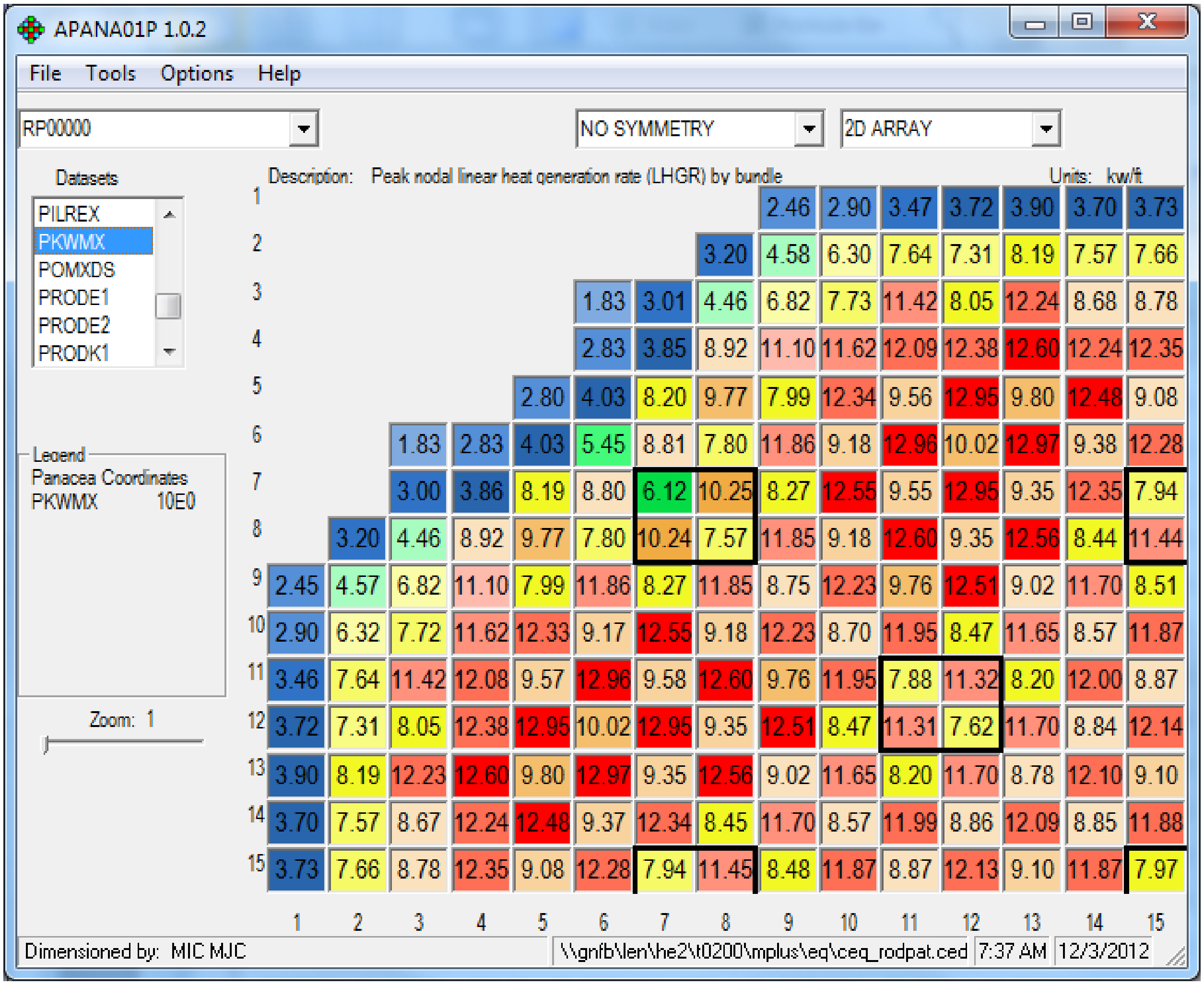
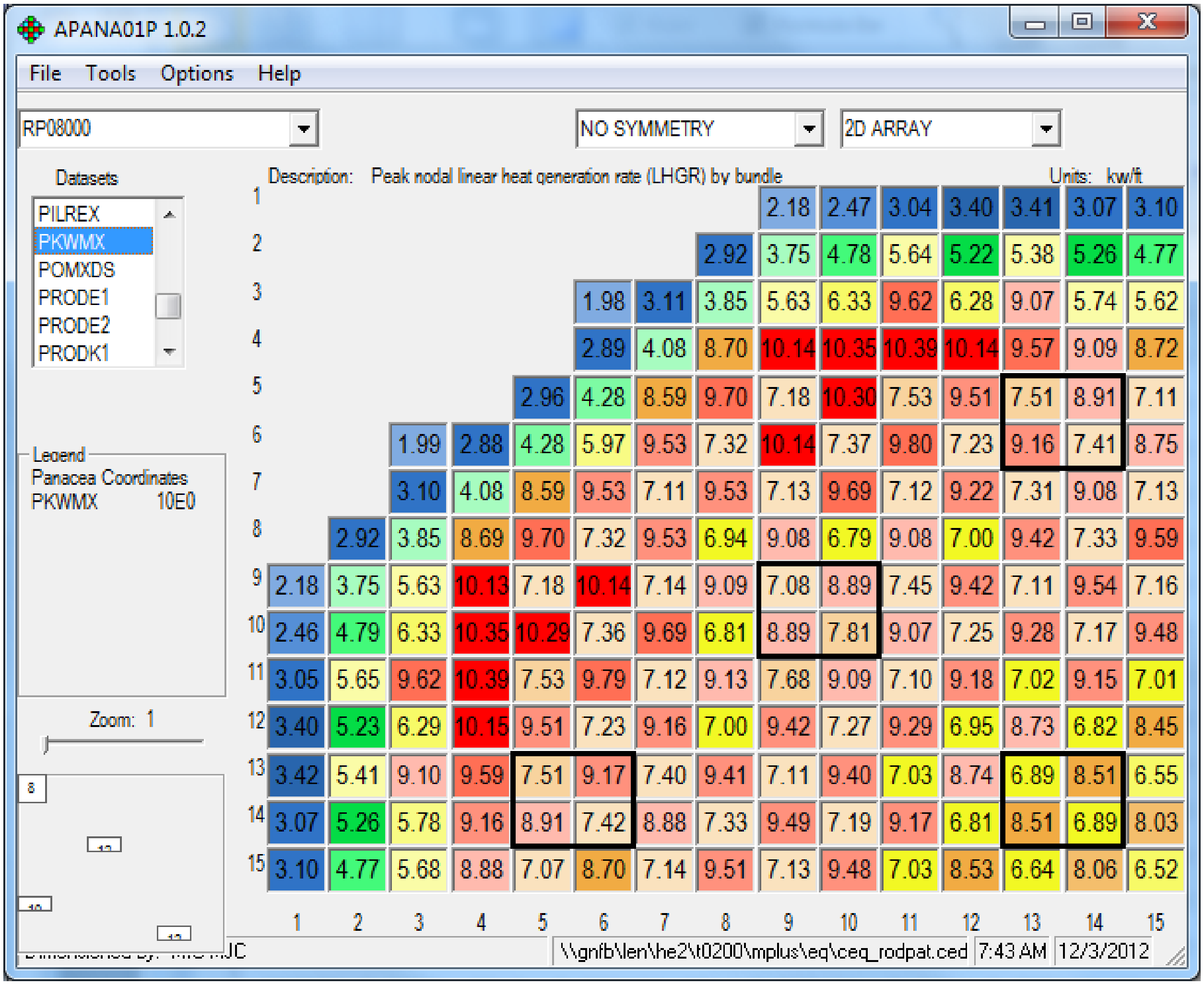
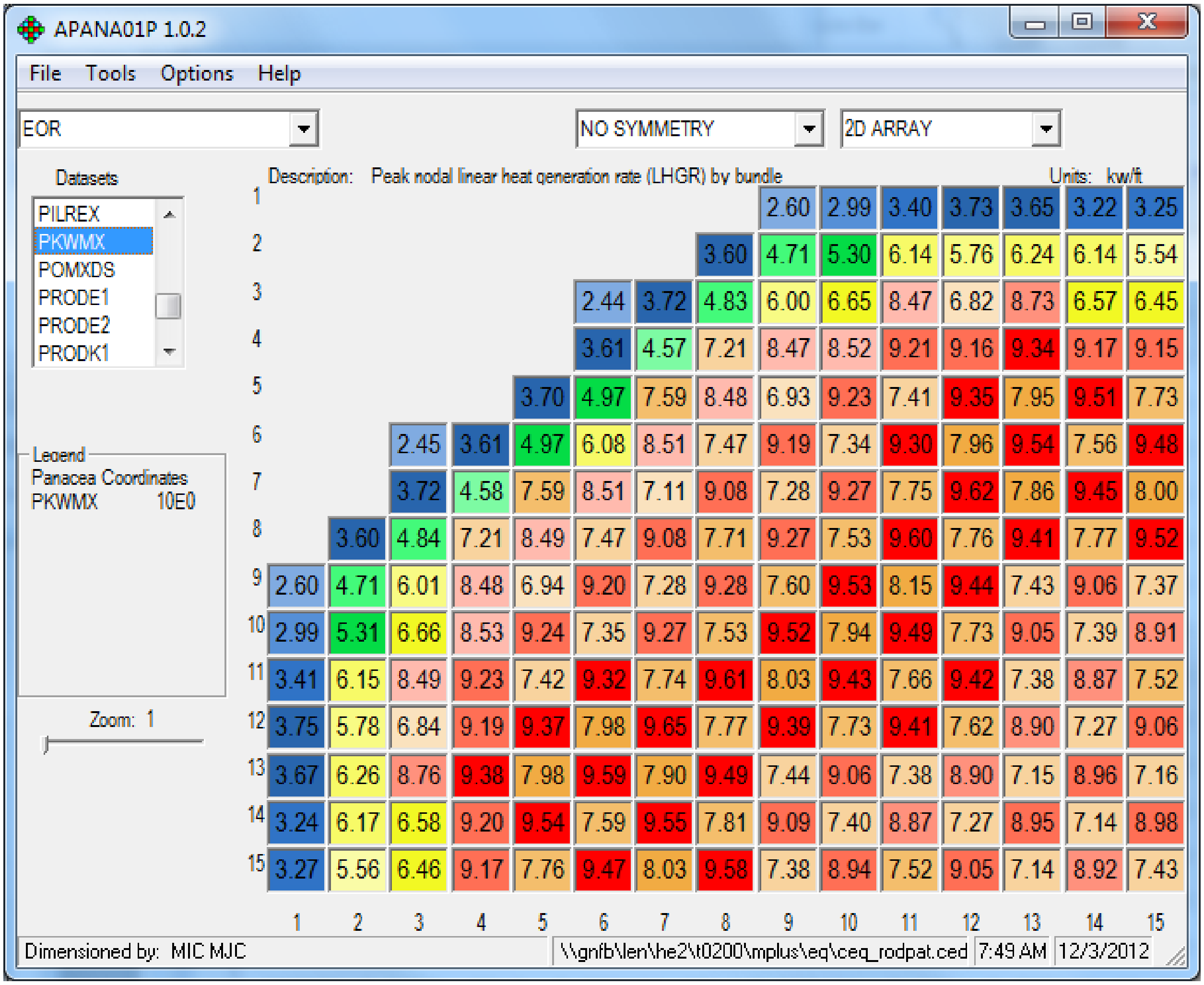


Figure 2-10 Bundle Operating LHGR (kW/ft) at BOC (0 MWd/ST) [Peak MFLPD Point]



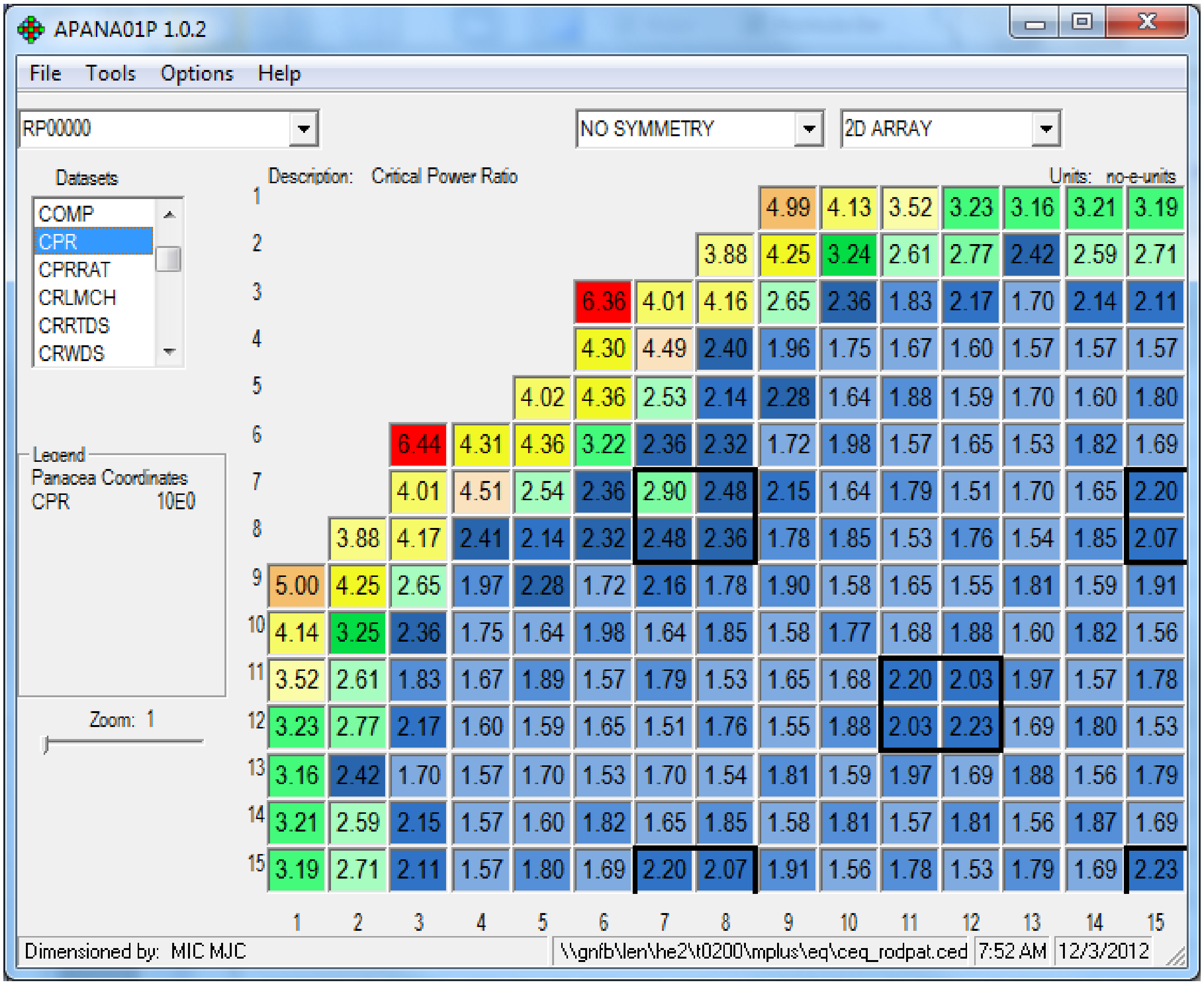
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1									2.18	2.47	3.04	3.40	3.41	3.07	3.10
2								2.92	3.75	4.78	5.64	5.22	5.38	5.26	4.77
3						1.98	3.11	3.85	5.63	6.33	9.62	6.28	9.07	5.74	5.62
4						2.89	4.08	8.70	10.14	10.35	10.39	10.14	9.57	9.09	8.72
5					2.96	4.28	8.59	9.70	7.18	10.30	7.53	9.51	7.51	8.91	7.11
6			1.99	2.88	4.28	5.97	9.53	7.32	10.14	7.37	9.80	7.23	9.16	7.41	8.75
7			3.10	4.08	8.59	9.53	7.11	9.53	7.13	9.69	7.12	9.22	7.31	9.08	7.13
8		2.92	3.85	8.69	9.70	7.32	9.53	6.94	9.08	6.79	9.08	7.00	9.42	7.33	9.59
9	2.18	3.75	5.63	10.13	7.18	10.14	7.14	9.09	7.08	8.89	7.45	9.42	7.11	9.54	7.16
10	2.46	4.79	6.33	10.35	10.29	7.36	9.69	6.81	8.89	7.81	9.07	7.25	9.28	7.17	9.48
11	3.05	5.65	9.62	10.39	7.53	9.79	7.12	9.13	7.68	9.09	7.10	9.18	7.02	9.15	7.01
12	3.40	5.23	6.29	10.15	9.51	7.23	9.16	7.00	9.42	7.27	9.29	6.95	8.73	6.82	8.45
13	3.42	5.41	9.10	9.59	7.51	9.17	7.40	9.41	7.11	9.40	7.03	8.74	6.89	8.51	6.55
14	3.07	5.26	5.78	9.16	8.91	7.42	8.88	7.33	9.49	7.19	9.17	6.81	8.51	6.89	8.03
15	3.10	4.77	5.68	8.88	7.07	8.70	7.14	9.51	7.13	9.48	7.03	8.53	6.64	8.06	6.52

Figure 2-11 Bundle Operating LHGR (kW/ft) at MOC (8,000 MWd/ST)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1									2.60	2.99	3.40	3.73	3.65	3.22	3.25
2								3.60	4.71	5.30	6.14	5.76	6.24	6.14	5.54
3						2.44	3.72	4.83	6.00	6.65	8.47	6.82	8.73	6.57	6.45
4						3.61	4.57	7.21	8.47	8.52	9.21	9.16	9.34	9.17	9.15
5					3.70	4.97	7.59	8.48	6.93	9.23	7.41	9.35	7.95	9.51	7.73
6			2.45	3.61	4.97	6.08	8.51	7.47	9.19	7.34	9.30	7.96	9.54	7.56	9.48
7			3.72	4.58	7.59	8.51	7.11	9.08	7.28	9.27	7.75	9.62	7.86	9.45	8.00
8		3.60	4.84	7.21	8.49	7.47	9.08	7.71	9.27	7.53	9.60	7.76	9.41	7.77	9.52
9	2.60	4.71	6.01	8.48	6.94	9.20	7.28	9.28	7.60	9.53	8.15	9.44	7.43	9.06	7.37
10	2.99	5.31	6.66	8.53	9.24	7.35	9.27	7.53	9.52	7.94	9.49	7.73	9.05	7.39	8.91
11	3.41	6.15	8.49	9.23	7.42	9.32	7.74	9.61	8.03	9.43	7.66	9.42	7.38	8.87	7.52
12	3.75	5.78	6.84	9.19	9.37	7.98	9.65	7.77	9.39	7.73	9.41	7.62	8.90	7.27	9.06
13	3.67	6.26	8.76	9.38	7.98	9.59	7.90	9.49	7.44	9.06	7.38	8.90	7.15	8.96	7.16
14	3.24	6.17	6.58	9.20	9.54	7.59	9.55	7.81	9.09	7.40	8.87	7.27	8.95	7.14	8.98
15	3.27	5.56	6.46	9.17	7.76	9.47	8.03	9.58	7.38	8.94	7.52	9.05	7.14	8.92	7.43

Figure 2-12 Bundle Operating LHGR (kW/ft) at EOR (16,000 MWd/ST)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1									4.99	4.13	3.52	3.23	3.16	3.21	3.19
2								3.88	4.25	3.24	2.61	2.77	2.42	2.59	2.71
3						6.36	4.01	4.16	2.65	2.36	1.83	2.17	1.70	2.14	2.11
4						4.30	4.49	2.40	1.96	1.75	1.67	1.60	1.57	1.57	1.57
5					4.02	4.36	2.53	2.14	2.28	1.64	1.88	1.59	1.70	1.60	1.80
6			6.44	4.31	4.36	3.22	2.36	2.32	1.72	1.98	1.57	1.65	1.53	1.82	1.69
7			4.01	4.51	2.54	2.36	2.90	2.48	2.15	1.64	1.79	1.51	1.70	1.65	2.20
8		3.88	4.17	2.41	2.14	2.32	2.48	2.36	1.78	1.85	1.53	1.76	1.54	1.85	2.07
9	5.00	4.25	2.65	1.97	2.28	1.72	2.16	1.78	1.90	1.58	1.65	1.55	1.81	1.59	1.91
10	4.14	3.25	2.36	1.75	1.64	1.98	1.64	1.85	1.58	1.77	1.68	1.88	1.60	1.82	1.56
11	3.52	2.61	1.83	1.67	1.89	1.57	1.79	1.53	1.65	1.68	2.20	2.03	1.97	1.57	1.78
12	3.23	2.77	2.17	1.60	1.59	1.65	1.51	1.76	1.55	1.88	2.03	2.23	1.69	1.80	1.53
13	3.16	2.42	1.70	1.57	1.70	1.53	1.70	1.54	1.81	1.59	1.97	1.69	1.88	1.56	1.79
14	3.21	2.59	2.15	1.57	1.60	1.82	1.65	1.85	1.58	1.81	1.57	1.81	1.56	1.87	1.69
15	3.19	2.71	2.11	1.57	1.80	1.69	2.20	2.07	1.91	1.56	1.78	1.53	1.79	1.69	2.23

Figure 2-13 Bundle Operating MCPR at BOC (0 MWd/ST)

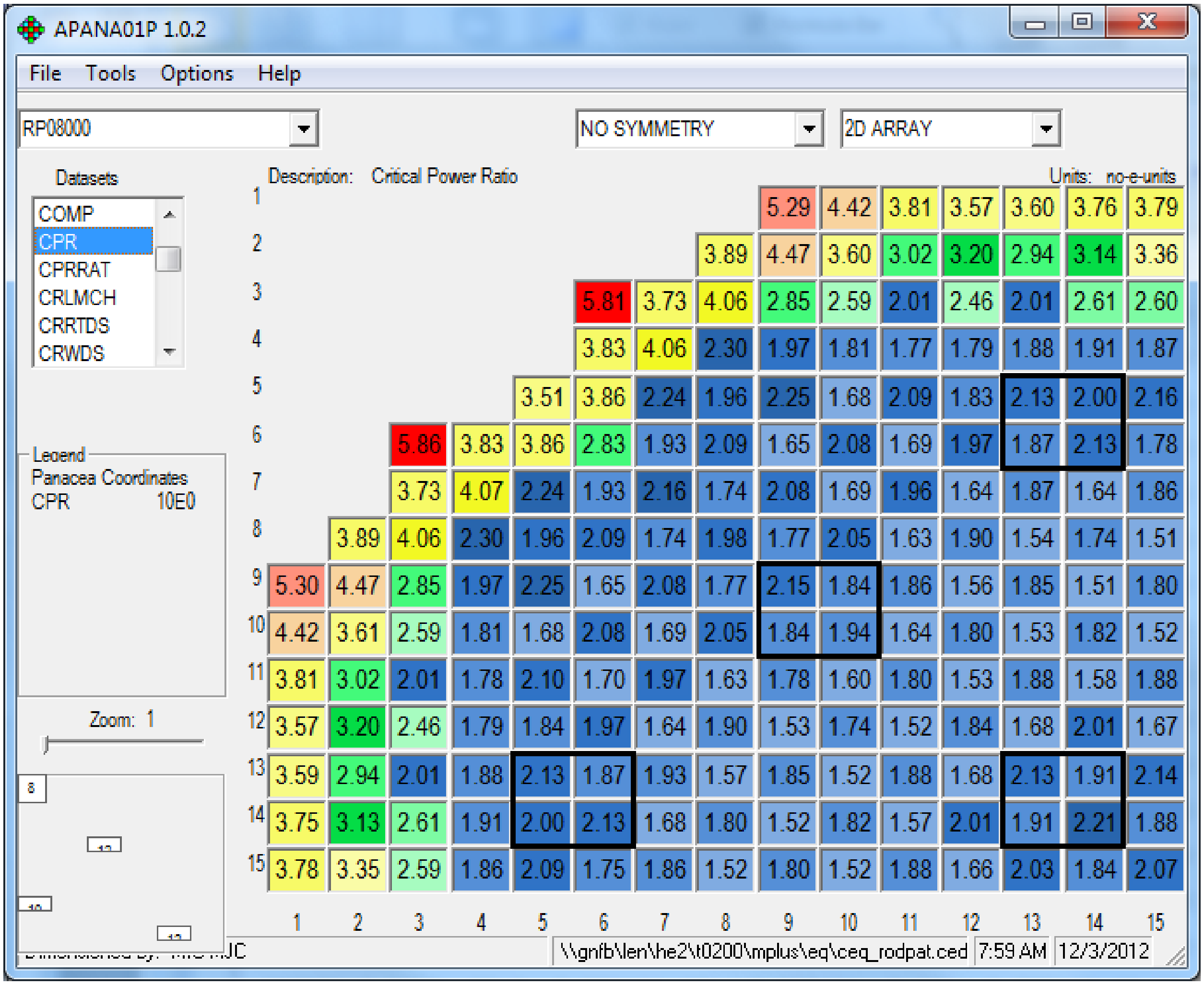
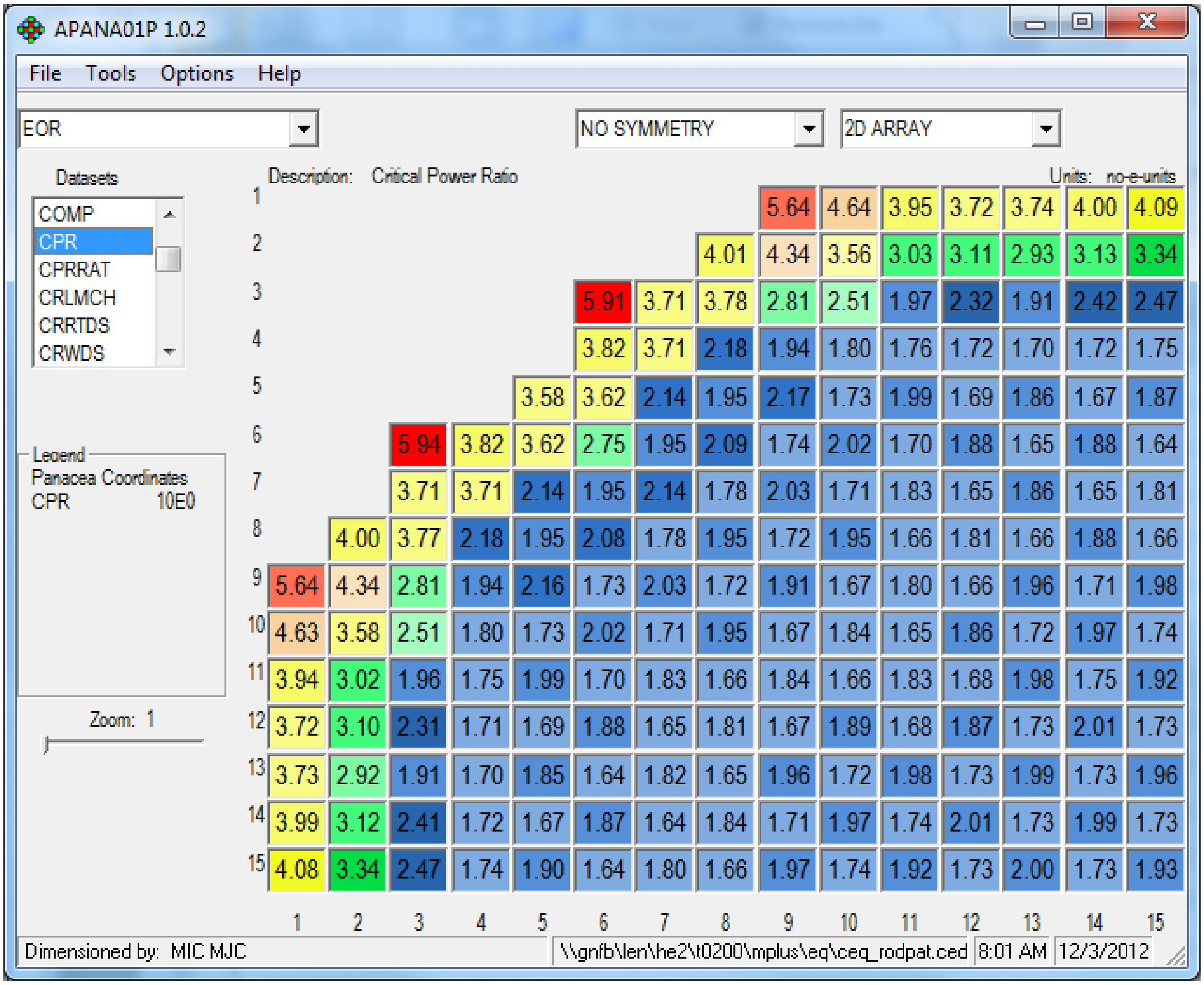


Figure 2-14 Bundle Operating MCPR at MOC (8,000 MWd/ST)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1									5.64	4.64	3.95	3.72	3.74	4.00	4.09
2								4.01	4.34	3.56	3.03	3.11	2.93	3.13	3.34
3						5.91	3.71	3.78	2.81	2.51	1.97	2.32	1.91	2.42	2.47
4						3.82	3.71	2.18	1.94	1.80	1.76	1.72	1.70	1.72	1.75
5					3.58	3.62	2.14	1.95	2.17	1.73	1.99	1.69	1.86	1.67	1.87
6			5.94	3.82	3.62	2.75	1.95	2.09	1.74	2.02	1.70	1.88	1.65	1.88	1.64
7			3.71	3.71	2.14	1.95	2.14	1.78	2.03	1.71	1.83	1.65	1.86	1.65	1.81
8		4.00	3.77	2.18	1.95	2.08	1.78	1.95	1.72	1.95	1.66	1.81	1.66	1.88	1.66
9	5.64	4.34	2.81	1.94	2.16	1.73	2.03	1.72	1.91	1.67	1.80	1.66	1.96	1.71	1.98
10	4.63	3.58	2.51	1.80	1.73	2.02	1.71	1.95	1.67	1.84	1.65	1.86	1.72	1.97	1.74
11	3.94	3.02	1.96	1.75	1.99	1.70	1.83	1.66	1.84	1.66	1.83	1.68	1.98	1.75	1.92
12	3.72	3.10	2.31	1.71	1.69	1.88	1.65	1.81	1.67	1.89	1.68	1.87	1.73	2.01	1.73
13	3.73	2.92	1.91	1.70	1.85	1.64	1.82	1.65	1.96	1.72	1.98	1.73	1.99	1.73	1.96
14	3.99	3.12	2.41	1.72	1.67	1.87	1.64	1.84	1.71	1.97	1.74	2.01	1.73	1.99	1.73
15	4.08	3.34	2.47	1.74	1.90	1.64	1.80	1.66	1.97	1.74	1.92	1.73	2.00	1.73	1.93

Figure 2-15 Bundle Operating MCPR at EOR (16,000 MWd/ST)

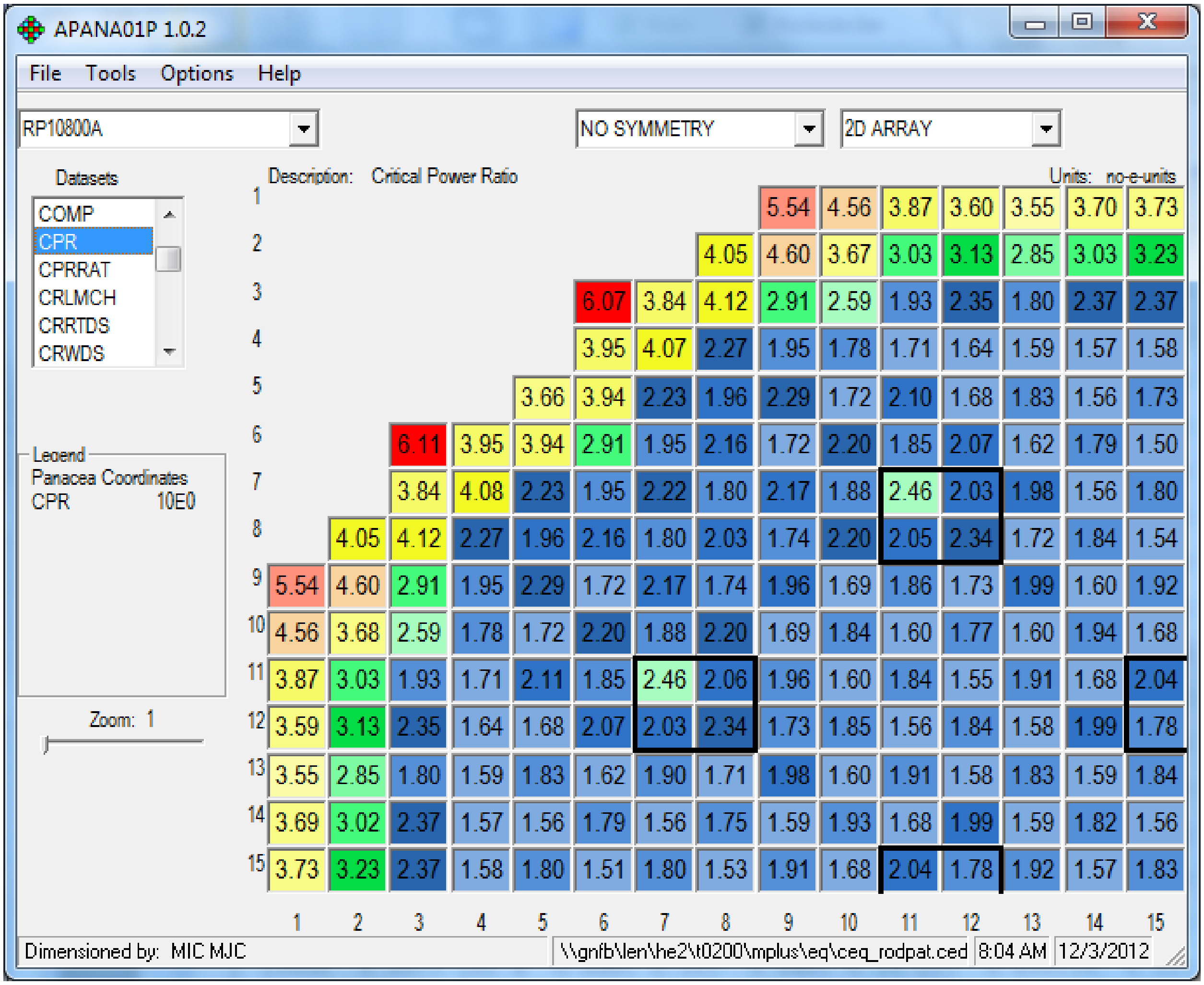


Figure 2-16 Bundle Operating MCPR at 10,800 MWd/ST [Peak MFLCPR Point]

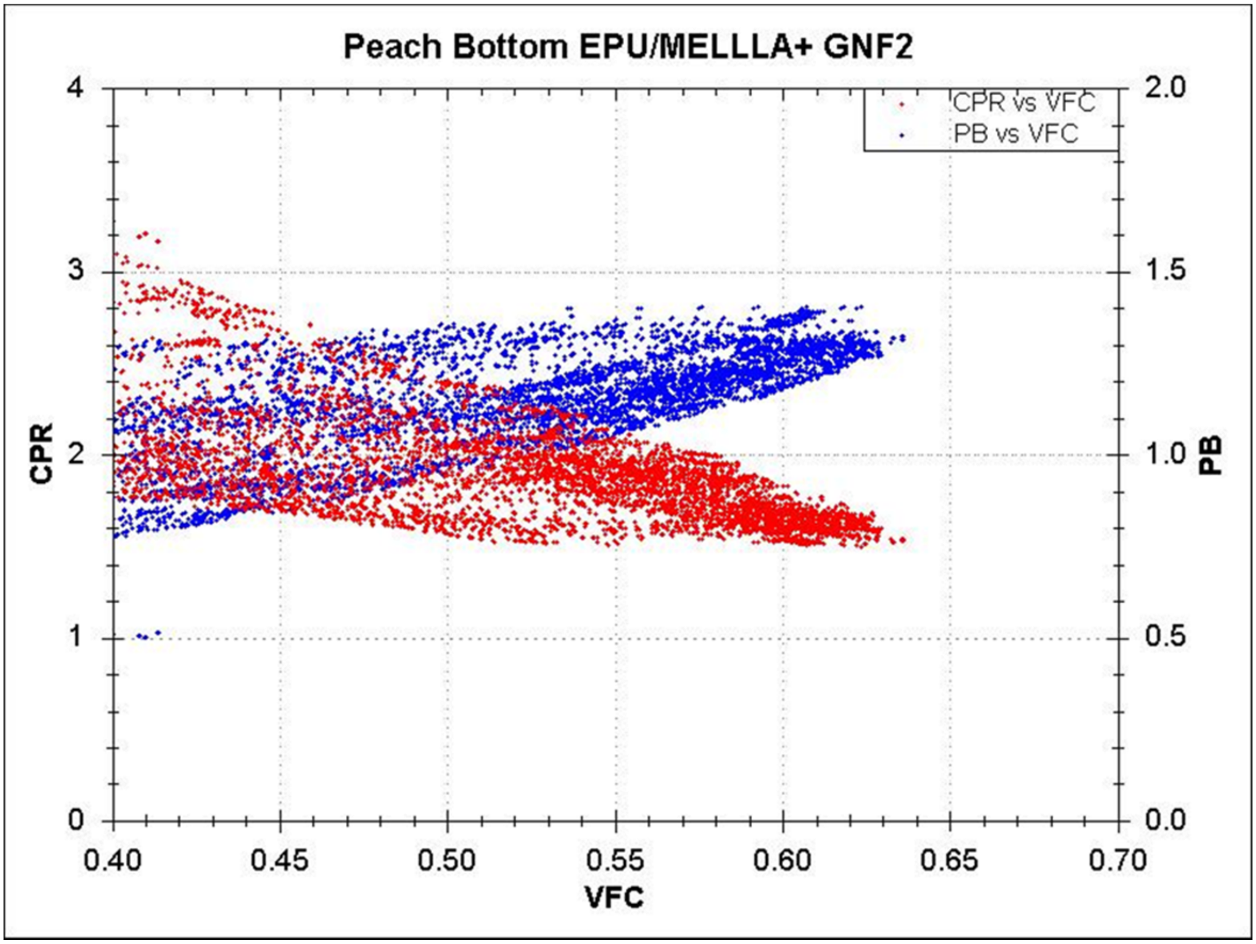


Figure 2-17 Bundle Average Void Fraction vs. Critical Power & Bundle Power

Notes:
PB = Integrated Bundle Power
VFC = Bundle Average In-Channel Void Fraction

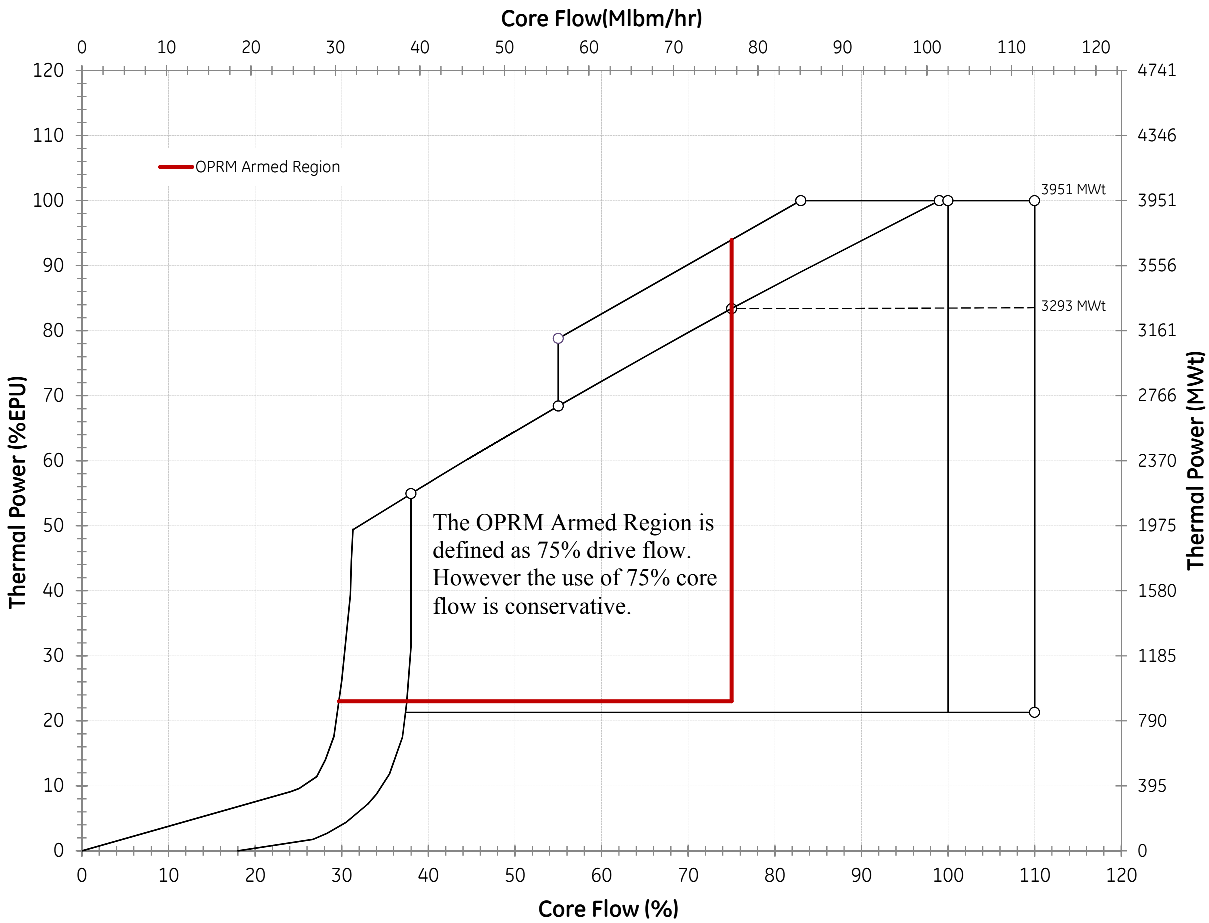


Figure 2-18 Required OPRM Armed Region

3.0 REACTOR COOLANT AND CONNECTED SYSTEMS

This section addresses the evaluations that are applicable to MELLLA+.

3.1 NUCLEAR SYSTEM PRESSURE RELIEF AND OVERPRESSURE PROTECTION

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Flow-Induced Vibration	Generic	Meets M+LTR Disposition
Overpressure Relief Capacity	Plant Specific	Meets M+LTR Disposition

3.1.1 Flow-Induced Vibration

The generic disposition of the Flow-Induced Vibration (FIV) topic in the M+LTR describes that because there is no increase in the maximum main steam (MS) line flow for the MELLLA+ operating domain expansion; there is no effect on the FIV of the piping and SRVs during normal operation. [[
]]

Consistent with the generic disposition discussed above, for PBAPS, maximum main steam line (MSL) flow in the MELLLA+ operating domain does not increase. The numerical values showing no increase in maximum steam flow rate are presented in Table 1-2. MELLLA+ does not result in any increase to the PBAPS maximum MSL flow, and there is no effect on the FIV experienced by the SRVs or piping during normal operation. [[
]]

Therefore, PBAPS meets all M+LTR dispositions for FIVs.

3.1.2 Overpressure Relief Capacity

The pressure relief system prevents overpressurization of the nuclear system during AOOs, the plant ASME upset overpressure protection event, and postulated ATWS events. The SRVs and spring safety valves (SSVs), along with other functions, provide this protection. For PBAPS, the limiting overpressure event is the main steam isolation valve closure with scram on high flux (MSIVF). The peak RPV bottom head pressure remains less than the ASME Service Level B limit of 1,375 psig.

The SRV and SSV setpoint tolerance is independent of the MELLLA+ operating domain expansion. [[
]] The AOO, ASME overpressure, and ATWS response evaluations for MELLLA+ are performed using the same PBAPS SRV and SSV setpoint tolerance (3%) as used for the analysis to support operation at CLTP. The SRV setpoint tolerances are monitored at PBAPS for compliance to the TS requirements. The tolerance is consistent with the actual SRV and SSV performance testing conducted on the PBAPS SRVs and

SSVs per TS Surveillance Requirement 3.4.3.1 and the PBAPS in-service testing (IST) program. The IST program requirements are subject to NRC inspection by either the NRC resident inspectors or special in-service inspection (ISI)/IST inspections.

There are no changes to the PBAPS current licensing basis for the ASME overpressure event. Assumptions and code input parameters are consistent with those in the current licensing basis, other than the addition of the MELLLA+ flow domain change, which allows full power operation at CFs as low as 83% of RCF.

There are no changes to the existing licensing basis assumptions and code inputs used for the PBAPS ASME overpressure event analysis.

The ASME overpressure analysis for PBAPS was performed at the 110% ICF CF statepoint, and at the 83% minimum CF statepoint using a representative MELLLA+ equilibrium core. The analysis of the limiting overpressure event for PBAPS demonstrates that no change in overpressure relief capacity is required. The ATWS analysis discussed in Section 9.3.1 concludes that no increase in the number of SRVs credited in the analysis is required to demonstrate acceptable results. No other changes in the pressure relief system or SRV and SSV setpoints are required for MELLLA+. The analysis of the Overpressure Relief Capacity topic finds that PBAPS overpressure relief capacity is acceptable. The ASME overpressure event continues to be analyzed as a part of each reload analysis and is reported in the SRLR. This process is unchanged by MELLLA+.

3.2 REACTOR VESSEL

The RPV structure and support components form a pressure boundary to contain reactor coolant and form a boundary against leakage of radioactive materials into the drywell. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Fracture Toughness	Plant Specific	Meets M+LTR Disposition
Reactor Vessel Structural Evaluation	Generic	Meets M+LTR Disposition

3.2.1 Fracture Toughness

The MELLLA+ operating domain expansion results in a slightly higher operating neutron flux in the upper portion of the core due to decreased water density. The effect of this water density reduction is [[ ]] in peak vessel and peak shroud flux. In accordance with M+LTR SER Limitation and Condition 12.8, the MELLLA+ flux is calculated using the GEH flux evaluation methodology contained in NEDC-32983P-A (Reference 16), which is consistent with Regulatory Guide (RG) 1.190 and was approved by the NRC in November 2005. The MELLLA+ operating domain flux distribution is assumed to be similar to that of the current licensed operating domain flux distribution, whereas the magnitude of flux level is proportional to the thermal power. The change to the PBAPS 54 effective full power

years (EFPY) vessel internal diameter (ID) peak fluence as a result of implementing MELLLA+ is [[ ]] For purposes of comparison, key numerical flux/fluence results and their respective parameters are provided in Table 3-1.

Because there is a negligible change to the PBAPS 54 EFPY vessel ID peak fluence as a result of MELLLA+, there is a negligible change to:

- the beltline adjusted reference temperature (ART). Therefore, the CLTP pressure-temperature curves for Units 2 and 3 remain applicable to MELLLA+ operation.
- the upper shelf energy (USE). PBAPS continues to remain bounded by the BWR Owners' Group (BWROG) equivalent margin analysis (EMA), thereby demonstrating compliance with 10 CFR 50, Appendix G.

The revised fluence is used to evaluate the vessel against the requirements of 10 CFR 50, Appendix G. The results of these evaluations indicate that:

(a) The USE will maintain the margin requirements of 10 CFR 50, Appendix G, as determined using equivalent margin methods. The maximum decrease in USE for the beltline plate materials is 14.5% (< Boiling Water Reactor Vessel Internals Project (BWRVIP)-74-A limits (Reference 17)) for 54 EFPY. The maximum decrease in USE for the beltline weld materials is 19.5% (< BWRVIP-74-A limits (Reference 17)) for 54 EFPY. These values are provided in Tables 3-2a and 3-2b and continue to be bounded by the EMA.

(b) The beltline material reference temperature of nil-ductility transition (RT_{NDT}) remains below 200°F.

(c) The CLTP P-T curves remain bounding for MELLLA+ including the effects of the N16 water level instrumentation nozzle that occurs within the beltline region.

(d) The 54 EFPY shift is increased by a negligible amount (for limiting materials), and consequently, results in a negligible increase in the ART, which is the initial RT_{NDT} plus the shift. These values are provided in Tables 3-3a and 3-3b. The corresponding CLTP values are shown in Tables 2.1-2a and 2.1-2b of Reference 18.

(e) The 54 EFPY beltline circumferential weld material RT_{NDT} remains bounded by the requirements of GL 98-05 (Reference 19), BWRVIP-05 (References 20 and 21), and BWRVIP-74-A (Reference 17). This comparison is provided in Tables 3-4a and 3-4b.

Because there is a negligible change to the PBAPS 54 EFPY vessel ID peak fluence as a result of MELLLA+, there is a negligible change to the weld inspection relief criteria. Therefore, the inspection relief request does not require revision as a result of MELLLA+ operating domain expansion.

As a result of MELLLA+, there is a negligible change in the PBAPS 54 EFPY vessel ID peak fluence. Therefore, no changes to the PBAPS ART, USE or weld inspection relief values are required as a result of MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for fracture toughness.

3.2.2 Reactor Vessel Structural Evaluation

The disposition of the Reactor Vessel Structural Evaluation topic in the M+LTR (Reference 1) describes that the reactor vessel components will not be affected by the proposed expansion of the power / flow map because none of the parameters that affect the stress or fatigue for the reactor vessel components (i.e., reactor operating pressure, FW flow or steam flow rate, or other applicable mechanical loads) will be changed or increased. Therefore, the M+LTR concludes that there is no change in the stress or fatigue for the reactor vessel components as a result of MELLLA+, and no further evaluation is required.

For PBAPS, there are no increases in the reactor operating pressure, or maximum steam or FW flow rates for the MELLLA+ operating domain expansion. The numerical values showing no increases in reactor operating pressure, or maximum steam or FW flow rates are presented in Table 1-2. Other PBAPS mechanical loads do not increase as a result of the MELLLA+ operating domain expansion. Therefore, there is no change in the stress and fatigue for the PBAPS reactor vessel components, and no further evaluation of PBAPS reactor vessel structural integrity is required.

Additionally, a plant-specific evaluation was performed for EPU to include the effects of environmental fatigue due to reactor coolant environment, and to demonstrate that the FW nozzle meets the ASME Code acceptance criteria for a 60-year plant life. This evaluation is applicable for the MELLLA+ operating domain expansion because there is no change in the operating parameters such as operating pressure, FW temperature and flow, and reactor coolant chemistry parameters, or applicable mechanical loads.

PBAPS meets all M+LTR dispositions for the reactor vessel structural and fatigue evaluation. Additional plant-specific evaluations for FW nozzle fatigue life and effects of environmental fatigue on the RPV components were performed to demonstrate PBAPS compliance with the applicable ASME Code requirements for a 60-year plant life.

3.3 REACTOR INTERNALS

3.3.1 Reactor Internal Pressure Differences

The reactor internals include core support structure and non-core support structure components. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Fuel Assembly Lift Forces	Generic	Meets M+LTR Disposition
Reactor Internals Pressure Differences for Normal, Upset, Emergency and Faulted Conditions	Generic	Meets M+LTR Disposition
Reactor Internals Pressure Differences (Acoustic and Flow-Induced Loads) for Faulted Conditions	Plant Specific	Meets M+LTR Disposition

Topic	M+LTR Disposition	PBAPS Result
Reactor Internals Structural Evaluation for Normal, Upset, and Emergency Conditions	Plant Specific	Meets M+LTR Disposition
Reactor Internals Structural Evaluation for Faulted Conditions	Plant Specific	Meets M+LTR Disposition
Steam Separator and Dryer Performance	Plant Specific	Meets M+LTR Disposition

3.3.1.1 Fuel Assembly Lift Forces

The M+LTR describes that fuel assembly lift forces are calculated for normal, upset, emergency, and faulted conditions consistent with the existing plant design basis. There are no significant changes in the core exit steam flow, reactor operating pressure, FW or steam flow rates for the MELLLA+ operating domain expansion. Because none of the preceding values change significantly, the only remaining variable affecting the forces on the fuel assemblies for the normal, upset, emergency and faulted conditions in the MELLLA+ operating domain is the CF. Maximum CF is reduced in the MELLLA+ operating domain. [[

]] Therefore, no further evaluation of fuel assembly lift forces is required.

For PBAPS, the difference between the 100% CLTP / 110% CF ICF operation point core exit steam flow and the 100% CLTP / 83% CF MELLLA+ operation point core exit steam flow is a 0.28% increase. The differences between the vessel steam flow and FW flow rates for the two power-flow points are both less than a 0.3% decrease. The dome pressures for the two power-flow points are identical. The small differences between the core exit steam flows, vessel steam flows and FW flow rates will have a negligible effect on the fuel assembly lift forces calculated for normal, upset, emergency and faulted conditions. Therefore, because the PBAPS CF at the MELLLA+ statepoint at 83% CF is less than the current licensed operating domain statepoint at 110% CF, the normal, upset, emergency and faulted fuel assembly lift forces for the MELLLA+ operating domain [[

]] and no further evaluation of these forces is required.

Therefore, PBAPS meets all M+LTR dispositions for the fuel assembly forces.

3.3.1.2 Reactor Internal Pressure Differences for Normal, Upset, Emergency and Faulted Conditions

The M+LTR describes that RIPDs (pressure differentials across the components) are calculated for normal, upset, emergency and faulted conditions consistent with the existing plant design basis. There are no significant changes in the core exit steam flow, reactor operating pressure,

FW or steam flow rates for the MELLLA+ operating domain expansion. Because none of the preceding values change significantly, the only remaining variable affecting the RIPDs for the normal, upset, emergency and faulted conditions in the MELLLA+ operating domain is the CF. Maximum CF is reduced in the MELLLA+ operating domain. [[

]] Therefore, no further evaluation of RIPDs for normal, upset, emergency and faulted conditions is required.

For PBAPS, the difference between the 100% CLTP / 110% CF ICF operation point core exit steam flow and the 100% CLTP / 83% CF MELLLA+ operation point core exit steam flow is a 0.28% increase. The differences between the vessel steam flow and FW flow rates for the two power-flow points are both less than a 0.3% decrease. The dome pressures for the two power-flow points are identical. The small differences between the core exit steam flows, vessel steam flows and FW flow rates will have a negligible effect on the RIPDs for normal, upset, emergency and faulted conditions. Therefore, because the PBAPS CF at the MELLLA+ statepoint at 83% CF is less than the current licensed operating domain statepoint at 110% CF, the normal, upset, emergency and faulted condition RIPDs for the MELLLA+ operating domain [[

]] and no further evaluation of these pressure differentials is required for normal, upset, emergency and faulted conditions.

Therefore, PBAPS meets all M+LTR dispositions for the normal, upset, emergency and faulted RIPDs.

3.3.1.3 Reactor Internals Pressure Differences (Acoustic and Flow-Induced Loads) for Faulted Conditions

As part of RIPDs, the faulted acoustic and flow-induced loads in the RPV annulus on jet pump, core shroud and core shroud support resulting from the recirculation line break LOCA have been considered in the PBAPS evaluation. [[

]] and PBAPS RIPDs for faulted conditions continue to be acceptable.

Therefore, PBAPS meets all M+LTR dispositions for the RIPDs for faulted conditions.

3.3.2 Reactor Internals Structural Evaluation

Structural integrity evaluations for MELLLA+ operating domain expansion are performed consistent with the existing design basis of the components. [[

]]

Therefore, no further structural evaluation of the reactor internals is required. An evaluation of the load categories applicable to the reactor internals under normal, upset, and emergency conditions is presented below:

Load Category	MELLLA+ Results for Normal, Upset and Emergency Conditions
Dead Weight	[[
Seismic	
RIPDs	
Thermal Effects	
Flow	]]

Therefore, PBAPS meets all M+LTR dispositions for the reactor internals structural evaluation for normal, upset, and emergency conditions.

3.3.2.1 Reactor Internals Structural Evaluation for Faulted Conditions

[[

]] The M+LTR also defines that if the load conditions do not increase in the MELLLA+ operating domain, then the existing analysis results are bounding and no further evaluation is required. Applicable loads, load combinations, and service conditions are evaluated consistent with the plant design basis for each component. As shown below, [[

]] and thus no further evaluation is required.

Load Category	MELLLA+ Results for Faulted Conditions
Dead Weight	[[
Seismic	
RIPDs	
Thermal Effects	
Flow	
Acoustic and Flow-Induced Loads Due To Recirculation Line Break	]]

The faulted condition loads for the PBAPS reactor internal components resulting from the MELLLA+ operating domain conditions [[

]] no further evaluation for reactor internals structural evaluation for faulted conditions is required.

Therefore, PBAPS meets all M+LTR dispositions for the reactor internals structural evaluation for faulted conditions.

3.3.3 Steam Separator and Dryer Performance

The performance of the PBAPS steam separator-dryer has been evaluated to determine the moisture content of the steam leaving the RPV. Compared to the current licensed operating domain, 100% CF state point, the average separator inlet flow decreases and the average separator inlet quality increases at MELLLA+ conditions. These factors, in addition to the core radial power distribution, affect the steam separator-dryer performance. Steam separator-dryer performance was evaluated at equilibrium cycle limiting conditions of high radial power peaking and 83% RCF to assess their capability to provide the quality of steam necessary to meet operational criteria at MELLLA+ operating conditions.

The PBAPS plant-specific evaluation concluded that the performance of the steam dryer and separator remains acceptable because moisture carryover (MCO) values under MELLLA+ conditions are bounded by the pre-MELLLA+ conditions. Carryunder performance under MELLLA+ conditions remains acceptable.

3.4 FLOW INDUCED VIBRATION

The FIV evaluation addresses the influence of the MELLLA+ operating domain expansion on reactor coolant pressure boundary (RCPB) piping, RCPB piping components and RPV internals. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Piping FIV Evaluation Recirculation Piping Main Steam Piping Feedwater Piping Safety Related Thermowells and Probes	Generic	Meets M+LTR Disposition
RPV Internals FIV Evaluation	Generic	Meets M+LTR Disposition

3.4.1 FIV Influence on Piping

The generic disposition of the FIV Influence on Piping topic in the M+LTR describes that [[ ]] Flow rates in the recirculation system piping, MS piping, and FW piping as well as associated MS and FW branch lines do not increase as a result of MELLLA+ operating domain expansion. [[ ]] and no further evaluation of FIV influence on recirculation, MS, and FW piping is required.

Consistent with the generic disposition discussed above, for PBAPS, previous EPU evaluations for FIV bound the MELLLA+ operating domain FIV conditions. For PBAPS, there are no increases in the recirculation system, MS, or FW flow rates as a result of MELLLA+ operating domain expansion as compared to the current licensed operating domain. The numerical values showing no increases in recirculation system, MS, or FW flow rates are presented in Table 1-2. [[ ]] and no further evaluation of FIV influence on recirculation, MS, and FW piping is required.

The generic disposition of the FIV Influence on Piping topic in the M+LTR also finds that [[ ]] Because the flow rates in these piping systems do not increase for MELLLA+, there is no increase in FIV for the safety-related thermowells and probes. [[ ]] and no further evaluation of FIV influence on safety-related thermowells and probes is required.

Also, consistent with the generic disposition discussed above, previous PBAPS FIV evaluations performed in support of the EPU for the safety-related thermowells and probes in the MS and FW piping bound the MELLLA+ operating domain. For PBAPS, there is no increase in flow in these systems for MELLLA+. Therefore, there is no increase in FIV for the safety-related thermowells and probes. [[

]] and no further evaluation of FIV influence on safety-related thermowells and probes is required.

Therefore, PBAPS meets all M+LTR dispositions for the FIV evaluation for these piping systems, including safety-related thermowells and probes.

3.4.2 FIV Influence on Reactor Internals

The generic disposition of the FIV Influence on Reactor Internals topic in the M+LTR describes [[

]] The generic disposition evaluates the effect of the MELLLA+ operating domain expansion on the following components: shroud, shroud head and steam separator, steam dryer, core spray (CS) line, low pressure coolant injection (LPCI) coupling, control rod guide tube (CRGT), in-core guide tubes, fuel channel, LPRM / intermediate range monitor (IRM) tubes, jet pumps, jet pump sensing lines (JPSLs) and FW sparger. The MELLLA+ operating domain expansion results in decreased core and recirculation flow. There is no increase in the MS or FW flow rates. The generic evaluation shows that [[

]]

Consistent with the generic disposition discussed above, the effect of the MELLLA+ operating domain expansion is presented for the following components:

Component(s)	MELLLA+ Results
Shroud Shroud Head and Separator Steam Dryer	[[
CS Line CRGT In-Core Guide Tubes	
Fuel Channel LPRM/IRM Tubes	
Jet Pumps	

Component(s)	MELLLA+ Results
JPSLs	
FW Sparger	]]

For PBAPS, the MELLLA+ operating domain expansion results in decreased core and recirculation flow and no increase in the MS or FW flow rates. The numerical values showing a decrease in CF and no increase in maximum steam or FW flow rates are presented in Table 1-2. As presented in the table above, [[ ]] The reduced CF and recirculation flow in the MELLLA+ domain [[ ]] Therefore, no further evaluation of the FIV influence on reactor internals is required for the PBAPS MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for the FIV evaluation of the reactor internals.

3.5 PIPING EVALUATION

3.5.1 Reactor Coolant Pressure Boundary Piping

The RCPB piping systems evaluation consists of a number of safety-related piping subsystems that move fluid through the reactor and other safety systems. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Main Steam and Feedwater (Inside Containment)	Generic	Meets M+LTR Disposition
Recirculation and Control Rod Drive	Generic	Meets M+LTR Disposition
Reactor Core Isolation Cooling (RCIC) High Pressure Coolant Injection (HPCI) Reactor Water Cleanup (RWCU) Core Spray (CS) Line Standby Liquid Control (SLC) Residual Heat Removal (RHR) RPV Head Vent Line SRV Discharge Line (SRVDL) Safety Related Thermowells	Generic	Meets M+LTR Disposition

The piping systems are required to comply with the structural requirements of the ASME Boiler and Pressure Vessel Code (or an equivalent Code) applicable at the time of construction or the governing code used in the stress analysis for a modified component.

3.5.1.1 Main Steam and Feedwater Piping Inside Containment

The generic disposition of the RCPB Piping - MS and FW Inside Containment topic in the M+LTR describes that the system temperatures, pressures, and flows in the MELLLA+ operating domain are within the range of rated operating parameters for the MS and FW piping system (inside containment). [[

]] The generic disposition in the M+LTR concludes that provided the temperatures, pressures, and flows in MS and FW systems for MELLLA+ operation are within the range of rated operating parameters for those systems, no further evaluation is required related to RCPB piping for MS and FW piping inside containment.

Consistent with the generic disposition discussed above, for PBAPS, the MS and connected branch piping (i.e., RCIC and HPCI steam lines) and FW piping temperatures, pressures and flows are within the rated operating parameters for the MS and FW systems. MS and FW temperatures, flows, and pressures at MELLLA+ conditions are bounded by the CLTP temperatures, flows, and pressures, and as such are within the design values used in the design of the piping and supports chosen for worst case conditions. PBAPS MS and FW piping inside containment is designed in accordance with the codes identified in UFSAR Appendix A. Because the PBAPS temperatures, pressures and flows in the MELLLA+ operating domain are within the range of rated operating parameters, the piping and support loads due to MSIV and TSV closure evaluated by the EPU analysis bound MELLLA+ conditions. Consistent with the generic disposition in the M+LTR, the temperatures, pressures, and flows in PBAPS MS and FW systems for MELLLA+ operation are within the range of rated operating parameters for those systems, and no further evaluation is required related to the PBAPS RCPB piping for MS and FW inside containment.

The generic disposition in the M+LTR does recognize that the MCO may increase for a period of time during the cycle when a plant is operating at or near the MELLLA+ minimum CF rate. The time that a plant spends in this flow condition is not excessive. The generic disposition concludes that the change in erosion/corrosion rates as a result of increased carryover is adequately managed by the existing programs discussed in Section 10.7.

Consistent with this generic disposition, the MCO from the moisture separators may increase for a period of time during the cycle when a plant is operating at or near the MELLLA+ minimum CF rate. The time that a plant spends in this flow condition is not excessive. Analysis confirms the MCO exiting the RPV remains within the limits analyzed for CLTP, therefore, there is no increase in the erosion/corrosion rates in the MS lines inside of containment. PBAPS implements programs adequate to manage any changes in the erosion/corrosion rate as described in Section 10.7.

Therefore, PBAPS meets all M+LTR dispositions for the MS and connected branch piping (i.e., RCIC and HPCI steam lines) and FW piping inside containment.

3.5.1.2 Reactor Recirculation and Control Rod Drive Systems

The generic disposition of the RCPB Piping - Reactor Recirculation and CRD systems topic in the M+LTR describes that there is no change in the maximum operating system temperatures, pressures, and flows in the MELLLA+ operating domain for the recirculation piping system and attached RHR piping system. [[

]] Therefore, the generic disposition concludes that no further evaluation of the RCPB Piping - Reactor Recirculation and CRD systems is required for MELLLA+ operating domain expansion.

Consistent with the generic disposition discussed above, for PBAPS, the Reactor Recirculation and CRD system temperatures, flows, and pressures at MELLLA+ conditions are bounded by the

CLTP temperatures, flows, and pressures, and as such are within the design values used in the design of the piping and supports chosen for worst case conditions.

Therefore, PBAPS meets all M+LTR dispositions for the reactor recirculation and CRD systems.

3.5.1.3 Other RCPB Piping Systems

3.5.1.3.1 Other RCPB Piping Systems –CS, RHR/LPCI, and SLCS

The generic disposition of the RCPB Piping - Other RCPB Piping Systems (with no flow while on-line) topic in the M+LTR describes that [[

]] The susceptibility of piping systems meeting the M+LTR criteria to erosion/corrosion does not increase, and no further evaluation of these Other RCPB Piping Systems is required.

CS, RHR/LPCI, and SLCS system temperatures, flows, and pressures at MELLLA+ conditions are bounded by the CLTP temperatures, flows, and pressures, and as such are within the design values used in the design of the piping and supports chosen for worst case conditions.

Each of these PBAPS systems [[

]] Consistent with the generic disposition, their susceptibility to erosion/corrosion does not increase, and no further evaluation of these Other RCPB Piping Systems is required for PBAPS.

3.5.1.3.2 Other RCPB Piping Systems – RPV Head Vent Line and SRV Discharge Lines

[[

]] For the RPV head vent line and the SRVDL, there is no change in the temperature, pressure, or flows in these systems as a result of MELLLA+ operating domain expansion. Because the piping systems have no change in system temperature, pressure, or flow as a result of MELLLA+ operating domain expansion, [[

]] Their susceptibility to erosion/corrosion does not increase, and no further evaluation of these Other RCPB Piping Systems is required.

Consistent with the generic disposition discussed above, MELLLA+ operating domain expansion for PBAPS does not change the maximum operating temperature, pressure, or flow rate of the RPV head vent line or SRVDL. These conditions are bounded by those used in the design of the

piping and supports. Additionally, there is no flow through the SRVDL during normal operating conditions.

The RPV head vent line and the SRVDL are unaffected by MELLLA+ operating domain expansion. Consistent with the generic disposition, their susceptibility to erosion/corrosion does not increase, and no further evaluation of these Other RCPB Piping Systems is required for PBAPS.

3.5.1.3.3 Other RCPB Piping Systems – RWCU

[[

]] Because the RWCU system has no change in system temperature, pressure, or flow as a result of MELLLA+ operating domain expansion, [[ ]] RWCU system susceptibility to erosion/corrosion does not increase, and no further evaluation of the RWCU system is required.

Consistent with the generic disposition discussed above, MELLLA+ operating domain expansion for PBAPS does not change the maximum operating temperature, pressure, or flow rate of the RWCU system. These conditions are bounded by those used in the design of the piping and supports chosen for worst case conditions. The PBAPS RWCU system is unaffected by MELLLA+ operating domain expansion. Consistent with the generic disposition, the RWCU system susceptibility to erosion/corrosion does not increase, and no further evaluation of the RWCU system is required.

3.5.1.3.4 Other RCPB Piping Systems – Safety Related Thermowells

The generic disposition in the M+LTR recognizes that [[ ]]. Because the RCPB piping systems evaluated for EPU do not experience any increase in pressure, temperature, or flow at MELLLA+, their susceptibility to erosion/corrosion does not increase, and no further evaluation of safety-related thermowells is required for PBAPS.

Consistent with the generic disposition described above, the PBAPS safety-related thermowells are unaffected by MELLLA+ as the evaluations performed for the currently licensed operating domain are bounding for MELLLA+ conditions. [[ ]] Their susceptibility to erosion/corrosion does not increase and no further evaluation of safety-related thermowells is required for PBAPS.

3.5.1.3.5 Other RCPB Piping Systems – Conclusion

Because all of the piping systems in Section 3.5.1.3 meet the criteria listed in the generic disposition for the MELLLA+ operating domain expansion, their susceptibility to erosion/corrosion does not increase, and no further evaluation of these Other RCPB Piping Systems is required.

Therefore, PBAPS meets all M+LTR dispositions for Other RCPB Piping Systems.

3.5.1.4 Other-Than-Category "A" RCPB Material

As required by M+LTR SER Limitation and Condition 12.9, the following discussion is presented regarding NUREG-0313, Revision 2, other-than-Category "A" materials that exist in the RCPB piping.

NUREG-0313 (Reference 22) discusses power plant susceptibility to intergranular stress corrosion cracking (IGSCC), and categorizes piping/weldments based on material type, stress relief, inspection results and other factors. Although most of the PBAPS RCPB piping is classified Category "A", other-than-Category "A" materials still exist in several PBAPS RCPB piping welds: Unit 2, Category D and Category E; Unit 3, Category C and Category E.

For IGSCC to occur, three conditions must be present: (1) a susceptible material; (2) the presence of residual or applied tensile stress (such as from welding); and (3) an aggressive environment. Operation at MELLLA+ conditions results in no increase in temperature or flow within the RCPB piping and does not affect the other susceptibility factors associated with IGSCC.

PBAPS has a limited number of other-than-Category "A" welds within the RCPB. Several IGSCC mitigation processes have been applied to PBAPS to reduce the RCPB components' susceptibility to IGSCC. PBAPS is designed, fabricated, and constructed with IGSCC addressed in most welds by one of three methods: (1) corrosion resistant materials; (2) solution heat treatment; or (3) clad with resistant materials. For the weldments where these three processes were not used, stress improvement processes were applied to reduce IGSCC susceptibility.

Exelon's corporate BWR Strategic Water Chemistry Plan (Reference 23), as applied to PBAPS Units 2 and 3, is consistent with both BWRVIP recommendations for water chemistry and the Experience Reports and Application guidelines for noble metal chemical addition (NMCA). PBAPS hydrogen water chemistry (HWC) with noble metals reduces the potential for IGSCC of RCPB components. The PBAPS augmented inspection program frequency is based on normal water chemistry. While PBAPS has implemented HWC with noble metals, the augmented program includes more frequent inspections than those required by BWRVIP-75-A (Reference 24).

The PBAPS ISI program for RCPB piping is implemented in accordance with requirements of ASME Boiler and Pressure Vessel Code Section XI and coupled with the augmented program for reactor coolant piping based on Generic Letter 88-01 (Reference 25), NUREG-0313, and BWRVIP-75-A. The augmented inspection program is designed to detect degradation from IGSCC. Continued implementation of the current program ensures the prompt identification of any degradation of RCPB components experienced during MELLLA+ operating conditions.

The proposed MELLLA+ conditions are acceptable with respect to RCPB materials for two reasons:

1. Although some of the PBAPS Unit 2 and Unit 3 RCPB is classified other-than-Category "A" material, as defined by NUREG-0313, Revision 2, the current RCPB inspection strategy for PBAPS is adequate to manage any potential IGSCC effects of MELLLA+.

2. Plant operation under MELLLA+ conditions does not increase IGSCC within the RCPB.

The effect of MELLLA+ on the susceptibility of RCPB materials to IGSCC has been reviewed. Appropriate degradation management programs have been identified to address any potential effects on the integrity of RCPB materials due to plant operation under MELLLA+ conditions. The RCPB materials will continue to be acceptable following implementation of the proposed MELLLA+ and will continue to meet the requirements of draft GDC-1, final GDC-14, final GDC-31, 10 CFR 50 Appendix G, and 10 CFR 50.55a. Therefore, the proposed MELLLA+ is acceptable with respect to PBAPS RCPB materials.

3.5.2 Balance-of-Plant Piping

The BOP piping evaluation consists of a number of piping subsystems that move fluid through systems outside the RCPB. The topics considered in this section are:

Topic	M+LTR Disposition	PBAPS Result
Main Steam and Feedwater (Outside Containment)	Generic	Meets M+LTR Disposition
Reactor Core Isolation Cooling High Pressure Coolant Injection Core Spray Residual Heat Removal	Generic	Meets M+LTR Disposition
Offgas System Neutron Monitoring System	Generic	Meets M+LTR Disposition

3.5.2.1 Main Steam and Feedwater (Outside Containment)

The M+LTR states that for all MS and FW piping systems, including the associated branch piping, the temperature, pressure, flow, and mechanical loads do not increase due to the MELLLA+ operating domain expansion. [[

]] As discussed in Section 3.5.1.1, the susceptibility of these piping systems to erosion/corrosion does not increase. No further evaluation is required for BOP piping – MS and FW (outside containment).

MELLLA+ operating domain expansion for PBAPS does not increase the maximum operating temperature, pressure, flow rate, or mechanical loads for the MS and FW piping outside containment. MS and FW system temperatures, flows, and pressures at MELLLA+ conditions are bounded by the CLTP temperatures, flows, and pressures, and as such are within the design values used in the design of the piping and supports chosen for worst case conditions. The PBAPS MS and FW piping outside containment is unaffected by the MELLLA+ operating domain expansion. PBAPS MS and FW piping outside containment is designed in accordance with the codes identified in UFSAR Table 3.2-1. [[

]] The FW piping outside containment susceptibility to erosion/corrosion does not increase, as the FW flow does not increase, and no further evaluation is required.

As discussed in Section 3.3.3, the MCO from the moisture separators may increase for a period of time during the cycle when a plant is operating at or near the MELLLA+ minimum CF rate. The time that a plant spends in this flow condition is not excessive. Analysis confirms the MCO exiting the RPV remains within the limits analyzed for CLTP, therefore, there is no increase in the erosion/corrosion rates in the MSLs outside of containment. PBAPS implements programs adequate to manage any changes in the erosion/corrosion rate as described in Section 10.7.

Therefore, PBAPS meets all M+LTR dispositions for MS and FW piping outside containment except for flow-accelerated corrosion (FAC) consideration.

3.5.2.2 Other BOP Piping Systems

3.5.2.2.1 Other BOP Piping Systems - RCIC, HPCI, CS, and RHR

The M+LTR describes that the loads and temperatures used in the analyses of the other BOP piping systems (RCIC, HPCI, CS, and RHR) depend on the containment hydrodynamic loads and temperature evaluation results (Section 4.1). [[

]] The design basis LOCA dynamic loads including the pool swell loads, vent thrust loads, condensation oscillation (CO) loads, and chugging loads have been defined and evaluated for the current licensed operating domain which includes consideration of FFWTR. The pool temperatures due to a design basis LOCA were also defined for the current licensed operating domain. The values for the MELLLA+ operating domain remain within these bounding values. [[

]] For these BOP piping systems, no further evaluation is required as a result of MELLLA+.

The MELLLA+ operating domain expansion for PBAPS does not change the maximum operating temperature, pressure, or flow rate, or increase mechanical loads for any of the following systems: RCIC, HPCI, CS, and RHR.

RCIC, HPCI, CS, and RHR system temperatures, flows, and pressures at MELLLA+ conditions are bounded by the CLTP temperatures, flows, and pressures, and as such are within the design values used in the design of the piping and supports chosen for worst case conditions.

For each of the PBAPS systems described above, the loads and temperatures used in the analyses continue to be bounded by the loads and temperatures used in the analyses performed for the current licensed operating domain. Section 4.1 shows that the PBAPS LOCA dynamic loads including the pool swell loads, vent thrust loads, CO loads, and chugging loads have been evaluated and are bounded by the current design basis. The PBAPS peak suppression pool temperatures due to a design basis LOCA are also bounded by the current design basis. [[

]] For these BOP piping systems, no further evaluation is required as a result of MELLLA+.

3.5.2.2.2 Other BOP Piping Systems – Offgas System and Neutron Monitoring System

[[

]] For these BOP piping systems, no further evaluation is required as a result of MELLLA+.

There is no change to the PBAPS reactor operating pressure or power level as a result of MELLLA+ operating domain expansion. The numerical values showing no increases in reactor operating pressure are presented in Table 1-2. [[ ]] For these BOP piping systems, no further evaluation is required as a result of MELLLA+.

Because all of the piping systems in Section 3.5.2.2 meet the criteria listed [[ ]] their susceptibility to erosion/corrosion does not increase, and no further evaluation of these other BOP piping systems is required.

Therefore, PBAPS meets all M+LTR dispositions for other BOP piping systems.

3.6 Reactor Recirculation System

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
System Evaluation	Generic	Meets M+LTR Disposition
Net Positive Suction Head (NPSH)	Generic	Meets M+LTR Disposition
Single Loop Operation	Generic	Meets M+LTR Disposition
Flow Mismatch	Addressed in Section 4.3.8	

3.6.1 System Evaluation

The generic disposition of the Reactor Recirculation System (RRS) Evaluation topic in the M+LTR describes that all of the RRS operating conditions for the MELLLA+ operating domain are within the operating conditions in the current licensed operating domain. SLO is not allowed in the MELLLA+ operating domain. [[ ]] and no further evaluation of this topic is required.

Consistent with the generic disposition discussed above, the PBAPS RRS operating conditions in the MELLLA+ operating domain are within the operating conditions in the current licensed operating domain. For PBAPS, there are no increases in the RRS temperature, pressure, or flow rates as a result of MELLLA+ operating domain expansion as compared to the current licensed operating domain. RRS system temperature for the current licensed operating domain is 528.4°F and in the MELLLA+ operating domain is 523.3°F. RRS system pressure for the current

licensed operating domain and in the MELLLA+ operating domain is 1,050 psia. For PBAPS, SLO is not allowed in the MELLLA+ operating domain. Therefore, consistent with the generic disposition, the PBAPS RRS and its components are unaffected by the MELLLA+ operating domain expansion, and no further evaluation of this topic is required.

3.6.2 Net Positive Suction Head

The generic disposition of the RRS- NPSH topic in the M+LTR describes that [[

]] Therefore, no further evaluation of the RRS NPSH topic is required.

Consistent with the generic disposition discussed above, PBAPS (a variable speed pump plant) [[

]] flow rate and FW temperature and as described above, the interlocks are not changed by MELLLA+. [[

]] The numerical values showing no significant changes in FW temperature and flow are presented in Table 1-2. Therefore, no further evaluation of the RRS NPSH topic is required.

Therefore, PBAPS meets all M+LTR dispositions for the RRS NPSH.

3.6.3 Single Loop Operation

The generic disposition of the RRS-SLO topic in the M+LTR states that SLO is not allowed in the MELLLA+ operating domain.

Consistent with the generic disposition, SLO is not allowed in the MELLLA+ operating domain. PBAPS SLO limitations are identified in proposed TS 3.4.1. Therefore, SLO is not allowed in the MELLLA+ operating range and is not affected by the MELLLA+ domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for SLO.

3.6.4 Flow Mismatch

Flow mismatch is discussed in Section 4.3.8.

3.7 MAIN STEAM LINE FLOW RESTRICTORS

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Structural Integrity	Generic	Meets M+LTR Disposition

The generic disposition of the MSL Flow Restrictor Structural Integrity topic in the M+LTR states that there is no increase in MS flow as a result of the MELLLA+ operating domain expansion. [[ ]] and no further evaluation of this topic is required.

Consistent with the generic disposition, there is no increase in PBAPS MS flow as a result of MELLLA+ operating domain expansion. The numerical values showing that MS flow does not increase as a result of MELLLA+ are presented in Table 1-2.

Therefore, PBAPS meets all M+LTR dispositions for the MSL flow restrictors.

3.8 MAIN STEAM ISOLATION VALVES

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Isolation Performance	Generic	Meets M+LTR Disposition
Valve Pressure Drop	Generic	Meets M+LTR Disposition

The generic disposition of the MSIV topic in the M+LTR states that there is no increase in MS pressure, flow, or pressure drop as a result of the MELLLA+ operating domain expansion. [[ ]] and no further evaluation of this topic is required.

Consistent with the generic disposition, there is no increase in PBAPS MS pressure, flow, or pressure drop as a result of MELLLA+ operating domain expansion. The MS pressure for the current licensed operating domain and in the MELLLA+ operating domain is 1,050 psia. The numerical values showing that MS flow does not increase as a result of MELLLA+ are presented in Table 1-2. The calculated pressure drop across the MSIVs is 7.66 psid for the current licensed operating domain and slightly less than 7.66 psid for the MELLLA+ operating domain due to the slight decrease in steam flow.

Therefore, PBAPS meets all M+LTR dispositions for the MSIVs.

3.9 REACTOR CORE ISOLATION COOLING

The RCIC system provides inventory makeup to the reactor vessel when the vessel is isolated from the normal high-pressure makeup systems. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
System Hardware	Generic	Meets M+LTR Disposition
System Initiation	Generic	Meets M+LTR Disposition
Net Positive Suction Head	Generic	Meets M+LTR Disposition
Inventory Makeup Level Margin to Top of Active Fuel (TAF)	Addressed in Section 9.1.3	

3.9.1 System Hardware

The generic disposition of the RCIC System Hardware topic in the M+LTR states that there are no changes to the RCIC system hardware as a result of MELLLA+ operating domain expansion.

Consistent with the generic disposition, there are no changes to the PBAPS RCIC system hardware as a result of MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for the RCIC system hardware.

3.9.2 System Initiation

The generic disposition of the RCIC System Initiation topic in the M+LTR states that there are no changes to the normal reactor operating pressure, decay heat, or SRV setpoints as a result of MELLLA+ operating domain expansion. As a result, the generic disposition in the M+LTR concludes that [[

]] Provided the conditions of the generic disposition are met, no further evaluation of this topic is required.

Consistent with the generic disposition, there are no changes to the normal reactor operating pressure, decay heat, or SRV setpoints as a result of MELLLA+ operating domain expansion. The numerical values showing that reactor operating pressure does not increase as a result of MELLLA+ are presented in Table 1-2. As described in Section 1.2.3, the generic disposition in the M+LTR concludes that there is no increase in decay heat as a result of MELLLA+ operating domain expansion. As discussed in Section 3.1.2, SRV setpoints are unchanged by MELLLA+ operating domain expansion. Therefore, for PBAPS [[

]]

PBAPS meets the conditions of the generic disposition. No further evaluation of this topic is required.

Therefore, PBAPS meets all M+LTR dispositions for the RCIC system initiation.

3.9.3 Net Positive Suction Head

The generic disposition of the RCIC NPSH topic in the M+LTR states that the NPSH available for the RCIC pump [[

]] The specified operational temperature limit for the process water does not change with MELLLA+. The NPSH required by the RCIC pump [[

]] Therefore, no further evaluation is required for this topic.

Consistent with the generic disposition, for PBAPS, there are no physical changes to the pump suction configuration. The PBAPS RCIC flow rate for the current licensed operating domain and in the MELLLA+ operating domain is 600 gpm. Minimum atmospheric pressure in the suppression chamber and the CST for the current licensed operating domain and in the MELLLA+ operating domain is 14.7 psia. The RCIC system has the capability of using the CST or the suppression pool as a suction source at CLTP and MELLLA+ conditions. The CST provides additional head over that provided by the suppression pool for the RCIC pump, and the CST is not subject to the heat addition from reactor blowdown, which reduces suction head. Consequently, suppression pool suction is more limiting for RCIC NPSH. PBAPS calculations demonstrate that the RCIC pump would have adequate NPSH given a suppression pool water temperature of 140°F.

The design basis function of the RCIC system is to provide coolant to the reactor vessel so that the core is not uncovered as a result of loss of off-site alternating current (AC) power or for a loss of feedwater (LOFW) event. Because MELLLA+ does not increase core power and therefore decay heat, the EPU evaluation is not affected and remains bounding for the MELLLA+ operating domain expansion.

The NPSH required by the PBAPS RCIC pump [[

]] Therefore, no further evaluation is required for this topic.

Therefore, PBAPS meets all M+LTR dispositions for the RCIC NPSH.

3.9.4 Inventory Makeup Level Margin to TAF

The makeup capacity of RCIC and the level margin to the TAF are evaluated in Section 9.1.3.

3.10 RESIDUAL HEAT REMOVAL SYSTEM

The RHR system is designed to restore and maintain the reactor coolant inventory following a LOCA and remove reactor decay heat following reactor shutdown for normal, transient, and accident conditions. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Low Pressure Coolant Injection Mode	Addressed in Section 4.2.4	
Suppression Pool and Containment Spray Cooling Modes	Generic	Meets M+LTR Disposition
Shutdown Cooling Mode	Generic	Meets M+LTR Disposition
Steam Condensing Mode	Not Applicable to PBAPS	
Fuel Pool Cooling Assist	Addressed in Section 6.3.1	

The primary design parameters for the RHR system are the decay heat in the core and the amount of reactor heat discharged into the containment during a LOCA. The RHR system operates in various modes, depending on plant conditions. [[

]]

3.10.1 LPCI Mode

The LPCI mode, as it supports the LOCA response, is discussed in Section 4.2.4, Low Pressure Coolant Injection.

3.10.2 Suppression Pool and Containment Spray Cooling Modes

The generic disposition of the RHR-Suppression Pool and Containment Spray Cooling Modes topic in the M+LTR describes that the SPC mode is manually initiated to maintain the containment pressure and suppression pool temperature within design limits following isolation transients or a postulated LOCA. [[
]]

Consistent with the generic disposition, [[
]] Therefore, no further evaluation is required for this topic.

Therefore, PBAPS meets all M+LTR dispositions for the RHR suppression pool and containment spray cooling modes.

3.10.3 Shutdown Cooling Mode

The generic disposition of the RHR-Shutdown Cooling (SDC) Mode topic in the M+LTR describes that the SDC mode is designed to remove the sensible and decay heat from the reactor primary system during a normal reactor shutdown. This non-safety related mode allows the reactor to be cooled down within a certain time, so that the SDC mode of operation does not become a critical path during refueling operations. [[

]]

Consistent with the generic disposition, [[ ]] Therefore, no further evaluation is required for this topic.

Therefore, PBAPS meets all M+LTR dispositions for the RHR SDC mode.

3.10.4 Steam Condensing Mode

The steam condensing mode is not applicable for PBAPS.

3.10.5 Fuel Pool Cooling Assist Mode

The fuel pool cooling assist mode, using existing RHR heat removal capacity, provides supplemental fuel pool cooling in the event that the fuel pool heat load exceeds the capability of the fuel pool cooling and cleanup system. [[ ]] Therefore, there is no effect on the fuel pool cooling assist mode.

3.11 Reactor Water Cleanup System

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
System Performance	Generic	Meets M+LTR Disposition
Containment Isolation	Generic	Meets M+LTR Disposition

3.11.1 System Performance

The generic disposition of the RWCU System Performance topic in the M+LTR describes that the MELLLA+ operating domain expansion does not change the pressure or fluid thermal conditions experienced by the RWCU system. Operation in the MELLLA+ operating domain does not increase the quantity of fission products, corrosion products, and other soluble and insoluble impurities in the reactor water. Reactor water chemistry is within fuel warranty and TS limits on effluent conductivity and particulate concentration, and thus, no changes will be made in water quality requirements.

Consistent with the generic disposition discussed above, for PBAPS, there is no increase in the quantity of fission products, corrosion products, and other soluble and insoluble impurities in the reactor water (see Section 8.4). Consistent with the generic disposition discussed above, for PBAPS, there is no significant change in the FW line temperature, pressure, or flow rate. FW line temperature for the current licensed operating domain and in the MELLLA+ operating domain is ~381°F (upstream of the RWCU return). As shown in Table 1-2, the FW flow rate in the MELLLA+ operating domain decreases slightly from the flow rate in the current licensed operating domain. As discussed in Section 1.2, reactor pressure for the current licensed operating domain and in the MELLLA+ operating domain does not change. Therefore, FW

system resistance and operating conditions do not change and the pressure at the RWCU/FW system interface does not change. As discussed in Sections 1.2 and 3.6, reactor and recirculation system parameters are bounded by or unchanged from CLTP conditions. Therefore, there is no effect on RWCU inlet conditions due to MELLLA+. Because there is no change to the pressure or fluid thermal conditions experienced by the RWCU system, and because there is no increase in the quantity of fission products, corrosion products, and other soluble and insoluble impurities in the reactor water, no further evaluation of this topic is required.

Therefore, PBAPS meets all M+LTR dispositions for RWCU system performance.

3.11.2 Containment Isolation

The generic disposition of the RWCU Containment Isolation topic in the M+LTR describes that the RWCU system is a normally operating system with no safety-related functions other than containment isolation. [[
]] because there is no change in the FW line pressure, temperature, and flow rate.

Consistent with the generic disposition discussed above, for PBAPS, there is no significant change in the FW line temperature, pressure, or flow rate. FW line temperature for the current licensed operating domain and in the MELLLA+ operating domain is ~381°F (upstream of the RWCU return). As shown in Table 1-2, the maximum FW flow rate in the MELLLA+ operating domain decreases slightly from the maximum flow rate in the current licensed operating domain. As such, the FW flow rates in the MELLLA+ operating domain remain within the FW flow rates in the current licensed operating domain. As discussed in Section 1.2, reactor pressure for the current licensed operating domain and in the MELLLA+ operating domain does not change. Therefore, FW system resistance and operating conditions do not change and the pressure at the RWCU/FW system interface does not change for RWCU return lines. As discussed in Section 3.11.1 above, there is no change to RWCU inlet conditions.

Therefore, PBAPS meets all M+LTR dispositions for RWCU containment isolation.

Table 3-1 Key Results for MELLLA+ Fluence Evaluation

Item	Parameter	Unit	CLTP Value	MELLLA+ Value	CLTP to M+ 120% OLTP Comparison
1	Peak flux at RPV ID	n/cm^2-s	1.10E9	1.12E9	Ratio of M+/CLTP peak flux is 1.02
2	Capsule (30º azimuth) flux	n/cm^2-s	1.13E9	1.11E9	Ratio of M+/CLTP flux is 0.98
3	Capsule lead factor	N/A	1.03	0.99	N/A
4	Peak flux at shroud ID	n/cm^2-s	2.01E12	2.15E12	Ratio of M+/CLTP peak flux is 1.07
5	Peak flux at top guide	n/cm^2-s	2.80E13	2.16E13	Ratio of M+/CLTP peak flux is 0.77
6	Peak flux at core plate	n/cm^2-s	3.97E11	3.92E11	Ratio of M+/CLTP peak flux is 0.99
7	54-EFPY peak fluence at RPV ID	n/cm^2	1.61E18	1.62E18	Ratio of M+/CLTP peak fluence is 1.01

Table 3-2a Upper Shelf Energy 60-Year License (54 EFPY) – Unit 2

EMA Plant Applicability Verification Form for PBAPS Unit 2 Including MELLLA+ Conditions 60-Year License (54 EFPY)			
BWR/3-6 Plate			
[[ ]]			
[[			(Reference 26)
			(Charpy Curves)
		]]	(RG 1.99, Revision 2, Figure 2)
Limiting Beltline Plate USE (Heat C2873-1):			
%Cu		0.12	
54 EFPY 1/4T Fluence		1.12E+18 n/cm^2	
RG 1.99 Predicted % Decrease		13.0	(RG 1.99, Revision 2, Figure 2)
Adjusted % Decrease		N/A	(RG 1.99, Revision 2, Position 2.2)
		13.0%	[[ ]] (Reference 17)
Therefore, the vessel plates are bounded by the EMA			

EMA Plant Applicability Verification Form for PBAPS Unit 2 Including MELLLA+ Conditions 60-Year License (54 EFPY)			
BWR/2-6 Weld			
[[ ]]			
[[			(Reference 26)
			(Charpy Curves)
		]]	(RG 1.99, Revision 2, Figure 2)
Limiting Beltline Weld USE (Heat 37C065):			
%Cu		0.182	
54 EFPY 1/4T Fluence		1.12E+18 n/cm^2	
RG 1.99 Predicted % Decrease		19.5	(RG 1.99, Revision 2, Figure 2)
Adjusted % Decrease		N/A	(RG 1.99, Revision 2, Position 2.2)
		19.5%	[[ ]] (Reference 17)
Therefore, the vessel welds are bounded by the EMA			

Table 3-2b Upper Shelf Energy 60-Year License (54 EFPY) – Unit 3

EMA Plant Applicability Verification Form for PBAPS Unit 3 Including MELLLA+ Conditions 60-Year License (54 EFPY)			
BWR/3-6 Plate			
[[ ]]			
[[			(Reference 26)
			(Charpy Curves)
			(RG 1.99, Revision 2, Figure 2)
			(Charpy Curves)
			(RG 1.99, Revision 2, Figure 2)
			(Charpy Curves)
		]]	(RG 1.99, Revision 2, Figure 2)
Limiting Beltline Plate USE (Heat C2773-2):			
%Cu		0.15	
54 EFPY 1/4T Fluence		1.07E+18 n/cm^2	
RG 1.99 Predicted % Decrease		14.5	(RG 1.99, Revision 2, Figure 2)
Adjusted % Decrease		N/A	(RG 1.99, Revision 2, Position 2.2)
		14.5%	[[ ]] (Reference 17)
Therefore, the vessel plates are bounded by the EMA			

Table 3-2b is continued on the next page.

Table 3-2b Upper Shelf Energy 60-Year License (54 EFPY) – Unit 3 (Continued)

EMA Plant Applicability Verification Form for PBAPS Unit 3 Including MELLLA+ Conditions 60-Year License (54 EFPY)			
BWR/2-6 Weld			
[[ ]]			
[[			(Reference 26)
			(Charpy Curves)
			(RG 1.99, Revision 2, Figure 2)
			(Charpy Curves)
			(RG 1.99, Revision 2, Figure 2)
			(Charpy Curves)
			(RG 1.99, Revision 2, Figure 2)
			(Charpy Curves)
		]]	(RG 1.99, Revision 2, Figure 2)
Limiting Beltline Weld USE (Heat 37C065):			
%Cu		0.182	
54 EFPY 1/4T Fluence		1.07E+18 n/cm^2	
RG 1.99 Predicted % Decrease		19.5	(RG 1.99, Revision 2, Figure 2)
Adjusted % Decrease		N/A	(RG 1.99, Revision 2, Position 2.2)
		19.5%	[[ ]] (Reference 17)
Therefore, the vessel welds are bounded by the EMA			

Table 3-3a Adjusted Reference Temperatures 60-Year License (54 EFPY) – Unit 2

Lower-Intermediate Shell Plates and Axial Welds
Thickness in inches = 6.125
54 EFPY Peak I.D. fluence = 1.62E+18 n/cm^2
54 EFPY Peak 1/4T fluence = 1.12E+18 n/cm^2

Lower Shell Plates, Circumferential Weld and Axial Welds
Thickness in inches = 6.125
54 EFPY Peak I.D. fluence = 1.22E+18 n/cm^2
54 EFPY Peak 1/4T fluence = 8.45E+17 n/cm^2

Water Level Instrumentation Nozzle (Lower-Intermediate Shell)
Thickness in inches = 6.125
54 EFPY Peak I.D. fluence = 4.73E+17 n/cm^2
54 EFPY Peak 1/4T fluence = 3.28E+17 n/cm^2

Component	Heat	% Cu	% Ni	CF	Initial RT_{NDT} °F	1/4T Fluence n/cm^2	54 EFPY ΔRT_{NDT} °F	σ_I	σ_Δ	Margin °F	54 EFPY Shift °F	54 EFPY ART °F
PLANT-SPECIFIC CHEMISTRIES												
Plates:												
Lower Shell Mark 57	C2791-2	0.12	0.52	81.4	-8	8.45E+17	31.3	0	15.6	31.3	62.5	54.5
	C2761-1	0.11	0.54	73.4	-14	8.45E+17	28.2	0	14.1	28.2	56.4	42.4
	C2873-2	0.12	0.57	82.4	-20	8.45E+17	31.6	0	15.8	31.6	63.3	43.3
Lower-Intermediate Shell Mark 58	C2894-2	0.13	0.42	85.6	-20	1.12E+18	37.7	0	17.0	34.0	71.7	51.7
	C2873-1	0.12	0.57	82.4	-6	1.12E+18	36.3	0	17.0	34.0	70.3	64.3
	C2761-2	0.11	0.54	73.4	-20	1.12E+18	32.3	0	16.2	32.3	64.6	44.6
Axial Welds:												
Lower Shell B1, B2, B3	37C065	0.182	0.181	94.5	-45	8.45E+17	36.3	16	18.1	48.4	84.7	39.7
Lower-Int Shell C1, C2, C3	37C065	0.182	0.181	94.5	-45	1.12E+18	41.6	16	20.8	52.5	94.1	49.1

Table 3-3a is continued on the next page.

Table 3-3a Adjusted Reference Temperatures 60-Year License (54 EFPY) – Unit 2 (Continued)

Component	Heat	% Cu	% Ni	CF	Initial RT_{NDT} °F	1/4T Fluence n/cm^2	54 EFPY ΔRT_{NDT} °F	σ_I	σ_Δ	Margin °F	54 EFPY Shift °F	54 EFPY ART °F
Circumferential Welds:												
BC	S3986 Linde 124 Lot 3876	0.056	0.96	76.4	-32	8.45E+17	29.3	0	14.7	29.3	58.7	26.7
Nozzles:												
N16 [1]	[[										]]	32.1
BEST ESTIMATE CHEMISTRIES FROM BWRVIP-135 R2 (Reference 26)												
[[											]]	28.8
Integrated Surveillance Program (BWRVIP-135 R2 (Reference 26)):												
Plate [2]	[[											37.2
Weld [3]											]]	29.1

Notes:

1. The N16 water level instrumentation nozzle occurs in the beltline region. [[
]]
2. The ISP plate material is not the vessel target material, [[
]]
3. The ISP weld material is not the vessel target material and does not occur within the Unit 2 beltline region. Therefore, this material is considered in determining the limiting ART. The CF is determined using RG 1.99 for the ISP chemistry.

Table 3-3b Adjusted Reference Temperatures 60-Year License (54 EFPY) – Unit 3

Intermediate Shell Plates, Axial Welds and Circumferential Weld (EF)
Thickness in inches = 6.125
54 EFPY Peak I.D. fluence = 9.49E+17 n/cm^2
54 EFPY Peak 1/4T fluence = 6.57E+17 n/cm^2

Lower-Intermediate Shell Plates and Axial Welds
Thickness in inches = 6.125
54 EFPY Peak I.D. fluence = 1.54E+18 n/cm^2
54 EFPY Peak 1/4T fluence = 1.07E+18 n/cm^2

Lower Shell Plates, Circumferential Weld, Axial Weld, and Circumferential Weld (DE)
Thickness in inches = 6.125
54 EFPY Peak I.D. fluence = 9.16E+17 n/cm^2
54 EFPY Peak 1/4T fluence = 6.34E+17 n/cm^2

Water Level Instrumentation Nozzle (Lower-Intermediate Shell)
Thickness in inches = 6.125
54 EFPY Peak I.D. fluence = 4.49E+17 n/cm^2
54 EFPY Peak 1/4T fluence = 3.11E+17 n/cm^2

Component	Heat	% Cu	% Ni	CF	Initial RT_{NDT} °F	1/4T Fluence n/cm^2	54 EFPY ΔRT_{NDT} °F	σ_I	σ_Δ	Margin °F	54 EFPY Shift °F	54 EFPY ART °F
PLANT-SPECIFIC CHEMISTRIES												
Plates:												
Lower Shell												
6-146-1	C4689-2	0.12	0.56	82.2	-10	6.34E+17	27.3	0	13.6	27.3	54.6	44.6
6-146-3	C4684-2	0.13	0.58	90.4	-20	6.34E+17	30.0	0	15.0	30.0	60.0	40.0
6-146-7	C4627-1	0.12	0.57	82.4	-20	6.34E+17	27.4	0	13.7	27.4	54.7	34.7
Lower-Intermediate Shell												
6-139-10	C2773-2	0.15	0.49	104.0	10	1.07E+18	44.7	0	17.0	34.0	78.7	88.7
6-139-11	C2775-1	0.13	0.46	86.8	10	1.07E+18	37.3	0	17.0	34.0	71.3	81.3
6-139-12	C3103-1	0.14	0.6	100.0	10	1.07E+18	43.0	0	17.0	34.0	77.0	87.0

Table 3-3b is continued on the next two pages.

Table 3-3b Adjusted Reference Temperatures 60-Year License (54 EFPY) – Unit 3 (Continued)

Component	Heat	% Cu	% Ni	CF	Initial RT_{NDT} °F	1/4T Fluence n/cm^2	54 EFPY ΔRT_{NDT} °F	σ_I	σ_Δ	Margin °F	54 EFPY Shift °F	54 EFPY ART °F
Intermediate Shell												
6-146-5	C4608-1	0.12	0.55	82.0	10	6.57E+17	27.7	0	13.9	27.7	55.5	65.5
6-146-4	C4689-1	0.12	0.56	82.2	10	6.57E+17	27.8	0	13.9	27.8	55.6	65.6
6-146-2	C4654-1	0.11	0.55	73.5	10	6.57E+17	24.9	0	12.4	24.9	49.7	59.7
Axial Welds:												
Lower Shell D1, D2, D3	37C065	0.182	0.181	94.5	-45	6.34E+17	31.4	16	15.7	44.8	76.2	31.2
Lower-Int Shell E1, E2, E3	37C065	0.182	0.181	94.5	-45	1.07E+18	40.6	16	20.3	51.7	92.3	47.3
Intermediate Shell F1, F2, F3	37C065	0.182	0.181	94.5	-45	6.57E+17	32.0	16	16.0	45.2	77.2	32.2
Circumferential Welds:												
Lower to Lower-Int DE	3P4000 Linde 124 Lot 3932	0.020	0.934	27.0	-50	6.34E+17	9.0	0	4.5	9.0	17.9	-32.1
Lower-Int to Intermediate EF	1P4217 Linde 124 Lot 3929	0.102	0.942	136.9	-50	6.57E+17	46.3	0	23.1	46.3	92.6	42.6
Nozzles:												
N16 [1]	[[										]]	46.9

Table 3-3b is continued on the next page.

Table 3-3b Adjusted Reference Temperatures 60-Year License (54 EFPY) – Unit 3 (Continued)

Component	Heat	% Cu	% Ni	CF	Initial RT_{NDT} °F	1/4T Fluence n/cm^2	54 EFPY ΔRT_{NDT} °F	σ_I	σ_Δ	Margin °F	54 EFPY Shift °F	54 EFPY ART °F
BEST ESTIMATE CHEMISTRIES FROM BWRVIP-135 R2 (Reference 26)												
[[												-32.1
											]]	44.2
Integrated Surveillance Program (BWRVIP-135 R2 (Reference 26)):												
Plate [2]	[[											91.8
Weld [3]												25.5
Weld [3]											]]	47.8

Notes:

1. The N16 water level instrumentation nozzle occurs in the beltline region. [[
   ]]
2. The ISP plate material is not the vessel target material and does not occur within the Unit 3 beltline region. Therefore, this material is not considered in determining the limiting ART. The CF is determined using RG 1.99 for the ISP chemistry.
3. The ISP weld material is not the vessel target material and does not occur within the Unit 3 beltline region. Therefore, this material is not considered in determining the limiting ART. The CF is determined using RG 1.99 for the ISP chemistry.
4. The ISP best estimate chemistry is used.

Table 3-4a 54 EFPY Effects of Irradiation on RPV Circumferential Weld Properties – Unit 2

Parameter	NRC Staff Assessment for 64 EFPY [4] (Circ Welds)	PBAPS Unit 2 54 EFPY
	(CB&I RPV)	(CB&I Vessel)
Cu%	0.10	0.058
Ni%	0.99	0.949
CF	134.9	79.2
Fluence at clad/weld interface (10^{19} n/cm^2)	1.02	0.122
$RT_{NDT(U)}$ (°F)	-65	-32
ΔRT_{NDT} w/o margin (°F) (See Note 3)	135.6	36.3
Mean RT_{NDT} (°F)	70.6	4.3
P (F/E) NRC (See Note 1)	1.78E-05	(Note 2)

Notes:
1. P (F/E) stands for "Probability of a failure event".
2. Although a conditional failure probability has not been calculated, the fact that the PBAPS Unit 2 values at the end of license are less than the 64 EFPY value provided by the NRC leads to the conclusion that the PBAPS Unit 2 RPV conditional failure probability is bounded by the NRC analysis, consistent with the requirements defined in GL 98-05.
3. $\Delta RT_{NDT} = CF * f^{(0.28 - 0.10 \log f)}$
4. From Table 2.6-5 of Reference 20, with corrected CF from Reference 21.

Table 3-4b 54 EFPY Effects of Irradiation on RPV Circumferential Weld Properties – Unit 3

Parameter	NRC Staff Assessment for 64 EFPY [4] (Circ Welds)	PBAPS Unit 3 54 EFPY [5]
	(CB&I RPV)	(CB&I Vessel)
Cu%	0.10	0.104
Ni%	0.99	0.938
CF	134.9	139.3
Fluence at clad/weld interface (10^{19} n/cm^2)	1.02	0.095
$RT_{NDT(U)}$ (°F)	-65	-50
ΔRT_{NDT} w/o margin (°F) (See Note 3)	135.6	56.6
Mean RT_{NDT} (°F)	70.6	6.6
P (F/E) NRC (See Note 1)	1.78E-05	(Note 2)

Notes:
1. P (F/E) stands for "Probability of a failure event".
2. Although a conditional failure probability has not been calculated, the fact that the PBAPS Unit 3 values at the end of license are less than the 64 EFPY value provided by the NRC leads to the conclusion that the PBAPS Unit 3 RPV conditional failure probability is bounded by the NRC analysis, consistent with the requirements defined in GL 98-05.
3. $\Delta RT_{NDT} = CF * f^{(0.28 - 0.10 \log f)}$
4. From Table 2.6-5 of Reference 20, with corrected CF from Reference 21.
5. Best estimate chemistries are used for conservatism.

4.0 ENGINEERED SAFETY FEATURES

This section addresses the evaluations that are applicable to MELLLA+.

4.1 CONTAINMENT SYSTEM PERFORMANCE

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Short-Term Pressure and Temperature Response	Plant Specific	Meets M+LTR Disposition
Long-Term Suppression Pool Temperature Response	Generic	Meets M+LTR Disposition
Containment Dynamic Loads		
Loss-of-Coolant Accident Loads	Plant Specific	Meets M+LTR Disposition
Subcompartment Pressurization	Plant Specific	Meets M+LTR Disposition
Safety Relief Valve Loads		
SRV Containment Dynamic Loads	Generic	Meets M+LTR Disposition
SRV Piping Loads	Generic	Meets M+LTR Disposition
Containment Isolation	Generic	Meets M+LTR Disposition
Generic Letter 89-10	Generic	Meets M+LTR Disposition
Generic Letter 89-16	Generic	Meets M+LTR Disposition
Generic Letter 95-07	Generic	Meets M+LTR Disposition
Generic Letter 96-06	Generic	Meets M+LTR Disposition

4.1.1 Short-Term Pressure and Temperature Response

According to Section 4.1.1 of the M+LTR (Reference 1), operation in the MELLLA+ range may change the break energy for the DBA recirculation suction line break (RSLB). The break energy is derived from the break flow rate and enthalpy. [[

]]

The PBAPS short-term RSLB containment temperature and pressure responses are affected by the change in enthalpy as a result of MELLLA+ operating domain expansion. Short-term RSLB

containment analyses were performed at the power / flow Points J and K in Figure 1-1, and it was determined that Point J is the more limiting point in the MELLLA+ domain. Table 4-1 shows the comparison of the peak containment pressure and the short term peak containment temperatures for the limiting Point J to the limiting cases in CLTP for the design and bounding cases. The design and bounding cases are defined the same as in Reference 18. The difference between the design and bounding cases is the initial containment conditions as shown in the last column of Table 4-1. The comparison demonstrates that peak drywell temperatures from the short-term RSLB for the current licensed operating domain and the MELLLA+ operating domain are bounded by the CLTP results reported in Reference 18. Table 4-1 also shows that the peak short-term RSLB pressures for the MELLLA+ operating domain are bounded by peak pressures obtained for the CLTP RSLB reported in Reference 18 and are below the design limit of 56.0 psig. These comparisons of MELLLA+ results to CLTP results demonstrate that the short-term drywell temperature and pressure responses in the MELLLA+ operating domain are less limiting than the current licensed operating domain responses.

The PBAPS evaluation concludes that the short-term drywell temperature and pressure responses are acceptable in that the peak drywell temperature and peak drywell pressure are all less limiting than the peak drywell temperature and peak drywell pressure associated with the current licensed operating domain responses.

4.1.1.1 Long-Term Suppression Pool Cooling Temperature Response

[[

]]

Therefore, no further evaluation of this topic is required.

For PBAPS, the sensible and decay heat do not change as a result of MELLLA+ operating domain expansion. [[ ]] No further evaluation of this topic is required.

Therefore, PBAPS meets all M+LTR dispositions for long-term suppression pool temperature response.

4.1.2 Containment Dynamic Loads

4.1.2.1 LOCA Loads

As described in the M+LTR, an evaluation is performed to determine the effect of MELLLA+ on the LOCA containment dynamic loads. Results from [[ ]] are used to evaluate the effect of the MELLLA+ operating domain expansion on LOCA containment dynamic loads. The key parameters are [[ ]] The LOCA dynamic loads include vent thrust, pool swell, CO, and chugging loads.

These loads have been defined generically for Mark I plants as part of the Mark I containment program and are described in detail in the Mark I Containment Load Definition Report (LDR)

(Reference 27). The LDR was reviewed and approved by the NRC in NUREG-0661 (Reference 28).

The results of the LOCA containment dynamic loads evaluation demonstrate that CLTP (Reference 18) vent thrust, pool swell, CO, and chugging load definitions remain bounding for operation in the MELLLA+ operating domain. Therefore, the LOCA containment dynamic loads are not affected by the MELLLA+ operating domain expansion.

4.1.2.2 Subcompartment Pressurization

Consistent with Section 4.1 of the M+LTR, there is the potential for a change in the thermal hydraulic conditions in the reactor vessel at MELLLA+, which may lead to increased break flow rates from liquid line breaks and thus require plant-specific subcompartment pressurization evaluations as performed for PBAPS.

An annular structure of reinforced concrete is located inside the drywell around the RPV in order to provide thermal and radiation shielding, and is called the sacrificial shield wall (SSW). The SSW is designed to withstand the differential pressure (DP) or pressure difference that would develop across the wall as a result of a high pressure pipe break within the annulus (i.e., between the RPV and the SSW).

Subcompartment Pressurization Evaluation Results for SSW

The calculations to determine the maximum pressure difference on the SSW due to the limiting RSLB between the RPV and the SSW treat the break flow as a subcooled liquid for a conservative evaluation of mass and energy release. The results, including the effects of the CLTP and the limiting off-rated condition along the MELLLA operating domain upper boundary (minimum recirculation pump speed (MPS) point with FFWTR) in addition to the MELLLA+ operating domain, indicate that the design limit of the SSW pressure difference is not exceeded for the whole operating domain, including MELLLA+. The SSW DP analysis results for MELLLA+ in comparison with CLTP are summarized in Table 4-2.

Subcompartment Pressurization Evaluation Results for Shield Plugs

This evaluation also included consideration of the jet force impinging on the shield plugs in the SSW penetrations and the stagnation pressure in the annulus resulting from the FW line break pressurizing the shield annulus. [[

]] With consideration of steam flashing for annulus pressurization and the thrust multiplication factor for jet impingement, the results, including the effects of the CLTP and the off-rated conditions in addition to the MELLLA+ operating domain, indicate that the design limit for shield plug pressure difference is not exceeded for the whole operating domain including MELLLA+. The off-rated conditions analyzed for CLTP include limiting operating conditions other than the CLTP rated condition along the MELLLA operating domain upper boundary such as the MPS power flow point with FFWTR to support the whole operating domain, including MELLLA+. The shield plugs DP analysis results for MELLLA+ in comparison with CLTP are summarized in Table 4-3.

Conclusions for Subcompartment Pressurization Evaluations

The peak SSW pressure load resulting from the limiting RSLB at CLTP and MELLLA+ conditions remains below the SSW design DP. The peak shield plug pressure load resulting from the limiting FW line break at CLTP and MELLLA+ conditions remains below the shield plug design DP.

Therefore, PBAPS meets all M+LTR dispositions for subcompartment pressurization.

4.1.2.3 SRV Piping – Containment Dynamic Loads

The generic disposition of the piping SRV loads topic in the M+LTR describes that because the sensible and decay heat do not change in the MELLLA+ operating domain and because the SRV setpoints do not change, the SRV loads do not change. Therefore, no further evaluation of this topic is required.

Consistent with the generic disposition in the M+LTR, the sensible and decay heat do not change as a result of MELLLA+ operating domain expansion. This response is discussed in Section 1.2.3. Also, there is no change to the PBAPS SRV setpoints as a result of MELLLA+ operating domain expansion. This topic is discussed in Section 3.1.2. Therefore, there is no change to the PBAPS SRV loads. No further evaluation of this topic is required.

Therefore, PBAPS meets all M+LTR dispositions for the piping SRV loads.

4.1.2.4 SRV Containment Dynamic Loads

Section 4.1 of the M+LTR (Reference 1) provides the following disposition for the effect of MELLLA+ on long-term suppression pool temperature response and SRV loads: [[

]]

The basis for the M+LTR (Reference 1) generic SRV containment load disposition was confirmed to be applicable to PBAPS.

Therefore, PBAPS meets all M+LTR dispositions for SRV containment dynamic loads.

4.1.3 Containment Isolation

The generic disposition of the Containment Isolation topic in the M+LTR concludes that [[

]] then a plant-specific evaluation is required to demonstrate the adequacy of the containment isolation system.

Consistent with the generic disposition discussed above, [[

]] Therefore, no containment isolation system evaluations are required for PBAPS.

Therefore, PBAPS meets all M+LTR dispositions for containment isolation.

4.1.4 Generic Letter 89-10

[[

]] then a plant-specific evaluation to evaluate changes to the GL 89-10 program is required.

[[

]] Sections 6.6 and 10.1 confirm that other parameters with the potential to affect the capability of safety-related MOVs, such as the ambient temperature profile, are unchanged. For each of the assessed parameters, the values in the MELLLA+ operating domain are bounded by those in the PBAPS current licensed operating domain. Therefore, a GL 89-10 MOV program evaluation is not required.

Therefore, PBAPS meets all M+LTR dispositions for the GL 89-10 program.

4.1.5 Generic Letter 89-16

In response to Generic Letter 89–16, some plants have installed a hardened wetwell vent system. One of the design requirements for the hardened wetwell vent is the ability to exhaust energy equivalent to 1% CLTP. [[

]]

4.1.6 Generic Letter 95-07

[[

]] then a plant-specific evaluation of the GL 95-07 program is required.

[[

]] Therefore, no GL 95-07 evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the GL 95-07 program.

4.1.7 Generic Letter 96-06

[[

]] then a plant-specific evaluation of the GL 96-06 program is required.

[[
]] Therefore, no GL 96-06 evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the GL 96-06 program.

4.2 EMERGENCY CORE COOLING SYSTEMS

The ECCS includes HPCI, the CS system, the LPCI mode of the RHR system, and the automatic depressurization system (ADS). The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
High Pressure Coolant Injection	Generic	Meets M+LTR Disposition
High Pressure Core Spray	N/A for PBAPS	
Core Spray	Generic	Meets M+LTR Disposition
Low Pressure Coolant Injection Mode of the RHR System	Generic	Meets M+LTR Disposition
Automatic Depressurization System	Generic	Meets M+LTR Disposition
ECCS Net Positive Suction Head	Generic	Meets M+LTR Disposition

4.2.1 High Pressure Coolant Injection

The generic disposition of the HPCI system in the M+LTR describes that the HPCI system is a turbine driven system designed to pump water into the reactor vessel over a wide range of operating pressures. The primary purpose of the HPCI system is to maintain reactor vessel coolant inventory in the event of a small break LOCA that does not depressurize the reactor vessel. In this event, the HPCI system maintains reactor water level and helps depressurize the reactor vessel. In addition, the HPCI system serves as a backup to the RCIC system to provide makeup water in the event of a LOFW flow transient. For the MELLLA+ operating domain expansion, there is no change in the reactor operating pressure, decay heat, and the SRV setpoints. [[
]]
the generic disposition finds that no further evaluation of the HPCI system is required.

Consistent with the generic disposition, there is no change to the reactor pressure as a result of MELLLA+ operating domain expansion. The numerical values showing no increases in reactor operating pressure are presented in Table 1-2. The sensible and decay heat do not change as a result of MELLLA+ operating domain expansion. This response is discussed in Section 1.2.3. Also, there is no change to the PBAPS SRV setpoints as a result of MELLLA+ operating domain

expansion. This topic is discussed in Section 3.1.2. [[

]] Therefore, all criteria related to the generic disposition of the HPCI system are met, and no further evaluation of the HPCI system is required.

Therefore, PBAPS meets all M+LTR dispositions for HPCI.

4.2.2 High Pressure Core Spray

The high pressure core spray system is not applicable to PBAPS.

4.2.3 Core Spray

The generic disposition of the CS system in the M+LTR describes that the CS system is automatically initiated in the event of a LOCA. The primary purpose of the CS system is to provide reactor coolant makeup for a large break LOCA and for any small break LOCA after the reactor vessel has depressurized. It also provides spray cooling for long-term core cooling in the event of a LOCA. [[

]] Provided the above criteria are met, the generic disposition requires no further evaluation of the CS system for MELLLA+.

Consistent with the generic disposition, there is no change to the reactor pressure as a result of MELLLA+ operating domain expansion. The numerical values showing no increases in reactor operating pressure are presented in Table 1-2. [[

]] Therefore, all criteria related to the generic disposition of the CS system are met, and no further evaluation of the CS system is required. In the event of a design basis Appendix R event, the CS system injects water into the reactor vessel to restore inventory and maintain core cooling following vessel depressurization.

Therefore, PBAPS meets all M+LTR dispositions for CS.

4.2.4 Low Pressure Coolant Injection

The generic disposition of the LPCI system in the M+LTR describes that the LPCI mode of the RHR system is automatically initiated in the event of a LOCA. The primary purpose of the LPCI mode is to provide reactor coolant makeup for a large break LOCA and for any small break LOCA after the reactor vessel has depressurized. [[

]] Provided the above criteria are met, the generic disposition requires no further evaluation of the LPCI system is required for MELLLA+.

Consistent with the generic disposition, there is no change to the reactor pressure as a result of MELLLA+ operating domain expansion. The numerical values showing no increases in reactor operating pressure are presented in Table 1-2. [[

]] Therefore, all criteria related to the generic disposition of the LPCI system are met, and no further evaluation of the LPCI system is required. In the event of a design basis Appendix R event, the LPCI system injects water into the reactor vessel to restore inventory and maintain core cooling following vessel depressurization.

Therefore, PBAPS meets all M+LTR dispositions for LPCI.

4.2.5 Automatic Depressurization System

The generic disposition of the ADS in the M+LTR describes that the ADS uses SRVs to reduce the reactor pressure following a small break LOCA, when it is assumed that the high pressure systems have failed. This allows the CS and LPCI systems to inject coolant into the reactor vessel. [[

]] Provided that the above criteria are met, the generic disposition finds that no further evaluation of the ADS is required.

[[

]] Therefore, all criteria related to the generic disposition of the ADS are met, and no further evaluation of the ADS is required.

Therefore, PBAPS meets all M+LTR dispositions for the ADS.

4.2.6 ECCS Net Positive Suction Head

The M+LTR describes that the MELLLA+ operating domain expansion does not result in an increase in the heat addition to the suppression pool following a LOCA (both large and small breaks), Station Blackout (SBO), or Appendix R event. This disposition is also applicable to other PBAPS events such as loss of RHR normal shutdown cooling function (NSDC), stuck open relief valve (SORV) and shutdown and cool down of the second (non-accident) PBAPS unit during a DBA-LOCA (on the other PBAPS unit) concurrent with the loss of off-site power (LOOP) and the loss of an emergency diesel generator (EDG). [[

]] There are no physical changes in the piping or system arrangement.

There is no increase in the heat addition to the suppression pool following a LOCA, loss of RHR NSDC, SORV, shutdown and cooldown of the second (non-accident) PBAPS unit during a DBA-LOCA (on the other PBAPS unit) concurrent with LOOP and loss of EDG, SBO, or Appendix R event (see Sections 4.1.1.1, 9.3.2, and 6.7, respectively). For PBAPS, the most limiting case for ECCS NPSH is confirmed to occur at the long-term suppression pool temperature, [[ ]] There are also no changes in the PBAPS ECCS piping or system arrangement. Therefore, all criteria related to the M+LTR disposition of ECCS-NPSH are met, and no further evaluation is required for these above stated accidents and other events.

4.2.6.1 ECCS NPSH During ATWS

Consistent with M+LTR SER Limitations and Conditions 12.23.9 and 12.23.10, a PBAPS plant-specific evaluation of ECCS pump NPSH for ATWS was performed. The plant-specific MELLLA+ ATWS analysis, in Section 9.3, shows an increase in the peak suppression pool (torus) temperature from the current licensing basis peak suppression pool temperature.

For the MELLLA+ ATWS event, the only ECCS pumps operating from the suppression pool are the RHR pumps. The HPCI pumps supply makeup to the RPV with alignment to the CST, which is unchanged from the PBAPS current licensing basis for ATWS. The CS pumps are not credited for the ATWS event, which is also consistent with the PBAPS current licensing basis. Therefore, only the RHR pump NPSH is evaluated for the MELLLA+ ATWS event.

The NPSH margin for the RHR pumps is evaluated for the limiting conditions following an ATWS. The limiting NPSH conditions depend on the pump flow rates, debris loading on the suction strainers (for debris generating events), pipe frictional losses, suppression pool level, and suppression pool temperature. Maximum torus pressure is assumed to be 14.638 psia. No containment accident pressure (CAP) is used for calculating net positive suction head available (NPSHA), which is consistent with the PBAPS current licensing basis. MELLLA+ calculations for the RHR pump NPSH are consistent with RG 1.82 (Reference 32) for the DBA-LOCA and meet the requirements of recent NRC guidance with respect to CAP (Reference 33).

The torus water level for the ATWS event NPSH analysis is adjusted for the drawdown level consistent with RG 1.82 (Reference 32) requirements. For ATWS, torus water level will increase from the initial torus water level, 14.5 feet, due to the use of HPCI for RPV makeup with the HPCI inventory being supplied from the CST. Therefore, for the NPSH analysis of ATWS, inventory addition from the CST is credited in the torus water level calculation.

ATWS is a non-LOCA event. Consistent with the guidance, Reference 33 and the current licensing basis for PBAPS, the ECCS pump NPSHR used in NPSH margin evaluations at MELLLA+ conditions contains a 21% uncertainty for the large break DBA-LOCA and small break LOCA, and 0% uncertainty for other events. The NPSHR including uncertainty (effective NPSHR or $NPSHR_{eff}$), is determined as follows:

$$NPSHR_{eff} = (1 + uncertainty)NPSHR_{3\%}$$

$NPSHR_{3\%}$ is the ECCS pump NPSH based on a 3% reduction in pump head during testing ($NPSHR_{3\%}$). The $NPSHR_{eff}$ is used in calculation of all ECCS pump NPSH margins.

The NPSH margin was calculated assuming a system flow rate that meets or exceeds the RHR pump operational requirements for ATWS. The ATWS safety analysis RHR pump flow rate is 8,600 gpm and the RHR pump flow rate used in the ATWS NPSH evaluation is 8,732 gpm. The RHR pump flow used in the ATWS NPSH analysis was increased by a factor of $1/\sqrt{0.97}$ (1.015) to account for the possible reduction of pump total developed head, 3%, when $NPSHR_{3\%}$ curves are utilized for comparison NPSHA.

The RHR pumps have been analyzed for operation time within the maximum erosion zone, defined as NPSH margin ratios between 1.2 and 1.6. The margin ratio is defined by $NPSHA/NPSHR_{3\%}$. As shown in Table 4-4, the NPSH margin ratio remains above 1.6.

Consideration of ECCS suction strainer debris loading within the NPSH evaluations at MELLLA+ conditions is consistent with the PBAPS current analysis of record for the large break (RSLB) DBA-LOCA event. For PBAPS MELLLA+, the ATWS event includes RHR pump suction strainer debris loading in the NPSH evaluation, which is consistent with the current licensing basis.

The limiting values of the maximum suppression pool temperature, NPSHA, NPSH margin, and operating time in the maximum erosion zone (<1.6 margin ratio) for the ATWS event are listed in Table 4-4. The suppression pool (torus) water level at the maximum analyzed NPSH suppression pool temperature of 172.8°F is 15.93 feet. The calculated maximum ATWS suppression pool temperature is 171.1°F as listed in Table 4-4. The NPSH analysis results for the ATWS event are conservative with respect to maximum suppression pool temperature of 171.1°F. The pump flow rates used in the ECCS NPSH evaluation are conservatively higher than those used in the safety analysis that provides the suppression pool temperature response. Time-history plots of the NPSHA and NPSH margin ratios are shown in Figures 4-1 and 4-2.

The RHR pumps have been analyzed for plant-specific conditions and have sufficient NPSH margin to perform satisfactorily during an ATWS initiated at MELLLA+. This plant-specific analysis is consistent with M+LTR SER Limitation and Condition 12.17 concerning evaluation of the safety system performance during the long-term cooling phase of an ATWS in terms of available NPSH.

Therefore, PBAPS meets all M+LTR dispositions for the ECCS NPSH.

4.3 EMERGENCY CORE COOLING SYSTEM PERFORMANCE

The PBAPS ECCS is designed to provide protection against postulated LOCAs caused by ruptures in the primary system piping. The ECCS performance characteristics do not change for the MELLLA+ operating domain expansion.

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Large Break Peak Clad Temperature	Plant Specific	Meets M+LTR Disposition
Small Break Peak Clad Temperature	Plant Specific	Meets M+LTR Disposition
Local Cladding Oxidation	Generic	Meets M+LTR Disposition
Core Wide Metal Water Reaction	Generic	Meets M+LTR Disposition
Coolable Geometry	Generic	Meets M+LTR Disposition
Long-Term Cooling	Generic	Meets M+LTR Disposition
Flow Mismatch Limits	Generic	Meets M+LTR Disposition

These topics are described in Sections 4.3.1 through 4.3.8.

4.3.1 Break Spectrum Response and Limiting Single Failure

[[

]] SAFER evaluation experience shows that the basic break spectrum response is not affected by changes in CF (Reference 34). [[

]]

M+LTR SER Limitation and Condition 12.14 requires that for plants that will implement MELLLA+, a sufficient number of small break sizes shall be analyzed at the rated CLTP power level to ensure that the peak peak cladding temperature (PCT) break size is identified. A number of small break sizes were evaluated at the rated CLTP power/MELLLA+ flow domain to determine the worst case small break.

The factors influencing the selection of the limiting single failure for PBAPS are consistent with the discussion and disposition in the M+LTR. The trends discussed in the M+LTR regarding the first and second clad temperature peaks are applicable to PBAPS. [[

]]

Therefore, the limiting Appendix K large break single failure for PBAPS MELLLA+ operating range expansion remains the battery single failure.

The factors influencing the selection of the small break limiting single failure for PBAPS are consistent with the discussion and disposition in the M+LTR. [[

]] Therefore, the limiting small break single failure for PBAPS MELLLA+ operating range expansion remains the battery single failure.

4.3.2 Large Break Peak Clad Temperature

The effect of MELLLA+ operating domain expansion on the PBAPS LOCA performance is similar to that observed in the current licensed operating domain, which includes the MELLLA operating domain low CF region. The PCT response following a large recirculation line break has two peaks. The first peak is determined by the boiling transition during CF coastdown early in the event. The second peak is determined by the core uncovery and reflooding.

MELLLA+ operating domain expansion has two effects on the boiling transition and first peak PCT. First, the reduced CF causes the boiling transition to occur earlier and lower in the bundle. Second, the reduced CF causes the initial subcooling in the downcomer to be higher so that the break flow is greater in the early phase of the LOCA event. For a given power level, the early boiling transition times (boiling transitions that occur before jet pump uncovery) for PBAPS occur earlier in the event and penetrate lower in the fuel bundle as the CF is reduced, but the effect of the earlier boiling transition on the LOCA PCT depends on the particular conditions.

<u>Effect of MELLLA+ at Rated Power</u>

The large break PCT results are shown in Table 4-5. [[

]]

<u>Effect of MELLLA+ at Less Than Rated Power</u>

M+LTR SER Limitation and Condition 12.10.a requires the M+SAR provide a discussion on the power/flow combination scoping calculations that were performed to identify the limiting statepoints in terms of DBA-LOCA PCT response for the operation within the MELLLA+ boundary. As required by this limitation, [[

]]

The PCT results summarized in Table 4-5 show that there are no unusual trends in PCT in the MELLLA+ region and that there is margin to the 2,200°F PCT limit.

<u>Effect of Axial Power Shape</u>

As required by M+LTR SER Limitation and Condition 12.11 (Reference 1) and Methods LTR SER Limitation and Condition 9.7 (Reference 4), for MELLLA+ applications, the small and large break ECCS-LOCA analyses shall include top-peaked and mid-peaked power shape in establishing the MAPLHGR and determining the PCT. This limitation is applicable to both the Licensing Basis PCT and the Upper Bound PCT. Both top-peaked and mid-peaked axial power shapes are considered in the MELLLA+ evaluations. The large break Appendix K PCT for

MELLLA+ operating domain expansion confirms that the mid-peaked axial power shape is limiting. The sensitivity to axial power shape is shown in Table 4-5.

4.3.3 Small Break Peak Clad Temperature

[[

]]

Effect of MELLLA+ at Rated Power

The small break PCT results are shown in Table 4-6. [[

]]

M+LTR SER Limitation and Condition 12.13, as stated in Section 4.3.2.5 of Reference 1, requires that the M+SAR include calculations for the limiting small break at rated power/MELLLA+ minimum CF boundary, if the small break PCT at rated power/RCF is limiting, or within [[ ]] of the limiting Appendix K (large break) PCT. For PBAPS, the small break PCT is limiting. Therefore, small break PCT calculations are performed for the rated power/MELLLA+ minimum CF statepoint, and the PCT results are shown in Table 4-6.

Effect of MELLLA+ at Less Than Rated Power

M+LTR SER Limitation and Condition 12.10 requires the M+SAR provide a justification why the transition statepoint ECCS-LOCA response bounds the 55% low CF statepoint. [[

]]

As noted above, MELLLA+ analyses of the limiting small break have been performed at the rated power/MELLLA+ minimum CF boundary. The requirement of M+LTR SER Limitation and Condition 12.13, as stated in Section 4.3.2.5 of Reference 1, is satisfied in that the [[

]] The PCT results summarized in Tables 4-5 and 4-6 show that there are no unusual trends in PCT in the MELLLA+ region and that there is margin to the 2,200°F PCT limit.

Effect of Axial Power Shape

As required by M+LTR SER Limitation and Condition 12.11 and Methods LTR SER Limitation and Condition 9.7, for MELLLA+ applications, the small and large break ECCS-LOCA analyses have included top-peaked and mid-peaked power shape in establishing the MAPLHGR and determining the PCT. This limitation is applicable to both the Licensing Basis PCT and the Upper Bound PCT. The PBAPS applications have confirmed the limiting small and large break with [[

]]

Small Break Licensing Basis PCT

Reference 36 provides justification for the elimination of the 1,600ºF Upper Bound PCT limit and generic justification that the Licensing Basis PCT will be conservative with respect to the Upper Bound PCT. The NRC SER in Reference 36 accepted this position by noting that, because plant-specific Upper Bound PCT calculations have been performed for all plants, other means may be used to demonstrate compliance with the original SER limitations. These other means are acceptable provided there are no significant changes to a plant's configuration that would invalidate the existing Upper Bound PCT calculations. The changes in magnitude of the PCT due to MELLLA+ demonstrate that this plant configuration change does not invalidate the existing Upper Bound PCT calculations.

M+LTR SER Limitations and Conditions 12.12.a and 12.12.b, along with Methods LTR SER Limitation and Condition 9.8, require that the ECCS-LOCA evaluation report both nominal and Appendix K PCTs for all calculated statepoints in the upper boundary of the expanded operating domains. [[

]] The GNF2 Licensing Basis PCT is determined to be 1,920°F based on that limiting case. [[

]]

4.3.4 Local Cladding Oxidation

[[

]] Sections 4.3.2 and 4.3.3 that determine the effect on the PCT. [[

]] Therefore, acceptable plant-specific results for the PCT analyses performed in Sections 4.3.2 and 4.3.3 ensure that the local cladding oxidation criterion is met.

For PBAPS, Sections 4.3.2 and 4.3.3 show acceptable PCT results that meet the 2,200°F limit. The margin to the 2,200˚F PCT limit is 280°F. [[

]] This demonstrates that the 10 CFR 50.46 limit of 17% regarding local cladding oxidation is met.

Therefore, PBAPS meets all M+LTR dispositions for local cladding oxidation.

4.3.5 Core Wide Metal Water Reaction

[[

]] Sections 4.3.2 and 4.3.3 that determine the effect on the PCT. [[

]] Therefore, acceptable plant-specific results for the PCT analyses performed in Sections 4.3.2 and 4.3.3 ensure that the core wide metal water reaction criterion is met.

For PBAPS, Sections 4.3.2 and 4.3.3 show acceptable PCT results that meet the 2,200°F limit. The margin to the 2,200˚F PCT limit is 280°F. [[

]] This demonstrates that 10 CFR 50.46 limits regarding core wide metal water reaction are met.

Therefore, PBAPS meets all M+LTR dispositions for the core wide metal water reaction.

4.3.6 Coolable Geometry

[[

]]

Therefore, PBAPS compliance with the coolable geometry acceptance criteria is maintained, and PBAPS meets all M+LTR dispositions for coolable geometry.

4.3.7 Long Term Cooling

[[

]]

Therefore, PBAPS compliance with the long-term cooling acceptance criteria is maintained, and PBAPS meets all M+LTR dispositions for long-term cooling.

4.3.8 Flow Mismatch Limits

The M+LTR describes that limits have been placed on recirculation drive flow mismatch over a range of CFs. For most plants, the limits on flow mismatch are more relaxed at lower CF rates. The drive flow mismatch affects the CF coastdown following the break. The effect of the drive flow mismatch on the LOCA evaluation is similar to a small change in the initial CF. [[

]]

The discussion and trends in the M+LTR are applicable to PBAPS. Therefore, the current recirculation drive flow mismatch limits remain acceptable in the MELLLA+ domain for PBAPS, and PBAPS meets all M+LTR dispositions for flow mismatch limits.

4.4 MAIN CONTROL ROOM ATMOSPHERE CONTROL SYSTEM

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Iodine Intake	Generic	Meets M+LTR Disposition

The generic disposition of the Iodine Intake topic in the M+LTR describes that the MELLLA+ operating domain expansion does not result in a change in the source terms or the release rates (Section 8.0). [[

]] Provided this criterion is met, no further evaluation of the Main Control Room (MCR) atmosphere control system is required.

Consistent with the generic disposition presented above, there is no change in the PBAPS source term or release rates as a result of MELLLA+ operating domain expansion. [[

]] No further evaluation of the MCR atmosphere control system is required.

Therefore, PBAPS meets all M+LTR dispositions for the MCR atmosphere control system.

4.5 STANDBY GAS TREATMENT SYSTEM

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Flow Capacity	Generic	Meets M+LTR Disposition
Iodine Removal Capability	Generic	Meets M+LTR Disposition

4.5.1 Flow Capacity

The generic disposition of the SGTS Flow Capacity topic in the M+LTR describes that the SGTS is designed to maintain secondary containment at a negative pressure and to filter the exhaust air for removal of fission products potentially present during abnormal conditions. By limiting the release of airborne particulates and halogens, the SGTS limits off-site dose following a postulated DBA. [[

]] and no further evaluation of the SGTS flow capacity is required.

Consistent with the generic disposition discussed above, the design flow capacity of the PBAPS SGTS was selected to maintain the secondary containment at the required negative pressure to minimize the potential for exfiltration of air from the Reactor Building. [[

]] and no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the SGTS flow capacity.

4.5.2 Iodine Removal Capacity

The generic disposition of the SGTS Iodine Removal Capacity topic in the M+LTR describes that the SGTS is designed to maintain secondary containment at a negative pressure and to filter the exhaust air for removal of fission products potentially present during abnormal conditions. By limiting the release of airborne particulates and halogens, the SGTS limits off-site dose following a postulated DBA. [[

]]

Consistent with the generic disposition discussed above, the core fission product inventory is not changed by the MELLLA+ operating domain expansion (Section 8.3), and coolant activity levels are defined by TS and do not change, so no change occurs in the SGTS adsorber iodine loading, decay heat rates, or iodine removal efficiency. Therefore, there is no effect on the SGTS. No further evaluation of this topic is required.

Therefore, PBAPS meets all M+LTR dispositions for the SGTS iodine removal capability.

4.6 MAIN STEAM ISOLATION VALVE LEAKAGE CONTROL SYSTEM

PBAPS does not use a MSIV leakage control system.

4.7 POST-LOCA COMBUSTIBLE GAS CONTROL SYSTEM

The revised 10 CFR 50.44 (68 FR 54123, dated September 16, 2003) does not define a design basis LOCA hydrogen release and eliminates the requirements for hydrogen control systems to mitigate such releases. PBAPS License Amendment Numbers 256 and 259 for Units 2 and 3 respectively, issued in 2005 (Reference 37), eliminated the requirements for the hydrogen/oxygen monitors and PBAPS License Amendment Numbers 274 and 278 for Units 2 and 3 respectively, issued in 2010 (Reference 38), eliminated the requirements for the containment atmospheric dilution system.

MELLLA+ operating domain expansion has no effect on the design of these systems or on the ability of these systems to perform their intended functions. However, as this system is no longer required to be maintained as a post-LOCA combustible gas control system, no further evaluation is necessary relative to the MELLLA+ operating domain expansion. The generic disposition of the system in accordance with Reference 1 is no longer applicable to PBAPS.

Table 4-1 Comparison of MELLLA+ Short Term Containment Response to CLTP

	Power (%)	Flow (%)	FWT[1]	Peak Drywell Pressure (psig)	Maximum Drywell Temperature (°F)	Initial Drywell Temperature (°F) / Pressure (psig)
CLTP	102.0	100.0	Reduced	50.4	298	70°F / 2.5 psig (Design)
MELLLA+	102.0	83.0	Normal	49.9	297	70°F / 2.5 psig (Design)
CLTP	102.0	100.0	Reduced	48.7	296	125°F / 2.0 psig (Bounding)
MELLLA+	102.0	83.0	Normal	47.5	295	125°F / 2.0 psig (Bounding)

Note:
1. Operating with FFWTR is not allowed in the MELLLA+ operating domain.

Table 4-2 SSW DP Analysis Results for MELLLA+ in Comparison With CLTP

Parameter	102% CLTP	MPS	MELLLA+	Design Limit (psid)
Critical Mass Flux (lbm/sec-ft^2)	9,786.1 (Subcooled)	13,304.3 (Subcooled)	11,589.7 (Subcooled)	N/A
Maximum SSW DP (psid)	37.6	51.1	44.5	72.0
Margin to Design Limit (psid)	34.4	20.9	27.5	N/A

Table 4-3 Shield Plugs DP Analysis Results for MELLLA+ in Comparison With CLTP

Parameter	102% CLTP	MPS	MELLLA+	Design Limit (psid)
Critical Mass Flux (lbm/sec-ft^2)	20,716.2 (Subcooled)	22,257.0 (Subcooled)	20,719.5 (Subcooled)	N/A
Mass Flux of Steam After Flashing (lbm/sec-ft^2)	3,363.5	2,332.7	3,361.9	N/A
DP From Pressurization (psid)	9.3	6.4	9.3	N/A
Jet Pressure (psid)	39.1	39.1	39.1	N/A
Maximum Shield Plugs DP (psid)	48.4	45.5	48.4	52
Margin to Design Limit (psid)	3.6	6.5	3.6	N/A

Table 4-4 RHR Pump NPSH – MELLLA+ ATWS

Parameter	Units	Current Licensing Basis	MELLLA+
Safety Analysis Flow Rate	gpm	8,600	8,600
NPSH Evaluation Pump Flow Rate	gpm	8,732	8,732
Maximum Torus Temperature	°F	168.3	171.1
Uncertainty	%	0	0
$NPSHR_{eff}$	feet	16.00	16.00
NPSHA	feet	31.54	30.25
NPSH Margin	feet	15.54	14.25
Time <1.6 Margin Ratio	hours	0	0

Table 4-5 Large Break PCT Sensitivity to Axial Power Shape

Power/ Flow [1]	Nominal PCT (°F) [2]		Appendix K PCT (°F)	
	1st Peak	2nd Peak	1st Peak	2nd Peak
[[				
				]]

Notes:

1. Flow level shown is percent of RCF.
2. Nominal cases are performed for the corresponding limiting Appendix K statepoint only.

Table 4-6 Small Break PCT Sensitivity to Axial Power Shape

Power/ Flow [1]	Nominal PCT (°F) [2]	Appendix K PCT (°F)
	2nd Peak	2nd Peak
[[		
		]]

Notes:

1. Flow level shown is percent of RCF.
2. Nominal cases are performed for the corresponding limiting Appendix K statepoint only.

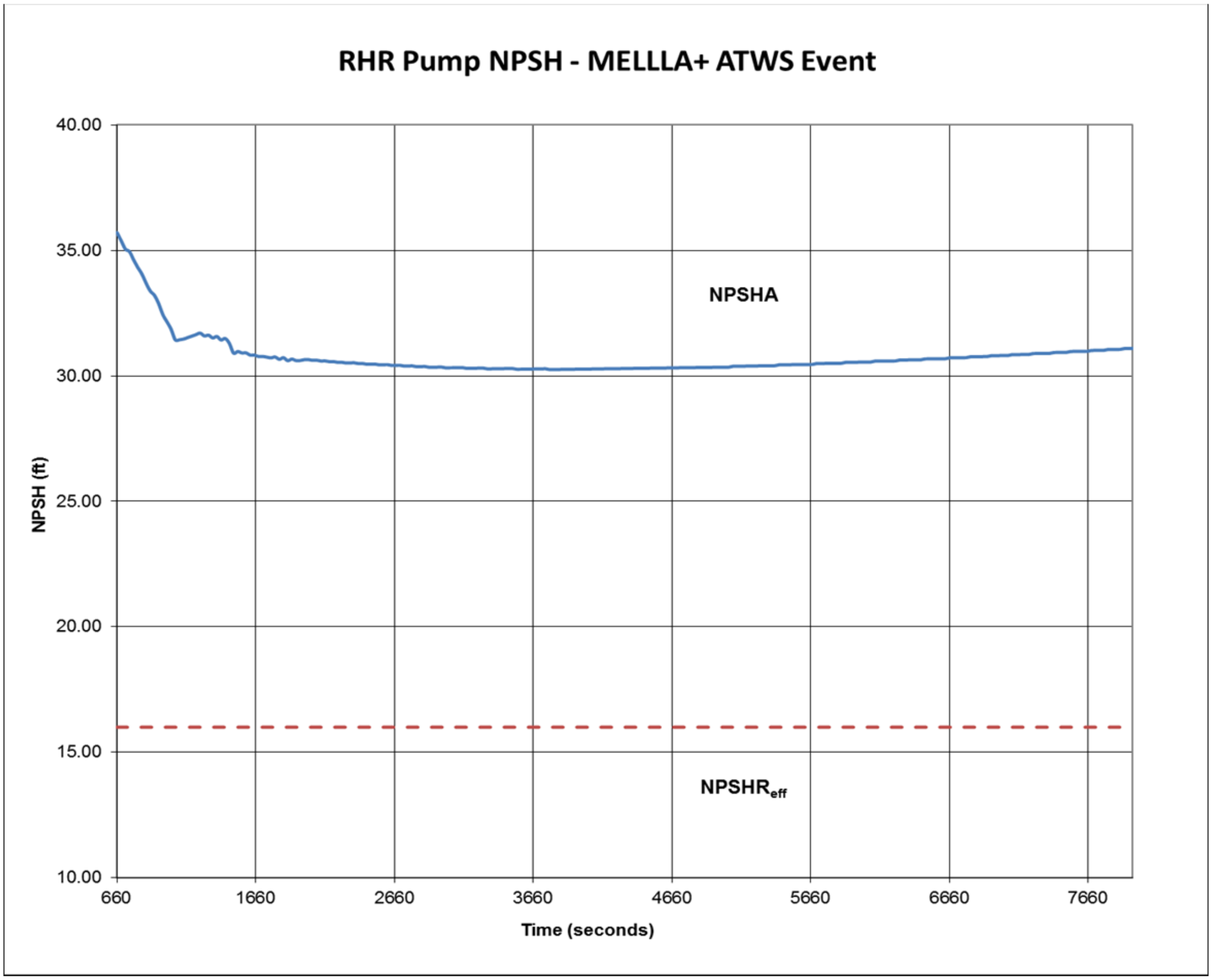


Figure 4-1 ATWS Event RHR Pump NPSH vs. Time

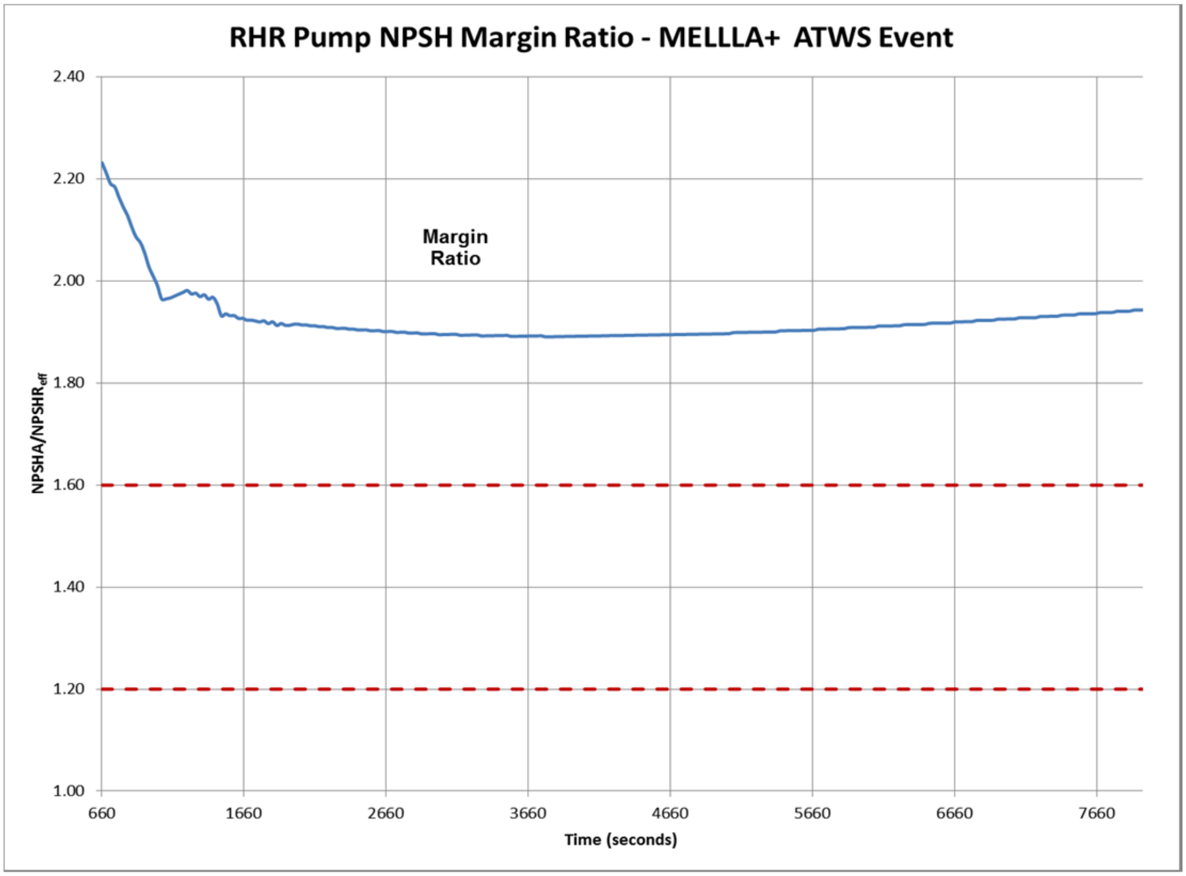


Figure 4-2 ATWS Event RHR Pump NPSH Margin Ratio

5.0 INSTRUMENTATION AND CONTROL

This section addresses the evaluations that are applicable to MELLLA+.

5.1 NSSS MONITORING AND CONTROL

Changes in process parameters resulting from the MELLLA+ operating domain expansion and their effects on instrument performance are evaluated in the following sections. The PBAPS TS changes required for the MELLLA+ operating domain expansion are described in Attachments 1 and 2 of the PBAPS MELLLA+ LAR. The effect on TS allowable values (AVs) due to the operating domain expansion is discussed in Section 5.3. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Average Power Range, Intermediate Range, and Source Range Monitors	Generic	Meets M+LTR Disposition
Local Power Range Monitors	Generic	Meets M+LTR Disposition
Rod Block Monitor	Generic	Meets M+LTR Disposition
Rod Worth Minimizer	Generic	Meets M+LTR Disposition
Traversing Incore Probes	Generic	Plant-Specific Evaluation Acceptable

5.1.1 Average Power Range, Intermediate Range, and Source Range Monitors

The disposition of APRMs, IRMs, and source range monitors (SRMs) topic in the M+LTR describes that the APRM output signals are calibrated to read 100% at the CLTP. At PBAPS, the SRMs and IRMs were replaced by the wide range neutron monitoring (WRNM) system, which is a functional replacement of the SRM and IRM systems. [[

]] The APRMs and WRNMs are installed at PBAPS in accordance with the requirements established by the GEH design specifications. Using normal plant surveillance procedures, the WRNMs may be adjusted to ensure adequate overlap with the APRMs. Therefore, no further evaluation of the APRMs or WRNMs is required for MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for the APRMs and WRNMs.

5.1.2 Local Power Range Monitors

The M+LTR describes that there is no change in the neutron flux experienced by the LPRMs resulting from the MELLLA+ operating domain expansion. [[

]] The

LPRMs are installed at PBAPS in accordance with the requirements established by the GEH design specifications. No further evaluation of these topics is required for MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for the LPRMs.

5.1.3 Rod Block Monitors

The M+LTR describes that the rod block monitor (RBM) uses LPRM instrumentation inputs that are combined and referenced to an APRM channel. And as described in Sections 5.1.1 and 5.1.2, [[
]]

No further evaluation of these topics is required for MELLLA+.

Section 9.1.1 evaluates the adequacy of the generic RBM setpoints.

Therefore PBAPS meets all M+LTR dispositions for the RBM.

5.1.4 Rod Worth Minimizer

The generic disposition of the Rod Worth Minimizer (RWM) topic in the M+LTR describes that the function of the RWM is to support the operator by enforcing rod patterns until reactor power has reached appropriate levels. The RWM functions to limit the local power in the core to control the effects of the postulated control rod drop accident (CRDA) at low power. [[ ]] Therefore, no further evaluation is required.

Consistent with the generic disposition discussed above, the PBAPS RWM supports the operator by enforcing rod patterns until reactor power has reached appropriate levels. [[ ]] Therefore, no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the RWM.

5.1.5 Traversing Incore Probes

The generic disposition of the Traversing Incore Probes (TIPs) topic in the M+LTR describes that there is no change in the neutron flux experienced by the TIPs resulting from the MELLLA+ operating domain expansion. [[ ]] The TIPs are installed at PBAPS in accordance with the requirements established by the GEH design specifications. No further evaluation of this topic is required for MELLLA+.

In accordance with Methods LTR SER Limitation and Condition 9.17 and M+LTR SER Limitation and Condition 12.15, for PBAPS, the predicted bypass void fraction at the D-Level LPRMs satisfies the [[ ]] design requirement. The SRLR will validate that the power distribution in the core is achieved while maintaining individual fuel bundles within the allowable thermal limits as defined in the COLR. When moving down and left on the MELLLA+ upper boundary, the hot channel exit void in the bypass region increases. The predicted hot channel exit void in the bypass region does not exceed [[ ]] in the MELLLA+ operating domain as shown in Table 5-1.

M+LTR SER Limitation and Condition 12.15 addresses the use of thermal neutron TIPs operating with predicted bypass voiding above the D-level LPRMs in excess of [[ ]]. PBAPS utilizes gamma TIPs and operates with bypass voiding at the TIP exit below the limit of concern. Thus, operator actions and procedures that mitigate the effect of bypass voiding on the thermal TIPs and the core simulator are not required for PBAPS.

Therefore, PBAPS meets all M+LTR dispositions for the TIPs, and no special operator actions or procedures are required.

5.2 BOP Monitoring and Control

Operation of the plant in the MELLLA+ domain has no effect on the BOP system instrumentation and control devices. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Pressure Control System	Generic	Meets M+LTR Disposition
Turbine Steam Bypass System (Normal Operation)	Generic	Meets M+LTR Disposition
Turbine Steam Bypass System (Safety Analysis)	Generic	Meets M+LTR Disposition
Feedwater Control System (Normal Operation)	Generic	Meets M+LTR Disposition
Feedwater Control System (Safety Analysis)	Generic	Meets M+LTR Disposition
Leak Detection System	Generic	Meets M+LTR Disposition

5.2.1 Pressure Control System

The disposition of the Pressure Control System topic in the M+LTR describes that [[

]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

For PBAPS, there are no increases in reactor operating pressure, MS flow rate, or FW flow rate. The numerical values showing no increases in reactor operating pressure, MS flow rate, or FW flow rate are presented in Table 1-2. The system dynamic characteristics of the PBAPS pressure control system are not changed. Therefore, no further evaluation of this system is required as a result of MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for the pressure control system.

5.2.2 Turbine Steam Bypass System (Normal Operation)

The disposition of the Turbine Steam Bypass System (Normal Operation) topic in the M+LTR describes that [[ ]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

For PBAPS, there are no increases in reactor operating pressure, MS flow rate, or FW flow rate. The numerical values showing no increases in reactor operating pressure, MS flow rate, or FW flow rate are presented in Table 1-2. The system dynamic characteristics of the PBAPS turbine steam bypass system under normal operation are not changed. [[ ]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for the turbine steam bypass system under normal operation.

5.2.3 Turbine Steam Bypass System (Safety Analysis)

The disposition of the Turbine Steam Bypass System (Safety Analysis) topic in the M+LTR describes that [[ ]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

For PBAPS, there are no increases in reactor operating pressure, MS flow rate, or FW flow rate. The numerical values showing no increases in reactor operating pressure, MS flow rate, or FW flow rate are presented in Table 1-2. The system dynamic characteristics of the PBAPS turbine steam bypass system in safety analysis conditions are not changed. [[ ]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for the turbine steam bypass system in safety analysis conditions.

5.2.4 Feedwater Control System (Normal Operation)

The disposition of the FW Control System (Normal Operation) topic in the M+LTR describes that [[ ]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

For PBAPS, there are no increases in reactor operating pressure, MS flow rate, or FW flow rate. The numerical values showing no increases in reactor operating pressure, MS flow rate, or FW flow rate are presented in Table 1-2. The system dynamic characteristics of the PBAPS FW

control system under normal operation are not changed. [[
]]
Therefore, no further evaluation of this system is required as a result of MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for the FW control system under normal operation.

5.2.5 Feedwater Control System (Safety Analysis)

The disposition of the FW Control System (Safety Analysis) topic in the M+LTR describes that [[
]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

For PBAPS, there are no increases in reactor operating pressure, MS flow rate, or FW flow rate. The numerical values showing no increases in reactor operating pressure, MS flow rate, or FW flow rate are presented in Table 1-2. The system dynamic characteristics of the PBAPS FW control system in safety analysis conditions are not changed. [[
]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for the FW control system in safety analysis conditions.

5.2.6 Leak Detection System

The disposition of the Leak Detection System topic in the M+LTR describes that [[
]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

For PBAPS, there are no increases in reactor operating pressure, MS flow rate, or FW flow rate. In addition, RWCU, RHR, HPCI, and RCIC pressures, temperatures, and flows are also unchanged. The numerical values showing no increases in reactor operating pressure, MS flow rate, or FW flow rate are presented in Table 1-2. Therefore, the system dynamic characteristics of the PBAPS leak detection system are not changed. [[
]]
Therefore, no further evaluation of this system is required as a result of MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for the leak detection system.

5.3 TECHNICAL SPECIFICATION INSTRUMENT SETPOINTS

The TS instrument AVs and the nominal trip setpoints (NTSPs) are those sensed variables which initiate protective actions and are generally associated with the safety analysis. The determination of the AV and NTSP includes consideration of measurement uncertainty and is

derived from the AL. Standard GEH setpoint methodology (References 9 and 39) is used to generate the AVs and NTSPs from the related ALs.

GEH uses the approved simplified process to determine the instrument AV and NTSP for MELLLA+ applications. The NRC staff has previously reviewed and accepted the simplified approach in the review of NEDC-33004P-A (Reference 9). Consistent with that approval, for PBAPS the following criteria are satisfied for using the simplified process:

1. [[
   ]]
2. NRC approved GEH or plant-specific methodologies are used (Reference 39).
3. [[
   ]]

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
APRM Flow-Biased Scram	Plant Specific	Meets M+LTR Disposition
Rod Block Monitor	Generic	Meets M+LTR Disposition

5.3.1 APRM Flow-Biased Scram

The MELLLA+ APRM flow biased simulated thermal power (STP) scram AL line is established to [[

]]

The MELLLA+ operating domain expansion results in the development of two ALs. The MELLLA+ APRM flow biased STP AL expressions are:

$AL_{M+ROD\ BLOCK} = 0.61W + 59.7\%$, for the Rod Block, and

$AL_{M+SCRAM} = 0.61W + 69.3\%$, for the Scram.

SLO is not applicable to the MELLLA+ operating domain as discussed in Section 3.6.3. Therefore, the SLO setpoints are unchanged.

The evaluation of APRM flow biased STP scram setpoints is consistent with the methods described for plant-specific evaluations of this topic in the M+LTR. The APRM flow biased STP scram setpoints for the PBAPS evaluation are therefore acceptable.

5.3.2 Rod Block Monitor

The M+LTR describes that the RBM setpoints are established to mitigate the rod withdrawal error (RWE) event during power operation.

For plants such as PBAPS with APRM / RBM / TS (ARTS) RBM systems, [[

]]

For PBAPS there is no change in reactor power level as a result of MELLLA+ operating domain expansion. PBAPS has an ARTS RBM system. [[

]] In accordance with M+LTR SER Limitation and Condition 12.16, an RWE analysis was performed to confirm the adequacy of the generic RBM setpoints. The RWE was simulated using the three-dimensional core simulator PANAC. The analysis was performed with an approximate equilibrium core at the MELLLA+ 100% power (3,951 MWt), 83% CF statepoint for a comprehensive set of RBM setpoints. The results of this RWE analysis confirmed the validity of the generic RBM setpoints. Therefore, no further evaluation of the RBM COLR values is required as a result of MELLLA+.

Therefore, PBAPS meets all M+LTR dispositions for the RBM COLR setpoints.

Table 5-1 Hot Channel Bypass Voiding at Steady-State and Off-Rated Conditions

Statepoint on Power / Flow Map	Core Power (%rated)	Core Flow (%rated)	Hot Channel Void Fraction in Bypass Region at Core Exit (ISCOR)	Hot Channel Void Fraction in Bypass Region at TIP Exit (ISCOR Node 22 & 23 Average)	Hot Channel Void Fraction in Bypass Region at Instrumentation D-level (ISCOR Node 21)
"D"	100.0	99.0	0.000	0.000	0.000
"J"	100.0	83.0	0.000	0.000	0.000
"K"	78.8	55.0	0.017	0.000	0.000
"L"	68.4	55.0	0.013	0.000	0.000

6.0 ELECTRICAL POWER AND AUXILIARY SYSTEMS

This section addresses the evaluations that are applicable to MELLLA+. Because there is no change in power output, most of the topics in this section are unaffected by the MELLLA+ operating domain expansion.

6.1 AC Power

The AC power supply includes both off-site and on-site power. The on-site power distribution system consists of transformers, buses, and switchgear. AC power to the distribution system is provided from the transmission system or from on-site diesel generators. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
AC Power (Normal or Degraded Voltage)	Generic	Meets M+LTR Disposition

The M+LTR describes that there is no change in the thermal power from the reactor or the electrical output from the station that results from the MELLLA+ operating domain expansion. [[

]]

No further evaluation of the AC power system is required.

There is no change in the PBAPS reactor thermal power or the electrical output from the station that results from the MELLLA+ operating domain expansion. [[

]] No further evaluation of the AC power system is required.

Therefore, PBAPS meets all M+LTR dispositions for the AC power system.

6.2 DC Power

The direct current (DC) power distribution system provides control and motive power for various systems/components within the plant. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
DC Power	Generic	Meets M+LTR Disposition

The M+LTR describes that the MELLLA+ operating domain expansion does not change system requirements for control or motive power loads. [[ ]] Therefore, no further evaluation of this topic is required.

[[ ]] as a result of MELLLA+ operating domain expansion. The MELLLA+ operating domain expansion does not change system requirements for control or motive power loads. Therefore, no further evaluation of the DC power system is required.

Therefore, PBAPS meets all M+LTR dispositions for the DC power system.

6.3 FUEL POOL

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Fuel Pool Cooling	Generic	Meets M+LTR Disposition
Crud Activity and Corrosion Products	Generic	Meets M+LTR Disposition
Radiation Levels	Generic	Meets M+LTR Disposition
Fuel Racks	Generic	Meets M+LTR Disposition

6.3.1 Fuel Pool Cooling

The M+LTR describes that the MELLLA+ operating domain expansion does not increase the core power level. [[ ]] No further evaluation of the fuel pool cooling systems are required for MELLLA+ operating domain expansion.

PBAPS reactor power level does not increase as a result of MELLLA+ operating domain expansion. [[ ]] No further evaluation of the PBAPS fuel pool cooling systems are required for MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for fuel pool cooling.

6.3.2 Crud Activity and Corrosion Products

The M+LTR describes that [[ ]] No further evaluation of the crud and corrosion products in the SFP is required for MELLLA+ operating domain expansion.

[[ ]] Therefore, no further evaluation of the crud and

corrosion products in the SFP is required for the PBAPS MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for crud and corrosion products in the SFP.

6.3.3 Radiation Levels

The M+LTR describes that [[ ]] No further evaluation of the radiation levels in the SFP is required for MELLLA+ operating domain expansion.

[[ ]] Therefore, no further evaluation of the radiation levels in the SFP is required for the PBAPS MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for radiation levels in the SFP.

6.3.4 Fuel Racks

The M+LTR describes that the MELLLA+ operating domain expansion does not increase the core power level. [[ ]] No further evaluation of the fuel racks is required for MELLLA+ operating domain expansion.

Consistent with the generic disposition presented above, the MELLLA+ operating domain expansion does not increase the PBAPS core power level. [[ ]] No further evaluation of the fuel racks is required for MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for fuel racks.

6.3.4.1 New and Spent Fuel Storage Criticality Review

Per Appendix C of the NRC SER for the M+LTR, the plant-specific application should include confirmation or discussion on how the spent fuel criticality requirement can be met for bundles that operated at MELLLA+ conditions.

The PBAPS spent fuel storage criticality analyses include conservative assumptions relative to enrichment, exposure, and void history. With these assumptions that tend to maximize reactivity, analyses show margin to fuel storage criticality safety limits and ensure that fuel storage racks will maintain sub-critical conditions in the SFP. The CLTP SFP criticality analysis with GNF2 fuel remains applicable for operation in the MELLLA+ region. Thus, the spent fuel storage facility will be capable of storing CLTP MELLLA+ fuel within the TS limits.

6.4 WATER SYSTEMS

The water systems are designed to provide a reliable supply of cooling water for normal operation and DBA conditions. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Water Systems	Generic	Meets M+LTR Disposition

The M+LTR describes that the performance of the safety-related service water system during and following the most limiting design basis event, the LOCA, is not affected by the MELLLA+ operating domain expansion. [[

]] No further evaluation of water systems is required for MELLLA+.

For PBAPS, the MELLLA+ operating domain expansion does not affect the performance of the safety-related emergency service water system or the RHR service water system during and following the most limiting design basis event, the LOCA, as discussed in Section 4.3. [[

]] No further evaluation of the PBAPS water systems is required for MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for the water systems.

6.5 STANDBY LIQUID CONTROL SYSTEM

The SLCS is a manually operated system that pumps a sodium pentaborate solution into the vessel to provide neutron absorption and achieve a subcritical reactor condition in the situation where some or all of the control rods cannot be inserted. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Shutdown Margin	Generic	Meets M+LTR Disposition
System Hardware	Plant Specific	Meets M+LTR Disposition
ATWS Requirements	Plant Specific	Meets M+LTR Disposition

6.5.1 Shutdown Margin

The generic disposition of the Shutdown Margin topic in the M+LTR describes that [[

]] An increase in the reactor boron concentration may be achieved by increasing, either individually or collectively: (1) the minimum solution volume; (2) the minimum specified solution concentration; or (3) the

isotopic enrichment of the boron-10 in the stored neutron absorber solution. As stated in Section 2.3.3, the PBAPS current design requirements for SLCS shutdown margin are unchanged by MELLLA+. The MELLLA+ operating conditions do not change the PBAPS methods that are used to evaluate that the SLCS shutdown margin meets the current PBAPS design requirements.

The SLCS shutdown margin for PBAPS is calculated as a part of the standard reload process. Because no new fuel product line designs are introduced for MELLLA+ operating domain expansion, the PBAPS TS Bases and UFSAR Section 3.8.3 value for minimum reactor coolant boron concentration of 660 ppm natural boron does not change as a result of MELLLA+ operating domain expansion. Therefore, no further evaluation of SLCS shutdown margin is required for MELLLA+.

PBAPS has increased the SLCS boron-10 enrichment from 61.92 atom-% to 92 atom-% as part of the plant modifications to support operation at CLTP. This increase in boron-10 enrichment exceeds the NRC recommendation stated in Section 9.3.1.4 of the Reference 1 NRC SER for licensees that plan to implement MELLLA+/EPU.

Therefore, PBAPS meets all M+LTR dispositions for the SLCS shutdown margin.

6.5.2 System Hardware

The M+LTR describes that the SLCS is typically designed for injection at a maximum reactor pressure equal to the upper analytical setpoint for the lowest group of SRVs operating in the relief mode. [[

]] therefore, the operation of the SLCS pump discharge relief valves will be considered on a plant-specific basis and documented in the M+SAR.

The PBAPS reactor operating pressure is unchanged by MELLLA+ operating domain expansion. The numerical values showing no increases in reactor operating pressure are presented in Table 1-2. As discussed in Section 3.1.2, there are no changes to the PBAPS SRV/SSV setpoints as a result of MELLLA+ operating domain expansion. Because the reactor dome pressure and SRV/SSV setpoints are unchanged for MELLLA+, the PBAPS process parameters are within the capability of the SLCS to perform its shutdown function. Therefore, the PBAPS SLCS remains capable of performing its shutdown function.

Therefore, PBAPS meets all M+LTR dispositions for the SLCS system hardware.

6.5.3 ATWS Requirements

As described in the M+LTR, the SLCS ATWS performance is evaluated in Section 9.3.1 for a representative core design in the MELLLA+ operating domain. The representative MELLLA+ evaluation shows that the SLCS maintains the capability to mitigate an ATWS and that the current boron injection rate is sufficient relative to the peak suppression pool temperature. The ATWS analysis is described in Section 9.3.1.

The PBAPS plant-specific ATWS analysis shows the maximum reactor lower plenum pressure following the limiting ATWS event reaches 1,191 psig during the time the SLCS is analyzed to

be in operation. This is no increase in the limiting ATWS results for CLTP within the MELLLA domain. The pressure margin for the pump discharge relief valves is 184 psig for MELLLA+ and remains above the minimum value needed to ensure that the SLCS relief valves remain closed during system injection. For the PBAPS LOOP ATWS event there is no difference in SRV/SSV operating characteristics (e.g., opening setpoints) from the SRV/SSV characteristics for the bounding, in terms of peak reactor pressure, pressure regulator failure - open (PRFO) ATWS event. The minimum reactor pressure, just prior to the time when SLCS initiates, remains low enough to ensure SLCS relief valve closure prior to the analyzed SLCS initiation time in the event of an early initiation of the SLCS during the initial ATWS transient pressure response. Therefore, SLCS operation during an ATWS is acceptable with the MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for the SLCS ATWS requirements.

6.6 HEATING, VENTILATION AND AIR CONDITIONING

The heating, ventilation, and air conditioning (HVAC) systems consists mainly of heating and cooling supply, exhaust, and recirculation units in the turbine building, reactor building and the drywell, and the radwaste building. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Heating, Ventilation. and Air Conditioning	Generic	Meets M+LTR Disposition

The M+LTR describes that the process temperatures and heat load from motors and cables do not change due to MELLLA+ operating domain expansion. [[

]] No further evaluations of the HVAC system are required for MELLLA+ operating domain expansion.

For PBAPS HVAC systems, the process temperatures and heat load from motors and cables are bounded by the CLTP process temperatures and heat loads and as such are within the design of the HVAC equipment chosen for worst case conditions. [[

]] No further evaluations of the PBAPS HVAC systems are required for MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for the HVAC systems.

6.7 FIRE PROTECTION

This section addresses the fire protection program, fire suppression and detection systems, and safe shutdown system responses to postulated 10 CFR 50 Appendix R fire events. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Fire Protection	Generic	Meets M+LTR Disposition

The disposition of the Fire Protection topic in the M+LTR describes that because the decay heat does not change for the MELLLA+ operating domain expansion, there are no changes in vessel water level response, operator response time, PCT, and peak suppression pool temperature and containment pressure. Therefore, the MELLLA+ operating domain expansion does not affect any features of the fire protection design. Although fire responses, operator actions, and safe shutdown systems are plant-specific, MELLLA+ does not change the design requirements of fire events or requirements for operator actions and safe shutdown systems. Provided the above criteria are met, no further evaluation of fire protection is required for MELLLA+ operating domain expansion.

For PBAPS, these parameters do not change as a result of MELLLA+ operating domain expansion. As discussed in Section 1.2.3, decay heat does not change as a result of MELLLA+ operating domain expansion. Reactor vessel water level response is unchanged by MELLLA+ operating domain expansion. Operator response times are not affected by MELLLA+ because: [[

]] and no further evaluation of fire protection is required for MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for fire protection.

6.8 OTHER SYSTEMS AFFECTED

The topics addressed in this evaluation are other systems that may be affected by the MELLLA+ operating domain expansion:

Topic	M+LTR Disposition	PBAPS Result
Other Systems	Generic	Meets M+LTR Disposition

The disposition of the Other Systems Affected topic in the M+LTR describes that the systems typically found in a BWR power plant have been evaluated to establish those systems that are affected by the MELLLA+ operating domain expansion. Those systems that are significantly affected by the MELLLA+ operating domain expansion are addressed in this report. Other systems not addressed by this report are not significantly affected by the MELLLA+ operating domain expansion.

The PBAPS systems evaluated [[ ]] were reviewed for MELLLA+ operating domain expansion to ensure that all significantly affected systems were addressed. This topic confirms that those systems that are significantly affected by the MELLLA+ operating domain expansion are addressed in this report. Other systems not addressed by this report are not significantly affected by the MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for the other systems.

7.0 POWER CONVERSION SYSTEMS

This section addresses the evaluations that are applicable to MELLLA+. Because the pressure, steam and FW flow rate, and FW fluid temperature ranges are unchanged by the operating domain expansion, the power conversion systems are unaffected.

7.1 TURBINE-GENERATOR

The turbine-generator converts the thermal energy in the steam into electrical energy. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Turbine-Generator	Generic	Meets M+LTR Disposition

The disposition of the Turbine-Generator topic in the M+LTR describes that the MELLLA+ operating domain expansion does not change the pressure, thermal energy, and steam flow from the reactor. Likewise, there is no change in the electrical output of the generator. Therefore, there is no change in the previous missile avoidance and protection analysis. No further evaluation of this topic is required.

There is no change in the reactor power level as a result of MELLLA+ operating domain expansion. For PBAPS, there are no increases in reactor operating pressure or MS flow rates. The numerical values showing no increases in reactor operating pressure and MS flow rates are presented in Table 1-2. The electrical output in the current licensed operating domain does not change for operation in the MELLLA+ operating domain. Therefore, there is no change to the PBAPS missile avoidance and protection analysis for the current licensed operating domain. No further evaluation of this topic is required.

Therefore, PBAPS meets all M+LTR dispositions for the turbine generator.

7.2 CONDENSER AND STEAM JET AIR EJECTORS

The condenser removes heat from the steam discharged from the turbine and provides liquid for the condensate and FW systems. The steam jet air ejectors remove non-condensable gases from the condenser to improve thermal performance. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Condenser And Steam Jet Air Ejectors	Generic	Meets M+LTR Disposition

The disposition of the Condenser and Steam Jet Air Ejectors topic in the M+LTR describes that the MELLLA+ operating domain expansion does not change the steam flow rate or power level. [[

]] MELLLA+ operating domain expansion does not affect the condenser and steam jet air ejectors, and no further evaluation is required.

There is no change in the reactor power level as a result of MELLLA+ operating domain expansion. For PBAPS, there are no increases in reactor operating pressure or MS flow rates. The numerical values showing no increases in reactor operating pressure and MS flow rates are presented in Table 1-2. [[ ]] MELLLA+ operating domain expansion does not affect the PBAPS condenser and steam jet air ejectors, and no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the condenser and steam jet air ejectors.

7.3 TURBINE STEAM BYPASS

The turbine steam bypass system provides a means of accommodating excess steam generated during normal plant maneuvers and transients. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Turbine Steam Bypass	Generic	Meets M+LTR Disposition

The disposition of the Turbine Steam Bypass topic in the M+LTR describes that there is no change in the power level, pressure, or steam flow for the MELLLA+ operating domain expansion. Therefore, MELLLA+ operating domain expansion does not affect the turbine steam bypass system, and no further evaluation is required.

There is no change in the reactor power level as a result of the MELLLA+ operating domain expansion. For PBAPS, there are no increases in the reactor operating pressure or MS flow rates. The numerical values showing no increases in the reactor operating pressure and MS flow rates are presented in Table 1-2. Therefore, MELLLA+ operating domain expansion does not affect the PBAPS turbine steam bypass system, and no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the turbine steam bypass system.

7.4 FEEDWATER AND CONDENSATE SYSTEMS

The FW and condensate systems provide the source of makeup water to the reactor to support normal plant operation. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Feedwater And Condensate Systems	Generic	Meets M+LTR Disposition

The M+LTR describes that there is no change in the FW pressure, temperature, or flow for the MELLLA+ operating domain expansion. The performance requirements for the FW and condensate systems are not changed by MELLLA+ operating domain expansion, and no further evaluation is required.

There is no change in the PBAPS FW pressure, temperature, and flow rates. Because FW flow is unchanged in the MELLLA+ domain, system resistance and therefore operating pressures in the

MELLLA+ operating domain are not changed. The numerical values showing no increases in FW temperature and flow rates are presented in Table 1-2. Therefore, MELLLA+ operating domain expansion does not affect the PBAPS FW and condensate systems, and no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the FW and condensate systems.

8.0 RADWASTE SYSTEMS AND RADIATION SOURCES

This section addresses the evaluations that are applicable to MELLLA+.

8.1 LIQUID AND SOLID WASTE MANAGEMENT

The liquid radwaste system collects, monitors, processes, stores and returns processed radioactive waste to the plant for reuse or discharge. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Coolant Fission and Corrosion Product Levels	Addressed in Section 8.4	
Waste Volumes	Generic	Plant Specific Evaluation Acceptable

8.1.1 Coolant Fission and Corrosion Product Levels

A discussion of the coolant activation products as well as fission and activated corrosion products levels in the coolant is presented in Section 8.4.

8.1.2 Waste Volumes

The M+LTR describes that because the power level, FW flow, and steam flow do not change for the MELLLA+ operating domain expansion, the volume of liquid radwaste and the coolant concentrations of fission and corrosion products will be unchanged. Although the volume of waste generated is not expected to increase, higher MCO in the reactor steam could result in slightly higher loading on the condensate full flow filtration (CFFF) filter and the condensate demineralizers. The M+LTR also indicates that if the MCO from the reactor water to the steam increases by any significant amount, a plant-specific reassessment of the carryover of fission and corrosion products to the condensate system would be performed.

There is no change in the reactor power level as a result of MELLLA+ operating domain expansion. For PBAPS, there are no increases in the MS or FW flow rates. The numerical values showing no increases in MS and FW flow rates are presented in Table 1-2. For PBAPS, an evaluation was performed using a conservatively high MCO of 0.3 wt. %. This value bounds the expected MCO as a result of operating in the MELLLA+ operating domain. The PBAPS evaluation indicated that most of the fission and corrosion products carried over are removed in the moisture separators and returned to the reactor vessel via the FW system. The very small amounts of MCO and fission and corrosion products that pass through the low pressure turbine to the condenser result in a negligible increase in the loading on the CFFF filters and the condensate demineralizers. Because there is no increase in MCO leaving the reactor, there is no increase in reactor MCO reaching the condenser, the CFFF filter backwash frequency and volume are not changed, and the disposal frequency of the condensate demineralizer resins is not changed.

Additionally, the RWCU filter demineralizer backwash frequency is not changed because the RWCU system is not affected by operation in the MELLLA+ operating domain (see

Section 3.11). Thus, the PBAPS waste volumes will not be affected by operation in the MELLLA+ operating domain.

Therefore, waste volumes remain acceptable for the MELLLA+ operating domain.

8.2 GASEOUS WASTE MANAGEMENT

The primary function of the Gaseous Waste Management (offgas) system is to process and control the release of gaseous radioactive effluents to the site environs so that the total radiation exposure of persons in off-site areas is as low as reasonably achievable (ALARA) and does not exceed applicable guidelines. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Off-Site Release Rate	Generic	Meets M+LTR Disposition
Recombiner Performance	Generic	Meets M+LTR Disposition

8.2.1 Off-Site Release Rate

The M+LTR describes that the radiological release rate is administratively controlled to remain within existing limits and is a function of fuel cladding performance, main condenser air inleakage, charcoal adsorber inlet dew point, and charcoal adsorber temperature. [[

]] No further evaluation of this topic is required.

The PBAPS radiological release rate is administratively controlled to remain within existing release rate limits. In addition, none of the applicable identified parameters are affected by MELLLA+ operating domain expansion. Therefore, the PBAPS off-site release rate is unaffected by the MELLLA+ operating domain expansion, and no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the off-site release rate.

8.2.2 Recombiner Performance

The M+LTR describes that [[

]] Therefore, recombiner performance is unaffected by the MELLLA+ operating domain expansion, and no further evaluation is required.

The PBAPS-specific value for radiolytic gas flow rates are 0.052 cfm/MWt (Unit 2) and 0.046 cfm/MWt (Unit 3), which do not change as a result of MELLLA+ operating domain expansion. Therefore, the PBAPS recombiner performance is unaffected by the MELLLA+ operating domain expansion, and no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the recombiner performance.

Therefore, PBAPS meets all M+LTR dispositions for the gaseous waste management system.

8.3 RADIATION SOURCES IN THE REACTOR CORE

During power operation, the radiation sources in the core are directly related to the fission rate. These sources include radiation from the fission process, accumulated fission products, and neutron activation reactions. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Post Operational Radiation Sources for Radiological and Shielding Analysis	Generic	Meets M+LTR Disposition

The M+LTR describes that the post-operation radiation sources in the core are primarily the result of accumulated fission products. [[

]] Therefore, no further evaluation of radiation sources in the reactor core is required.

The reactor power does not increase as a result of MELLLA+ operating domain expansion. PBAPS core average exposure for MELLLA+ is [[

]]

No further evaluation of radiation sources in the reactor core is required.

Therefore, PBAPS meets all M+LTR dispositions for the radiation sources in the reactor core.

8.4 RADIATION SOURCES IN REACTOR COOLANT

Radiation sources in the reactor coolant include activation products, activation corrosion products, and fission products. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Coolant Activation Products	Generic	Meets M+LTR Disposition
Fission and Activated Corrosion Products	Plant Specific	Meets M+LTR Disposition

8.4.1 Coolant Activation Products

As described in the M+LTR, during reactor operation the coolant passing through the core region becomes radioactive as a result of nuclear reactions, thus, producing coolant activation products. Coolant activation is the dominant process resulting in the production of short-lived radionuclides of N-16 and other activation products, and is the primary source of radiation in the turbines. The M+LTR states that if [[

]]

no further evaluation of this topic is required.

The reactor power does not increase as a result of MELLLA+ operating domain expansion. The PBAPS steam flow rate does not change as a result of MELLLA+ operating domain expansion. Numerical values demonstrating that the MS flow does not increase are provided in Table 1-2. [[

]] No further evaluation of this topic is required.

Therefore, PBAPS meets all M+LTR dispositions for the coolant activation products in the reactor core.

8.4.2 Fission and Activation Corrosion Products

The reactor coolant contains fission products and activated corrosion products. For the MELLLA+ operating domain there is no change in the steam flow, or power, and a negligible change in FW flow. However, [[

]]

For PBAPS, reactor power does not change as a result of the MELLLA+ operating domain expansion. The PBAPS MS flow does not change and the FW flow only changes negligibly as a result of the MELLLA+ operating domain expansion. Therefore, the MELLLA+ operating domain expansion does not affect the total activity concentration in the reactor coolant.

Steam separator and dryer performance for MELLLA+ operation is discussed in Section 3.3.3. The moisture content of the MS leaving the vessel has been confirmed to remain below 0.3% at times while operating near the minimum CF in the MELLLA+ operating domain. It should be noted that the current coolant radiation source term assumed contingent MCO values of 0.1% and 0.3% (Reference 18). The inputs to the PBAPS coolant source term analysis do not change; therefore, the coolant radiation source term as reported in Reference 18 is applicable and unchanged for MELLLA+ conditions.

PBAPS meets all M+LTR dispositions for the coolant activation products in the reactor core.

8.5 RADIATION LEVELS

Radiation levels during operation are derived from coolant sources. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Normal Operational Radiation Levels	Plant Specific	Meets M+LTR Disposition
Post-Shutdown Radiation Levels	Plant Specific	Meets M+LTR Disposition
Post-Accident Radiation Levels	Plant Specific	Meets M+LTR Disposition

8.5.1 Normal Operational Radiation Levels

The M+LTR describes that plant radiation levels for normal and post-shutdown operation are directly dependent upon radiation levels and radionuclide species in the reactor coolant (steam and water) except where the core is directly involved. [[

]]

For PBAPS, reactor power does not change as a result of the MELLLA+ operating domain expansion. The PBAPS MS flow rate does not change as a result of the MELLLA+ operating domain expansion. Numerical values demonstrating the MS flow rate does not increase are provided in Table 1-2. Because there is no change in power or steam flow rate for the MELLLA+ expanded operating domain, the radiation levels from the coolant activation products do not vary significantly. These radionuclide concentrations in the coolant do not vary significantly unless the MCO from the vessel increases, which affects the equilibrium concentrations in the coolant. The moisture content of the moisture separator outlet may increase at certain times while operating in the MELLLA+ operating domain. However, considering the replacement steam dryer (RSD) improved MCO performance, the resulting MS MCO and radiation levels will remain within the CLTP results. In addition, the PBAPS cycle average value will be monitored and controlled within the existing analytical assumption of 0.3 wt % used in the determination of normal operation radiation levels. The overall radiological effect of moisture content is a function of the plant water radiochemistry and the levels of activated corrosion products maintained. PBAPS maintains appropriate health physics and ALARA controls to address variations in the normal operation radiation levels.

8.5.2 Post-Shutdown Radiation Levels

The M+LTR describes that plant radiation levels for normal and post-shutdown operation are directly dependent upon radiation levels and radionuclide species in the reactor coolant (steam and water) except where the core is directly involved. [[

]]

For PBAPS, reactor power does not change as a result of the MELLLA+ operating domain expansion. The PBAPS MS flow rate does not change as a result of the MELLLA+ operating domain expansion. Numerical values demonstrating the MS flow rate does not increase are provided in Table 1-2. The shutdown radiation levels are dominated by the accumulated contamination of some fission and activated corrosion products. These radionuclide

concentrations in the coolant do not vary significantly unless the MCO from the vessel increases, which affects the equilibrium concentrations in the coolant. The moisture content of the moisture separator outlet may increase at certain times while operating in the MELLLA+ operating domain. However, considering the RSD improved MCO performance, the resulting MS MCO and radiation levels will remain within the CLTP results. In addition, the PBAPS cycle average value will be monitored and controlled within the existing analytical assumption of 0.3 wt % used in the determination of normal operation radiation levels. The overall radiological effect of moisture content is a function of the plant water radiochemistry and the levels of activated corrosion products maintained. PBAPS maintains appropriate health physics and ALARA controls to address variations in the shutdown radiation levels.

8.5.3 Post-Accident Radiation Levels

The M+LTR describes that the post-accident radiation levels depend primarily upon the core inventory of fission products and TS levels of radionuclides in the coolant. [[

]] Section 9.2 discusses off-site doses for post-accident calculations.

8.6 NORMAL OPERATION OFF-SITE DOSES

The primary source of normal operation off-site doses is: (1) airborne releases from the offgas system, and (2) gamma shine from the plant turbines. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Plant Gaseous Emissions	Generic	Plant Specific Evaluation Acceptable
Gamma Shine from the Turbine	Generic	Meets M+LTR Disposition

8.6.1 Plant Gaseous Emissions

The M+LTR describes that for the MELLLA+ operating domain expansion, there is no change in the core power and the steam flow rate. [[
]] No further evaluation of plant gaseous emissions is required.

The reactor power does not change as a result of the MELLLA+ operating domain expansion. The PBAPS steam flow rate does not change as a result of the MELLLA+ operating domain expansion. Numerical values demonstrating that the MS flow does not increase are provided in Table 1-2. [[ ]]

In the MELLLA+ operating domain, the moisture content of the moisture separator outlet may increase at certain times while operating in the MELLLA+ operating domain. However, considering the RSD improved MCO performance, MS MCO will remain within the CLTP

analyzed limits. Therefore, PBAPS doses to the public remain a small percentage of the 10 CFR 50 Appendix I design objectives and remain within the applicable regulatory guidance of 10 CFR 20.

Therefore, plant gaseous emissions remain acceptable for the MELLLA+ operating domain.

8.6.2 Gamma Shine from the Turbine

The M+LTR describes that for the MELLLA+ operating domain expansion, [[

]] Provided these conditions are met, no further evaluation of gamma shine from the turbine is required.

The PBAPS steam flow rate does not change as a result of the MELLLA+ operating domain expansion. Numerical values demonstrating the MS flow does not increase are provided in Table 1-2. There is no increase in moisture content in the reactor steam for MELLLA+ operation. Therefore, the moisture content in the reactor steam for MELLLA+ operation will not affect the N-16 activity concentration (in units of μCi/g) because the total N-16 amount contained in the moisture is small compared to that contained in the dry steam. [[

]]

Therefore, PBAPS meets all M+LTR dispositions for gamma shine from the turbine.

9.0 REACTOR SAFETY PERFORMANCE EVALUATIONS

This section addresses the evaluations that are applicable to MELLLA+.

9.1 ANTICIPATED OPERATIONAL OCCURRENCES

The PBAPS UFSAR defines the licensing basis AOOs. Table 9-1 of the M+LTR provides an assessment of the effect of the MELLLA+ operating domain expansion on each of the Reference 6 limiting AOO events and key non-limiting events. Table 9-1 of the M+LTR includes fuel thermal margin, overpressure, and loss of water level events. The overpressure protection analysis events are addressed in Section 3.1. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Fuel Thermal Margins Events	Plant Specific	Meets M+LTR Disposition
Power and Flow Dependent Limits	Plant Specific	Meets M+LTR Disposition
Non-Limiting Events	Generic	Meets M+LTR Disposition

9.1.1 Fuel Thermal Margin Events

[[

]] The limiting thermal margin events defined in Reference 6 include:

- Generator Load Rejection Without Bypass (LRNBP) or Turbine Trip Without Bypass (TTNBP)
- Feedwater Controller Failure (Maximum Demand) (FWCF)
- Inadvertent HPCI Start with Level 8 Trip (HPCIL8)
- Loss of Feedwater Heating (LFWH)
- Control Rod Withdrawal Error (RWE)

The fuel loading error is categorized as an Infrequent Incident. However, if the licensee does not meet the requirements of GESTAR II (Reference 6), the fuel loading error event would be analyzed as an AOO. PBAPS does not meet the requirements of Reference 6. Therefore, the fuel loading error event is evaluated as an AOO for each reload. [[

]]

TRACG was used to perform the AOO pressurization transient analyses. The previous PBAPS EPU AOO analyses were performed with ODYN rather than TRACG. In order to provide a direct comparison of TRACG results that are representative of PBAPS, the MELLLA+ results are compared with PBAPS Unit 2, Cycle 20 TRACG results. Table 9-1 provides a comparison of MELLLA+ analysis results with the limiting ICF results of the PBAPS Unit 2 Cycle 20 TRACG reload analysis. The Cycle 20 analysis was performed at a rated core power of 3,514 MWt with full power flow rates from 82.8% to 110% of RCF. The PBAPS TRACG model uses the actual PBAPS flow configuration, as required by M+LTR SER Limitation and Condition 12.24.1. The TRACG interfacial shear model complies with the NRC SE for Reference 5, as required by Methods LTR SER Limitation and Condition 9.20.

The operational results for the limiting event, LRNBP, for the MELLLA+ 83% CF statepoint are presented in Figure 9-1, and the results for the PBABS Unit 2, Cycle 20 LRNBP analysis are presented in Figure 9-2. Table 9-1 summarizes the results for the LRNBP, TTNBP, FWCF, HPCIL8, RWE, and LFWH events. [[

]]

The thermal margin event analysis is performed as part of the reload process for each reload core and results are documented in the SRLR. From M+LTR SER Limitation and Condition 12.4, the limiting thermal margin events will be analyzed for the MELLLA+ operating domain expansion and the results will be included in the plant-specific M+SAR. Additionally, the SRLR for the initial MELLLA+ implementation cycle shall be submitted for NRC Staff confirmation. The limiting fuel thermal margin transients for PBAPS MELLLA+ were determined using a plant-specific TRACG model. In accordance with Methods LTR SER Limitation and Condition 9.15, the void reactivity coefficients bias and uncertainties used in the latest version of TRACG are applicable to the GNF2 lattice designs loaded in the core.

In accordance with M+LTR SER Limitation and Condition 12.16, an RWE analysis was performed to confirm the adequacy of the generic RBM setpoints. The RWE was simulated

using the three-dimensional core simulator PANAC. The analysis was performed with an approximate equilibrium core at the MELLLA+ 100% power (3,951 MWt), 83% CF statepoint for a comprehensive set of RBM setpoints. The results of this RWE analysis confirmed the validity of the generic RBM setpoints. The RWE results also meet the 1% cladding circumferential plastic strain and fuel centerline melt acceptance criteria.

In accordance with Methods LTR SER Limitations and Conditions 9.9, 9.10, and 9.11, acceptable fuel rod T-M performance for both UO_2 and Gd_2O_3 fuel rods was demonstrated during core-wide AOOs. Specifically, during an AOO, analyses demonstrated that the: (1) loss of fuel rod mechanical integrity will not occur due to fuel rod melting; and (2) loss of fuel rod mechanical integrity will not occur due to pellet-cladding mechanical interaction. Results for all AOO pressurization transient events analyzed, including EOOS, showed margin to the fuel centerline melt and the 1% cladding circumferential plastic strain acceptance criteria. Given that the void history bias is incorporated into the transient model within the TRACG code, additional 10% margin to the fuel centerline melt and the 1% cladding circumferential plastic strain is no longer required. The minimum calculated margin to the fuel centerline melt criterion was 6.9%. The minimum calculated margin to the cladding strain criterion was 25.6%. Fuel rod T-M performance will be evaluated as part of the reload licensing analyses performed for the cycle specific core. [[
]]

Therefore, PBAPS meets all M+LTR dispositions for fuel thermal margin events.

9.1.2 Power and Flow Dependent Limits

The operating MCPR, LHGR, and/or MAPLHGR thermal limits are modified by a flow factor when the plant is operating at less than 100% CF. The MCPR flow dependent limits ($MCPR_f$) and the LHGR flow factor ($LHGRFAC_f$) are primarily based upon an evaluation of the slow recirculation flow increase event. [[

]] Table 9-6 summarizes the results of the slow recirculation flow increase analysis and compares them with the MCPR flow dependent limits. The $MCPR_f$ limits in Table 9-6 bound the slow recirculation flow increase results performed for the MELLLA+ operating domain. [[
]]

Similarly, the thermal limits are modified by a power factor ($MCPR_p$) when the plant is operating at less than 100% power. [[

]]

Therefore, PBAPS meets all M+LTR dispositions for power and flow dependent limits.

9.1.3 Non-Limiting Events

The M+LTR provides an assessment of the effect of the MELLLA+ operating range expansion for each of the Reference 6 limiting AOO events and key non-limiting events. Provided these evaluations are applicable to PBAPS, no further evaluations are required for non-limiting events. The results of the M+LTR assessment are presented in the table below:

Event	Discussion
Fuel Thermal Margin Events	
Slow Recirculation Increase (Flow Dependent Power Limit (K_f), $MCPR_f$) (Reference 6 event – bounds recirculation event AOOs)	[[
Fast Recirculation Increase	
Generator Load Rejection	
Main Steam Isolation Valve Closure, All Valves	
Main Steam Isolation Valve Closure, One Valve	]]
Transient Overpressure Events	
Turbine Trip, Bypass Failure, with Scram on High Flux (Failure of Direct Scram)	[[ ]]

[[

]]

Therefore, PBAPS meets all M+LTR dispositions for non-limiting events.

9.2 DESIGN BASIS ACCIDENTS AND EVENTS OF RADIOLOGICAL CONSEQUENCE

9.2.1 Design Basis Events

This section addresses the radiological consequences of a DBA. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Control Rod Drop Accident	Plant Specific	Meets M+LTR Disposition
Instrument Line Break Accident (ILBA)	Not Applicable to PBAPS	
Main Steam Line Break Accident (MSLBA) (Outside Containment)	Generic	Meets M+LTR Disposition
Loss-of-Coolant Accident (Inside Containment)	Generic	Meets M+LTR Disposition
Large Line Break (Feedwater or Reactor Water Cleanup)	Not Applicable to PBAPS	
Liquid Radwaste Tank Failure	Not Applicable to PBAPS	
Fuel Handling Accident (FHA)	Generic	Meets M+LTR Disposition
Offgas System Failure	Not Applicable to PBAPS	
Cask Drop	Not Applicable to PBAPS	

9.2.1.1 Control Rod Drop Accident

The M+LTR describes that the radiological consequences of this DBA are evaluated to determine off-site doses as well as control room operator doses. DBA calculations are generally based on core inventory sources or TS source terms, [[

]]

For PBAPS, two postulated CRDA events govern the analysis of radiological consequences. For Event 1, the release path is via the mechanical vacuum pump at low power operation. For Event 2, the release path is at normal power and the release path is via the condenser and the steam jet air ejectors. For Event 1, the plant is not operating in the MELLLA+ operating domain as shown by the power/flow map, and therefore there is no effect on the results. Because PBAPS may operate with portions of the offgas system bypassed, Event 2 represents the bounding radiological consequences.

The CRDA release is dependent on the source terms and maximum peaking factor. Operation in the MELLLA+ operating domain does not affect the alternate source term (AST) CRDA source term and the peaking factor remains bounding. There are no changes to removal, transport, or dose conversion assumptions for this event. Therefore, the PBAPS CRDA evaluation for the MELLLA+ operating domain is bounded by the analysis for the current licensed operating domain, and no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the CRDA.

9.2.1.2 Instrument Line Break Accident

The ILBA is not applicable to PBAPS.

9.2.1.3 Main Steam Line Break Accident (Outside Containment)

The M+LTR describes that the radiological consequences of this DBA are evaluated to determine off-site doses as well as control room operator doses. DBA calculations are generally based on core inventory sources or TS source terms, [[

]] Table 9-4 of the M+LTR provides a detailed evaluation of the MSLBA events. [[

]] then no further review is required.

For PBAPS, the source terms for the MSLBA are dependent on the relative amount of water and steam released. Radionuclide concentrations are set at conservative values for the coolant source terms and at TS limits, which remain bounding and unchanged. The MELLLA+ operating domain expansion results in more steam voids in the reactor vessel resulting in a larger fraction of steam release than in the current licensed operating domain. The fission product release is weighted by the water, because the concentration of iodine in water is 50 times that of steam. The increase in steam and decrease in water results in lower releases such that the current analysis is bounding. These results are equally applicable to the AST analysis used at PBAPS. In addition, the analysis of record for the worst-case MSLBA radiological consequences is at hot standby conditions, which is outside of the MELLLA+ operating domain as shown by the power/flow map. Therefore the PBAPS MSLBA evaluation is not affected by the MELLLA+ operating domain expansion and no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the MSLBA.

9.2.1.4 Loss-of-Coolant Accident (Inside Containment)

The M+LTR describes that the radiological consequences of this DBA are evaluated to determine off-site doses as well as control room operator doses. DBA calculations are generally based on core inventory sources or TS source terms, [[

]] Table 9-4 of the M+LTR provides a detailed evaluation of the LOCA event. [[

]] then no further review is required.

The design input and assumptions for suppression pool pH were previously evaluated. The source term assumptions are not changing for MELLLA+. In addition, the acid production terms are not changing for MELLLA+ conditions. The use of sodium pentaborate as a buffer per UFSAR Section 3.8.1 continues to be appropriate.

[[

]] Therefore, the PBAPS LOCA evaluation is not affected by the MELLLA+ operating domain expansion and no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the LOCA.

9.2.1.5 Large Line Break (Feedwater or Reactor Water Cleanup)

The large line break is not applicable to PBAPS.

9.2.1.6 Liquid Radwaste Tank Failure

The liquid radwaste tank failure is not applicable to PBAPS.

9.2.1.7 Fuel Handling Accident

The M+LTR describes that the radiological consequences of a FHA are evaluated to determine off-site doses as well as control room operator doses. DBA calculations are generally based on core inventory sources or TS source terms, [[

]] Table 9-4 of the M+LTR provides a detailed evaluation of the FHA event. [[

]] then no further review is required.

[[

]]

Therefore, the PBAPS FHA evaluation for the MELLLA+ operating domain is bounded by the analysis for the current licensed operating domain, and no further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for the FHA.

9.2.1.8 Offgas System Failure

The offgas system failure is not applicable to PBAPS.

9.2.1.9 Cask Drop

The cask drop accident is not applicable to PBAPS.

9.2.2 Other Events with Radiological Consequences

This section addresses the radiological consequences of other events as described in the M+LTR. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Instrument Line Break Accident	Not Applicable to PBAPS	
Large Line Break (Feedwater or Reactor Water Cleanup)	Not Applicable to PBAPS	
Liquid Radwaste Tank Failure	Not Applicable to PBAPS	
Offgas System Failure	Not Applicable to PBAPS	
Cask Drop	Not Applicable to PBAPS	

9.2.2.1 Instrument Line Break Accident

This topic is not applicable to PBAPS because the ILBA is not a reviewed accident per the PBAPS UFSAR.

9.2.2.2 Large Line Break (Feedwater or Reactor Water Cleanup)

This topic is not applicable to PBAPS because the large line break (FW or RWCU) is not an evaluated accident per the PBAPS UFSAR.

9.2.2.3 Liquid Radwaste Tank Failure

This topic is not applicable to PBAPS because the liquid radwaste tank failure is not an evaluated accident per the PBAPS UFSAR.

9.2.2.4 Offgas System Failure

This topic is not applicable to PBAPS because the offgas system failure is not an evaluated accident per the PBAPS UFSAR.

9.2.2.5 Cask Drop

This topic is not applicable to PBAPS because the cask drop is not an evaluated accident per the PBAPS UFSAR.

9.3 SPECIAL EVENTS

This section considers three special events: ATWS, SBO, and ATWSI. The operator actions required as a result of ATWS are reviewed and discussed as a part of Section 10.9. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
ATWS (Overpressure)	Plant Specific	Meets M+LTR Disposition
ATWS (Suppression Pool Temperature and Containment Pressure)	Plant Specific	Meets M+LTR Disposition
ATWS (Peak Cladding Temperature and Oxidation)	Plant Specific	Meets M+LTR Disposition
Station Blackout	Generic	Meets M+LTR Disposition
ATWS with Core Instability	Generic	Plant Specific Evaluation Acceptable

9.3.1 Anticipated Transients without Scram

There is no change in core power, decay heat, pressure, or steam flow as a result of the MELLLA+ operating range expansion. [[

]] The ATWS evaluation acceptance criteria are to:

- Maintain reactor vessel integrity (i.e., peak vessel bottom pressure less than the ASME Service Level C limit of 1,500 psig)
- Maintain containment integrity (i.e., maximum containment pressure lower than the design pressure of the containment structure and maximum suppression pool temperature lower than the pool temperature limit)
- Maintain coolable core geometry

Plant-specific ATWS analyses are performed to demonstrate that the ATWS acceptance criteria are met for operation in the MELLLA+ operating domain. PBAPS meets the ATWS mitigation requirements in 10 CFR 50.62 for an alternate rod insertion (ARI) system, SLCS boron injection equivalent to 86 gpm, and automatic RPT logic (i.e., ATWS-RPT). The plant-specific ATWS analyses take credit for the ATWS-RPT and SLCS. However, ARI is not credited.

The key input parameters to the plant-specific ATWS analyses are provided in Table 9-2. For key input parameters that are important to simulating the ATWS analysis and are specified in the TS (e.g., SLCS parameters, ATWS-RPT), the calculation assumptions are consistent with the allowed PBAPS TS values and plant configuration. Although conservative inputs consistent

with the PBAPS TS values were used, this does not imply that ATWS is part of the TS Bases. In some instances, nominal input parameters are used consistent with the approach in Reference 40. Reference 40 contained sensitivity studies on key parameters for information. However, there was no specific uncertainty treatment applied. In addition, the EOOS assumptions for ATWS are consistent with TS requirements. M+LTR SER Limitation and Condition 12.23.2 requires that the plant-specific automatic settings be modeled for ATWS. For PBAPS, the plant automatic settings, which include the ATWS-RPT, low pressure isolation, and SRV actuation, are modeled based on the input parameters in Table 9-2. As required by M+LTR SER Limitation and Condition 12.23.8, the plant-specific ATWS analyses account for plant- and fuel-design-specific features including debris filters.

The ATWS overpressure and ATWSI events for PBAPS MELLLA+ were evaluated using a plant-specific TRACG model. In accordance with Methods LTR SER Limitation and Condition 9.20, the void reactivity coefficients bias and uncertainties used in the latest version of TRACG are applicable to the GNF2 lattice designs loaded in the core.

Consistent with M+LTR SER Limitation and Condition 12.23.9, the PBAPS plant-specific ATWS analysis contains information relevant to the licensing bases in terms of NPSH and system performance for the duration of the event.

9.3.1.1 Anticipated Transients without Scram (Licensing Basis)

The plant-specific ATWS overpressure analysis is performed using the approved TRACG overpressure methodology documented in NEDE-32906P Supplement 3-A (Reference 5). The plant-specific ATWS long-term analysis is performed using the approved ODYN methodology documented in Section 5.3.4 of the LTR "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate" ELTR1 (Reference 7). The ATWS analysis using the TRACG ATWS overpressure methodology and the ODYN ATWS long-term methodology forms the plant's licensing basis for this application.

[[

]]

TRACG ATWS Overpressure LTR SER Limitation and Condition 4.2 requires reporting the plant-specific power-to-flow ratio at rated power and minimum CF (Reference 41). Additionally, TRACG ATWS Overpressure LTR SER Limitation and Condition 4.3 mandates the actual power level be stated from the TRACG ATWS application. [[

]]

The calculated HSBW is approximately 710 gallons. The HSBW injection time for PBAPS is 14.5 minutes. The injection time includes conservatism in the SLCS delivery rate compared to the design flow rate. This is the HSBW injection time for both MELLLA+ and non-MELLLA+ conditions.

A licensing basis ATWS analysis was performed to demonstrate the effect of MELLLA+ on the ATWS acceptance criteria. [[

]]

The limiting results of the licensing basis ATWS analysis are provided in Table 9-3. Additional limiting event-specific values for reactor power, reactor vessel bottom pressure, PCT and suppression pool temperature are provided in Table 9-4. The tabulated peak value and time trace for reactor power, reactor vessel bottom pressure, PCT and suppression pool temperature is provided in Table 9-4 for the limiting event in the ATWS analysis. For reactor power, analysis results are provided for the limiting event with respect to peak reactor vessel pressure. The limiting event is the MSIVC for ATWS overpressure at BOC and MSIVC for long-term suppression pool temperature and containment pressure response at EOC.

[[

]] The peak vessel bottom pressure response is dependent on several inputs, including the SRV upper tolerances assumed in the ATWS analysis. In accordance with M+LTR SER Limitation and Condition 12.23.3, the MELLLA+ ATWS analysis assumed SRV setpoints that account for a 3% drift tolerance. PBAPS as-found SRV lift setpoint tests do not show a propensity for setpoint drift higher than the 3% drift tolerance. Therefore, the SRV upper tolerances used in the ATWS analysis are consistent with the plant-specific performance.

[[

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The suppression pool temperature following an ATWS remains below the NPSH limit for the ECCS pumps. [[

]] M+LTR SER Limitation and Condition 12.23.11 requires that the use of suppression pool temperature limits higher than the heat capacity temperature limit (HCTL)

for emergency depressurization must be justified. The containment design limit is the ATWS acceptance criteria. [[

]] A best estimate TRACG analysis modeling emergency depressurization is not required if the suppression pool temperature from the licensing basis ODYN long-term calculation remains below the HCTL.

[[
]] Consistent with M+LTR SER Limitation and Condition 12.23.10, the PBAPS plant specific ATWS analysis contains information relevant to any increase in containment pressure during the event. PBAPS does not credit CAP in the ECCS NPSH analyses and therefore the maximum suppression pool temperature cannot exceed the saturation temperature of water.

A coolable core geometry is assured by meeting the 2,200°F PCT and 17% local cladding oxidation acceptance criteria of 10 CFR 50.46. [[

]]

The results of the licensing basis TRACG ATWS overpressure analysis and the ODYN ATWS long-term analysis meet the ATWS acceptance criteria. Therefore, the PBAPS response to an ATWS event initiated in the MELLLA+ operating domain is acceptable.

9.3.1.2 Anticipated Transients without Scram (Best-Estimate Calculation)

The HCTL is provided in PBAPS EOPs. The HCTL is a function of operating reactor pressure and suppression pool water level. For normal suppression pool water level, the HCTL is approximately 177°F near the SRV opening pressure. At the extreme upper suppression pool water level covered by EOPs, the HCTL is approximately 175°F near the SRV opening pressure. Figure 9-3 shows the HCTL at various reactor pressures and suppression pool levels.

PBAPS EOPs require depressurization during an ATWS event when the suppression pool temperature reaches the HCTL. Plant-specific ODYN ATWS results demonstrate that the peak suppression pool temperature remains below the HCTL. The ODYN ATWS analysis assumes RPV water level at five feet above TAF. Therefore, no further analysis is required.

For PBAPS, the boron-10 enrichment is 92 atom% at MELLLA+ operating conditions. The results of the MELLLA+ licensing basis ODYN long-term calculation are compared to the HCTL. [[

]]

As a result of the peak suppression pool temperature remaining below the HCTL at MELLLA+ due to the currently high level of boron-10 enrichment, the best-estimate TRACG ATWS analysis is not required to meet the ATWS acceptance criteria.

9.3.2 Station Blackout

The disposition of the SBO topic in the M+LTR describes that there is no significant change in core power, decay heat, pressure, or steam flow as a result of the MELLLA+ operating domain expansion. [[

]]

There is no change in the reactor power level as a result of the MELLLA+ operating domain expansion. As discussed in Section 1.2.3, there is no significant change in decay heat as a result of the MELLLA+ operating domain expansion. For PBAPS, there are no increases in reactor operating pressure as result of MELLLA+ operating domain expansion. For PBAPS, there are no significant changes in the MS flow rate. The numerical values showing no significant changes to reactor operating power and MS flow rate are presented in Table 1-2. [[

]] No further evaluation is required.

Therefore, PBAPS meets all M+LTR dispositions for SBO.

9.3.3 ATWS with Core Instability

The NRC has reviewed and accepted GEH's disposition of the effect of large coupled thermal-hydraulic/neutronic core oscillations during a postulated ATWS event, presented in NEDO-32047-A (Reference 42). The companion report, NEDO-32164 (Reference 43) was approved by the same NRC SER. The NRC review concluded that the GEH TRACG code is an adequate tool to estimate the behavior of operating reactors during transients that may result in large power oscillations. The review also concluded that despite the severity of the event, the following criteria are met:

1. Radiological consequences must be maintained within 10 CFR 100 guidelines;
2. Primary system integrity to be maintained;

3. Fuel damage limited so as not to significantly distort the core, impede core cooling, or prevent safe shutdown;
4. Containment integrity to be maintained; and
5. Long-term shutdown and cooling capability to be maintained.

Furthermore, the NRC review concluded that the specified operator actions are sufficient to mitigate the consequences of an ATWS event with large core power oscillations. [[

]]

M+LTR SER Limitation and Condition 12.19 requires that a plant-specific ATWSI calculation be performed to demonstrate that PBAPS EOP actions, including boron injection and water level control strategy, effectively mitigate an ATWS event with large power oscillations in the MELLLA+ operating domain. The plant-specific ATWSI calculation was: (1) based on the limiting peak reactivity exposure condition (for PBAPS, MOC); (2) modeled the plant-specific configuration important to the ATWSI response; and (3) used the limiting channel grouping scheme (for PBAPS, regional mode). M+LTR SER Limitation and Condition 12.23.5 requires that the power density be less than 52.5 MWt/Mlbm/hr. For PBAPS, the plant-specific maximum power-to-flow ratio at rated power and minimum CF is 46.4 MWt/Mlbm/hr and meets the requirement. The plant-specific TRACG calculation modeled in-channel water rod flow in accordance with M+LTR SER Limitation and Condition 12.24.1. The plant-specific ATWSI calculation was performed using the latest NRC-approved neutronic and thermal-hydraulic codes TGBLA06/PANAC11 and TRACG04 (Reference 5). A GNF equilibrium core was used for the calculation, and this complies with M+LTR SER Limitation and Condition 12.3.d. The TRACG ATWSI analysis results are included in this section in compliance with M+LTR SER Limitation and Condition 12.23.6.

[[

]]

The results of the plant-specific TRACG ATWSI calculation are provided in Table 9-5. Figures 9-7 and 9-8 show the mitigating effect of decreasing water level for the TTWBP ATWSI event.

[[

]]

The results of the plant-specific TRACG ATWSI calculation meet the ATWS review criteria. Therefore, the PBAPS response to an ATWSI event initiated in the MELLLA+ operating domain is acceptable. PBAPS EOP actions, including boron injection and water level control strategy, effectively mitigate an ATWS event with large power oscillations in the MELLLA+ operating domain.

Table 9-1 AOO Event Results Summary

Power (MWt) / Flow (% of Rated)	Event	Peak Dome Pressure (psia)	Peak Vessel Pressure (psia)	Peak Neutron Flux (%)	Peak Power (%Rated(3))	GNF2 ΔCPR/ICPR or ΔCPR(1)(4)
3,514/110	LRNBP	1,231	1,260	305	107	0.16
3,951/83	LRNBP	1,255	1,278	289	108	0.19
3,514/110	TTNBP	1,230	1,259	280	106	0.16
3,951/83	TTNBP	1,254	1,277	271	107	0.19
3,514/110	FWCF	1,201	1,226	194	110	0.14
3,951/83	FWCF	1,225	1,245	190	109	0.17
3,514/100	HPCIL8	1,199	1,224	182	113	0.14
3,951/83	HPCIL8	1,222	1,242	187	114	0.18
3,951/99	LFWH	- (2)	- (2)	- (2)	- (2)	0.12
3,951/83	LFWH	- (2)	- (2)	- (2)	- (2)	0.12
3,951/100	RWE	- (2)	- (2)	- (2)	- (2)	0.27
3,951/83	RWE	- (2)	- (2)	- (2)	- (2)	0.27

Notes:
1. For the pressurization events, the uncorrected ΔCPR/ICPR values are presented and for the slow transients (LFWH and RWE), Option B ΔCPR is presented.
2. The PANAC code is used to analyze slow events; therefore, system response parameters are not applicable.
3. Rated power is 3,514 MWt for the PBAPS Unit 2 Cycle 20 representative analyses and 3,951 MWt for the MELLLA+ analyses.
4. ICPR: Initial Critical Power Ratio

Table 9-2 Key Input Parameters for ATWS Analyses

Parameter	CLTP	MELLLA+	Basis
Rated Thermal Power (MWt)	3,951	3,951	[[
Analyzed Power (MWt)	3,951	3,951	
Analyzed Core Flow (Mlbm/hr / % Rated)	101.475 / 99.0	85.075 / 83.0	
Reactor Dome Pressure (psig)	1,035	1,035	
MSIV Closure Time (sec)	4.0	4.0	
High Pressure ATWS-RPT Setpoint (psig)	1,106.0	1,106.0	
Low Pressure Isolation Setpoint (psig)	825.0	825.0	
RCIC Flow Rate (gpm)	600.0	600.0	
HPCI Flow Rate (gpm)	5,000.0	5,000.0	
Number of SRVs / SRVOOS	11 / 1	11 / 1	
Number of SSVs / SSVOOS	3 / 0	3 / 0	
Each SRV Capacity at 1,080 psig (lbm/hr)	800,000	800,000	
SRV Analytical Opening Setpoints (psig)	1,169.1 – 1,189.7	1,169.1 – 1,189.7	
SLCS Injection Location	Lower Plenum	Lower Plenum	
SLCS Injection Rate (gpm)	49.1	49.1	
Boron-10 Enrichment (Atom %)	92.0	92.0	
Sodium Pentaborate Concentration (% by Weight)	8.3	8.3	
SLCS Liquid Transport Time (sec)	20.0	20.0	]]

Table 9-2 is continued on the next page.

Table 9-2 Key Input Parameters for ATWS Analyses (Continued)

Parameter	CLTP	MELLLA+	Basis
Initial Suppression Pool Liquid Volume (ft^3)	122,900	122,900	[[
Initial Suppression Pool Temperature (°F)	86.0	86.0	
Number of RHR Suppression Pool Cooling Loops	1	1	
RHR Heat Exchanger Effectiveness Per Loop (BTU/sec-°F)	610.0	610.0	
RHR Service Water Temperature (°F)	86.0	86.0	]]

Table 9-3 Key Results for Licensing Basis ATWS Analysis

ATWS Acceptance Criteria	CLTP	MELLLA+	Design Limit
Peak Vessel Bottom Pressure; TRACG (psig)	[[		1,500
Peak Suppression Pool Temperature (°F)			180.0
Peak Containment Pressure (psig)			56.0
Peak Cladding Temperature (°F)			2,200
Peak Local Cladding Oxidation (%) [1]		]]	17

Notes:

1. [[

]]

2. [[

]]

Table 9-4 ATWS Analysis Limiting Event Results

Parameter	**Limiting Event**	**Peak Value**	**Time Trace**
Reactor Power (neutron flux)	MSIVC at BOC	[[	Figure 9-4
Reactor Vessel Bottom Pressure	MSIVC at BOC		Figure 9-4
Suppression Pool Temperature	MSIVC at EOC		Figure 9-5
Peak Cladding Temperature	PRFO at EOC	]]	Figure 9-6

Table 9-5 Key Results for ATWS with Core Instability Analysis from MELLLA+ Operating Domain

ATWS Acceptance Criteria	MELLLA+	Design Limit
Peak Vessel Bottom Pressure (psig) [1]	[[	1,500
Peak Suppression Pool Temperature (°F) [2]		180
Peak Containment Pressure (psig) [2]		56.0
Peak Cladding Temperature (°F)		2,200
Peak Local Cladding Oxidation (%) [3]	]]	17

Notes:

1. Peak vessel bottom pressure for ATWSI is always less than the peak value taken from the licensing basis ATWS (Table 9-3). As a result, the non-limiting peak value is not tabulated here.
2. The ATWSI evaluation assumes the main condenser is available because isolation does not occur. Therefore, less energy is deposited into the suppression pool compared to the MSIVC (Table 9-3) event, which is a vessel isolation event. As a result, the peak suppression pool temperature and containment pressure are not explicitly calculated for ATWSI.
3. [[

]]

Table 9-6 Comparison of Slow Recirculation Flow Increase Results and MCPR Flow Dependent Off-Rated Limits

Flow (%)	Slow Recirculation Flow Increase MCPR	$MCPR_f$ Flow Dependent Limit
83.0	1.17	1.25
81.0	1.16	1.25
74.0	1.15	1.29
70.0	1.15	1.31
60.0	1.14	1.37
55.0	1.13	1.40

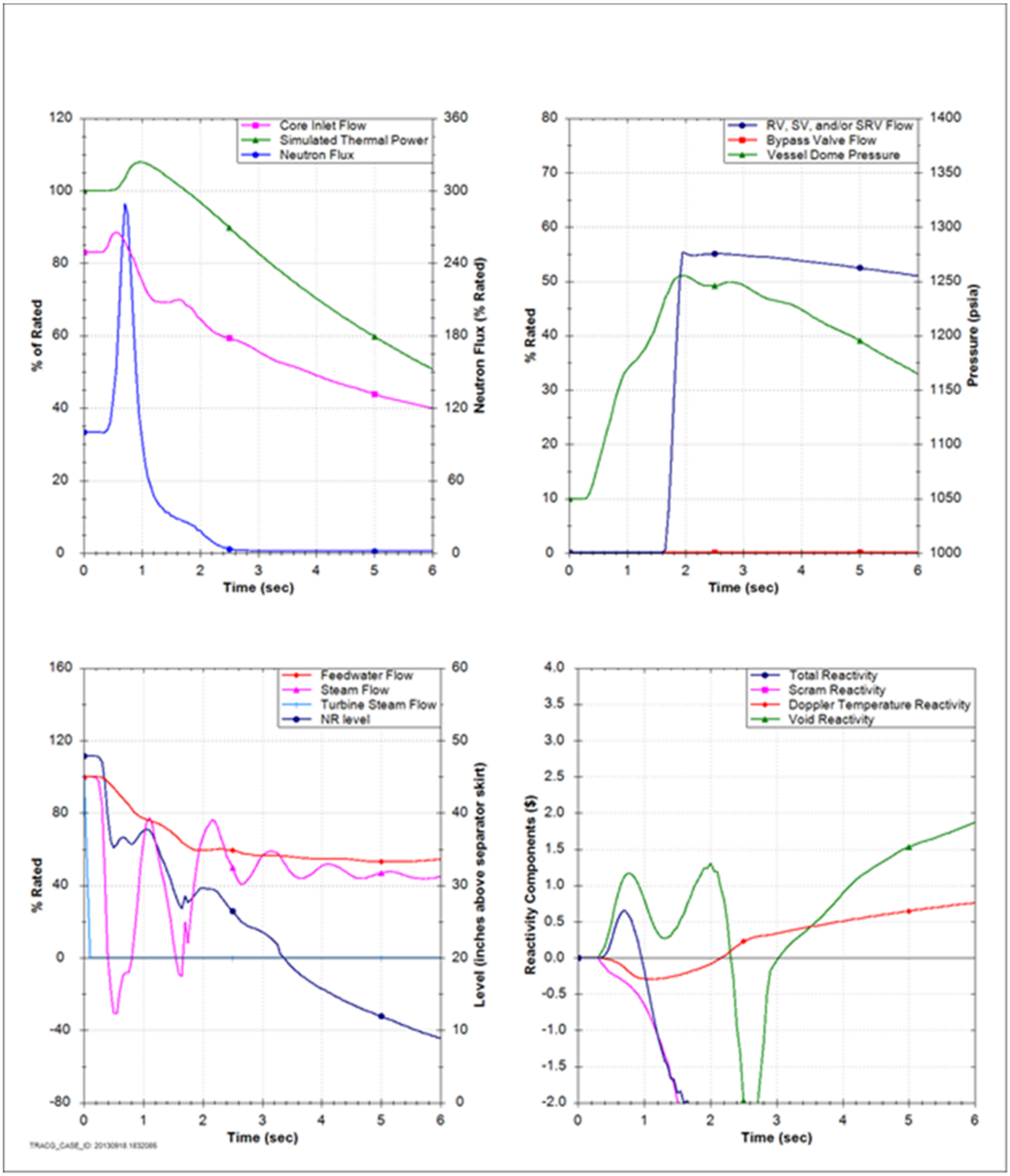

Figure 9-1 LRNBP MELLLA+ Operating Domain with 83% Core Flow

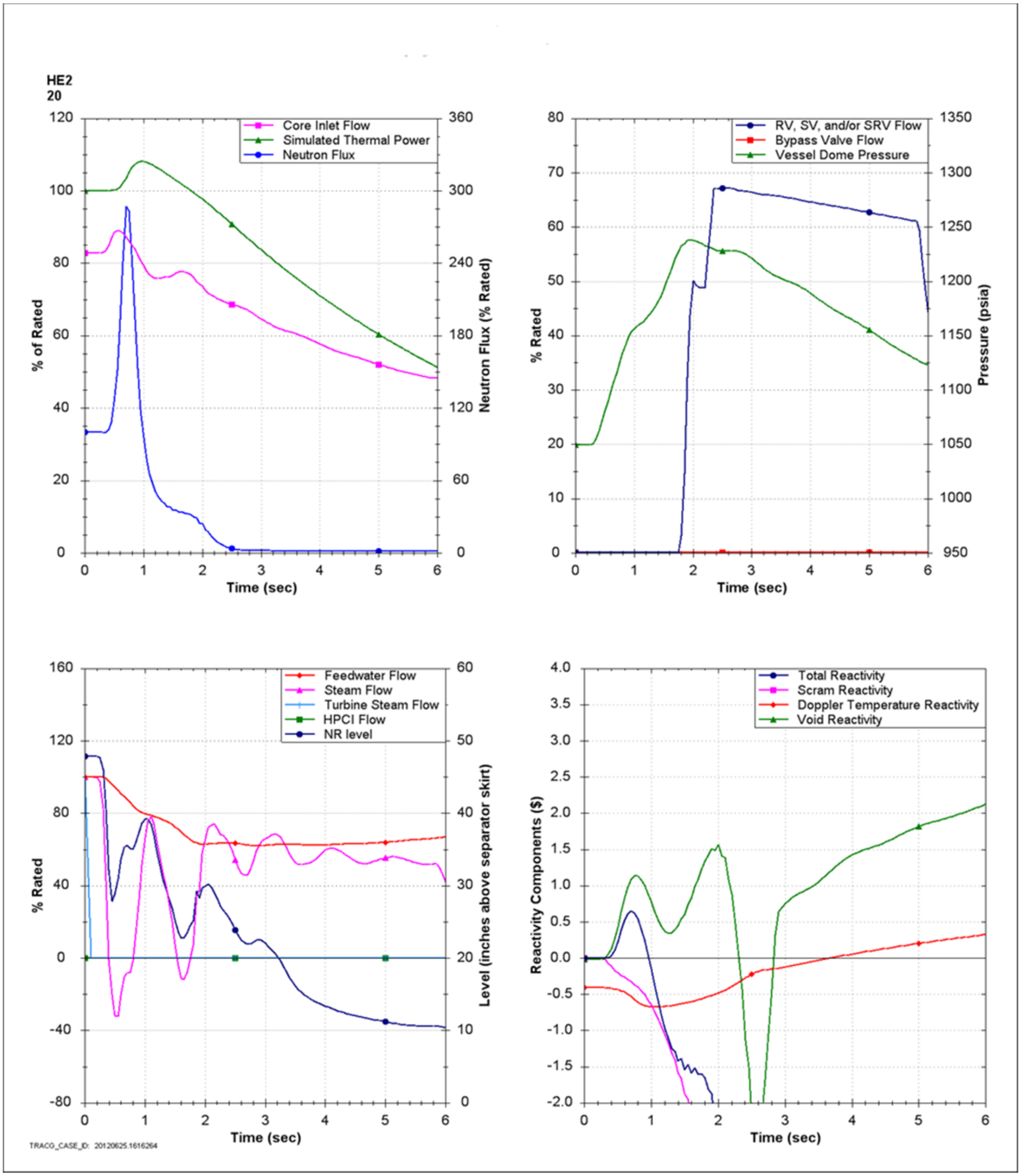

Figure 9-2 LRNBP Comparison Case at 3,514 MWt, MELLLA Flow

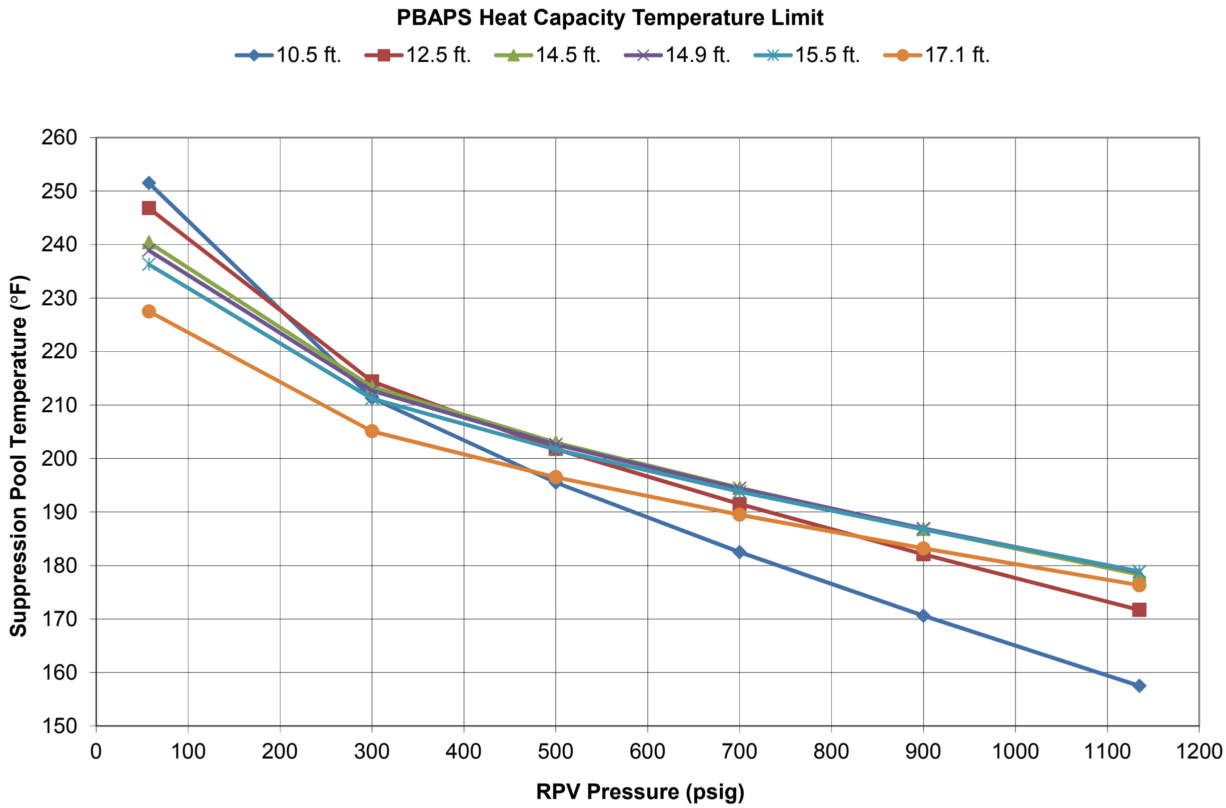

Figure 9-3 HCTL As a Function of Reactor Pressure

[[

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Figure 9-4 TRACG ATWS Overpressure Analysis – MSIVC at BOC Short Term Results

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Figure 9-5 ODYN ATWS Long-Term Analysis – MSIVC at EOC Suppression Pool Temperature

[[

]]

Figure 9-6 ODYN ATWS Long-Term Analysis – PRFO at EOC PCT

[[

]]

Figure 9-7 ATWS Instability from MELLLA+ Operating Domain – Turbine Trip With Full Bypass

[[

]]

Figure 9-8 ATWS Instability from MELLLA+ Operating Domain – Turbine Trip With Full Bypass

10.0 OTHER EVALUATIONS

This section addresses the evaluations in Section 10 of the M+LTR.

10.1 HIGH ENERGY LINE BREAK

HELBs are evaluated for their effects on equipment qualification. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Steam Lines	Generic	Meets M+LTR Disposition
Balance-of-Plant Liquid Lines	Generic	Meets M+LTR Disposition
Other Liquid Lines	Generic	Meets M+LTR Disposition

10.1.1 Steam Lines

The generic disposition of the HELB Steam Lines topic in the M+LTR describes that MELLLA+ operating domain expansion has no effect on the steam pressure or enthalpy at the postulated steam line break locations. Therefore, MELLLA+ has no effect on the mass and energy releases from a HELB in a steam line. Therefore, no plant-specific evaluation is required for steam line breaks.

Consistent with the generic disposition presented above, a review of the heat balances produced for PBAPS MELLLA+ operating domain expansion confirms that there is no effect on the steam pressure or enthalpy at the postulated break locations (e.g., MS, HPCI, and RCIC).

Therefore, PBAPS meets all M+LTR dispositions for HELBs in steam lines.

10.1.2 Balance-of-Plant Liquid Lines

The disposition of the HELB BOP Liquid Lines topic in the M+LTR describes that MELLLA+ operating domain expansion has no effect on the steam pressure or enthalpy at the postulated FW, RWCU, and RHR line break locations. Therefore, MELLLA+ has no effect on the mass and energy releases from a HELB in a FW, RWCU, and RHR line. Therefore, no plant-specific evaluation is required for BOP liquid line breaks.

A review of the heat balances produced for MELLLA+ confirms that there is no effect on the liquid line conditions at the postulated FW, RWCU, and RHR break locations, and the mass and energy release for MELLLA+ is bounded by the MELLLA domain analyzed for EPU including FFWTR. Therefore, MELLLA+ has no adverse effect on the existing mass and energy releases from a HELB in a FW, RWCU, or RHR line. Therefore, no plant-specific evaluation is required for BOP liquid line breaks.

Therefore, PBAPS meets all M+LTR dispositions for HELBs in BOP liquid lines.

10.1.3 Other Liquid Lines

The disposition of the HELB Other Liquid Lines topic in the M+LTR describes that [[

]] The scope of these evaluations includes MELLLA+ operating domain expansion effects on subcompartment pressures and temperatures, pipe whip, jet impingement, and flooding, consistent with the plant licensing basis.

A review of the PBAPS design basis confirms that there are no additional high energy lines at PBAPS. The evaluations described in Section 10.1.2 above encompass all high energy piping at PBAPS. The scope of these evaluations includes MELLLA+ operating domain expansion effects on subcompartment pressures and temperatures, pipe whip, jet impingement, and flooding, consistent with the plant licensing basis. Therefore, no plant-specific evaluation is required for other liquid line breaks.

Therefore, PBAPS meets all M+LTR dispositions for HELBs in other liquid lines.

10.2 MODERATE ENERGY LINE BREAK

Moderate energy line breaks (MELBs) are evaluated for their effects on equipment qualification. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Flooding	Generic	Meets M+LTR Disposition
Environmental Qualification	Generic	Meets M+LTR Disposition

10.2.1 Flooding

The disposition of the Flooding topic in the M+LTR describes that [[

]]

A review of the PBAPS auxiliary flow rates and system inventories shows that MELLLA+ operating domain expansion does not affect the flow rates of moderate energy piping systems. Also, for PBAPS, no operational modes evaluated for MELB are affected by MELLLA+ operating domain expansion. [[

]]

Therefore, PBAPS meets all M+LTR dispositions for MELB flooding.

10.2.2. Environmental Qualification

The disposition of the MELB EQ topic in the M+LTR describes that [[

]]

A review of the PBAPS auxiliary flow rates and system inventories shows that MELLLA+ operating domain expansion does not affect the flow rates of moderate energy piping systems. Also, for PBAPS, no operational modes evaluated for MELB are affected by MELLLA+ operating domain expansion. [[

]]

Therefore, PBAPS meets all M+LTR dispositions for MELB EQ.

10.3 ENVIRONMENTAL QUALIFICATION

Safety-related components are required to be qualified for the environment in which they operate. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Electrical Equipment	Generic	Meets M+LTR Disposition
Mechanical Equipment with Non-Metallic Components	Generic	Meets M+LTR Disposition
Mechanical Component Design Qualification	Generic	Meets M+LTR Disposition

10.3.1 Electrical Equipment

The M+LTR describes that there is no change in core power, radiation levels, decay heat, pressure, steam flow, or FW flow as a result of the MELLLA+ operating domain expansion. [[

]] No further evaluation is required for EQ of electrical equipment as a result of MELLLA+ operating domain expansion.

The reactor power does not increase as a result of MELLLA+ operating domain expansion. There is no change in radiation levels in any of the plant areas where safety-related equipment is located (see Section 8.5). There is also no change in decay heat (see Section 1.2.3). For PBAPS,

there are no increases in reactor operating pressure, MS flow rate, or FW flow rate. The numerical values showing no increases in reactor operating pressure, MS flow rate, or FW flow rate are presented in Table 1-2. [[

]] No further evaluation is required for EQ of electrical equipment as a result of MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for EQ of electrical equipment.

10.3.2 Mechanical Equipment With Non-Metallic Components

The disposition of the Mechanical Equipment with Non-Metallic Components topic in the M+LTR describes that operation in the MELLLA+ operating domain does not increase any of the normal process temperatures. [[

]] No further evaluation is required for EQ of mechanical equipment with non-metallic components as a result of the MELLLA+ operating domain expansion.

For PBAPS, normal process temperatures are not affected by MELLLA+. There is no change in radiation levels in any of the plant areas where safety-related equipment is located (see Section 8.5). [[

]] No further evaluation is required for EQ of mechanical equipment with non-metallic components as a result of the MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for EQ of mechanical equipment with non-metallic components.

10.3.3 Mechanical Component Design Qualification

The disposition of the Mechanical Component Design Qualification topic in the M+LTR describes that operation in the MELLLA+ operating domain does not change any of the normal process temperatures, pressures, or flow rates. [[

]] The change in fluid induced loads on safety-related components is discussed in Sections 3.2.2, 3.5, and 4.1.3. [[

]]

For PBAPS, normal process temperatures, pressures, and flow rates are not affected by MELLLA+. There is no change in radiation levels in any of the plant areas where safety-related equipment is located (see Section 8.5). [[

]]

Therefore, PBAPS meets all M+LTR dispositions for mechanical component design qualification.

10.4 TESTING

When the MELLLA+ operating domain expansion is implemented, testing is recommended to confirm operational performance and control aspects of the MELLLA+ changes. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Steam Separator-Dryer Performance	Plant Specific	Meets M+LTR Disposition
APRM Calibration	Plant Specific	Meets M+LTR Disposition
Core Performance	Plant Specific	Meets M+LTR Disposition
Pressure Regulator	Plant Specific	Meets M+LTR Disposition
Water Level Setpoint Changes	Plant Specific	Meets M+LTR Disposition
Neutron Flux Noise Surveillance	Plant Specific	Meets M+LTR Disposition

10.4.1 Steam Separator-Dryer Performance

The performance of the steam separator-dryer (i.e., MCO) is determined by a test similar to that performed in the original startup test program. Testing will be performed in the MELLLA+ domain near 100% CLTP for the purpose of defining the MCO magnitude and trend. This test does not involve safety-related considerations.

10.4.2 Average Power Range Monitor Calibration

The APRM system is calibrated and functionally tested. The APRM STP scram and rod block are calibrated with the MELLLA+ equations and the APRM trips and alarms tested. This test will confirm that the APRM trips, alarms, and rod blocks perform as intended in the MELLLA+ operating domain.

10.4.3 Core Performance

The core performance test will evaluate the core thermal power, fuel thermal margin, and CF performance to ensure a monitored approach to CLTP in the MELLLA+ operating domain.

Measurements of reactor parameters are taken in the MELLLA+ operating domain. Core thermal power and fuel thermal margin are calculated using accepted methods. After steady-state conditions are established, measurements will be taken, core thermal power and fuel thermal margin calculated, and evaluated against projected values and operational limits.

10.4.4 Pressure Regulator

The pressure regulator test will confirm that the pressure control system settings established for operation with the current power versus flow upper boundary at CLTP are adequate in the MELLLA+ operating domain. The pressure regulator should not require any changes from the settings established for the current licensed operating domain. The pressure control system response to pressure setpoint changes is determined by making a down setpoint step change and, after conditions stabilize, an upward setpoint step change.

10.4.5 Water Level Setpoint Changes

The water level setpoint changes test verifies that the FW control system can provide acceptable reactor water level control in the MELLLA+ operating domain. Reactor water level setpoint step changes are introduced into the FW control system, while the plant response is monitored.

10.4.6 Neutron Flux Noise Surveillance

The neutron flux noise surveillance test verifies that the neutron flux noise level in the reactor is within expectations in the MELLLA+ operating domain. The noise will be recorded by monitoring the LPRMs and APRMs at steady state conditions in the MELLLA+ operating domain.

10.5 INDIVIDUAL PLANT EXAMINATION

This section provides an assessment of the risk increase, including core damage frequency (CDF) and large early release frequency (LERF), associated with operation in the MELLLA+ range. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Initiating Event Categories and Frequency	Generic	Meets M+LTR Disposition
Component Reliability	Generic	Meets M+LTR Disposition
Operator Response	Generic	Meets M+LTR Disposition
Success Criteria	Generic	Meets M+LTR Disposition
External Events	Generic	Meets M+LTR Disposition
Shutdown Risk	Generic	Meets M+LTR Disposition

Topic	M+LTR Disposition	PBAPS Result
PRA Quality	Generic	Meets M+LTR Disposition

In accordance with M+LTR SER Limitation and Condition 12.21, a plant-specific probabilistic risk assessment (PRA) evaluation was performed, which included CDF and LERF effects associated with operation in the MELLLA+ operating domain. The evaluation scope included all of the elements of Section 10.5, Individual Plant Examination, of the M+LTR (Reference 1).

The CDF risk increase for at-power internal events due to MELLLA+ is a delta CDF of 3.7E-8/yr. The LERF increase for at-power internal events due to MELLLA+ is a delta LERF of 3.6E-8/yr. Using the NRC guidelines established in RG 1.174 and the calculated results from the Level 1 and 2 PRA, the CDF risk increase (3.7E-8/yr) and the LERF increase (3.6E-8/yr) are both within Region III (i.e., changes that represent very small risk changes).

Based on the risk results from the plant-specific PRA evaluation, operation within the proposed PBAPS MELLLA+ operating domain is acceptable.

10.5.1 Initiating Event Categories and Frequency

The MELLLA+ expanded operating domain involves changes to the operating power/CF map and a small number of setpoints and alarms. There is no change in the operating pressure and power, and the steam and FW flow rates are essentially unchanged. MELLLA+ implementation does not include changes to plant hardware or operating procedures that would create additional event categories or have a significant effect on initiating event frequencies.

The MELLLA+ changes do not result in any new initiating events. The changes are not extensive and are not of the type that could result in a new initiating event. The power conversion systems, electrical systems, and other auxiliary systems are not changed as a result of MELLLA+ operation. MELLLA+ operation affects the core and some aspects of the NSSS, including moisture content in the steam, but it does not change thermal power or normal operating pressure, and the steam flow, FW flow, and FW temperature are essentially unchanged. Although a RPT could result in a reactor trip, this frequency is low and subsumed by the total reactor trip initiating event frequency. The limited plant changes (hardware, procedures, setpoints, and operation) are not expected to result in an effect on initiating event frequencies, as the intent of plant change is to prevent such events.

The MELLLA+ expanded operating domain does not significantly change the probability of an instability event. As noted in Section 2.4.3, the BSP, which is considered a part of the DSS-CD stability solution, may be used when the OPRM system is temporarily inoperable. Thus, the effect of the stability region modifications on the PRA is negligible.

The MELLLA+ expanded operating domain will not change the probability of an ATWS event. MELLLA+ implementation does not involve any changes to reactivity control systems and does not increase the scram demand frequency.

10.5.2 Component and System Reliability

The expanded operating domain does not affect the system or component reliability (and thereby, the CDF and LERF results). There is no change in the operating pressure and power, and the steam and FW flow rates are essentially unchanged. The MELLLA+ expanded operating domain does not require major plant hardware modifications. The TS ensure that plant and system performance parameters are maintained within the values assumed in the safety analyses. The TS setpoints, AVs, operating limits, and the like are selected such that the equipment parameter values are equal to or more conservative than the values used in the safety analyses. Therefore, there will be no significant changes in component and system reliability.

10.5.3 Operator Response

The operator responses to anticipated occurrences, accidents, and special events for CLTP with MELLLA+ conditions are basically the same as for CLTP conditions. MELLLA+ does not cause changes in any of the automatic safety actions. After the applicable automatic responses have initiated, the post-event operator actions for plant safety (e.g., maintaining safe shutdown, core cooling, containment cooling) remain the same for MELLLA+. It is assumed these actions are performed by cognizant staff, using applicable procedures, to mitigate the accident scenario.

Because decay heat is unchanged, the time for boil-off is unchanged. Therefore, long term core cooling is not affected by the MELLLA+ expanded operating domain.

Conditions during an ATWS are potentially more severe post reactor RPT during MELLLA+ operation. At reduced flow rates with power at 120% of the OLTP, the post RPT power level may be slightly higher during MELLLA+ operation. RPV water level would potentially drop quicker and containment heat up would initially be quicker if power level is a little higher. This would potentially reduce the time for operator response and this was assessed for effect on the PRA.

The PRA impact review resulted in changes to the human error probabilities associated with short term ATWS response actions. These revised human error probabilities were part of the changes that were incorporated into the PRA model to determine the increase in CDF and LERF due to MELLLA+ reported above in Section 10.5.

10.5.4 Success Criteria

Systems success criteria credited in a PRA to perform the critical safety functions were analyzed based on MELLLA+. The critical safety functions are as follows:

1) Reactivity Control
2) Overpressure Control
3) Vessel Depressurization
4) Reactor Coolant Makeup
5) Containment Heat Removal

The expanded operating domain involves changes to the operating power/CF map and a small number of setpoints and alarms. There is no change in the operating pressure and power, and the steam and FW flow rates are essentially unchanged. The MELLLA+ expanded operating domain does not impose any additional requirements on any of the safety, BOP, electrical, or auxiliary systems. Adequate SRV and SSV capacity is provided to ensure that the ATWS overpressure requirement for MELLLA+ is satisfied. The EPU-PRA model determined that two SRVs/SSVs OOS is realistically acceptable for the ATWS overpressure success criteria. However, this assumption could be challenged by operation at MELLLA+ for the limiting cases analyzed. Therefore, a modification was made to the EPU-PRA model that changed the success criteria from 12 of 14 SRVs/SSVs to 13 of 14 SRVs/SSVs being required for overpressure protection in ATWS scenarios. The potential increase in probability of overpressure protection failure in the ATWS model based on this change to the PRA success criteria was incorporated into the PRA model to determine the increase in CDF and LERF due to MELLLA+ reported above in Section 10.5.

10.5.5 External Events

The expanded operating domain is not expected to significantly affect the elements of an internal event PRA, as discussed in Sections 10.5.1 to 10.5.4. The few changes that were made to the PRA were reviewed for effect on the external events hazard groups, and it was determined to be negligible.

10.5.6 Shutdown Risks

The expanded operating domain does not change the shutdown conditions; therefore, it has no effect on the plant PRA shutdown risks.

10.5.7 PRA Quality

The EPU version of the PRA model was used as the starting point for the MELLLA+ risk evaluation. An evaluation of the PRA quality was performed as part of the EPU LAR risk assessment. The conclusion from the EPU LAR risk assessment that the few open observations from the peer review have negligible risk effect is also applicable to this risk assessment for MELLLA+. Therefore, the PBAPS PRA model is of sufficient scope and quality to measure the potential changes in plant risk due to MELLLA+ implementation.

10.6 Operator Training and Human Factors

Additional training is required to prepare for PBAPS operation in the MELLLA+ operating domain. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Operator Training and Human Factors	Plant Specific	Meets M+LTR Disposition

The description of the Operator Training and Human Factors topic in the M+LTR describes that the operator training program and plant simulator will be evaluated to determine the specific changes required. The selection of training topics, operator training, the control room

modifications, and simulator modifications are within the scope of the Licensee. Required changes are part of the MELLLA+ implementation plan and will be made consistent with the Licensee's current plant training program requirements. These changes will be made consistent with similar changes made for other plant modifications and include any changes to TS, EOPs, and plant systems.

The operator responses to anticipated occurrences, accidents and special events may be affected by operation in the MELLLA+ domain. Significant events result in automatic plant shutdown (scram). Some events result in automatic RCPB pressure relief, ADS actuation and/or automatic ECCS actuation (for low water level events). MELLLA+ operating domain expansion does not cause changes in any of the automatic safety functions. After the automatic responses have initiated, the operator actions for plant safety (e.g., maintaining safe shutdown, core cooling, containment cooling) do not change for MELLLA+ operating domain expansion. The ATWSI plant-specific analyses for MELLLA+ use operator actions consistent with prior generic analyses performed in NEDO-32164 (Reference 43). These operator actions become part of the plant-specific requirements at MELLLA+ conditions.

Consistent with the requirements for the plant-specific analysis as described in the M+LTR, the operator training program and plant simulator will be evaluated to determine the specific changes required. Simulator changes and fidelity validation will be performed in accordance with applicable American National Standards Institute (ANSI) standards currently being used at the training simulator. Section 10.9 addresses the MELLLA+ operating domain effects on the EOPs.

The primary effects of MELLLA+ operating domain expansion on MCR operation involve changes to the power/flow map. There are no major physical changes to the MCR controls, displays or alarms as a result of MELLLA+ operating domain expansion. In support of MELLLA+, the PRNMS requires hardware and software changes through implementation of the DSS-CD solution, including an ABSP. As a result, some changes are required to MCR panel board alarm settings and automatic actuation setpoints to accommodate changes due to MELLLA+ operating domain expansion.

The APRM STP scram and rod block AVs are also being changed as a result of MELLLA+ operating domain expansion. These changes are described in Section 5.3. Changes to the automatic actuation setpoints are implemented as design changes in accordance with the PBAPS configuration control procedures. The configuration control process includes a review by operations and training personnel. Training and implementation requirements are identified and tracked, including effects on the simulator. Verification of training is required as part of the design change closure process.

There are no planned upgrades of controls, displays or alarms from analog to digital instruments as part of MELLLA+ operating domain expansion. There are no changes to the analog and digital inputs for the safety parameter display system (SPDS) for MELLLA+ operating domain expansion.

Training required to operate PBAPS following the MELLLA+ operating domain expansion will be conducted prior to operation in the MELLLA+ domain. Training of appropriate operation

personnel for the MELLLA+ startup testing program will be performed. Data obtained during operation in the MELLLA+ domain will be incorporated into additional training, as needed. The classroom training will cover various aspects of MELLLA+ operating domain expansion, including changes to the power/flow map, changes to important setpoints, changes to plant procedures, and startup test procedures. The classroom training may be combined with simulator training for normal operational sequences unique to operation in the MELLLA+ domain. Because the plant dynamics do not change substantially for operation in the MELLLA+ domain, specific simulator training on transients is not anticipated. However, enhanced training on ATWS event mitigation in the MELLLA+ domain will be conducted.

The planned scope of PBAPS operator training and human factors is consistent with the guidance presented in the M+LTR and meets current industry standards.

10.7 PLANT LIFE

The plant life evaluation identifies degradation mechanisms influenced by increases in fluence and flow rate. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Irradiation Assisted Stress Corrosion Cracking (IASCC)	Plant Specific	Meets M+LTR Disposition
Flow-Accelerated Corrosion	Generic	Meets M+LTR Disposition

10.7.1 Irradiation Assisted Stress Corrosion Cracking

With regard to IASCC, the M+LTR states that the longevity of most equipment is not affected by the MELLLA+ operating domain expansion. The peak fluence experienced by the reactor internals may increase, representing a minor increase in the potential for IASCC. However, the current inspection strategy for the reactor internal components is adequate to manage any potential effects of MELLLA+.

Section 3.2.1 provides an evaluation of the change in fluence experienced by the reactor internals.

Fluence calculations using neutron energies > 1 MeV performed at MELLLA+ conditions as required by M+LTR SER Limitation and Condition 12.22 indicate that the top guide, shroud, and core plate exceed the 5E20 n/cm^2 threshold value for IASCC. The top guide fluence was calculated to be 3.74E22 n/cm^2. The shroud fluence was calculated to be 3.67E21 n/cm^2. The core plate fluence was calculated to be 6.78E20 n/cm^2.

The increase in fluence due to operation in the MELLLA+ domain does cause an increased potential for IASCC. However, the inspection strategies and inspections recommended by BWRVIP-25, 26, 76 and 183 (References 46, 47, 48, and 49, respectively) are based on component configuration and field experience and this inspection program is considered adequate to address the increase in potential for IASCC in the top guide, core plate, and shroud.

Exelon does not follow the guidance contained in BWRVIP-25 (Reference 46), for core plate bolts. PBAPS has implemented an approved, alternate inspection strategy (Reference 50). Although PBAPS Units 2 and 3 do not have lateral restraint wedges installed, an assessment of the minimum number of core plate bolts required to resist lateral movement against seismic shear loads has been performed, and is applicable to both PBAPS Units 2 and 3. For each unit, the minimum number of bolts required in the faulted condition, discounting the integrity of the aligner pins, is eighteen (18), which results in a margin of 89% of allowable stresses (total 34 bolts installed). Inspections of the top guide have been conducted at PBAPS Units 2 and 3 in accordance with the guidelines of BWRVIP-26-A (Reference 47) and no indications in the top guide grid beams have been identified to date.

The BWRVIP evaluated the failure modes and effects of reactor vessel internals and published the results in BWRVIP-06 (Reference 51). This evaluation for the shroud concluded that the inspections and evaluations performed in response to GL 94-03 (Reference 52) provided conservative assurance that the shroud is able to perform its safety function. The inspections of the shroud, top guide, and core plate are conducted using the guidance of BWRVIP- 25, 26, 76 and 183 (References 46, 47, 48, and 49, respectively). These guidelines in the areas of detection, inspection, repair or mitigation ensure the long-term function of these components. Therefore, the current inspection strategy based on the BWRVIP guidelines (Reference 48) is sufficient to address the small increase in fluence.

10.7.2 Flow-Accelerated Corrosion

The M+LTR describes that for MELLLA+, there is no increase in the MS flow rate or temperature, or the FW flow rate and temperature. As described in Section 3.3.6, the moisture content of the moisture separator outlet may increase at certain times while operating in the MELLLA+ operating domain. However, considering the RSD improved MCO performance, MCO will remain within the CLTP analyzed limits. [[

]] The Maintenance Rule also provides oversight for the other mechanical and electrical components important to plant safety, to guard against age-related degradation. Therefore, no further evaluation of this topic is required per the M+LTR.

For PBAPS, there are no significant changes in MS or FW temperatures, or MS or FW flow rates. The MS temperature in the MELLLA+ operating domain and in the current licensed operating domain is ~540°F. As discussed in Section 3.3.6, the moisture content of the moisture separator outlet may increase at certain times while operating in the MELLLA+ operating domain. However, considering the RSD improved MCO performance as documented in Reference 53, MCO will remain within the CLTP analyzed limits. Therefore, there is no change in the potential for FAC. The evaluation of and inspection for flow-induced erosion/corrosion in piping systems affected by FAC is addressed by compliance with NRC Generic Letter (GL) 89-08 (Reference 54). The requirements of GL 89-08 are implemented at PBAPS by utilization of the Electric Power Research Institute (EPRI) generic program, "CHECWORKS." PBAPS-specific parameters are entered into this program to develop requirements for monitoring

and maintenance of specific system components. No changes are required to the PBAPS specific parameters that are entered into the CHECWORKS program. The FAC monitoring programs are adequate to manage potential effects of MELLLA+ operating domain expansion.

In addition to FAC, a periodic non-destructive examination program was established to inspect safety-related piping and heat exchangers at known or suspected high corrosion, biofouling or silt buildup areas in response to GL 89-13. This program is supplemented by visual inspections of opened piping and heat exchangers whenever possible.

The Maintenance Rule also provides oversight for other mechanical and electrical components important to plant safety, to monitor performance and guard against age-related degradation. The longevity of PBAPS equipment is not affected by the MELLLA+ operating domain expansion.

Therefore, PBAPS meets all M+LTR dispositions for FAC.

10.8 NRC AND INDUSTRY COMMUNICATIONS

The topic addressed in this evaluation is:

Topic	M+LTR Disposition	PBAPS Result
Plant Disposition of NRC and Industry Communications	Generic	Meets M+LTR Disposition

The M+LTR describes that NRC and industry communications could affect the plant design and safety analyses. As discussed in Section 1.0, the MELLLA+ operating domain expansion has a limited effect on the SEs and system assessments. Because the maximum thermal power and CF rate do not change for MELLLA+ operating domain expansion, the effect of the changes is limited to the NSSS, primarily within the core. The evaluations and calculations included in this M+SAR, along with any supplements, demonstrate that the MELLLA+ operating domain expansion can be accomplished within the applicable design criteria. Because these evaluations of plant design and safety analyses inherently include any effect as a result of NRC and industry communications, it is not necessary to review prior communications and no additional information is required in this area.

Therefore, PBAPS meets all M+LTR dispositions for NRC and industry communications.

10.9 EMERGENCY AND ABNORMAL OPERATING PROCEDURES

Emergency and abnormal operating procedures (EOPs, AOPs) can be affected by MELLLA+ operating domain expansion. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	PBAPS Result
Emergency Operating Procedures	Plant Specific	Meets M+LTR Disposition
Abnormal Operating Procedures	Plant Specific	Meets M+LTR Disposition

10.9.1 Emergency Operating Procedures

EOPs include variables and limit curves, which define conditions where operator actions are indicated. The EOPs remain symptom-based. A site-specific ATWS analysis was performed for MELLLA+. As a result, operator immediate action sequence and/or priority may be changed to meet ATWS analysis assumptions. The EOPs will be reviewed for any effect and revised as necessary prior to implementation of MELLLA+ operating domain expansion. Any changes identified to the EOPs will be included in the operator training to be conducted prior to implementation of MELLLA+. These actions meet the requirements of M+LTR SER Limitation and Condition 12.23.4.

10.9.2 Abnormal Operating Procedures

AOPs include event based operator actions. Minor AOP revisions are expected as a result of MELLLA+ operating domain expansion. The AOPs will be reviewed for any effect and revised as necessary prior to implementation of MELLLA+ operating domain expansion. Any changes identified to the AOPs will be included in the operator training to be conducted prior to implementation of MELLLA+.

11.0 LICENSING EVALUATIONS

The proposed changes to the PBAPS TS and Facility Operating License are described in Attachments 1 and 2 of the PBAPS MELLLA+ LAR. The Environmental Assessment is provided in Section 5.0 of Attachment 1 of the PBAPS MELLLA+ LAR. The Significant Hazards Consideration Assessment is provided in Section 4.3 of Attachment 1 of the PBAPS MELLLA+ LAR.

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Appendix A – Limitations from Safety Evaluation for LTR NEDC-33173P

Disposition of additional limitations and conditions related to the SE for
NEDC-33173P, "Applicability of GE Methods to Expanded Operating Domains"

There are 24 limitations and conditions listed in Section 9 of the Methods LTR SER. The table below lists each of the 24 limitations and conditions and identifies which section of the M+SAR discusses compliance with each limitation and condition.

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.1	TGBLA/PANAC Version	The neutronic methods used to simulate the reactor core response and that feed into the downstream safety analyses supporting operation at EPU/MELLLA+ will apply TGBLA06/PANAC11 or later NRC-approved version of neutronic method.	Comply	Table 1-1 and Section 2.6.1
9.2	3D Monicore	For EPU/MELLLA+ applications, relying on TGBLA04/PANAC10 methods, the bundle RMS difference uncertainty will be established from plant-specific core-tracking data, based on TGBLA04/PANAC10. The use of plant-specific trendline based on the neutronic method employed will capture the actual bundle power uncertainty of the core monitoring system.	N/A	(1)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.3	Power/Flow Ratio	Plant-specific EPU and expanded operating domain applications will confirm that the core thermal power to core flow ratio will not exceed 50 MWt/Mlbm/hr at any statepoint in the allowed operating domain. For plants that exceed the power-to-flow value of 50 MWt/Mlbm/hr, the application will provide power distribution assessment to establish that neutronic methods axial and nodal power distribution uncertainties have not increased.	Comply	Sections 1.2.1 and 2.2.5 (2)
9.4	SLMCPR 1	Limitation has been removed according to Appendix I of this SE.	N/A	(3)
9.5	SLMCPR 2	This Limitation has been revised according to Appendix I of this SE. For operation at MELLLA+, including operation at the EPU power levels at the achievable core flow state-point, a 0.01 value shall be added to the cycle-specific SLMCPR value for power-to-flow ratios up to 42 MWt/Mlbm/hr, and a 0.02 value shall be added to the cycle-specific SLMCPR value for power-to-flow ratios above 42 MWt/Mlbm/hr.	Comply	Sections 2.2.1 and 2.2.5

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.6	R-Factor	The plant specific R-factor calculation at a bundle level will be consistent with lattice axial void conditions expected for the hot channel operating state. The plant-specific EPU/MELLLA+ application will confirm that the R-factor calculation is consistent with the hot channel axial void conditions.	Comply	Section 2.2
9.7	ECCS-LOCA 1	For applications requesting implementation of EPU or expanded operating domains, including MELLLA+, the small and large break ECCS-LOCA analyses will include top-peaked and mid-peaked power shape in establishing the MAPLHGR and determining the PCT. This limitation is applicable to both the licensing bases PCT and the upper bound PCT. The plant-specific applications will report the limiting small and large break licensing basis and upper bound PCTs.	Comply	Sections 4.3.2 and 4.3.3 (11) (12)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.8	ECCS-LOCA 2	The ECCS-LOCA will be performed for all statepoints in the upper boundary of the expanded operating domain, including the minimum core flow statepoints, the transition statepoint as defined in Reference 1 and the 55 percent core flow statepoint. The plant-specific application will report the limiting ECCS-LOCA results as well as the rated power and flow results. The SRLR will include both the limiting statepoint ECCS-LOCA results and the rated conditions ECCS-LOCA results.	Comply	Section 4.3.3 (2) (13)
9.9	Transient LHGR 1	Plant-specific EPU and MELLLA+ applications will demonstrate and document that during normal operation and core-wide AOOs, the T-M acceptance criteria as specified in Amendment 22 to GESTAR II will be met. Specifically, during an AOO, the licensing application will demonstrate that the: (1) loss of fuel rod mechanical integrity will not occur due to fuel melting and (2) loss of fuel rod mechanical integrity will not occur due to pellet–cladding mechanical interaction. The plant-specific application will demonstrate that the T-M acceptance criteria are met for the both the UO_2 and the limiting GdO_2 *[sic]* rods.	Comply	Section 9.1.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.10	Transient LHGR 2	Each EPU and MELLLA+ fuel reload will document the calculation results of the analyses demonstrating compliance to transient T-M acceptance criteria. The plant T-M response will be provided with the SRLR or COLR, or it will be reported directly to the NRC as an attachment to the SRLR or COLR.	Comply	Section 9.1.1
9.11	Transient LHGR 3	To account for the impact of the void history bias, plant-specific EPU and MELLLA+ applications using either TRACG or ODYN will demonstrate an equivalent to 10 percent margin to the fuel centerline melt and the 1 percent cladding circumferential plastic strain acceptance criteria due to pellet-cladding mechanical interaction for all of limiting AOO transient events, including equipment out-of-service. Limiting transients in this case, refers to transients where the void reactivity coefficient plays a significant role (such as pressurization events). If the void history bias is incorporated into the transient model within the code, then the additional 10 percent margin to the fuel centerline melt and the 1 percent cladding circumferential plastic strain is no longer required.	Comply	Section 9.1.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.12	LHGR and Exposure Qualification	In MFN 06-481, GE committed to submit plenum fission gas and fuel exposure gamma scans as part of the revision to the T-M licensing process. The conclusions of the plenum fission gas and fuel exposure gamma scans of GE 10x10 fuel designs as operated will be submitted for NRC staff review and approval. This revision will be accomplished through Amendment to GESTAR II or in a T-M licensing LTR. PRIME (a newly developed T-M code) has been submitted to the NRC staff for review (Reference 15). Once the PRIME LTR and its application are approved, future license applications for EPU and MELLLA+ referencing LTR NEDC-33173P must utilize the PRIME T-M methods.	Comply	Section 2.6.3 (4)
9.13	Application of 10 Weight Percent Gd	Before applying 10 weight percent Gd to licensing applications, including EPU and expanded operating domain, the NRC staff needs to review and approve the T-M LTR demonstrating that the T-M acceptance criteria specified in GESTAR II and Amendment 22 to GESTAR II can be met for steady-state and transient conditions. Specifically, the T-M application must demonstrate that the T-M acceptance criteria can be met for thermal overpower (TOP) and	N/A	(5)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
		mechanical overpower (MOP) conditions that bounds the response of plants operating at EPU and expanded operating domains at the most limiting statepoints, considering the operating flexibilities (e.g., equipment out-of-service). Before the use of 10 weight percent Gd for modern fuel designs, NRC must review and approve TGBLA06 qualification submittal. Where a fuel design refers to a design with Gd-bearing rods adjacent to vanished or water rods, the submittal should include specific information regarding acceptance criteria for the qualification and address any downstream impacts in terms of the safety analysis. The 10 weight percent Gd qualifications submittal can supplement this report.		
9.14	Part 21 Evaluation of GESTR-M Fuel Temperature Calculation	Any conclusions drawn from the NRC staff evaluation of the GE's Part 21 report will be applicable to the GESTR-M T-M assessment of this SE for future license application. GE submitted the T-M Part 21 evaluation, which is currently under NRC staff review. Upon completion of its review, NRC staff will inform GE of its conclusions.	N/A	(6)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.15	Void Reactivity 1	The void reactivity coefficient bias and uncertainties in TRACG for EPU and MELLLA+ must be representative of the lattice designs of the fuel loaded in the core.	Comply	Sections 2.2 and 9.1.1 (7)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.16	Void Reactivity 2	A supplement to TRACG /PANAC11 for AOO is under NRC staff review (Reference 5). TRACG internally models the response surface for the void coefficient biases and uncertainties for known dependencies due to the relative moderator density and exposure on nodal basis. Therefore, the void history bias determined through the methods review can be incorporated into the response surface "known" bias or through changes in lattice physics/core simulator methods for establishing the instantaneous cross-sections. Including the bias in the calculations negates the need for ensuring that plant-specific applications show sufficient margin. For application of TRACG to EPU and MELLLA+ applications, the TRACG methodology must incorporate the void history bias. The manner in which this void history bias is accounted for will be established by the NRC staff SE approving NEDE-32906P, Supplement 3, "Migration to TRACG04/PANAC11 from TRACG02/PANAC10," May 2006 (Reference 5). This limitation applies until the new TRACG/PANAC methodology is approved by the NRC staff.	N/A	(7) (15) (16)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.17	Steady-State 5 Percent Bypass Voiding	The instrumentation specification design bases limit the presence of bypass voiding to 5 percent (LRPM levels). Limiting the bypass voiding to less than 5 percent for long-term steady operation ensures that instrumentation is operated within the specification. For EPU and MELLLA+ operation, the bypass voiding will be evaluated on a cycle-specific basis to confirm that the void fraction remains below 5 percent at all LPRM levels when operating at steady-state conditions within the MELLLA+ upper boundary. The highest calculated bypass voiding at any LPRM level will be provided with the plant-specific SRLR.	Comply	Sections 2.1.2 and 5.1.5 (2)
9.18	Stability Setpoints Adjustment	The NRC staff concludes that the presence bypass voiding at the low-flow conditions where instabilities are likely can result in calibration errors of less than 5 percent for OPRM cells and less than 2 percent for APRM signals. These calibration errors must be accounted for while determining the setpoints for any detect and suppress long term methodology. The calibration values for the different long-term solutions are specified in the associated sections of this SE, discussing the stability methodology.	N/A	Section 2.4.1 (10)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.19	Void-Quality Correlation 1	For applications involving PANCEA/ODYN/ISCOR/TASC for operation at EPU and MELLLA+, an additional 0.01 will be added to the OLMCPR, until such time that GE expands the experimental database supporting the Findlay-Dix void-quality correlation to demonstrate the accuracy and performance of the void-quality correlation based on experimental data representative of the current fuel designs and operating conditions during steady-state, transient, and accident conditions.	N/A	Section 2.2.2 (2) (14)
9.20	Void-Quality Correlation 2	The NRC staff is currently reviewing Supplement 3 to NEDE-32906P, “Migration to TRACG04/PANAC11 from TRACG02/PANAC10,” dated May 2006 (Reference 5). The adequacy of the TRACG interfacial shear model qualification for application to EPU and MELLLA+ will be addressed under this review. Any conclusions specified in the NRC staff SE approving Supplement 3 to LTR NEDC-32906P (Reference 5) will be applicable as approved.	Comply	Sections 9.1.1 and 9.3.1 (7)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.21	Mixed Core Method 1	Plants implementing EPU or MELLLA+ with mixed fuel vendor cores will provide plant-specific justification for extension of GE's analytical methods or codes. The content of the plant-specific application will cover the topics addressed in this SE as well as subjects relevant to application of GE's methods to legacy fuel. Alternatively, GE may supplement or revise LTR NEDC-33173P (Reference 4) for mixed core application.	N/A	(8)
9.22	Mixed Core Method 2	For any plant-specific applications of TGBLA06 with fuel type characteristics not covered in this review, GE needs to provide assessment data similar to that provided for the GEH/GNF fuels. The Interim Methods review is applicable to all GEH/GNF lattices up to GNF2. Fuel lattice designs, other than GEH/GNF lattices up to GNF2, with the following characteristics are not covered by this review: • square internal water channels water crosses • Gd rods simultaneously adjacent to water and vanished rods • 11x11 lattices • MOX fuel The acceptability of the modified epithermal	N/A	(8)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
		slowing down models in TGBLA06 has not been demonstrated for application to these or other geometries for expanded operating domains. Significant changes in the Gd rod optical thickness will require an evaluation of the TGBLA06 radial flux and Gd depletion modeling before being applied. Increases in the lattice Gd loading that result in nodal reactivity biases beyond those previously established will require review before the GEH methods may be applied.		
9.23	MELLLA+ Eigenvalue Tracking	In the first plant-specific implementation of MELLLA+, the cycle-specific eigenvalue tracking data will be evaluated and submitted to NRC to establish the performance of nuclear methods under the operation in the new operating domain. The following data will be analyzed: • Hot critical eigenvalue, • Cold critical eigenvalue, • Nodal power distribution (measured and calculated TIP comparison), • Bundle power distribution (measured and calculated TIP comparison), • Thermal margin, • Core flow and pressure drop uncertainties,	Comply	(9)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
		and • The MCPR importance parameter (MIP) Criterion (e.g., determine if core and fuel design selected is expected to produce a plant response outside the prior experience base). Provision of evaluation of the core-tracking data will provide the NRC staff with bases to establish if operation at the expanded operating domain indicates: (1) changes in the performance of nuclear methods outside the EPU experience base; (2) changes in the available thermal margins; (3) need for changes in the uncertainties and NRC-approved criterion used in the SLMCPR methodology; or (4) any anomaly that may require corrective actions.		

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
9.24	Plant-Specific Application	The plant-specific applications will provide prediction of key parameters for cycle exposures for operation at EPU (and MELLLA+ for MELLLA+ applications). The plant-specific prediction of these key parameters will be plotted against the EPU Reference Plant experience base and MELLLA+ operating experience, if available. For evaluation of the margins available in the fuel design limits, plant-specific applications will also provide quarter core map (assuming core symmetry) showing bundle power, bundle operating LHGR, and MCPR for BOC, MOC, and EOC. Because the minimum margins to specific limits may occur at exposures other than the traditional BOC, MOC, and EOC, the data will be provided at these exposures.	Comply	Section 2.1.2

Notes:

1. As shown in Table 1-1, the PBAPS M+SAR is based on TGBLA06/PANAC11, not TGBLA 04/PANAC10.
2. Correspondence concerning implementation of this limitation and condition is docketed the letter from James F. Harrison (GEH) to NRC, "Implementation of Methods Limitations - NEDC-33173P," MFN 08-693, September 18, 2008 (Reference 4).
3. This limitation was removed as noted in Reference 4.
4. The PRIME LTR and its application (Reference 15) was approved on January 22, 2010 and implemented in GESTAR II in September 2010. The PBAPS M+SAR is based on the GNF2 fuel product line, which has a PRIME T-M basis. PRIME fuel parameters will be used in all analyses requiring fuel performance parameters.
5. PBAPS uses GNF2 fuel, and as such does not seek to apply 10 wt% Gd to this licensing application.
6. This limitation and condition relates to GEH's treatment of the NRC staff review of the 10 CFR Part 21 report related to the GESTR-M T-M evaluation. The PBAPS M+SAR is based on the GNF2 fuel product line, which has a PRIME T-M and PRIME fuel temperature basis included. Therefore, this limitation is no longer applicable.
7. The PBAPS M+SAR licensing basis uses TRACG for AOO, DSS-CD, ATWS overpressure, and ATWSI analyses. The void reactivity coefficients bias and uncertainties used in the latest version of TRACG are in accordance with Reference 5 and are applicable to the GNF2 lattice designs loaded in the core.
8. The PBAPS M+SAR is based on a GNF2 equilibrium core design. Therefore, the mixed core limitations are not applicable.
9. If PBAPS is the first plant implementing MELLLA+, then GEH will collect, evaluate, and provide the required information. This limitation and condition relates to a GEH commitment to submit cycle-specific Eigenvalue tracking data to the NRC to establish performance of GEH methods under operation in the MELLLA+ operating domain. As such, this requirement specifies information to be supplied to the NRC at a later date by GEH. This is not a requirement to be addressed by PBAPS in the M+SAR.
10. Not applicable to DSS-CD because the significant conservatisms in the current licensing methodology and associated MCPR margins are more than sufficient to compensate for the overall uncertainty in the OPRM instrumentation.
11. Sections 4.3.2 and 4.3.3 confirm that the conclusions based on Licensing Basis PCT are also valid for the Upper Bound PCT.
12. Top-peaked and mid-peaked cases are reported for each break type, using the bounding shape, to determine LBPCT and UBPCT. LBPCT and UBPCT are reported for small break only as the large break case is not limiting; only one Licensing Basis PCT is reported per Reference 1.

13. The minimum CF and low flow (55%) cases are reported to demonstrate the limiting result along the upper boundary. For large break cases, the transition point is dispositioned by evaluation because the large break is shown to be bounded by the small break result.

14. The limiting fuel thermal margin transients for PBAPS MELLLA+ were determined using a plant specific TRACG model that is compliant with Reference 5. The NRC SE for Reference 5 states that this 0.01 OLMCPR penalty is not applicable to analysis using a TRACG model compliant with Reference 5. Therefore, this commitment to add an additional 0.01 penalty to the calculated OLMCPR is not applicable to PBAPS.

15. The reference that this limitation and condition refers to was approved in Reference 5; therefore, this limitation and condition is no longer applicable.

16. The PBAPS M+SAR licensing basis ATWS overpressure and ATWSI analyses use the TRACG code. The void reactivity coefficients bias and uncertainties used in the latest version of TRACG are applicable to the GNF2 lattice designs loaded in the core. The PBAPS M+SAR licensing basis ATWS PCT, oxidation thickness, suppression pool temperature, and containment pressure analyses use the ODYN code.

Appendix B - Limitations from Safety Evaluation for LTR NEDC-33006P

Disposition of additional limitations and conditions related to the SE for NEDC-33006P, "Maximum Extended Load Line Limit Analysis Plus”

There are 54 limitations and conditions listed in Section 12 of the M+LTR SER. The table below lists each of the 54 limitations and conditions and identifies which section of the M+SAR discusses compliance with each limitation and condition.

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.1	GEXL-PLUS	The plant-specific application will confirm that for operation within the boundary defined by the MELLLA+ upper boundary and maximum CF range, the GEXL-PLUS experimental database covers the thermal-hydraulic conditions the fuel bundles will experience, including, bundle power, mass flux, void fraction, pressure, and subcooling. If the GEXL-PLUS experimental database does not cover the within bundle thermal-hydraulic conditions, during steady state, transient conditions, and DBA conditions, GHNE will inform the NRC at the time of submittal and obtain the necessary data for the submittal of the plant-specific MELLLA+ application. In addition, the plant-specific application will confirm that the experimental pressure drop database for the pressure drop correlation covers the pressure drops anticipated in the MELLLA+ range. With subsequent fuel designs, the plant-specific applications will confirm that the database supporting the CPR correlations covers the powers, flows and void fractions BWR bundles will experience for operation at and within the MELLLA+ domain, during steady state, transient, and DBA conditions. The plant-specific submittal will also confirm that the NRC staff reviewed and approved the associated CPR	Comply	Sections 1.1.3 and 2.6.4

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
		correlation if the changes in the correlation are outside the GESTAR II (Amendment 22) process. Similarly, the plant-specific application will confirm that the experimental pressure drop database does cover the range of pressures the fuel bundles will experience for operation within the MELLLA+ domain.		
12.2	Related LTRs	Plant-specific MELLLA+ applications must comply with the limitations and conditions specified in and be consistent with the purpose and content covered in the NRC staff SEs approving the latest version of the following LTRs: NEDC-33173P, NEDC-33075P-A, and NEDC-33147-A.	Comply	Sections 1.0 and 1.1.3

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.3.a	Concurrent Changes	The plant-specific analyses supporting MELLLA+ operation will include all operating condition changes that are implemented at the plant at the time of MELLLA+ implementation. Operating condition changes include, but are not limited to, those changes that affect, an increase in the dome pressure, maximum CF, fuel cycle length, or any changes in the licensed operational enhancements. For example, with an increase in dome pressure, the following analyses must be analyzed: the ATWS analysis, the ASME overpressure analyses, the transient analyses, and the ECCS-LOCA analysis. Any changes to the safety system settings or any actuation setpoint changes necessary to operate with the increased dome pressure must be included in the evaluations (e.g., SRV setpoints).	Comply	Section 1.1.2

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.3.b		For all topics in LTR NEDC-33006P that are reduced in scope or generically dispositioned, the plant-specific application will provide justification that the reduced scope or generic disposition is applicable to the plant. If changes that invalidate the LTR dispositions are to be implemented at the time of MELLLA+ implementation, the plant-specific application will provide analyses and evaluations that demonstrate the cumulative effect with MELLLA+ operation. For example, if the dome pressure is increased, the ECCS performance will be evaluated on a plant-specific basis.	Comply	Section 1.1.1
12.3.c		Any generic bounding sensitivity analyses provided in LTR NEDC-33006P will be evaluated to ensure that the key plant-specific input parameters and assumptions are applicable and bounded. If these generic sensitivity analyses are not applicable or additional operating condition changes affect the generic sensitivity analyses, a plant-specific evaluation will be provided. For example, with an increase in the dome pressure, the ATWS sensitivity analyses that model operator actions (e.g., depressurization if the HCTL is reached) needs to be reanalyzed, using the bounding dome pressure condition.	Comply	Section 1.1.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.3.d		If a new GE fuel product line or another vendor's fuel is loaded at the plant, the applicability of any generic sensitivity analyses supporting the MELLLA+ application shall be justified in the plant-specific application. If the generic sensitivity analyses cannot be demonstrated to be applicable, the analyses will be performed including the new fuel. For example, the ATWS instability analyses supporting the MELLLA+ condition are based on the GE14 fuel response. New analyses that demonstrate the ATWS instability performance of the new GE fuel or another vendor's fuel for MELLLA+ operation shall be provided to support the plant-specific application.	Comply	Section 9.3.3
12.3.e		If a new GE fuel product line or another vendor's fuel is loaded at the plant prior to a MELLLA+ application, the analyses supporting the plant-specific MELLLA+ application will be based on a specific core configuration or bounding core conditions. Any topics that are generically dispositioned or reduced in scope in LTR NEDC-33006P will be demonstrated to be applicable, or new analyses based on the specific core configuration or bounding core conditions will be provided.	Comply	Section 2.1.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.3.f		If a new GE fuel product line or another vendor's fuel is loaded at the plant prior to a MELLLA+ application, the plant-specific application will reference an NRC-approved stability method supporting MELLLA+ operation, or provide sufficient plant-specific information to allow the NRC staff to review and approve the stability method supporting MELLLA+ operation. The plant-specific application will demonstrate that the analyses and evaluations supporting the stability method are applicable to the fuel loaded in the core.	Comply	Section 2.4.1
12.3.g		For MELLLA+ operation, core instability is possible in the event a transient or plant maneuver places the reactor at a high power/low-flow condition. Therefore, plants operating at MELLLA+ conditions must have a NRC-approved instability protection method. In the event the instability protection method is inoperable, the applicant must employ an NRC-approved backup instability method. The licensee will provide technical specification (TS) changes that specify the instability method operability requirements for MELLLA+ operation, including any backup stability protection methods.	Comply	Section 2.4.3

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.4	Reload analysis submittal	The plant-specific MELLLA+ application shall provide the plant-specific thermal limits assessment and transient analysis results. Considering the timing requirements to support the reload, the fuel and cycle-dependent analyses including the plant-specific thermal limits assessment may be submitted by supplementing the initial M+SAR. Additionally, the SRLR for the initial MELLLA+ implementation cycle shall be submitted for NRC staff confirmation.	Comply	Sections 1.1.1 and 9.1.1
12.5.a	Operating Flexibility	The licensee will amend the TS limiting condition for operation (LCO) for any equipment out-of-service (i.e., SLO) or operating flexibilities prohibited in the plant-specific MELLLA+ application.	Comply	Section 1.2.4
12.5.b		For an operating flexibility, such as FWHOOS, that is prohibited in the MELLLA+ plant-specific application but is not included in the TS LCO, the licensee will propose and implement a license condition.	Comply	Sections 1.2.4 and 2.4.4
12.5.c		The power flow map is not specified in the TS; however, it is an important licensed operating domain. Licensees may elect to be licensed and operate the plant under plant-specific-expanded domain that is bounded by the MELLLA+ upper boundary. Plant-specific applications approved for operation within the MELLLA+ domain will include the plant-specific power/flow map specifying the licensed domain in the COLR.	Comply	Section 1.2.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.6	SLMCPR Statepoints and CF Uncertainty	Until such time when the SLMCPR methodology (References 55 and 56) for off-rated SLMCPR calculation is approved by the staff for MELLLA+ operation, the SLMCPR will be calculated at the rated statepoint (120 percent P/100 percent CF), the plant-specific minimum CF statepoint (e.g., 120 percent P/80 percent CF), and at the 100 percent OLTP at 55 percent CF statepoint. The currently approved off-rated CF uncertainty will be used for the minimum CF and 55 percent CF statepoints. The uncertainty must be consistent with the CF uncertainty currently applied to the SLO operation or as NRC-approved for MELLLA+ operation. The calculated values will be documented in the SRLR.	Comply	Section 2.2.1
12.7	Stability	Manual operator actions are not adequate to control the consequences of instabilities when operating in the MELLLA+ domain. If the primary stability protection system is declared inoperable, a non-manual NRC-approved backup protection system must be provided, or the reactor core must be operated below a NRC-approved backup stability boundary specifically approved for MELLLA+ operation for the stability option employed.	Comply	Section 2.4.3

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.8	Fluence Methodology and Fracture Toughness	The applicant is to provide a plant-specific evaluation of the MELLLA+ RPV fluence using the most up-to-date NRC-approved fluence methodology. This fluence will then be used to provide a plant-specific evaluation of the RPV fracture toughness in accordance with RG 1.99, Revision 2.	Comply	Section 3.2.1
12.9	Reactor Coolant Pressure Boundary	MELLLA+ applicants must identify all other than Category “A” materials, as defined in NUREG-0313, Revision 2, that exist in its RCPB piping, and discuss the adequacy of the augmented inspection programs in light of the MELLLA+ operation on a plant-specific basis.	Comply	Section 3.5.1.4

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.10.a	ECCS-LOCA Off-rated Multiplier	The plant-specific application will provide the 10 CFR Part 50, Appendix K, and the nominal PCTs calculated at the rated EPU power/rated CF, rated EPU power/minimum CF, at the low-flow MELLLA+ boundary (Transition Statepoint). For the limiting statepoint, both the upper bound and the licensing PCT will be reported. The M+SAR will justify why the transition statepoint ECCS-LOCA response bounds the 55 percent CF statepoint. The M+SAR will provide discussion on what power/flow combination scoping calculations were performed to identify the limiting statepoints in terms of DBA-LOCA PCT response for the operation within the MELLLA+ boundary. The M+ SAR will justify that the upper bound and licensing basis PCT provided is in fact the limiting PCT considering uncertainty applications to the non-limiting statepoints.	Comply	Section 4.3.2 (5)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.10.b		LOCA analysis is not performed on cycle-specific basis; therefore, the thermal limits applied in the M+SAR LOCA analysis for the 55 percent CF MELLLA+ statepoint and/or the transition statepoint must be either bounding or consistent with cycle-specific off-rated limits. The COLR and the SRLR will contain confirmation that the off-rated limits assumed in the ECCS-LOCA analyses bound the cycle-specific off-rated limits calculated for the MELLLA+ operation. Every future cycle reload shall confirm that the cycle-specific off-rated thermal limits applied at the 55 percent CF and/or the transition statepoints are consistent with those assumed in the plant-specific ECCS-LOCA analyses.	Comply	Section 4.3.2 (6)
12.10.c		Off-rated limits will not be applied to the minimum CF statepoint.	Comply	Section 4.3.2 (1)
12.10.d		If credit is taken for these off-rated limits, the plant will be required to apply these limits during core monitoring.	Comply	Section 4.3.2

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.11	ECCS-LOCA Axial Power Distribution Evaluation	For MELLLA+ applications, the small and large break ECCS-LOCA analyses will include top-peaked and mid-peaked power shape in establishing the MAPLHGR and determining the PCT. This limitation is applicable to both the licensing bases PCT and the upper bound PCT. The plant-specific applications will report the limiting small and large break licensing basis and upper bound PCTs.	Comply	Sections 4.3.2 and 4.3.3 (7)
12.12.a	ECCS-LOCA Reporting	Both the nominal and Appendix K PCTs should be reported for all of the calculated statepoints, and	Comply	Section 4.3.3 (5)
12.12.b		The plant-variable and uncertainties currently applied will be used, unless the NRC staff specifically approves a different plant variable uncertainty method for application to the non-rated statepoints.	Comply	Section 4.3.3 (5)
12.13	Small Break LOCA	Small break LOCA analysis will be performed at the MELLLA+ minimum CF and the transition statepoints for those plants that: (1) are small break LOCA limited based on small break LOCA analysis performed at the rated EPU conditions; or (2) have margins of less than or equal to [[ ]] relative to the Appendix K or the licensing basis PCT.	Comply	Section 4.3.3 (8)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.14	Break Spectrum	The scope of small break LOCA analysis for MELLLA+ operation relies upon the EPU small break LOCA analysis results. Therefore, the NRC staff concludes that for plants that will implement MELLLA+, sufficient small break sizes should be analyzed at the rated EPU power level to ensure that the peak PCT break size is identified.	Comply	Section 4.3.1
12.15	Bypass Voiding Above the D-level	Plant-specific MELLLA+ applications shall identify where in the MELLLA+ upper boundary the bypass voiding greater than 5 percent will occur above the D-level. The licensee shall provide in the plant-specific submittal the operator actions and procedures that will mitigate the impact of the bypass voiding on the TIPs and the core simulator used to monitor the fuel performance. The plant-specific submittal shall also provide discussion on what impact the bypass voiding greater than 5 percent will have on the NMS as defined in Section 5.1.1.5. The NRC staff will evaluate on plant-specific bases acceptability of bypass voiding above D level.	Comply	Section 5.1.5
12.16	RWE	Plants operating at the MELLLA+ operating domain shall perform RWE analyses to confirm the adequacy of the generic RBM setpoints. The M+SAR shall provide a discussion of the analyses performed and the results.	Comply	Sections 5.3.2 and 9.1.1

Limitation and Condition Number from NRC SER	**Limitation and Condition Title**	**Limitation and Condition Description**	**Disposition**	**Section of PBAPS M+SAR which addresses the Limitation and Condition**
12.17	ATWS LOOP	As specified in LTR NEDC-33006P, at least two plant-specific ATWS calculations must be performed: MSIVC and PRFO. In addition, if RHR capability is affected by LOOP, then a third plant-specific ATWS calculation must be performed that includes the reduced RHR capability. To evaluate the effect of reduced RHR capacity during LOOP, the plant-specific ATWS calculation must be performed for a sufficiently large period of time after HSBW injection is complete to guarantee that the suppression pool temperature is cooling, indicating that the RHR capacity is greater than the decay heat generation. The plant-specific application should include evaluation of the safety system performance during the long-term cooling phase, in terms of available NPSH.	Comply	Sections 4.2.6.1 and 9.3.1.1
12.18.a	ATWS TRACG Analysis	For plants that do not achieve hot shutdown prior to reaching the heat capacity temperature limit (HCTL) based on the licensing ODYN code calculation, plant-specific MELLLA+ implementations must perform best-estimate TRACG calculations on a plant-specific basis. The TRACG analysis will account for all plant parameters, including water-level control strategy and all plant-specific emergency operating procedure (EOP) actions.	N/A	(3) (10)

Limitation and Condition Number from NRC SER	**Limitation and Condition Title**	**Limitation and Condition Description**	**Disposition**	**Section of PBAPS M+SAR which addresses the Limitation and Condition**
12.18.b		The TRACG calculation is not required if the plant increases the boron-10 concentration/enrichment so that the integrated heat load to containment calculated by the licensing ODYN calculation does not change with respect to a reference OLTP/75 percent flow ODYN calculation.	N/A	(3)
12.18.c		Peak cladding temperature (PCT) for both phases of the transient (initial overpressure and emergency depressurization) must be evaluated on a plant-specific basis with the TRACG ATWS calculation.	N/A	(3)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.18.d		In general, the plant-specific application will ensure that operation in the MELLLA+ domain is consistent with the assumptions used in the ATWS analysis, including equipment out of service (e.g., FWHOOS, SLO, SRVs, SLC pumps, and RHR pumps, etc.). If assumptions are not satisfied, operation in MELLLA+ is not allowed. The SRLR will specify the prohibited flexibility options for plant-specific MELLLA+ operation, where applicable. For key input parameters, systems and engineering safety features that are important to simulating the ATWS analysis and are specified in the Technical Specification (TS) (e.g., SLCS parameters, ATWS RPT, etc.), the calculation assumptions must be consistent with the allowed TS values and the allowed plant configuration. If the analyses deviate from the allowed TS configuration for long term equipment out of service (i.e., beyond the TS LCO), the plant-specific application will specify and justify the deviation. In addition, the licensee must ensure that all operability requirements are met (e.g., NPSH) by equipment assumed operable in the calculations.	N/A	(3)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.18.e		Nominal input parameters can be used in the ATWS analyses provided the uncertainty treatment and selection of the values of these input parameters are consistent with the input methods used in the original GE ATWS analyses in NEDE-24222. Treatment of key input parameters in terms of uncertainties applied or plant-specific TS value used can differ from the original NEDE-24222 approach, provided the manner in which it is used yields more conservative ATWS results.	N/A	(3)
12.18.f		The plant-specific application will include tabulation and discussion of the key input parameters and the associated uncertainty treatment.	N/A	(3)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.19	Plant-Specific ATWS Instability	Until such time that NRC approves a generic solution for ATWS instability calculations for MELLLA+ operation, each plant-specific MELLLA+ application must provide ATWS instability analysis that satisfies the ATWS acceptance criteria listed in SRP Section 15.8. The plant-specific ATWS instability calculation must: (1) be based on the peak-reactivity exposure conditions, (2) model the plant-specific configuration important to ATWS instability response including mixed core, if applicable, and (3) use the regional-mode nodalization scheme. In order to improve the fidelity of the analyses, the plant-specific calculations should be based on latest NRC-approved neutronic and thermal-hydraulic codes such as TGBLA06/PANAC11 and TRACG04.	Comply	Section 9.3.3

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.20	Generic ATWS Instability	Once the generic solution is approved, the plant-specific applications must provide confirmation that the generic instability analyses are relevant and applicable to their plant. Applicability confirmation includes review of any differences in plant design or operation that will result in significantly lower stability margins during ATWS such as: • turbine bypass capacity, • fraction of steam-driven feedwater pumps, • any changes in plant design or operation that will significantly increase core inlet subcooling during ATWS events, • significant differences in radial and axial power distributions, • hot-channel power-to-flow ratio, • fuel design changes beyond GE14.	N/A	(2)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.21	Individual Plant Evaluation	Licensees that submit a MELLLA+ application should address the plant-specific risk impacts associated with MELLLA+ implementation, consistent with approved guidance documents (e.g., NEDC-32424P-A, NEDC-32523P-A, and NEDC-33004P-A) and the Matrix 13 of RS-001 and re-address the plant-specific risk impacts consistent with the approved guidance documents that were used in their approved EPU application and Matrix 13 of RS-001. If an EPU and MELLLA+ application come to the NRC in parallel, the expectation is that the EPU submittal will have incorporated the MELLLA+ impacts.	Comply	Section 10.5
12.22	IASCC	The applicant is to provide a plant-specific IASCC evaluation when implementing MELLLA+, which includes the components that will exceed the IASCC threshold of $5x10^{20}$ n/cm^2 (E>1MeV), the impact of failure of these components on the integrity of the reactor internals and core support structures under licensing design bases conditions, and the inspections that will be performed on components that exceed the IASCC threshold to ensure timely identification of IASCC, should it occur.	Comply	Section 10.7.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.23.1	Limitations from the ATWS RAI Evaluations	See limitation 12.18.d.	N/A	(3)
12.23.2		The plant-specific ODYN and TRACG key calculation parameters must be provided to the staff so they can verify that all plant-specific automatic settings are modeled properly.	Comply	Sections 1.1.3 and 9.3.1
12.23.3		The ATWS peak pressure response would be dependent upon SRVs upper tolerances assumed in the calculations. For each individual SRV, the tolerances used in the analysis must be consistent with or bound the plant-specific SRV performance. The SRV tolerance test data would be statistically treated using the NRC's historical 95/95 approach or any new NRC-approved statistical treatment method. In the event that current EPU experience base shows propensity for valve drift higher than pre-EPU experience base, the plant-specific transient and ATWS analyses would be based on the higher tolerances or justify the reason why the propensity for the higher drift is not applicable the plant's SRVs.	Comply	Section 9.3.1.1
12.23.4		EPG/SAG parameters must be reviewed for applicability to MELLLA+ operation in a plant-specific basis. The plant-specific MELLLA+ application will include a section that discusses the plant-specific EOPs and confirms that the ATWS calculation is consistent with the operator actions.	Comply	Sections 9.3.1.1 and 10.9.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.23.5		The conclusions of this LTR and associated SE are limited to reactors operating with a power density lower than 52.5 MW/MLBM/hr for operation at the minimum allowable CF at 120 percent OLTP. Verification that reactor operation will be maintained below this analysis limit must be performed for all plant-specific applications.	Comply	Sections 1.2.3 and 9.3.3
12.23.6		For MELLLA+ applications involving GE fuel types beyond GE14 or other vendor fuels, bounding ATWS Instability analysis will be provided to the staff. Note: this limitation does not apply to special test assemblies.	Comply	Section 9.3.3
12.23.7		See limitation 12.23.6.	Comply	Section 9.3.3
12.23.8		The plant-specific ATWS calculations must account for all plant- and fuel-design-specific features, such as the debris filters.	Comply	Section 9.3.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.23.9		Plant-specific applications must review the safety system specifications to ensure that all of the assumptions used for the ATWS SE indeed apply to their plant-specific conditions. The NRC staff review will give special attention to crucial safety systems like HPCI, and physical limitations like NPSH and maximum vessel pressure that RCIC and HPCI can inject. The plant-specific application will include a discussion on the licensing bases of the plant in terms of NPSH and system performance. It will also include NPSH and system performance evaluation for the duration of the event.	Comply	Sections 4.2.6.1 and 9.3.1
12.23.10		Plant-specific applications must ensure that an increase in containment pressure resulting from ATWS events with EPU/MELLLA+ operation does not affect adversely the operation of safety-grade equipment.	Comply	Sections 4.2.6.1 and 9.3.1.1 (4)
12.23.11		The plant-specific applications must justify the use of plant-specific suppression pool temperature limits for the ODYN and TRACG calculations that are higher than the HCTL limit for emergency depressurization.	Comply	Section 9.3.1.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
12.24.1	Limitations from Fuel Dependent Analyses RAI Evaluations	For EPU/MELLLA+ plant-specific applications that use TRACG or any code that has the capability to model in-channel water rod flow, the supporting analysis will use the actual flow configuration.	Comply	Sections 2.6.2, 9.1.1, and 9.3.3
12.24.2		The EPU/MELLLA+ application would provide the exit void fraction of the high-powered bundles in the comparison between the EPU/MELLLA+ and the pre-MELLLA+ conditions.	Comply	Section 2.1.2
12.24.3		See limitation 12.6.	Comply	See Limitation and Condition 12. 6 above.
12.24.4		See limitation 12.18.d.	N/A	(3)

Notes:

1. PBAPS takes credit for off-rated limits along the MELLLA+ boundary down to the low flow point, but these begin to be applied below the MELLLA+ minimum flow point. The analysis complies with the requirement to not apply off-rated limits at the minimum CF point.
2. This requirement relates to implementation of a generic ATWSI solution, which is not yet approved by the NRC. PBAPS MELLLA+ is based on a plant-specific ATWSI analysis.
3. As further discussed in Sections 9.3.1.1 and 9.3.1.2, the best-estimate ATWS with emergency depressurization analysis is not required as the peak suppression pool temperature remains below the HCTL curves.
4. PBAPS does not credit CAP for ECCS NPSH.
5. The analysis has shown the small break to be limiting. Per the Reference 1 requirement, which is implemented by Reference 34, the survey of cases to identify the limiting power and flow statepoint has been done on an Appendix K basis, exclusively; the Nominal assumption calculation is performed for the limiting case of each break size only. Consideration of the transition point for applicable large breaks has been evaluated and justified as non-limiting, with an effect sufficiently small so as to justify that the Upper Bound and Licensing Basis PCT provided is, in fact, the limiting PCT. Sections 4.3.2 and 4.3.3 confirm that conclusions based on the Licensing Basis PCT are consistently valid for the Upper Bound PCT as well. With the Reference 1 requirement and the availability of Nominal assumption calculations for limiting cases only, the Upper Bound PCT and the Licensing Basis PCT are reported and used for defining the LBPCT with no change in applied plant variables and uncertainties.
6. The reload evaluation process includes a review of the cycle-specific off-rated limits and either confirms continuing applicability of the analysis basis or requires resolution for any indicated change.
7. Top-peaked and mid-peaked cases are reported for each break type, using the bounding shape to determine the LBPCT and the UBPCT. The LBPCT and UBPCT are reported only for the small break because the large break case is not limiting; therefore, only one Licensing Basis PCT is reported, per Reference 4.
8. This limitation and condition is written as a check against a potentially limiting small break case going undetected in light of bounding large break calculated results. The analysis for PBAPS MELLLA+ is small break limited. The bounding result at the minimum CF statepoint is calculated and reported. Because it is not limiting based on the small break LOCA analysis performed at the rated (flow) CLTP condition (Criteria 1), and the margin boundary of 50ºF is not relevant because the small break is bounding (Criteria 2), the calculation of the transition statepoint is not required. The transition statepoint is relevant to the large break case as discussed in Reference 1. Section 4.3.2.3 of Reference 4 confirms that for small breaks, a decrease in the power will reduce the PCT much more than any flow reduction; therefore, the small break transition point does not challenge the determination of limiting PCT and is not reported.

9. PBAPS uses GNF2 fuel, therefore, this limitation and condition is not applicable to the PBAPS M+SAR.

10. As further discussed in Sections 9.3.1.1 and 9.3.1.2, a best-estimate TRACG analysis modeling emergency depressurization is not required as the suppression pool temperature from the licensing basis ODYN long-term calculation remains below the HCTL.

Appendix C - Limitations from Safety Evaluation for LTR NEDC-33075P

Disposition of additional limitations and conditions related to the SE for NEDC-33075P, Revision 7, "General Electric Boiling Water Reactor Detect and Suppress Solution – Confirmation Density"

There are 4 limitations and conditions listed in Section 5 of the DSS-CD LTR Revision 7 SER. The table below lists each of the 4 limitations and conditions and identifies which section of the M+SAR discusses compliance with each limitation and condition.

Limitation and Condition Number from NRC SER	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
5.1	The NRC staff previously reviewed and approved the implementation of DSS-CD using the approved GEH Option III hardware and software. The DSS-CD solution is not approved for use with non-GEH hardware. The hardware components required to implement DSS-CD are expected to be those currently used for the approved Option III. If the DSS-CD hardware implementation deviates from the approved Option III solution, a hardware review by the NRC staff will be required. Implementations on other Option III platforms will require plant-specific reviews.	Comply	Section 2.4 (1)
5.2	The CDA setpoint calculation formula and the adjustable parameters values are defined in NEDC-33075P, Revision 7 (Reference 2). Deviation from the stated values or calculation formulas is not allowed without NRC review. To this end, the subject TR, when approved and implemented by a licensed nuclear power plant, must be referenced in the plant TSs, so that these values become controlled and part of the licensing bases.	Comply	Section 2.4.1 (2)
5.3	The NRC staff previously concluded that the plant-specific settings for eight of the FIXED parameters and three of the ADJUSTABLE parameters, as stated in section 3.6.3 of the NRC staff's SE for NEDC-33075P, Revision 5 (Reference 57), are licensing basis values. The process by which these values will be controlled must be addressed by licensees.	Comply	(3)
5.4	If plants other than Brunswick Steam Electric Plant, Units 1 and 2, use the DSS-CD trip function, those plant licensees must ensure the DSS-CD trip function is applicable in their plant licensing bases, including the optional BSP trip function, if it is to be installed.	Comply	(4)

Notes:

1. The DSS-CD solution is implemented on a GEH hardware that is currently installed and approved by NRC for Option III solution.
2. The subject topical report, or GESTAR II that includes the subject topical report, is being incorporated into the PBAPS Units 2 and 3 TSs.
3. The values of the FIXED and ADJUSTABLE parameters are established by GEH and will be documented in a DSS-CD Settings Report.
4. Verification and validation (V&V) of the DSS-CD trip function code was performed for transportability considerations.

Appendix D - Limitations and Conditions Applicable to the Use of TRACG04 / PANAC11 in ATWS Overpressure Analyses

This appendix addresses limitations and conditions relevant to the use of TRACG04 / PANAC11 in the analysis of the ATWS overpressure event. The use of TRACG04 / PANAC11 in this application has been previously reviewed by the NRC, as outlined below:

- NEDE-32906P-A, Revision 3 (Reference 58) represents approval of the application of TRACG for AOOs. There are five limitations and conditions for AOOs in Revision 3 that were included in the original Revision 0 Safety Evaluation (SE) dated October 21, 2001. The approval of Supplement 1 by the SE dated August 18, 2003 effectively negates Limitation and Condition 3 of the original Revision 0 approval.
- NEDE-32906P, Supplement 1-A (Reference 41) represents the approval of TRACG02 / PANAC10 for ATWS overpressure events. There are four limitations and conditions within Supplement 1-A and an additional statement of information required when a licensee uses TRACG for ATWS analysis in a license amendment.
- NEDC-32906P, Supplement 3-A, Revision 1 (Reference 5) represents the migration to TRACG04 / PANAC11 from TRACG02 / PANAC10 for AOO transients and ATWS overpressure events. The only Supplement 3-A limitation and condition required for submittal of this LAR is Limitation and Condition 4.33, which is dispositioned in this appendix.

The four limitations and conditions from the NRC SE of NEDE-32906P, Supplement 1-A are addressed in Table D-1 below. Supplement 3-A Limitation and Condition 4.33, Submittal Requirements Condition, replicates statements from Section 4, Conditions and Limitations, of Supplement 1-A and is addressed in Table D-2 below. Table D-3 in this appendix supplies the chosen parameters and conservative nature of the input parameters, as required in Supplement 3-A Limitation and Condition 4.33, Item 2.

Table D-1 NEDE-32906P, Supplement 1-A Limitations and Conditions

Limitation and Condition Number from NRC SER	Limitation and Condition Description	Disposition	Section of PBAPS M+SAR which addresses the Limitation and Condition
4.1	Application of the methodology is considered for prediction of the reactor vessel peak pressure only. The prediction is to be terminated at the time of the signal to initiate SLCS pump injection of boron into the reactor coolant system.	Comply	(1)
4.2	Simply referring to MELLLA+ in the application of the TRACG methodology to ATWS is not sufficient. The flow rate and power level used in the individual applications must be clearly stated and the power-to-flow ratios must not be outside the ranges used in this review. MELLLA+ is not applicable to the BWR/2 class of plants. This point needs to be made in the approved version of the LTR.	Comply	Section 9.3.1.1
4.3	For each application of the TRACG ATWS methodology, it must be made clear exactly what power level is being used, not only the percentage of licensed power, but the actual power level.	Comply	Section 9.3.1.1
4.4	Application of TRACG to ATWS events assumes there is no thermal/hydraulic -neutronic instability. The methodology has not been reviewed for applicability to instability conditions.	Comply	Section 9.3.3 (2)

Notes:

1. The TRACG ATWS Overpressure analysis simulates the event for 30 seconds, which is sufficient for demonstrating the peak vessel pressure.
2. The TRACG ATWS Overpressure LTR is not applicable to the TRACG ATWSI analysis. A plant-specific TRACG ATWSI analysis is performed to demonstrate compliance with the PCT acceptance criteria.

Table D-2 NEDE-32906P Supplement 3-A, Limitation and Condition 4.33

From NEDE-32906P Supplement 3-A, Limitation and Condition 4.33, Submittal Requirements Condition, "The NRC staff also notes that a generic LTR describing a code such as TRACG cannot provide full justification for each specific individual plant application. When a licensee proposes to reference the TRACG-based ATWS methodology for use in a license amendment, the individual licensee or applicant must provide justification for the specific application of the code in its request which is expected to include:"

Additional Justification Requirement Number from NRC SER	TRACG LTR Applicability Requirement	Applicability Assessment Parameter	Disposition
1	Nodalization	Specific guidelines used to develop the plant-specific nodalization. Deviations from the reference plant must be described and defended.	The nodalization is consistent with the TRACG AOO LTR with increased axial nodes in the bypass region consistent with the TRACG stability nodalization procedures.
2	Chosen Parameters and Conservative Nature of Input Parameters	A table that contains the plant-specific parameters and the range of the values considered for the selected parameter during the approval process. When plant-specific parameters are outside the range used in demonstrating acceptable code performance, the licensee or applicant will submit sensitivity studies to show the effect of that deviation.	The plant-specific operating parameters noted in Table D-3 below are compared to the parameters from Table 8-4 of NEDE-32906P Supplement 1-A.
3	Calculated Results	The licensee or applicant using the approved methodology must submit the results of the plant-specific analyses reactor vessel peak pressure.	The TRACG vessel peak pressure results are provided M+SAR Section 9.3.1.1.

Table D-3 Plant Specific Applicability Comparison for TRACG ATWS Overpressure LTR (NEDE-32906P, Supplement 1-A) Parameters

Parameter	TRACG ATWS Overpressure LTR Parameter Range	Plant Specific Parameter Value	Disposition
Total Core Power	The core power range of 90% to 100% power is evaluated. The basis chosen for plant specific analysis is 100% power.	The PBAPS MELLLA+ ATWS analysis is evaluated at 100% power consistent with the limiting core power basis provided in the TRACG ATWS Overpressure LTR.	Comply
Total Core Flow	The CF range of 73% to 100% RCF is evaluated. The basis chosen for plant specific analysis is the minimum CF at RCF.	The PBAPS MELLLA+ ATWS analysis is evaluated at 83% RCF consistent with the limiting CF basis provided in the TRACG ATWS Overpressure LTR.	Comply
Power to Flow Ratio	The maximum power to flow ratio range is not explicitly defined in the LTR. However, the LTR is applicable to BWR/2 thru BWR/6, which at low CF conditions may achieve a power to flow ratio of 50.0 MWt/Mlbm/hr.	The PBAPS MELLLA+ ATWS analysis is evaluated with a power to flow ratio of 46.4 MWt/Mlbm/hr.	Comply
Feedwater Temperature	The FW temperature range of rated to a FW temperature reduction of 80°F is evaluated. The basis chosen for plant specific analysis is rated FW temperature. Note, the 80°F temperature reduction is not a PBAPS specific range. The conclusion of the TRACG ATWS Overpressure LTR is applicable to plants with larger FW temperature reductions.	The PBAPS MELLLA+ ATWS analysis is evaluated at rated FW temperature consistent with the limiting CF basis provided in the TRACG ATWS Overpressure LTR.	Comply
Steam Dome Pressure	The steam dome pressure range of ± 18 psi from the nominal operating dome pressure is evaluated. The steam dome pressure has been characterized as insensitive.	The PBAPS MELLLA+ ATWS analysis evaluates the nominal dome pressure.	Comply

Parameter	TRACG ATWS Overpressure LTR Parameter Range	Plant Specific Parameter Value	Disposition
Downcomer Water Level	The downcomer water level range of ± 12 inches from the nominal operating narrow range level is evaluated. The downcomer water level has been characterized as insensitive.	The PBAPS MELLLA+ ATWS analysis evaluates the nominal operating narrow range water level.	Comply
Core Exposure Distribution	The core exposure distribution range of BOC, MOC and EOC is evaluated. The basis chosen for plant specific analysis is BOC exposure.	The PBAPS MELLLA+ ATWS analysis is evaluated at BOC exposure consistent with the limiting exposure basis provided in the TRACG ATWS Overpressure LTR.	Comply
Axial Power Distribution	The axial power distribution analysis evaluated in the LTR concluded the parameter to be not sensitive to the initial condition.	The PBAPS MELLLA+ ATWS analysis is evaluated with a bottom peak axial power shape.	Comply
MSIV Closure Time	The MSIV closure time range of 3 to 5 seconds is evaluated. The MSIV closure time has been characterized as insensitive.	The PBAPS MELLLA+ ATWS analysis evaluates the nominal MSIV closure time of 4 seconds.	Comply
Low Steamline Pressure Isolation Setpoint	The low steamline pressure isolation setpoint range of time 0 (setpoint equal to initial steamline pressure) to the lower AL is evaluated. The earlier (time 0) steamline isolation is limiting for PRFO event. Therefore, the MSIVC event is the limiting event for overpressure.	The PBAPS MELLLA+ ATWS analysis evaluates the low steamline pressure isolation setpoint of 825 psig, which is the TS AV.	Comply
SRV and SSV Capacity	The SRV and SSV range of ASME certified capacity to ASME certified capacity + 9.5% is evaluated. The SRV and SSV capacity is limiting at the ASME certified capacity value.	The PBAPS MELLLA+ ATWS analysis evaluates the ASME certified capacity.	Comply

ATTACHMENT 6

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. 50-277 and 50-278

MELLLA+ License Amendment Request

<u>Affidavits for Withholding Information Executed by GEH and EPRI for Attachment 4</u>

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Peter M. Yandow, state as follows:

(1) I am the Vice President, NPP/Services Licensing, Regulatory Affairs, GE-Hitachi Nuclear Energy Americas LLC (GEH), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in GEH proprietary report NEDC-33720P, "Safety Analysis Report for Peach Bottom Atomic Power Station Units 2 & 3 Maximum Extended Load Line Limit Analysis Plus," Revision 0, dated September 2014. GEH proprietary information in NEDC-33720P is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]]. GEH proprietary information in figures and large objects is identified by double square brackets before and after the object. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the *Freedom of Information Act* ("FOIA"), 5 U.S.C. §552(b)(4), and the *Trade Secrets Act*, 18 U.S.C. §1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F.2d 871 (D.C. Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F.2d 1280 (D.C. Cir. 1983).

(4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without a license from GEH constitutes a competitive economic advantage over other companies;

b. Information that, if used by a competitor, would reduce its expenditure of resources or improve its competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information that discloses trade secret or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions for proprietary or confidentiality agreements or both that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary and/or confidentiality agreements.

(8) The information identified in paragraph (2) is classified as proprietary because it contains detailed results and conclusions regarding supporting evaluations of the safety-significant changes necessary to demonstrate the regulatory acceptability of the Maximum Extended Load Line Limit Analysis Plus analysis for a GEH Boiling Water Reactor (“BWR”). The analysis utilized analytical models and methods, including computer codes, which GEH has developed, obtained NRC approval of, and applied to perform evaluations of Maximum Extended Load Line Limit Analysis Plus for a GEH BWR.

The development of the evaluation processes along with the interpretation and application of the analytical results is derived from the extensive experience and information databases that constitute major GEH assets.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and

technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH. The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 25th day of August 2014.

Peter M. Yandow
Vice President, NPP/Services Licensing
Regulatory Affairs
GE-Hitachi Nuclear Energy Americas LLC
3901 Castle Hayne Road, M/C A-65
Wilmington, NC 28401
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EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Kurt Edsinger
Director, PWR &
BWR Materials

August 21, 2014

Document Control Desk
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Request for Withholding of the following Proprietary Information Included in:

GE Hitachi Nuclear Energy, NEDC-33720P, Revision 0, dated September 2014 and entitled "SAFETY ANALYSIS REPORT FOR PEACH BOTTOM ATOMIC POWER STATION UNITS 2 & 3 MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS"

To Whom It May Concern:

This is a request under 10 C.F.R. §2.390(a)(4) that the U.S. Nuclear Regulatory Commission ("NRC") withhold from public disclosure the report identified in the enclosed Affidavit consisting of the proprietary information owned by Electric Power Research Institute, Inc. ("EPRI") identified in the attached report. Proprietary and non-proprietary versions of the Response and the Affidavit in support of this request are enclosed.

EPRI desires to disclose the Proprietary Information in confidence to assist the NRC review of the enclosed submittal to the NRC by Exelon. The Proprietary Information is not to be divulged to anyone outside of the NRC or to any of its contractors, nor shall any copies be made of the Proprietary Information provided herein. EPRI welcomes any discussions and/or questions relating to the information enclosed.

If you have any questions about the legal aspects of this request for withholding, please do not hesitate to contact me at (650) 855-2271. Questions on the content of the Report should be directed to Andy McGehee of EPRI at (704) 502-6440.

Sincerely,

Together . . . Shaping the Future of Electricity

ELECTRIC POWER RESEARCH INSTITUTE

AFFIDAVIT

RE: Request for Withholding of the Following Proprietary Information Included In:

GE Hitachi Nuclear Energy, NEDC-33720P, Revision 0, dated September 2014 and entitled "SAFETY ANALYSIS REPORT FOR PEACH BOTTOM ATOMIC POWER STATION UNITS 2 & 3 MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS"

I, Kurt Edsinger, being duly sworn, depose and state as follows:

I am the Director of PWR and BWR Materials at Electric Power Research Institute, Inc. whose principal office is located at 3420 Hillview Avenue, Palo Alto, CA. ("EPRI") and I have been specifically delegated responsibility for the above-listed report that contains EPRI Proprietary Information that is sought under this Affidavit to be withheld "Proprietary Information". I am authorized to apply to the U.S. Nuclear Regulatory Commission ("NRC") for the withholding of the Proprietary Information on behalf of EPRI.

EPRI Proprietary Information is identified in the above referenced report by a solid underline inside double square brackets. An example of such identification is as follows:

[[This sentence is an example.(E)]]

Tables containing EPRI Proprietary Information are identified with double square brackets before and after the object. In each case, the superscript notation (E) refers to this affidavit as the basis for the proprietary determination.

EPRI requests that the Proprietary Information be withheld from the public on the following bases:

Withholding Based Upon Privileged And Confidential Trade Secrets Or Commercial Or Financial Information (see e.g., 10 C.F.R. § 2.390(a)(4)):

a. The Proprietary Information is owned by EPRI and has been held in confidence by EPRI. All entities accepting copies of the Proprietary Information do so subject to written agreements imposing an obligation upon the recipient to maintain the confidentiality of the Proprietary Information. The Proprietary Information is disclosed only to parties who agree, in writing, to preserve the confidentiality thereof.

b. EPRI considers the Proprietary Information contained therein to constitute trade secrets of EPRI. As such, EPRI holds the Information in confidence and disclosure thereof is strictly limited to individuals and entities who have agreed, in writing, to maintain the confidentiality of the Information.

c. The information sought to be withheld is considered to be proprietary for the following reasons. EPRI made a substantial economic investment to develop the Proprietary Information and, by prohibiting public disclosure, EPRI derives an economic benefit in the form of licensing royalties and other additional fees from the confidential nature of the Proprietary Information. If the Proprietary Information were publicly available to consultants and/or other businesses providing services in the electric and/or nuclear power industry, they would be able to use the Proprietary Information for their own commercial benefit and profit and without expending the substantial economic resources required of EPRI to develop the Proprietary Information.

d. EPRI's classification of the Proprietary Information as trade secrets is justified by the Uniform Trade Secrets Act which California adopted in 1984 and a version of which has been adopted by over forty states. The California Uniform Trade Secrets Act, California Civil Code §§3426 – 3426.11, defines a "trade secret" as follows:

> "'Trade secret' means information, including a formula, pattern, compilation, program device, method, technique, or process, that:
>
> (1) Derives independent economic value, actual or potential, from not being generally known to the public or to other persons who can obtain economic value from its disclosure or use; and
>
> (2) Is the subject of efforts that are reasonable under the circumstances to maintain its secrecy."

e. The Proprietary Information contained therein are not generally known or available to the public. EPRI developed the Information only after making a determination that the Proprietary Information was not available from public sources. EPRI made a substantial investment of both money and employee hours in the development of the Proprietary Information. EPRI was required to devote these resources and effort to derive the Proprietary Information. As a result of such effort and cost, both in terms of dollars spent and dedicated employee time, the Proprietary Information is highly valuable to EPRI.

f. A public disclosure of the Proprietary Information would be highly likely to cause substantial harm to EPRI's competitive position and the ability of EPRI to license the Proprietary Information both domestically and internationally. The Proprietary Information can only be acquired and/or duplicated by others using an equivalent investment of time and effort.

I have read the foregoing and the matters stated herein are true and correct to the best of my knowledge, information and belief. I make this affidavit under penalty of perjury under the laws of the United States of America and under the laws of the State of California.

Executed at 3420 Hillview Avenue, Palo Alto, CA being the premises and place of business of Electric Power Research Institute, Inc

Date: 8/21/2014

Kurt Edsinger

(State of California)

Subscribed and sworn to (or affirmed) before me on this 21st day of August, 2014 by Berte Dahl, proved to me on the basis of satisfactory evidence to be the person(s) who appeared before me.

Signature ____________ (Seal)

My Commission Expires 20 day of March, 2015

BERTE A. DAHL
COMM. # 1926383
NOTARY PUBLIC-CALIFORNIA
SANTA CLARA COUNTY
MY COMM. EXP. MAR. 20, 2015