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Attachment 4 contains PROPRIETARY information

GNRO-2013/00012

September 25, 2013

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

SUBJECT: Maximum Extended Load Line Limit Analysis Plus (MELLLA+)
License Amendment Request

Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Entergy Operations, Inc. (Entergy) proposes to revise the Grand Gulf Nuclear Station, Unit 1 (GGNS) Operating License (OL) and Technical Specifications (TS) to allow plant operation in the expanded Maximum Extended Load Line Limit Analysis Plus (MELLLA+) domain.

There are no major plant hardware modifications associated with this license amendment request (LAR); however, it does involve changes to the operating power/flow map and changes to a number of instrument Allowable Values and setpoints, and to the current reactor core stability solution. Because there is no change in reactor operating pressure, reactor power, steam flow rate, or feedwater flow rate, there is no significant effect on plant hardware outside the Nuclear Steam Supply System.

Attachment 1 provides the analyses for the proposed changes to the OL and TS including:

- Descriptions of the proposed changes,
- The technical evaluation, and
- Associated no significant hazards determination and environmental evaluation.

Attachment 2 contains marked-up OL and TS pages indicating the proposed changes. Attachment 3 contains the associated draft marked-up TS Bases pages for information only.

Attachment 4 contains General Electric – Hitachi (GEH) Report NEDC-33612P, Revision 0, *Safety Analysis Report for Grand Gulf Nuclear Station – Maximum Extended Load Line Limit Analysis Plus* (M+SAR). The M+SAR is an integrated summary of the results of the safety analysis and evaluations performed specifically in support of this LAR.

When Attachment 4 is removed from this letter, the entire document is NON-PROPRIEATRY

GEH considers certain information contained in NEDC-33612P to be proprietary and, therefore, exempt from public disclosure pursuant to 10 CFR 2.390. The associated affidavit for withholding information, executed by GEH, is provided in the report. NEDC-33612P was provided to Entergy in a GEH transmittal that is referenced in the affidavit. On behalf of GEH, Entergy requests it be withheld from public disclosure in accordance with 10 CFR 2.390(b)(1). A non-proprietary version, NEDO-33612, is provided in Attachment 5.

This MELLLA+ LAR is based on the following GEH licensing topical reports (LTRs):

- NEDC-33006P-A, Revision 3, *Maximum Extended Load Line Limit Analysis Plus*
- NEDC-33075P, Revision 7, *General Electric Boiling Water Reactor Detect and Suppress Solution - Confirmation Density*
- NEDE-33147P-A, Revision 4, *DSS-CD TRACG Application*
- NEDC-33173P-A, Revision 4, *Applicability of GE Methods to Expanded Operating Domains*

NEDC-33006P-A, Revision 3, NEDC-33147P-A, Revision 4, and NEDC-33173P-A, Revision 4 have been approved by the NRC. At this time, NEDC-33075P, Revision 7 is being reviewed by the NRC and a draft safety evaluation has been issued thereby meeting the requirement for acceptance review specified in Section 3.1.1 of NRR Office Instruction LIC-109, "Acceptance Review Procedures." Section 3.1.1 states in part:

> "A licensee may reference a TR [technical report] once the NRC's draft safety evaluation for generic use has been issued, recognizing that the review of the TR is near completion."

Entergy has evaluated the proposed LAR in accordance with 10 CFR 50.91(a)(1) using the criteria in 10 CFR 50.92(c). We have determined this change involves no significant hazards consideration. The bases for this determination are included in Section 5.2 of Attachment 1.

By operating in the MELLLA+ domain, a significantly lesser number of control rod manipulations are required than is 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:

(a) Minimizes the likelihood of fuel failures; and

(b) Reduces the likelihood of events initiated by reactor maneuvers required to achieve an operating condition where control rods can be withdrawn.

Therefore, Entergy requests NRC approve the MELLLA+ LAR prior to February 1, 2015. Entergy plans to implement the resulting TS amendment within 90 days from the date of approval.

This letter contains new commitments, which are identified in Attachment 6.

If you have any questions or require additional information, please contact Mr. Guy Davant at (601) 368-5756.

I declare under penalty of perjury that the foregoing is true and correct; executed on September 25, 2013.

Sincerely,

BSF/ghd

Attachments:
1. MELLLA+ License Amendment Request – Analyses of Proposed Changes to the Operating License and Technical Specifications
2. Marked-Up Operating License and Technical Specification Pages
3. Draft Marked-Up Technical Specification Bases Pages (For Information Only)
4. GE Hitachi Nuclear Energy Report NEDC-33612P, Revision 0, *Safety Analysis Report for Grand Gulf Nuclear Station – Maximum Extended Load Line Limit Analysis Plus* (Proprietary)
5. GE Hitachi Nuclear Energy Report NEDO-33612, Revision 0, *Safety Analysis Report for Grand Gulf Nuclear Station – Maximum Extended Load Line Limit Analysis Plus*, (Non-Proprietary)
6. List of Regulatory Commitments

cc: Mr. Arthur T. Howell
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ATTACHMENT 1

GRAND GULF NUCLEAR STATION

GNRO-2013/00012

MELLLA+ LICENSE AMENDMENT REQUEST

ANALYSES OF PROPOSED CHANGES TO THE OPERATING LICENSE AND TECHNICAL SPECIFICATIONS

MELLLA+ LICENSE AMENDMENT REQUEST

ANALYSES OF PROPOSED CHANGES TO THE OPERATING LICENSE AND TECHNICAL SPECIFICATIONS

1.0 DESCRIPTION

Pursuant to 10 CFR 50.90, Entergy Operations, Inc. (Entergy) proposes to revise the Grand Gulf Nuclear Station, Unit 1 (GGNS) Operating License (OL) 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 OL and TS changes include:

- Prohibiting operation in the MELLLA+ domain when operating with the following plant configurations:
    - Reactor Recirculation System Single Loop Operation (SLO)
    - Feedwater Heaters Out of Service (FWHOOS)
- Increasing the discharge pressure for the Standby Liquid Control (SLC) System pump
- Changing the Allowable Value for APRM Flow Biased Simulated Thermal Power – High trip function
- Adding new CONDITIONs to TS 3.3.1.1, *Reactor Protection System*, pertaining to the Oscillation Power Range Monitor (OPRM) upscale trip function
- Eliminating Surveillance Requirement SR 3.3.1.1.23, which is no longer required by the proposed DSS-CD reactor core stability solution
- Changing TS Administrative Section 5.6.5 to require certain content in the Core Operating Limits Report (COLR)
- Adding new TS Administrative Section 5.6.7, which specifies the contents of a new report required for Oscillation Power Range Monitor (OPRM) inoperability
- Updating the applicable references in TS Administrative Section 5.0.

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, Revision 7, *General Electric Boiling Water Reactor Detect and Suppress Solution - Confirmation Density* (DSS-CD LTR) (Reference 2)

- NEDE-33147P-A, Revision 3, *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)

At this time, NEDC-33075P, Revision 7 is being reviewed by the NRC and a draft safety evaluation has been issued.

The marked-up OL 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-33612P, Revision 0, *Safety Analysis Report for Grand Gulf Nuclear 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 GGNS. The M+SAR follows the guidelines contained in the M+LTR (Reference 1). The NRC has specified limitations and conditions for the M+LTR, the DSS-CD LTR, and the Methods LTR. These are addressed in Appendices A, B, and C of the M+SAR, respectively.

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

2.0 PROPOSED CHANGES

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

- OL Section 2.C(47), *Feedwater Heaters Out of Service* (new section)

- TS 3.1.7, *Standby Liquid Control (SLC) System*

- TS 3.3.1.1, *Reactor Protection System (RPS) Instrumentation*

- TS 3.4.1, *Recirculation Loops Operating*

- TS 5.5.12, *10 CFR 50, Appendix J, Testing Program*

- TS 5.6.5, *Core Operating Limits Report (COLR)*

- TS 5.6.7, *Oscillation Power Range Monitor (OPRM) Report* (new section)

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

TABLE 1

Proposed TS Changes

OL/TS Section	Description of Change	M+SAR Section	Comments
OL Section 2.C			
2.C(47) (new)	Implement a new license condition that prohibits operating with Feedwater Heaters Out of Service (FWHOOS) while in the MELLLA+ domain.	1.2.4	FWHOOS is prohibited while operating in the MELLLA+ domain in accordance with Limitation and Condition 12.5.b of the M+LTR safety evaluation (Reference 1).
TS 3.1.7, *Standby Liquid Control (SLC) System*			
SR 3.1.7.7	Change the value for SLC pump discharge pressure from "≥ 1340 psig" to "≥ 1370 psig."	6.5.3	The increase in SLC pump discharge pressure is needed to meet ATWS requirements.

OL/TS Section	Description of Change	M+SAR Section	Comments
TS 3.3.1.1, *Reactor Protection System (RPS) Instrumentation*			
TS 3.3.1.1 Condition J	Replace REQUIRED ACTIONS J.1 and J.2 with new REQUIRED ACTIONS J.1, J.2, and J.3 to implement DSS-CD for the Oscillation Power Range Monitor (OPRM), as follows: J.1 Initiate action to implement the Manual BSP Regions defined in the COLR. AND J.2 Implement the Automated BSP Scram Region using the modified APRM Flow Biased Simulated Thermal Power – High trip function setpoints defined in the COLR. AND J.3 Initiate action to submit an OPRM report in accordance with Specification 5.6.7. The COMPLETION TIME for each is as follows: J.1: Immediately J.2: 12 hours J.3: 90 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). Actions J.2.1 and J.2.2 presented in Appendix A of the DSS-CD LTR have been numbered as Actions J.2 and J.3, respectively, to reflect correct TS numbering convention and format. The wording of Action J.3 has been modified slightly from that of Action J.2.2 presented in Appendix A of the DSS-CD LTR in order to specifically identify the intended action of submitting an OPRM report as discussed in Section 7.5.2 of the LTR.

OL/TS Section	Description of Change	M+SAR Section	Comments
TS 3.3.1.1 Condition K	Insert new CONDITION K and REQUIRED ACTIONS K.1, K.2, and K.3 to implement DSS-CD, as follows: K. Required Action and associated Completion Time of Condition J not met. K.1 Initiate action to implement the Manual BSP Regions defined in the COLR. AND K.2 Reduce operation to below the BSP Boundary defined in the COLR. AND K.3 - - - - - - - NOTE - - - - - - - - - LCO 3.0.4 is not applicable. - Restore required channels to OPERABLE. The COMPLETION TIME for each is as follows: K.1: Immediately K.2: 12 hours K.3: 120 days	2.4.3	This change is discussed in Sections 7.2, 7.3, and 7.4, and Table 8-1 of the DSS-CD LTR (Reference 2).

OL/TS Section	Description of Change	M+SAR Section	Comments
TS 3.3.1.1 Condition L (new)	To implement DSS-CD, change the current designation of CONDITION K and REQUIRED ACTION K.1 to CONDITION L and REQUIRED ACTION L.1.	2.4.3	This change is specified in Table 8-1 of the DSS-CD LTR (Reference 2).
	In REQUIRED ACTION L.1, change the value for % RTP from "21" to "16.8."	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 threshold power level, which is 21.8% for GGNS (see M+SAR Section 2.4.2). Therefore, DSS-CD must be operable at 16.8% (21.8% - 5%). This change is also specified in Table 8-1 of the DSS-CD LTR.
SR 3.3.1.1.23	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 surveillance requirement is specified in Table 8-1 of the DSS-CD LTR.
Table 3.3.1.1-1, *Reactor Protection System Instrumentation*			
Page 1 of 4, Function 2d	Add a designation for new Note (g) in the "Allowable Value" column to implement changes for DSS-CD. [See the entry of new Note (g) in the Notes section of Page 2 of 4, below.]	2.4.3	Section 7.4 of the DSS-CD LTR discusses this action. See also Table 8-1 of the DSS-CD LTR.

OL/TS Section	Description of Change	M+SAR Section	Comments
Page 1 of 4, Function 2f	Change the value in the APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS column from "≥ 21%" to "≥ 16.8%"	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 threshold power level, which is 21.8% for GGNS (see M+SAR Section 2.4.2). Therefore, DSS-CD must be operable at 16.8% (21.8% - 5%). This change is also specified in Table 8-1 of the DSS-CD LTR.
	Delete SR 3.3.1.1.23 from the SURVEILLANCE REQUIREMENTS column.	2.4.1	Deleting this surveillance requirement is specified in Table 8-1 of the DSS-CD LTR.
Page 2 of 4, Notes section	Change the Allowable Value for the APRM Flow Bias Simulated Thermal Power – High trip function specified in Note (b) from "0.58W + 59.1% RTP and ≤ 113% RTP" to "0.64W + 61.8% RTP and ≤ 113% RTP."	5.3.1	The change is made to maintain the margin between the operating domain and the current trip.
	Revise Note (f) to reflect the setpoints for the OPRM Upscale Confirmation Density Algorithm (CDA) is designated in the COLR.	2.4	This change reflects the change from Option III stability solution to DSS-CD.
	Add new Note (g) to require resetting the APRM Flow Biased Simulated Thermal Power – High trip function (Function 2.d) setpoints to the values defined in the COLR when the OPRM Upscale trip function (Function 2.f) is inoperable.	2.4.3	Section 7.4 of the DSS-CD LTR discusses this action. See also Table 8-1 of the DSS-CD LTR.
TS Section 3.4.1, *Recirculation Loops Operating*			
TS 3.4.1 LCO	Revise the OR statement in the LCO description to prohibit Single-Loop Operation (SLO) in the MELLLA+ domain.	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).

OL/TS Section	Description of Change	M+SAR Section	Comments
TS Section 5.5.12, *10 CFR 50, Appendix J, Testing Program*			
TS 5.5.12	Change the P_a value given in the last sentence from "14.8 psig" to "12.1 psig" to reflect the MELLLA+ containment response analysis.	4.1.1	The change in pressure is a result of revised volume inputs for containment response.
TS Section 5.6.5, *Core Operating Limits Report (COLR)*			
TS 5.6.5	To reflect implementation of DSS-CD, add new Subsection a.6) as follows: "The Manual Backup Stability Protection (BSP) Scram Region (Region I), the Manual BSP Controlled Entry Region (Region II), the modified APRM Flow Biased Simulated Thermal Power – High trip function (Function 2d) setpoints used in the OPRM, Automated BSP Scram Region, and BSP Boundary for Technical 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 Section 5.6.7, *Oscillation Power Range Monitor (OPRM) Report* (new)			
TS 5.6.7	Add new Section 5.6.7 as follows: 5.6.7 <u>Oscillation Power Range Monitor (OPRM) Report</u> When an OPRM report is required by CONDITION J of LCO 3.3.1.1, "RPS Instrumentation," it shall be submitted within 90 days of entering CONDITION J. The report shall outline the pre-planned 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.

3.0 BACKGROUND

3.1 Operating Domain

GGNS was originally licensed to operate at a maximum power level of 3,833 MWt. Entergy has since obtained two power uprates for GGNS. The first uprate increased the licensed thermal power by approximately 2% to 3,989 MWt. The second was an extended power uprate (EPU), which increased the maximum power level to 4,408 MWt (Reference 5).

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:

(a) Control rod movements; and

(b) 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 range to the EPU RTP limit at 80% core flow, thus creating a 20% 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:

(c) Minimizes the likelihood of fuel failures; and

(d) Reduces the likelihood of events initiated by reactor maneuvers required to achieve an operating condition where control rods can be withdrawn.

3.2 Stability Solution

GGNS currently operates with the Option III stability solution. The M+LTR requires changing from the Option III solution to the Detect and Suppress Solution – Confirmation Density (DSS-CD) solution. The DSS-CD solution 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 earlier power suppression trip signal exclusively based on successive period confirmation recognition. 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 (Reference 2) and NEDE-33147P-A (Reference 3), and are applicable to GGNS including any limitations and conditions associated with their use and approval.

The DSS-CD algorithm is currently installed in the plant's Power Range Neutron Monitoring System (PRNMS) but is disabled. This configuration was approved by the NRC in GGNS TS Amendment 188 (Reference 6). Upon implementation of the TS amendment associated with approval of the MELLLA+ LAR, DSS-CD will be enabled.

3.3 Technical Specification Task Force (TSTF)-493 Applicability

Changes to two TS Reactor Protection System (RPS) trip functions are proposed by this LAR:

(1) The Oscillation Power Range Monitor (OPRM) Upscale; and

(2) The Average Power Range Monitor (APRM) Flow Biased Simulated Thermal Power – High.

The requirements of TSTF-493 were applied to these functions by TS Amendment 188 (Reference 6); therefore, no further actions are required.

4.0 TECHNICAL ANALYSES

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 GGNS stability solution from Option III to DSS-CD; and

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

As specified in Section 1.0, above, the M+SAR is based on the M+LTR, the DSS-CD LTR, the TRACG LTR, and the Methods LTR. The evaluations contained in the M+SAR demonstrate that GGNS 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 M+LTR Safety Evaluation Report (SER) (Reference 1) and is being implemented 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.

5.0 REGULATORY ANALYSIS

5.1 Applicable Regulatory Requirements and Guidance

10 CFR 50.36 (c)(2)(ii) Criterion 2 requires TS Limiting Conditions for Operations (LCO) 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 OL 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).

5.2 No Significant Hazards Determination

In accordance with the requirements of 10 CFR 50.90, Entergy Operations, Inc. (Entergy) requests an amendment to Operating License NPF-29, for the Grand Gulf Nuclear Station, Unit 1 (GGNS). This license amendment request proposes to revise the GGNS Operating License (OL) and Technical Specifications (TS) to allow operating in the expanded Maximum Extended Load Line Limit Analysis Plus (MELLLA+) domain.

Entergy has evaluated the proposed license amendment request in accordance with 10 CFR 50.91 against the criteria of 10 CFR 50.92 and has determined that operating GGNS in accordance with the proposed amendment presents no significant hazards. Entergy's evaluation against each of the criteria in 10 CFR 50.92 is provided below.

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

RESPONSE: No.

The probability (frequency of occurrence) of design basis accidents occurring is not affected by the MELLLA+ operating domain because GGNS continues to comply with the regulatory and design basis criteria established for plant equipment. Furthermore, a probabilistic risk assessment demonstrates that the calculated core damage frequencies do not significantly change due to the MELLLA+.

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 shown to meet the plant's currently licensed regulatory criteria. In the area of fuel and core design, for example, the Safety Limit Minimum Critical Power Ratio (SLMCPR) is

still met. Continued compliance with the SLMCPR is 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 LOCA suppression pool temperature remains acceptable.

Based on the above, operating in the MELLLA+ domain does not increase 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.

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, which is applied 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. In addition, the changes have been assessed and determined not to introduce a different accident than that previously evaluated.

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 MELLLA+ operating domain affects only design and operating margins. Challenges to the fuel, reactor coolant pressure boundary, and containment were evaluated for 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.

Because the GGNS configuration and responses to transients and postulated accidents do not exceed the NRC-approved acceptance limits, the proposed changes do not involve a significant reduction in a margin of safety.

Based on the above, Entergy has determined that operation of the facility in accordance with the proposed change does not involve a significant hazards consideration as defined in 10 CFR 50.92(c), in that it:

(1) Does not involve a significant increase in the probability or consequences of an accident previously evaluated; or

(2) Does not create the possibility of a new or different kind of accident from any accident previously evaluated; or

(3) Does not involve a significant reduction in a margin of safety.

5.3 Environmental Consideration

The radiological environmental effects of operating in the MELLLA+ domain are controlled to the same limits as the current analyses. None of the present limits for plant radiological releases to the environment are increased as a consequence of operating in the MELLLA+ domain. In addition, MELLLA+ has no effect on the non-radiological elements of concern, and the plant will continue to operate in an environmentally acceptable manner as documented by the Environmental Assessment for GGNS' current licensed operating domain. Existing federal, state, and local regulatory permits presently in effect accommodate operating in the MELLLA+ domain without modification.

The evaluation of the effects of the MELLLA+ operating domain on normal radiological effluents is included in Section 8.0 of the M+SAR. This section indicates that the offsite doses from airborne releases of iodine and particulates could potentially increase by approximately 20% due to the increased moisture carryover predicted during operation in the MELLLA+ domain. With this increase, the normal effluents and doses continue to remain well below 10 CFR 20 limits and 10 CFR 50, Appendix I guidance. There is no change to the predicted doses from postulated accidents; 10 CFR 50.67 dose criteria continue to be met. In addition, the quantity of spent fuel does not increase as a result of operating in the MELLLA+ domain.

As addressed in Footnote 3 to Table B-1 of 10 CFR Part 51, Appendix B, for the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC regulations are considered small. Therefore, since GGNS will continue to remain well below 10 CFR 20 limits and 10 CFR 50, Appendix I guidance, Entergy has concluded the environmental impacts of operating in the MELLLA+ domain would be small.

Based on the above discussion, Entergy has determined that the proposed amendment would not change a requirement with respect to installation or use of a facility or component located within the restricted area, as defined in 10 CFR 20, nor would it change an inspection or surveillance requirement. Hence, this proposed amendment:

(i) Does not involve a significant hazards consideration; or

(ii) Does not authorize a significant change in the types or a significant increase in the amounts of any effluent that may be released offsite; or

(iii) Does not result in a significant increase in individual or cumulative occupational radiation exposure.

Accordingly, this proposed amendment meets the eligibility criterion for a categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), Entergy concludes no environmental impact statement or environmental assessment need be prepared in connection with this proposed amendment.

6.0 PRECEDENCE

This application is submitted using the following GEH LTRs:

- NEDC-33006P-A, Revision 3 and its associated safety evaluation report (Reference 1),
- NEDC-33075P, Revision 7 and its associated draft safety evaluation report (Reference 2),
- NEDE-33147P-A, Revision 3 and its associated safety evaluation report (Reference 3), and
- NEDC-33173P-A, Revision 4 and its associated safety evaluation report (Reference 4).

This LAR follows the methodologies and limitations of those LTRs and their respective SERs as documented in Appendices A, B, and C of the M+SAR.

As stated in Section 3.0, above, NEDC-33075P, Revision 7 is being reviewed by the NRC and a draft safety evaluation has been issued.

Monticello Nuclear Generating Plant submitted an LAR allowing reactor operation in the MELLLA+ domain (ADAMS Accession No. ML100280558). The NRC is in the final stages of review and approval of that submittal.

7.0 REFERENCES

1. GEH NEDC-33006P-A, *Maximum Extended Load Line Limit Analysis Plus*, Revision 3
2. GEH NEDC-33075P, *General Electric Boiling Water Reactor Detect and Suppress Solution - Confirmation Density*, Revision 7
3. GEH NEDE-33147P-A, *DSS-CD TRACG Application*, Revision 3
4. GEH NEDC-33173P-A, *Applicability of GE Methods to Expanded Operating Domains*, Revision 4

5. NRC letter to Entergy Operations, Inc., *Grand Gulf Nuclear Station, Unit 1 – Issuance of Amendment RE: Extended Power Uprate (TAC No. ME4679)*, July 18, 2012 (ADAMS Accession No. ML121210020) (GGNS TS Amendment 191)

6. NRC letter to Entergy Operations, Inc., *Grand Gulf Nuclear Station, Unit 1 – Issuance of Amendment RE: Power Range Neutron Monitoring System Replacement (TAC No. ME2531)*, March 28, 2012 (ADAMS Accession No. ML120400319) (GGNS TS Amendment 188)

ATTACHMENT 2

GRAND GULF NUCLEAR STATION

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MARKED-UP OPERATING LICENSE AND TECHNICAL SPECIFICATION PAGES

(h) This license condition shall expire upon satisfaction of the requirements in paragraph (f) provided that a visual inspection of the steam dryer does not reveal any new unacceptable flaw or unacceptable flaw growth that is caused by fatigue.

D. The facility required exemptions from certain requirements of Appendices A and J to 10 CFR Part 50 and from certain requirements of 10 CFR Part 100. These include: (a) exemption from General Design Criterion 17 of Appendix A until startup following the first refueling outage, for (1) the emergency override of the test mode for the Division 3 diesel engine, (2) the second level undervoltage protection for the Division 3 diesel engine, and (3) the generator ground over current trip function for the Division 1 and 2 diesel generators (Section 8.3.1 of SSER #7) and (b) exemption from the requirements of Paragraph III.D.2(b)(ii) of Appendix J for the containment airlock testing following normal door opening when containment integrity is not required (Section 6.2.6 of SSER #7). These exemptions are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. In addition, by exemption dated December 20, 1986, the Commission exempted licensees from 10 CFR 100.11(a)(1), insofar as it incorporates the definition of exclusion area in 10 CFR 100.3(a), until April 30, 1987 regarding demonstration of authority to control all activities within the exclusion area (safety evaluation accompanying Amendment No. 27 to License (NPF-29). This exemption is authorized by law, and will not present an undue risk to the public health and safety, and is consistent with the common defense and security. In addition, special circumstances have been found justifying the exemption. Therefore, these exemptions are hereby granted pursuant to 10 CFR 50.12. with the granting of these exemptions, the facility will operate, to the extent authorized herein, in conformity with the application, as amended, the provisions of the Act and the rules and regulations of the Commission.

E. The licensee shall fully implement and maintain in effect all provision of the Commission-approved physical security, training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The plans, which contain Safeguards Information protected under 10 CFR 73.21, are entitled: "Physical Security, Safeguards Contingency and Training and Qualification Plan," and were submitted to the NRC on May 18, 2006.

The licensee shall fully implement and maintain in effect all provisions of the Commission-approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The licensee's CSP was approved by License Amendment No. 186 as supplemented by a change approved by License Amendment No. 192.

(47) Feedwater Heaters Out-of-Service (FWHOOS)

Operation with FWHOOS in the Maximum Extended Load Line Limit Analysis Plus (MELLLA+) region is prohibited.

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.1.7.6	Verify each SLC subsystem manual, power operated, and automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, is in the correct position, or can be aligned to the correct position.	31 days
SR 3.1.7.7	Verify each pump develops a flow rate ≥ 41.2 gpm at a discharge pressure ≥ ~~1340~~ 1370 psig.	In accordance with the Inservice Testing Program
SR 3.1.7.8	Verify flow through one SLC subsystem from pump into reactor pressure vessel.	18 months on a STAGGERED TEST BASIS
SR 3.1.7.9	Determine Boron-10 enrichment in atom percent (E).	Once within 24 hours after boron is added to the solution.
SR 3.1.7.10	Verify piping between the storage tank and the pump suction is not blocked.	Once within 24 hours after solution temperature is restored to ≥ 45°F

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
I. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	I.1	Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.	Immediately
J. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	J.1	Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	12 hours
	AND		
	J.2	------- NOTE -------- LCO 3.0.4 is not applicable. ----------	
		Restore required channels to OPERABLE.	120 days
K. Required Action and associated Completion Time of Condition J not met.	K.1	Reduce THERMAL POWER to < 21% RTP.	4 hours

Replace with INSERT TS-1.

INSERT TS-1

J. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	J.1	Initiate action to implement the Manual BSP Regions defined in the COLR.	Immediately
	AND		
	J.2	Implement the Automated BSP Scram Region using the modified APRM Flow Biased Simulated Thermal Power – High trip function setpoints defined in the COLR.	12 hours
	AND		
	J.3	Initiate action to submit an OPRM report in accordance with Specification 5.6.7.	90 days
K. Required Action and associated Completion Time of Condition J not met.	K.1	Initiate action to implement the Manual BSP Regions defined in the COLR.	Immediately
	AND		
	K.2	Reduce operation to below the BSP Boundary defined in the COLR.	12 hours
	AND		
	K.3	- - - - - - - - NOTE - - - - - - - - LCO 3.0.4 is not applicable. - Restore required channels to OPERABLE.	120 days
L. Required Action and associated Completion Time of Condition K not met.	L.1	Reduce THERMAL POWER to < 16.8% RTP.	4 hours

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.20	----------NOTE---------- 1. For Function 2.a, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. 2. For Functions 2.a, 2.b, and 2.c, the APRM/OPRM channels and the 2-Out-Of-4 Voter channels are included in the CHANNEL FUNCTIONAL TEST. 3. For Functions 2.d and 2.f, the APRM/OPRM channels and the 2-Out-Of-4 Voter channels plus the flow input function, excluding the flow transmitters, are included in the CHANNEL FUNCTIONAL TEST. ---------- Perform CHANNEL FUNCTIONAL TEST.	184 days
SR 3.3.1.1.21	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months
SR 3.3.1.1.22	----------NOTE---------- For Function 2.e, "n" equals 8 channels for the purpose of determining the STAGGERED TEST BASIS Frequency. Testing APRM and OPRM outputs shall alternate. ---------- Verify the RPS RESPONSE TIME is within limits.	24 months on a STAGGERED TEST BASIS
~~SR 3.3.1.1.23~~	~~Verify OPRM is not bypassed when APRM Simulated Thermal Power is greater than or equal to 26% RTP and recirculation drive flow is less than 60% of rated recirculation drive flow.~~	~~24 months~~

Table 3.3.1.1-1 (page 1 of 4)
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. Intermediate Range Monitors					
a. Neutron Flux - High	2	3	H	SR 3.3.1.1.1 SR 3.3.1.1.3 SR 3.3.1.1.12 SR 3.3.1.1.13	≤ 122/125 divisions of full scale
	5(a)	3	I	SR 3.3.1.1.1 SR 3.3.1.1.4 SR 3.3.1.1.12 SR 3.3.1.1.13	≤ 122/125 divisions of full scale
b. Inop	2	3	H	SR 3.3.1.1.3 SR 3.3.1.1.13	NA
	5(a)	3	I	SR 3.3.1.1.4 SR 3.3.1.1.13	NA
2. Average Power Range Monitors					
a. Neutron Flux - High, Setdown	2	3(c)	H	SR 3.3.1.1.7 SR 3.3.1.1.10(d)(e) SR 3.3.1.1.19 SR 3.3.1.1.20	≤ 20% RTP
b. Fixed Neutron Flux - High	1	3(c)	G	SR 3.3.1.1.2 SR 3.3.1.1.7 SR 3.3.1.1.10(d)(e) SR 3.3.1.1.19 SR 3.3.1.1.20	≤ 119.3% RTP
c. Inop	1,2	3(c)	H	SR 3.3.1.1.20	NA
d. Flow Biased Simulated Thermal Power - High	1	3(c)	G	SR 3.3.1.1.2 SR 3.3.1.1.7 SR 3.3.1.1.10(d)(e) SR 3.3.1.1.17 SR 3.3.1.1.19 SR 3.3.1.1.20	(b)
e. 2-Out-Of-4 Voter	1,2	2	H	SR 3.3.1.1.19 SR 3.3.1.1.20 SR 3.3.1.1.21 SR 3.3.1.1.22	NA
f. OPRM Upscale	≥ ~~21%~~	3(c)	J	SR 3.3.1.1.7 SR 3.3.1.1.10(d)(e) SR 3.3.1.1.19 SR 3.3.1.1.20 ~~SR 3.3.1.1.23~~	(f)

(continued)

16.8% RTP

(g)

Table 3.3.1.1-1 (page 2 of 4)
Reactor Protection System Instrumentation

0.64W + 61.8%

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

(b) Two-Loop Operation ~~0.58W + 59.1%~~ RTP and ≤ 113% RTP
Single-Loop Operation 0.58W + 37.4% RTP

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

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

(e) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance 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 provid tolerances apply to the actual setpoint implemen to confirm channel performance. The NTSP and th the as-found and as-left tolerances are specified in the Technical Requirements Manual.

Confirmation Density Algorithm (CDA)

(f) The setpoint for the OPRM Upscale ~~Period Based Detection algorithm~~ is specified in the COLR.

(g) With the OPRM Upscale trip function (Function 2.f) inoperable, reset the APRM Flow Biased Simulated Thermal Power - High trip function (Function 2.d) setpoints to the values defined by the COLR to implement the Automated BSP Scram Region in accordance with Action J of this specification.

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 required limits modified for single loop operation as specified in the COLR.~~

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

APPLICABILITY: MODES 1 and 2.

ACTIONS

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

(continued)

One recirculation loop shall be in operation provided the plant is not operating in the MELLLA+ domain defined in the COLR and provided the required limits are modified for single loop operation as specified in the COLR.

5.5 Programs and Manuals (continued)

5.5.11 Technical Specifications (TS) Bases Control Program

This program provides a means for processing changes to the Bases of these Technical Specifications.

a. Changes to the Bases of the TS shall be made under appropriate administrative controls and reviews.

b. Licensees may make changes to Bases without prior NRC approval provided the changes do not require either of the following:

1. A change in the TS incorporated in the license; or

2. A change to the updated FSAR or Bases that requires NRC approval pursuant to 10 CFR 50.59.

c. The Bases Control Program shall contain provisions to ensure that the Bases are maintained consistent with the UFSAR.

d. Proposed changes that do not meet the criteria of either Specification 5.5.11.b.1 or Specification 5.5.11.b.2 above shall be reviewed and approved by the NRC prior to implementation. Changes to the Bases implemented without prior NRC approval shall be provided to the NRC on a frequency consistent with 10 CFR 50.71(e).

5.5.12 10 CFR 50, Appendix J, Testing Program

This program establishes the leakage rate testing program of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be implemented in accordance with the Safety Evaluation issued by the Office of Nuclear Reactor Regulation dated April 26, 1995 (GNRI-95/00087) as modified by the Safety Evaluation issued for Amendment No. 135 to the Operating License, except that the next Type A test performed after the November 24, 1993 Type A test shall be performed no later than November 23, 2008. Consistent with standard scheduling practices for Technical Specifications required surveillances, intervals for the recommended surveillance frequency for Type A, B and C testing may be extended by up to 25 percent of the test interval, not to exceed 15 months. The calculated peak containment internal pressure for the design basis loss of coolant accident, Pa, is ~~14.8~~ 12.1 psig.

5.6 Reporting Requirements

5.6.2 Annual Radiological Environmental Operating Report (continued)

results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted in a supplementary report as soon as possible.

5.6.3 Radioactive Effluent Release Report

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

5.6.4 Deleted

5.6.5 Core Operating Limits Report (COLR)

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

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

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

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

4) Deleted

5) LCO 3.3.1.1, RPS Instrumentation, Table 3.3.1.1-1 APRM Function 2.f

6) ~~Deleted~~

(continued)

The Manual Backup Stability Protection (BSP) Scram Region (Region I), the Manual BSP Controlled Entry Region (Region II), the modified APRM Flow Biased Simulated Thermal Power - High trip function (Function 2.d) setpoints used in the OPRM Automated BSP Scram Region, and the BSP Boundary for Specification 3.3.1.1.

5.6 Reporting Requirements

5.6.6 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 Operations Section 3.4.11, "RCS Pressure and Temperature (P/T) Limits"
ii) Surveillance Requirements Section 3.4.11, "RCS Pressure and Temperature (P/T) Limits"

b. The analytical methods used to determine the RCS pressure and temperature limits shall be those previously reviewed and approved by the NRC, specifically those described in the following document:

i) NEDC-33178P-A, "GE Hitachi Nuclear Energy Methodology for Development of Reactor Pressure Vessel Temperature Curves" Revision 1, June 2009

c. The PTLR shall be provided to the NRC upon issuance for each reactor vessel fluence period and for any revision or supplement thereto.

5.6.7 Oscillation Power Range Monitor (OPRM) Report

When an OPRM report is required by CONDITION J of LCO 3.3.1.1, "RPS Instrumentation," it shall be submitted within 90 days of entering CONDITION J. The report shall outline the pre-planned 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

GRAND GULF NUCLEAR STATION

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DRAFT MARKED-UP TECHNICAL SPECIFICATION BASES PAGES
(FOR INFORMATION ONLY)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.1.7.7

1370

Demonstrating each SLC System pump develops a flow rate ≥ 41.2 gpm at a discharge pressure ≥ ~~1340~~ psig without actuating the pump's relief valve ensures that pump performance has not degraded during the fuel cycle. This minimum pump flow rate requirement ensures that, when combined with the sodium pentaborate solution concentration requirements, the rate of negative reactivity insertion from the SLC System will adequately compensate for the positive reactivity effects encountered during power reduction, cooldown of the moderator, and xenon decay. This test confirms one point on the pump design curve, and is indicative of overall performance. Such inservice inspections confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance. The Frequency of this Surveillance is in accordance with the Inservice Testing Program.

SR 3.1.7.8

This Surveillance ensures that there is a functioning flow path from the boron solution storage tank to the RPV, including the firing of an explosive valve. The replacement charge for the explosive valve shall be from the same manufactured batch as the one fired or from another batch that has been certified by having one of that batch successfully fired. Other administrative controls, such as those that limit the shelf life of the explosive charges, must be followed. The pump and explosive valve tested should be alternated such that both complete flow paths are tested every 36 months, at alternating 18 month intervals. The Surveillance may be performed in separate steps to prevent injecting boron into the RPV. An acceptable method for verifying flow from the pump to the RPV is to pump demineralized water from a test tank through one SLC subsystem and into the RPV. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance test when performed at the 18 month Frequency; therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The 2-Out-Of-4 Voter Function votes APRM Functions 2.a, 2.b, and 2.d independently of Function 2.f. The voter also includes separate outputs to RPS for the two independently voted sets of functions, each of which is redundant (four total outputs). Function 2.e must be declared inoperable if any of its functionality is inoperable. However, due to the independent voting of APRM trips, and the redundancy of outputs, there may be conditions where the voter function 2.e is inoperable, but trip capability for one or more of the other APRM Functions through that voter is still maintained. This may be considered when determining the condition of other APRM Functions resulting from partial inoperability of the Voter Function 2.e.

There is no Allowable Value for this Function.

INSERT TSB-1

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

~~The OPRM Upscale Function, which implements the BWR Owners' Group Option III stability solution, complies with GDC 10 and GDC 12, thereby providing protection from exceeding the fuel MCPR SL due to anticipated thermal-hydraulic power oscillations.~~

~~References 13 and 14 describe three algorithms for detecting thermal-hydraulic instability related neutron flux oscillations: (1) the Period Based Detection Algorithm; (2) the Amplitude Based Algorithm; and (3) the Growth Rate Algorithm. All three are implemented via the OPRM Upscale Function, but the safety analysis takes credit only for the Period Based Detection Algorithm. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM Upscale Function OPERABILITY for Technical Specification purposes is based only on the Period Based Detection algorithm.~~

The OPRM Upscale Function receives input signals from the LPRMs, which are combined into "cells" for evaluation by the OPRM algorithms.

INSERT TSB-2

~~The OPRM Upscale Function is required to be OPERABLE when the plant is at > 21% RTP, the region of power-flow operation where anticipated events could lead to thermal-hydraulic instability and related neutron flux oscillations. Within this region, the automatic trip is enabled when THERMAL POWER, as indicated by the APRM Simulated Thermal Power, is > 26% RTP and reactor recirculation drive flow is < 60% of rated drive flow, the~~

(continued)

INSERT TSB-1

The OPRM Upscale trip function complies with GDC 10 and GDC 12, thereby providing protection from exceeding the fuel MCPR SL due to anticipated thermal-hydraulic power oscillations. This is accomplished by implementing the Detect and Suppress – Confirmation Density (DSS-CD) stability solution. DSS-CD introduces an enhanced detection algorithm, the Confirmation Density Algorithm (CDA) to the Option III stability solution, which reliably detects the inception of power oscillations and generates an early power suppression trip signal prior to any significant oscillation amplitude growth and MCPR degradation.

Reference 12 describes DSS-CD and the licensing basis for the CDA. It also describes the DSS-CD Armed Region and the three additional algorithms for detecting thermal-hydraulic instability related neutron flux oscillations: (1) the period based detection algorithm (PBDA), (2) the amplitude based algorithm (ABA), and (3) the growth rate algorithm (GRA). All four algorithms are implemented in the OPRM Upscale trip function; however 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 trip function OPERABILITY is based only on the CDA.

The hardware design is unchanged from the Option III solution described in Reference 15 while the firmware/software is modified relative to Option III to reflect the CDA to the Option III algorithms.

INSERT TSB-2

DSS-CD operability requires at least eight responsive OPRM cells per channel.

The OPRM Upscale Function is required to be OPERABLE when the plant is $\geq$ 16.8% 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 $\geq$ to 21.8% RTP corresponding to the plant-specific MCPR monitoring threshold and reactor recirculation drive flow, is < 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 though the DSS-CD Armed Region during both a single startup and a single shutdown following DSS-CD implementation.

An OPRM Upscale trip is issued from an OPRM channel when the CDA 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, and GRA) exceed trip conditions for one or more cells in that channel.

BASES

APPLICABLE SAFETY ANALYSES LCO, and APPLICABILITY (continued)

~~operating region where actual thermal-hydraulic oscillations may occur. The lower bound, 21% RTP, provides margin in the unlikely event of loss of feedwater heating while the plant is operating below the 26% automatic OPRM Upscale trip enable point. Loss of feedwater heating is the only identified event that could cause reactor power to increase into the region of concern without operator action. An OPRM Upscale trip is issued from an APRM/OPRM channel when the Period Based Detection algorithm in that channel detects oscillatory changes in the neutron flux indicated by the combined signals of the LPRM detectors in a cell, with period confirmations and relative cell amplitude exceeding specified setpoints. One or more cells in a channel exceeding the trip conditions will result in a channel trip. An OPRM Upscale trip is also issued from the channel if either the Growth Rate or Amplitude Based algorithms detect growing oscillatory changes is the neutron flux 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 MCPR SL is exceeded

CDA

There is no Allowable Value for this function. The setpoint for the OPRM Upscale ~~Period Based Detection algorithm~~ is specified in the COLR.

The OPRM Upscale function settings are not traditional instrumentation setpoints determined under an instrument setpoint methodology. In accordance with the NRC Safety Evaluation for Amendment 188 (Reference 13), the OPRM Upscale trip function is not LSSS SL-related. Reference 20 confirms the OPRM Upscale trip function settings based on DSS-CD also do not have traditional instrumentation setpoints determined under an instrument setpoint methodology.

(continued)

BASES

ACTIONS

C.1 (continued)

in trip). For Function 6 (Main Steam Isolation Valve Closure), this would require both trip systems to have each channel associated with the MSIVs in three MSLs (not necessarily the same MSLs for both trip systems), OPERABLE or in trip (or the associated trip system in trip). For Function 9 (Turbine Stop Valve Closure, Trip Oil Pressure Low), this would require both trip systems to have three channels, each OPERABLE or in trip (or the associated trip system in trip).

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour Completion Time is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

D.1

Required Action D.1 directs entry into the appropriate Condition referenced in Table 3.3.1.1-1. The applicable Condition specified in the table is Function and MODE or other specified condition dependent and may change as the Required Action of a previous Condition is completed. Each time an inoperable channel has not met any Required Action of Condition A, B, or C, and the associated Completion Time has expired, Condition D will be entered for that channel and provides for transfer to the appropriate subsequent Condition.

and

E.1, F.1, G.1, H.1, ~~and K.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 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 Times of Required Actions E.1 and K.1 are~~ consistent with the Completion Time provided in LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)."

Completion Time of Required Action E.1 is

(continued)

BASES

ACTIONS
(continued)

I.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. Subsequently, if the manual scram channels are inoperable, the reactor mode switch is locked in the shutdown position to prevent inadvertent control rod withdrawals.

INSERT TSB-3 →

J.1

If OPRM Upscale trip capability is not maintained, Condition J exists. Reference 15 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 6 requiring manual operator action to scram the plant if certain predefined events occur. The 12-hour allowed action time is based on engineering judgment to allow orderly transition to the alternate methods while limiting the period of time during which no automatic or alternate detect and suppress trip capability is formally in place. Based on the small probability of an instability event occurring at all, the 12 hours is judged to be reasonable.

J. 2

The alternate method to detect and suppress oscillations implemented in accordance with J.1 was evaluated (Reference 15) 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

(continued

INSERT TSB-3

J.1

If OPRM Upscale trip capability is not maintained, Condition J exists and Backup Stability Protection (BSP) is required. The Manual BSP Regions are described in Reference 12. The Manual BSP Regions are procedurally established consistent with the guidelines identified in Reference 12 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.

J.2

Action J.2 is required to be taken if OPRM Upscale trip capability is not maintained. As described in Section 7.4 of Reference 12, 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 flow-biased 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 action is reasonable, based on operational experience, and based on the importance of restoring an automatic reactor trip for thermal hydraulic instability events.

J.3

Backup Stability Protection is intended as a temporary means to protect against thermal-hydraulic instability events. The reporting requirement of Specification 5.6.7 to submit an OPRM report documents the corrective actions and schedule to restore the required channels to an OPERABLE status. Submitting the report in 90 days from entering Condition J 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.

K.1

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

K.2

The BSP Boundary, as described in Section 7.3 of Reference 12, 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 the immediate final statepoint for a flow reduction event initiated from this boundary and terminated at the core natural circulation

INSERT TSB-3 (cont'd)

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 12).

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.

K.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 K.1) and the BSP Boundary (see Action K.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 Action K.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.

L.1

If the required channels are not restored to OPERABLE status and the Actions of Condition K 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 < 16.8% 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

ACTIONS

J.2 (continued)

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.

LCO 3.0.4 is not applicable to J.2 to allow unit restart in the event of a shutdown during the 120-day completion time.

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 trip capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to OPERABLE status or the applicable Condition entered and Required Actions taken. This Note is based on the RPS reliability analysis (Ref. 9) assumption of the average time required to perform channel surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RPS will trip when necessary.

SR 3.3.1.1.1 and SR 3.3.1.1.19

Performance of the CHANNEL CHECK ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the instrument channels could be an indication of excessive instrument drift on one of the channels or something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.22 (continued)

In addition to these commitments, Reference 15 require that testing inputs to each RPS Trip System alternate.

Combining these frequency requirements, an acceptable test sequence is one that:

a. Tests each RPS trip system interface every other cycle,

b. Alternates testing APRM and OPRM outputs from any specific 2-Out-Of-4 Voter channel, and

c. Alternates between divisions at least every other test cycle.

Each test of an APRM or OPRM output tests each of the redundant outputs from the 2-Out-Of-4 Voter channel for that Function and each of the corresponding relays in RPS. Consequently, each of the RPS relays is tested every fourth cycle. The RPS relay testing frequency is twice the frequency justified by Reference 15.

SR 3.3.1.1.23

This SR ensures that scrams initiated from OPRM Upscale Function 2.f will not be inadvertently bypassed when TERMAL POWER, as indicated by the APRM Simulated Thermal Power is greater than or equal to 29% RTP and core flow as indicated by recirculation drive flow is less than 60% rated flow. This normally involves confirming the bypass setpoints. Adequate margins for the instrument setpoint methodologies are incorporated into the actual setpoint. The actual surveillance ensures that the OPRM Upscale Function 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 flow properly correlate with THERMAL POWER and core flow, respectively.

If any bypass setpoint is non-conservative (i.e., the OPRM Upscale function is bypassed when APRM Simulated Thermal Power is greater than or equal 29% RTP and recirculation drive flow is less than 60% of rated flow), then the affected channel is considered inoperable for the OPRM Upscale function. Alternatively, the bypass setpoint may be adjusted to place the channel in a conservative condition (non-bypassed). If placed in "non-bypassed," this SR is met and the channel is considered OPERABLE.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.23 (continued)

The Frequency of once every 24 months is based on engineering judgment recognizing that the actual values are stored digitally, so there is no drift, and any hardware failures that affect these setpoints will most likely be detected by the automatic self-test function.

REFERENCES

1. UFSAR, Figure 7.2-1.
2. UFSAR, Section 5.2.2.
3. UFSAR, Section 6.3.3.
4. UFSAR, Chapter 15.
5. UFSAR, Section 15.4.1.
6. NEDO-23842, "Continuous Control Rod Withdrawal in the Startup Range," April 18, 1978.
7. UFSAR, Section 15.4.9.

(continued)

BASES

REFERENCES 8. Letter, P. Check (NRC) to G. Lainas (NRC), "BWR (cc

12. NEDC-33075P, "General Electric Boiling Water Reactor Detect and Suppress Solution - Confirmation Density," Revision 7

13. NRC letter to Entergy Operations, Inc., "Grand Gulf Nuclear Station, Unit 1 - Issuance of Amendment Re: Power Range Neutron Monitoring System Replacement (TAC No. ME2531)," March 28, 2012 (TS Amendment 188)

10. NEDO-32291-A, "System Analyses for Elimination of Selected Response Time Testing Requirements," October 1995.

11. CNRI-97/00181, Amendment 133 to the Operating License.

~~12. NEDO-32339-A, ALong Term Stability Solution: Enhanced Option I-A.@~~

~~13. NEDO-31960-P-A, "BWR Owners' Group Long-Term Stability Solution Licensing Methodology," and Supplement 1.~~

Deleted

~~14. NEDO-32465-P-a, "BWR Owners' Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications"~~

15. NEDC-32410-P-A, "Nuclear Measurement Analysis and Control - Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Opiton III Stability trip Function," Vols 1 and 2, and Supplement 1

~~16. BWR Owners' Group Letter, L.A. England to the NRC, M.J. Virgilio, "BWR Owners' Group Guidelines for Stability Interim Corrective Action," June 6, 1994~~

17. TSTF-493, "Clarify Application of Setpoint Methodology for LSSS Functions"

APPLICABLE SAFETY ANALYSES (continued)

margins during abnormal operational transients (Ref. 2), which are analyzed in Chapter 15 of the UFSAR.

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

The transient analyses of Chapter 15 of the UFSAR have also been performed for single recirculation loop operation (Ref. 3) and demonstrate sufficient flow coastdown characteristics to maintain fuel thermal margins during the abnormal operational transients analyzed provided the MCPR requirements are modified. The APLHGR and MCPR limits for single loop operation are specified in the COLR.

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

LCO

Two recirculation loops are normally required to be in operation with their flows matched within the limits specified in SR 3.4.1.1 to ensure that during a LOCA caused by a break of the piping of one recirculation loop the assumptions of the LOCA analysis are satisfied. Alternatively, with only one recirculation loop in operation, modifications to the required APLHGR limits (LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)"), MCPR limits (LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)"), LCO 3.2.3 “Linear Heat Generation Rate” (LHGR), and LCO 3.3.1.1, “RPS Instrumentation”, must be applied to allow continued operation consistent with the assumptions of References 3.

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

The Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operating domain is not analyzed for reactor recirculation single loop operation (SLO). Therefore, SLO is prohibited in the MELLLA+ operating domain (Ref. 4).

(continued)

BASES (continued)

REFERENCES

1. UFSAR, Section 6.3.3.7.
2. UFSAR, Section 5.4.1.1.
3. UFSAR, Chapter 15, Appendix 15C.
4. ~~Deleted~~
5. Deleted

NEDC-33006P-A, "Maximum Extended Load Line Limit Analysis Plus," Revision 3

BASES

BACKGROUND (continued)

This Specification ensures that the performance of the primary containment, in the event of a DBA, meets the assumptions used in the safety analyses of References 1 and 2. SR 3.6.1.1.1 leakage rate requirements are in conformance with 10 CFR 50, Appendix J (Ref. 3), as modified by approved exemptions.

APPLICABLE SAFETY ANALYSES

The safety design basis for the primary containment is that it must withstand the pressures and temperatures of the limiting DBA without exceeding the design leakage rate.

The DBA that postulates the maximum release of radioactive material within primary containment is a LOCA. In the analysis of this accident, it is assumed that primary containment is OPERABLE such that release of fission products to the environment is controlled by the rate of primary containment leakage.

Analytical methods and assumptions involving the primary containment are presented in References 1 and 2. The safety analyses assume a nonmechanistic fission product release following a DBA, which forms the basis for determination of offsite doses. The fission product release is, in turn, based on an assumed leakage rate from the primary containment. OPERABILITY of the primary containment ensures that the leakage rate assumed in the safety analyses is not exceeded.

The maximum allowable leakage rate for the primary containment (L_a) is 0.682% by weight of the containment and drywell air per 24 hours at the maximum peak containment pressure (P_a) of ~~11.9~~ psig (Ref. 4).

12.1

Primary containment satisfies Criterion 3 of the NRC Policy Statement.

LCO

Primary containment OPERABILITY is maintained by limiting leakage to $\leq$ 1.0 L_a, except prior to the first unit startup after performing a required 10 CFR 50, Appendix J leakage test. At this time, the combined Type B and Type C leakage must be $< 0.6\ L_a$, and the overall Type A leakage must be $< 0.75\ L_a$. Compliance with this LCO will ensure a primary containment configuration, including equipment hatches, that is structurally sound and that will limit leakage to those

(continued)

BASES

BACKGROUND (continued)

DBA. Not maintaining air lock integrity or leak tightness may result in a leakage rate in excess of that assumed in the unit safety analysis.

APPLICABLE SAFETY ANALYSES

The DBA that postulates the maximum release of radioactive material within primary containment is a LOCA. In the analysis of this accident, it is assumed that primary containment is OPERABLE, such that release of fission products to the environment is controlled by the rate of primary containment leakage. The primary containment is designed with a maximum allowable leakage rate (L_a) of 0.682% by weight of the containment and drywell air per 24 hours at the calculated maximum peak containment pressure (P_a) of ~~11.9~~ psig. This allowable leakage rate forms the basis for the acceptance criteria imposed on the SRs associated with the air locks.

12.1

Primary containment air lock OPERABILITY is also required to minimize the amount of fission product gases that may escape primary containment through the air lock and contaminate and pressurize the secondary containment.

Primary containment air locks satisfy Criterion 3 of the NRC Policy Statement.

LCO

As part of the primary containment, the air lock's safety function is related to control of containment leakage rates following a DBA. Thus, the air lock's structural integrity and leak tightness are essential to the successful mitigation of such an event.

The primary containment air locks are required to be OPERABLE. For each air lock to be considered OPERABLE, the air lock interlock mechanism must be OPERABLE, the air lock must be in compliance with the Type B air lock leakage test, both air lock doors must be OPERABLE, and the test connection valves must be OPERABLE in accordance with LCO 3.6.1.3. These normally closed manual isolation valves are considered OPERABLE when closed or when intermittently opened under administrative controls. The interlock allows only one air lock door to be open at a time. This provision ensures that a gross breach of primary containment does not exist when primary containment is required to be OPERABLE.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.1.3.7 (continued)

each automatic PCIV will actuate to its isolation position on a primary containment isolation signal. The LOGIC SYSTEM FUNCTIONAL TEST in SR 3.3.6.1.7 overlaps this SR to provide complete testing of the safety function. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass this Surveillance when performed at the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.1.3.8

12.1

The analyses in Reference 2 is based on leakage that is less than the specified leakage rate. Leakage through any single main steam line must be ≤ 100 scfh when tested at a pressure of ~~11.9~~ psig. Leakage through all four steam lines must be ≤ 250 scfh when tested at P_a (~~11.9~~ psig). The MSIV leakage rate must be verified to be in accordance with the leakage test requirements of Reference 3, as modified by approved exemptions. A Note is added to this SR which states that these valves are only required to meet this leakage limit in MODES 1, 2 and 3. In the other conditions, the Reactor Coolant System is not pressurized and specific primary containment leakage limits are not required.

SR 3.6.1.3.9

Surveillance of hydrostatically tested lines provides assurance that the calculation assumptions of Reference 2 is met.

This SR is modified by a Note that states these valves are only required to meet the combined leakage rate in MODES 1, 2, and 3 since this is when the Reactor Coolant System is

(continued)

ATTACHMENT 4

GRAND GULF NUCLEAR STATION

GNRO-2013/00012

GE HITACHI NUCLEAR ENERGY REPORT NEDC-33612P, REVISION 0

SAFETY ANALYSIS REPORT FOR GRAND GULF NUCLEAR STATION – MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS

(PROPRIETARY)

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ATTACHMENT 5

GRAND GULF NUCLEAR STATION

GNRO-2013/00012

GE HITACHI NUCLEAR ENERGY REPORT NEDO-33612, REVISION 0

SAFETY ANALYSIS REPORT FOR GRAND GULF NUCLEAR STATION – MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS

(NON-PROPRIETARY)

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HITACHI

GE Hitachi Nuclear Energy

NEDO-33612
Revision 0
eDRF Section 0000-0125-1479 R2
September 2013

Non-Proprietary Information – Class I (Public)

SAFETY ANALYSIS REPORT
FOR
GRAND GULF NUCLEAR STATION
MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS

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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 Grand Gulf Nuclear Station (GGNS). 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 GGNS, 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 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 GGNS at current licensed thermal power (CLTP) of 4,408 MWt with CF as low as 80% of RCF with the assumption that the extended power uprate (EPU) has been implemented at GGNS. 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.
- Where applicable, more recent industry codes and standards were used.
- UFSAR updates for MELLLA+ related changes are implemented in accordance with the requirements of 10 CFR 50.71(e).
- No major hardware modifications to safety-related equipment are required to support MELLLA+ operating domain expansion. Modifications associated with MELLLA+ are reviewed in accordance with plant procedures to ensure compliance with 10 CFR 50.59.
- 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.
- Planned changes not yet implemented have also been reviewed for the effects of MELLLA+.

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 80% of RCF at 100% 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
AOR	Analysis of Record
AP	Annulus Pressurization
APRM	Average Power Range Monitor
ARI	Alternate Rod Insertion
ART	Adjusted Reference Temperature
ASME	American Society of Mechanical Engineers
ATWS	Anticipated Transient Without Scram
AV	Allowable Value
BOC	Beginning of Cycle
BOP	Balance-of-Plant
BPV	Boiler and Pressure Vessel
BSP	Backup Stability Protection
BSW	Biological Shield Wall
BTU/lbm	BTU per Pounds Mass
BWR	Boiling Water Reactor
BWRVIP	Boiling Water Reactor Vessel Internals Project
CDA	Confirmation Density Algorithm
CDF	Core Damage Frequency
CF	Core Flow
CFFF	Condensate Full Flow Filtration
cfm	Cubic Feet per Minute
CFR	Code of Federal Regulations

Term	Definition
CLR	Containment Load Report
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
CST	Condensate Storage Tank
DBA	Design Basis Accident
DC	Direct Current
D/G	Diesel Generator
DIR	Design Input Request
DOR	Division of Responsibility
DRF	Design Record File
DSS-CD	Detect and Suppress Solution–Confirmation Density
DSS-CD LTR	DSS-CD Licensing Topical Report
DSS-CD TRACG LTR	DSS-CD TRACG Licensing Topical Report
DTR	Draft Task Report
EBZ	Enriched Bottom Zone
ECCS	Emergency Core Cooling System
EDCT	Equipment Drain Collector Tank
EFPY	Effective Full Power Years
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
FHA	Fuel Handling Accident

Term	Definition
FIV	Flow-Induced Vibration
FMCPR	Final Minimum Critical Power Ratio (Final MCPR)
FPCCS	Fuel Pool Cooling and Cleanup System
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
GESSAR	General Electric Standard Safety Analysis Report
GESTAR	General Electric Standard Application for Reactor Fuel
GGNS	Grand Gulf Nuclear Station
GNF	Global Nuclear Fuel – Americas, LLC
GWd/ST	Gigawatt Days per Short Ton
HCTL	Heat Capacity Temperature Limit
HELB	High Energy Line Break
HFCL	High Flow Control Line
HPCS	High Pressure Core Spray
HPSP	High Power Setpoint
HVAC	Heating, Ventilation, and Air Conditioning
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
IMCPR	Initial Minimum Critical Power Ratio (Initial MCPR)
IPE	Individual Plant Examination
IRM	Intermediate Range Monitor
JPSL	Jet Pump Sensing Line
LAR	License Amendment Request
LCS	Leakage Control System
LERF	Large Early Release Frequency
LFWH	Loss of Feedwater Heater
LHGR	Linear Heat Generation Rate
$LHGRFAC_f$	Linear Heat Generation Rate Flow Factor

Term	Definition
LOCA	Loss-of-Coolant Accident
LOOP	Loss of Off-site Power
LPCI	Low Pressure Coolant Injection
LPCS	Low Pressure Core Spray
LPRM	Local Power Range Monitor
LPSP	Low Power Setpoint
LRNBP	Generator Load Rejection Without Bypass
LTR	Licensing Topical Report
MAPLHGR	Maximum Average Planar Linear Heat Generation Rate
MASR	Minimum Alternating Stress Ratio
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
M+LTR	MELLLA+ Licensing Topical Report
M+SAR	MELLLA+ Safety Analysis Report (Plant Specific Safety Analysis Report)
Mlbm/hr	Millions of Pounds Mass per Hour
MOC	Middle of Cycle
MOV	Motor-Operated Valve
MS	Main Steam
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
MSR	Moisture Separator Reheater
MWd/ST	Megawatt Days per Short Ton
MWe	Megawatt-Electric
MWt	Megawatt-Thermal
NCL	Natural Circulation Line
NFWT	Normal Feedwater Temperature

Term	Definition
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NTSP	Nominal Trip Setpoint
OLMCPR	Operating Limit Minimum Critical Power Ratio
OLTP	Original Licensed Thermal Power
OOS	Out-of-Service
OPRM	Oscillation Power Range Monitor
PCT	Peak Cladding Temperature
PHE	Peak Hot Excess
ppm	Parts per Million
PRA	Probabilistic Risk Assessment
PRFDS	Pressure Regulator Failure Downscale
PRFO	Pressure Regulator Failure - Open
PSA	Probabilistic Safety Analysis
psi	Pounds per Square Inch
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
RCIS	Rod Control and Information System
RCPB	Reactor Coolant Pressure Boundary
RCS	Reactor Coolant System
RE	Responsible Engineer
RG	Regulatory Guide
RHR	Residual Heat Removal
RIPD	Reactor Internal Pressure Difference
RLA	Reload Licensing Analysis
RPC	Rod Pattern Controller
RPT	Recirculation Pump Trip

Term	Definition
RPTOOS	Recirculation Pump Trip Out-of-Service
RPV	Reactor Pressure Vessel
RRS	Reactor Recirculation System
RSLB	Recirculation Suction Line Break
RWCU	Reactor Water Cleanup
RWE	Rod Withdrawal Error
RWL	Rod Withdrawal Limiter
S_{AD}	Amplitude Discriminator Setpoint
SAR	Safety Analysis Report
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
SLMCPR	Safety Limit Minimum Critical Power Ratio
SLO	Single Loop Operation
SPDS	Safety Parameter Display System
SPC	Suppression Pool Cooling
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
SSC	Structure, System, and Component
SSE	Safe Shutdown Earthquake
STP	Simulated Thermal Power
TAF	Top of Active Fuel
T_{FW}	Feedwater Temperature
TIP	Traversing Incore Probe
TLO	Two-Loop Operation

Term	Definition
T-M	Thermal-Mechanical
T_{min}	Minimum Stable Film Boiling Temperature
TR	Topical Report
TS	Technical Specification
TSD	Task Scoping Document
TSV	Turbine Stop Valve
TTNBP	Turbine Trip Without Bypass
TTWBP	Turbine Trip With Bypass
UCP	Upper Containment Pool
UHS	Ultimate Heat Sink
UFSAR	Updated Final Safety Analysis Report
USE	Upper Shelf Energy
V&V	Verification and Validation
VPF	Vane Passing Frequency
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 GGNS operation at a CLTP of 4,408 MWt and with a CF as low as 80% 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 GGNS, 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, GGNS will implement the DSS-CD solution, with limitations and conditions as identified in the DSS-CD LTR SER (Reference 2), consistent with the M+LTR. 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 and as contained in the LTR NEDC-33173P-A, "Applicability of GE Methods to Expanded Operating Domains," referred to as the Methods LTR (Reference 3).

The disposition of each 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, and DSS-CD LTR SER limitations and conditions and the sections of this report which address them is presented in Appendices A, B, and C, 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 GGNS EPU are unaffected because the MELLLA+ operating domain expansion effects are limited to the NSSS system.

This GGNS 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 4).

  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 Nuclear Regulatory Commission (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 4. [[

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  ]] No plant can enter the MELLLA+ domain unless the appropriate reload core analysis is performed and all criteria and limits documented in Reference 4 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).

Additionally, GGNS will submit the SRLR for the initial MELLLA+ implementation cycle for NRC staff confirmation.

As required by M+LTR SER Limitation and Condition 12.5.a, GGNS will modify Technical Specification (TS) 3.4.1 to recognize that single loop operation (SLO) operation is prohibited in the MELLLA+ operating domain. This information is presented in the GGNS MELLLA+ license amendment request (LAR) package.

As required by M+LTR SER Limitation and Condition 12.3.b, the applicability of the generic assessments to GGNS is identified and confirmed in the applicable sections. In the event that the generic assessment presented in the M+LTR is not applicable to GGNS, 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 GGNS-specific evaluation is provided for SEs not categorized as Generic. Where applicable, the assessment methodology in References 1, 4, 5, 6, or 7 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 GGNS 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 3) documents all analyses supporting the conclusions in this section that the application ranges of GE-Hitachi Nuclear Energy Americas LLC (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 GGNS-specific ODYN and TRACG calculations are provided to the NRC.

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, and DSS-CD LTR are discussed along with the relevant section of this report. A complete listing of the required M+LTR SER, Methods LTR SER, and DSS-CD SER limitations and conditions and

the sections of this report which address them is presented in Appendices A, B, and C, 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: Core and fuel performance parameters are confirmed for each fuel cycle, and will be 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 sonnected 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. However, slightly higher loading of the condensate demineralizers is possible if the moisture carryover (MCO) in the reactor steam increases. The radiological consequences are evaluated to show that applicable regulations are met.

Section 9.0, Reactor Safety Performance Evaluations: 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 GGNS vulnerability to severe accidents.

Section 11.0, Licensing Evaluations: This section includes the effect on TSs. The Environmental Assessment and the No Significant Hazards Consideration are provided as a part of the accompanying LAR.

1.1.5 Product Line Applicability

The M+LTR describes processes, evaluations, and dispositions applicable to the 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 GGNS, a BWR/6.

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 GGNS MELLLA+ project relied on the generic M+LTR (Reference 1) submitted to and approved by the NRC (Reference 1).

The project began with the respective GEH and Entergy 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 Entergy 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 Entergy prior to any technical work being performed. Each GEH task RE submitted a design input request (DIR) to the Entergy 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 design record file (DRF) maintained by the GEH RE with oversight by the respective engineering manager. Each DRF 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, and 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 Entergy and reviewed by the Entergy RE and other Entergy engineers, as appropriate. Subsequent comments were resolved between the GEH and the Entergy 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 Entergy Project Manager.

For the GGNS MELLLA+ project, Entergy 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 Entergy 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 Services Licensing Manager and the GEH Project Manager. The GEH Project Manager transmitted the verified draft M+SAR to Entergy where it received another complete review by Entergy's technical personnel, project staff, and Licensing staff.

Entergy personnel generated questions and comments, which were responded to by GEH's technical and Regulatory Affairs personnel. The M+SAR was then presented to the Entergy's on-site safety review committee. After resolution of any final comments, the final M+SAR was submitted to the NRC.

A technical assessment of GEH's work was performed by Entergy. The scope of these assessments included work performed by GEH and Global Nuclear Fuel – Americas, LLC (GNF) in support of the GGNS MELLLA+ project. Participating in those activities were representatives of GGNS mechanical/structural, nuclear, and reactor engineering disciplines, and project engineering. The GGNS team reviewed design inputs, analysis methodologies, and results in the GEH DRFs. The reviews included discussion with GEH technical task performers to obtain a thorough understanding of GEH analysis methods.

Entergy Scope

As noted in Section 1.1.6 above, a DOR between Entergy and GEH was used to further develop the work scope and assign REs from each organization. Tasks assigned to Entergy REs were performed under the Entergy 10 CFR 50, Appendix B QAP, where applicable. The

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

Entergy 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 Entergy 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.

DTRs were created that included a description of the analysis performed, inputs, methods applied, results obtained and included input to the applicable M+SAR section(s). Entergy engineering personnel, MELLLA+ project personnel, and Entergy subject matter experts, as appropriate, reviewed the DTR with M+SAR section, and an integrated set of comments on the DTR were forwarded for comment resolution and incorporation into the FTR. FTRs, when issued, are processed through the Entergy engineering change process as a final verification of acceptability and retained as quality records in the Entergy nuclear records management system.

1.2 OPERATING CONDITIONS AND CONSTRAINTS

1.2.1 Power/Flow Map

The GGNS 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+.

As required by M+LTR SER Limitation and Condition 12.5.c, GGNS will include the power/flow map in the COLR after the MELLLA+ operating domain expansion is approved.

The MELLLA+ domain extends from 55% RCF at 80.6% of CLTP to 80% RCF at 100% of CLTP. Normal core performance characteristics for plant power/flow maneuvers at near full power can be accomplished above 55% CF. 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 the operator must reduce power or increase flow in accordance with plant procedures 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 ‘C’ (55% RCF / 80.6% of CLTP). As GGNS 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 result of the lower operating CF.

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 MELLLA and MELLLA+ thermal-hydraulic operating conditions for GGNS. 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. [[

]]

M+LTR SER Limitation and Condition 12.23.5 states that the conclusion of the LTR and associated SE is limited to reactors operating with a power density lower than 52.5 MW/Mlbm/hr for operation at the minimum allowable CF at 120% original licensed thermal power (OLTP). GGNS is licensed for operation at 115% OLTP. At this power level, the power density is below 49 MW/Mlbm/hr, which satisfies this requirement.

1.2.4 Operational Enhancements

The following table provides a list of the performance improvement and equipment out-of-service (EOOS) features applicable to GGNS that are allowed in the MELLLA+ operating domain.

Operational Enhancements	MELLLA+	GGNS M+SAR
Increased Core Flow (ICF)	Allowed	Included
Safety Relief Valves – Out-of-Service (SRVOOS) (5 valves)	Allowed	Included
End of Cycle (EOC) Recirculation Pump Trip (RPT) Out-of-Service (RPTOOS)	Allowed	Included
Turbine Bypass Valves Out-of-Service (TBVOOS)	Allowed	Included
Main Steam Isolation Valve (MSIV) Out-of-Service (Below 75% Power)	Allowed	Included
One Automatic Depressurization System (ADS) Valve Out-of-Service	Allowed	Included
20 psi Operational Pressure Band	Allowed	Included
24 Month Cycle	Included	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.

In accordance with M+LTR SER Limitation and Condition 12.5.b, operation with feedwater heater out-of-service (FWHOOS) is not allowed in the MELLLA+ operating domain. The GGNS MELLLA+ LAR includes a proposed license condition to restrict the FWHOOS flexibility option.

SLO in the MELLLA+ domain is not allowed. The present licensing basis for SLO will remain available per plant TSs. As required by M+LTR SER Limitation and Condition 12.5.a, the GGNS MELLLA+ LAR includes a proposed change to TS 3.4.1 to prohibit SLO operation in the MELLLA+ operating domain.

1.3 SUMMARY AND CONCLUSIONS

This M+SAR documents the results of analyses necessary to expand the operating domain of the GGNS 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-designed boiling water reactors to the extent

specified and under the limitations delineated in the TR [topical report] and in the enclosed final SE."

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 TRACG ISCOR PANAC	05 04 09 11	Y Y(14) Y(1) Y(3)	NEDC-33213P-A NEDC-33147P-A Rev. 4 NEDE-24011P Rev. 0 SER NEDE-30130P-A
Reactor Internal Pressure Differences (RIPDs)	LAMB TRACG ISCOR	07 02 09	(4) Y(5) Y(1)	NEDE-20566-P-A, September 1986 NEDE-32176P, Rev. 4, January 2008 NEDC-32177P, Rev. 3, August 2007 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(2) Y(11, 12)	NEDE-30130P-A CCC-543
Containment System Response	M3CPT LAMB	05 08	Y (4)	NEDM-10320, March 1971 (Reference 8) and NUREG-0978 (Reference 9) NEDE-20566-P-A, September 1986 (Reference 10)
Break Flow Mass/Energy Release Rates	TRACG	04	N(16)	NEDE-32176P Rev. 4, January 2008 NEDE-32177P Rev. 3, August 2007 NEDO-33083-A Rev. 1, September 2010
Annulus Pressurization (AP) Loads	TRACG	04	N(17)	NEDE-33440P, Rev. 2, March 2010
AP Loads - Reactor Vessel (RPV) and Internal Structural Analysis	SAP4G PDA ANSYS	07 02 11	N(8) N(8) N(8)	NEDO-10909, Rev. 7, December 1979 NEDE-10813A, February 1976
ECCS-Loss-of-Coolant Accident (LOCA)	LAMB PRIME SAFER ISCOR TASC	08 03 04 09 03	Y Y(15) Y Y(1) Y	NEDE-20566-P-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
Transient Analysis	PANAC ODYN ISCOR TASC	11 09 09 03	Y Y Y(1) Y	NEDE-30130P-A (6) NEDE-24154P-A NEDC-24154P-A, Vol 4, Sup 1 NEDE-24011P Rev. 0 SER NEDC-32084P-A Rev. 2

Task	Computer Code*	Version or Revision	NRC Approved	Comments
Anticipated Transient Without Scram (ATWS)	ODYN	09	Y	NEDC-24154P-A, Vol 4, Sup 1
	STEMP	04	(7)	
	PANAC	11	Y(6)	
	TASC	03A	Y	NEDC-32084P-A Rev. 2
	ISCOR	09	Y(1)	NEDE-24011P Rev. 0 SER
	TRACG	04	N(13)	

* 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-24011-P 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 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 code ODYN. The use of PANAC Version 11 in this application 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.

(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) The use of DORTG was approved by the NRC through the letter from 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) The TRACG04 code is not approved by the NRC for long-term ATWS calculations including ATWS with depressurization and ATWS with core instability. However, TRACG04 is used as a best-estimate code, while ODYN remains as the licensing basis code for ATWS consistent with the NRC SE for NEDC-33006P. The use of TRACG04 for the best-estimate TRACG ATWS analysis is also consistent with the NRC SE for NEDC-33006P. 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.

(14) The GGNS plant-specific amplitude discriminator setpoint (S_{AD}) is based on TRACG04 evaluations. TRACG04 application for DSS-CD is documented in NEDC-33147P-A Revision 4 (Reference 11).

(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," September 2011 (Reference 3).

(16) The TRACG break flow model and qualification basis is described in NEDE-32176P and NEDE-32177P. The application of TRACG04 for the calculation of break flow mass/energy release rates has been approved for ESBWR LOCA application in NEDO-33083-A.

(17) The application of TRACG04 for the calculation of AP loads has been described for ESBWR AP application in NEDE-33440P. The application of TRACG04 for GGNS MELLLA+ has been applied in a manner consistent with NEDE-33440P.

Table 1-2 Comparison of Thermal-Hydraulic Parameters

Parameter	MELLLA 100% CLTP, 92.8% CF	MELLLA+ 100% CLTP, 80% CF	MELLLA+ 80.6% CLTP, 55% CF
Thermal Power (MWt)	4,408	4,408	3,553
Dome Pressure (psia)	1,040	1,040	1,013
Steam Flow Rate (Mlb/hr)	18.967	18.964	14.796
FW Flow Rate (Mlb/hr)	18.934	18.931	14.763
FW Temperature (°F)	420.0	420.0	397.0
CF (Mlb/hr)	104.4	90.0	61.9
Core Inlet Enthalpy (BTU/lbm)	523.1	518.7	505.2
Core Pressure Drop (psi)	20.0	15.3	6.8
Core Average Void Fraction	0.52	0.55	0.55
Average Core Exit Void Fraction	0.73	0.76	0.77

Table 1-3 Core Thermal Power to CF Ratios

Operating Domain	Point on the Power/Flow Map	Core Thermal Power (MWt / % CLTP)	CF (Mlbm/hr / % Rated)	Power-to-Flow Ratio (MWt / Mlbm/hr)
Current Operating Domain 92.8% RCF	E	4,408 / 100.0	104.4 / 92.8	42.2
MELLLA+ Operating Domain 80% RCF	D	4,408 / 100.0	90.0 / 80.0	49.0
MELLLA+ Operating Domain 55% RCF	C	3,553 / 80.6	61.9 / 55.0	57.4

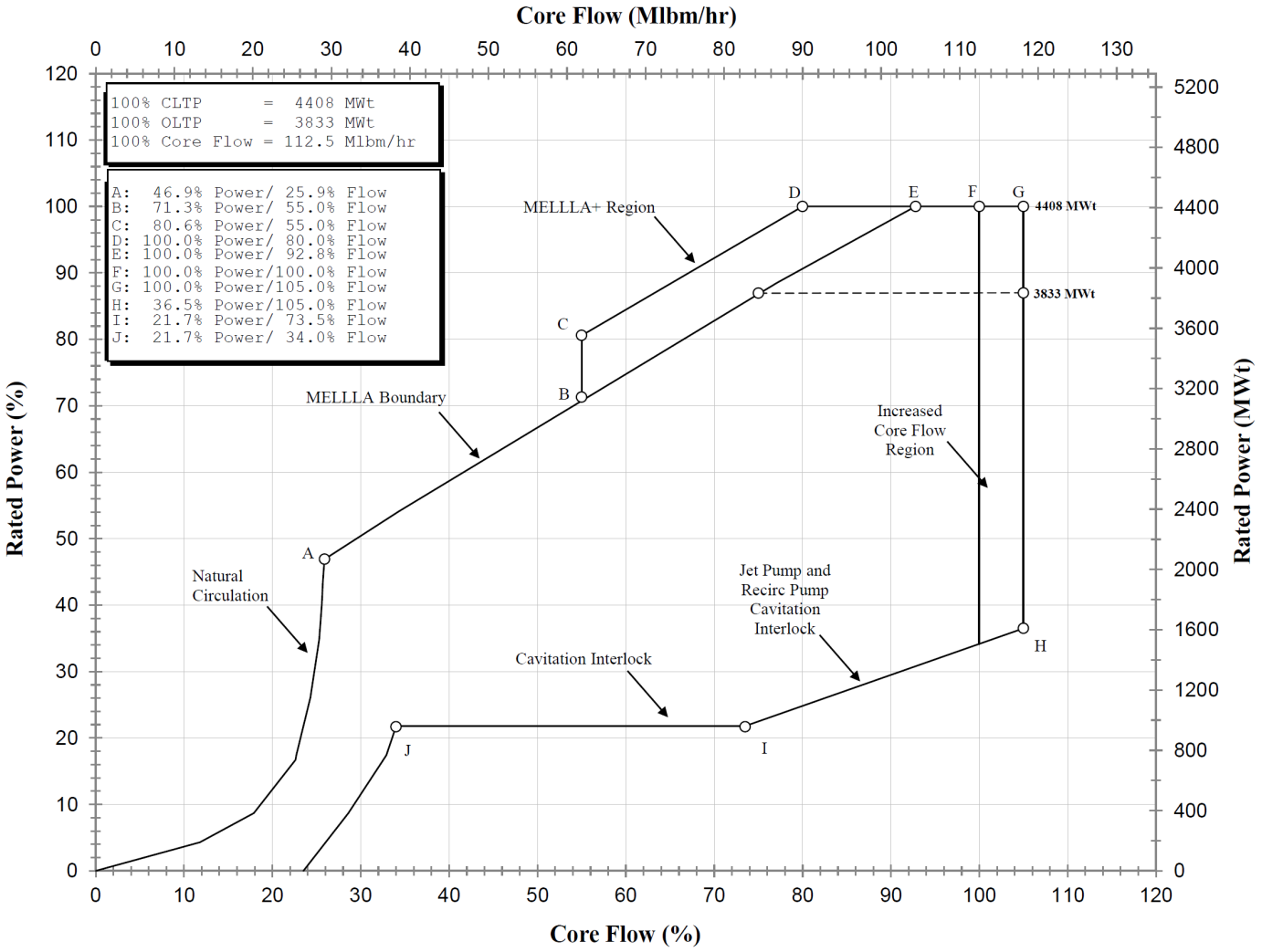

Figure 1-1 Power/Flow Operating Map for MELLLA+

2.0 REACTOR CORE AND FUEL PERFORMANCE

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

Because GGNS currently uses only GE fuel, the following limitations and conditions from the Methods LTR SER are not applicable to the GGNS M+SAR:

Methods LTR SER Limitations and Conditions:

APPLICATION OF 10 WEIGHT PERCENT GD: Limitation and Condition 9.13

MIXED CORE METHOD 1: Limitation and Condition 9.21

MIXED CORE METHOD 2: Limitation and Condition 9.22

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	GGNS Result
Fuel Product Line Design	[[	Meets M+LTR Disposition
Core Design		Meets M+LTR Disposition
Fuel Thermal Margin Monitoring Threshold	]]	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.

GGNS currently operates with GE fuel. The cycle in which MELLLA+ operating domain expansion is implemented shall contain fuel within the GNF2 fuel product line. For GGNS, no new fuel product line design is introduced and there is no change to fuel design limits required by the MELLLA+ introduction at GGNS. [[

]]

Therefore, 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 is applicable for GGNS.

[[

]]

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 GGNS fuel or fuel design limits as a result of MELLLA+. GGNS continues to use the GNF2 fuel product line. The CLTP remains at 4,408 MWt. This validates the conclusion that there are no changes needed to the fuel thermal monitoring threshold is applicable to GGNS.

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. The change in power distribution in the core is achieved, while 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 do change slightly as a result of MELLLA+ operating domain expansion. For GGNS, the predicted bypass void fraction at the D-Level local power range monitor (LPRM) satisfied 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 3:

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

As part of the information requested for 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) (0.2 GWd/ST), middle of cycle (MOC) (9.0 GWd/ST), and end of rated (EOR) (18.520 GWd/ST). The maximum fraction of limiting power density (MFLPD) occurs at 18.520 GWd/ST (Figure 2-12) and the largest maximum fraction of limiting critical power ratio (MFLCPR) occurs at 4.0 GWd/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 5.51. This factor equals 4,408/800, where 4,408 MWt is the RTP and 800 is the total number of fuel bundles in the core.

Table 2-1 shows that GGNS's peak nodal exposure is lower than the top three reference plants. Figures 2-1, 2-2, and 2-6 show that the GGNS MELLLA+ operation is in the expected range as compared to the reference plants. Figures 2-3 through 2-5 shows that exit voiding at GGNS 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 GGNS in the MELLLA+ operating domain are within expected parameters.

Therefore, GGNS 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	GGNS Result
Safety Limit MCPR	[[	Meets M+LTR Disposition
Operating Limit MCPR		Meets M+LTR Disposition
MAPLHGR Limit		Meets M+LTR Disposition
LHGR Limit	]]	Meets M+LTR Disposition

2.2.1 Safety Limit Minimum Critical Power Ratio

[[

]] 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 GGNS TS value, GGNS must implement a license amendment to change the TS.

The SLMCPR analysis for GGNS reflects the actual plant core loading pattern and is performed for each reload core. The cycle-specific SLMCPR is determined using the methods defined in Reference 4. 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 right corner of the MELLLA+ upper boundary (100% of CLTP / 80.0% of CF), the lower left corner of the MELLLA+ upper boundary (80.6% of CLTP / 55.0% of CF), and the CLTP at the ICF statepoint (100.0% of CLTP / 105.0% of CF) (i.e., Figure 1-1 statepoints F, D, C, and G, 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 D and at 55.0% of CF statepoint C. The calculated values will be documented in the SRLR.

As required by Methods LTR SER Limitation and Condition 9.5 and M+LTR SER Limitation and Condition 12.6, for MELLLA+ operation, a +0.02 SLMCPR adder will be added to the cycle-specific SLMCPR. The calculated values will be documented in the SRLR. A TS change will be requested if the current value is not bounding.

[[

]]

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 4. 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 GGNS 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 ignored for GGNS. The OLMCPR for GGNS is determined on a cycle-specific basis from the results of the reload transient analysis, as described in Reference 4. The GGNS 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. A +0.01 adder will be applied to the resulting OLMCPR as required by Methods LTR SER Limitation and Condition 9.19.

[[

]]

2.2.3 Maximum Average Planar Linear Heat Generation Rate Limits

The M+LTR describes that 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. [[

]]

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

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

[[

]]

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+. [[

]]

The GGNS LHGR limits ensure that the plant does not exceed fuel T-M design limits. There are no changes to the GGNS fuel or fuel design limits as a result of MELLLA+. GGNS continues to use the GNF2 fuel product line. [[

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

[[

]]

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 (rated power) and off-rated conditions along the MELLLA+ boundary is reported in Table 2-3.

[[

]]

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	GGNS Result
Hot Excess Reactivity	[[	Meets M+LTR Disposition
Strong Rod Out Shutdown Margin		Meets M+LTR Disposition
SLCS Shutdown Margin	]]	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.

[[

]] This evaluation assumes GGNS is operating on a 24-month cycle length. The MELLLA+ operating conditions do not change the GGNS 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.

[[

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

[[

]]

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.

[[

]] GGNS current design and SLCS TS requirements for minimum natural boron equivalent are unchanged by the SLCS performance modification or MELLLA+. The MELLLA+ operating conditions do not change the GGNS methods used to evaluate that the SLCS shutdown margin meets the current GGNS design and SLCS TS requirements. The SLCS performance modifications are to increase the boron injection rate to support ATWS evaluations and do not affect the SLCS shutdown margin evaluation.

[[

]]

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. GGNS will implement the DSS-CD solution consistent with the M+LTR. DSS-CD implementation includes any limitations and conditions in the DSS-CD LTR SER (Reference 2). In accordance with DSS-CD LTR SER Limitation and Condition 5.1 (Reference 2), because GGNS is 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 11.

Topic	M+LTR Disposition	GGNS Result
DSS-CD Setpoints	[[	Meets M+LTR Disposition
Armed Region		Meets M+LTR Disposition
Backup Stability Protection (BSP)	]]	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.

GGNS 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 GGNS 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 GGNS incorporates appropriate [[ ]] analyses to be performed if a specific reload analysis [[

]]

A plant-specific review procedure has been established 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 procedure (Tables 6-3 and 6-4 of Reference 2) are performed to demonstrate adequate SLMCPR protection and to extend the DSS-CD applicability envelop.

[[

]]

The CDA setpoint calculation formula and the adjustable parameter values are defined in the DSS-CD LTR (Reference 2). In accordance with DSS-CD LTR SER Limitation and Condition 5.2 (Reference 2), the DSS-CD LTR, or GESTAR II including the approved DSS-CD LTR, is referenced in the proposed TS changes for implementation of DSS-CD.

2.4.2 Armed Region

[[

]]

The generic boundaries of the OPRM Armed Region were approved as part of Revision 6 of the DSS-CD LTR. [[

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

Because GGNS is implementing the DSS-CD solution consistent with the DSS-CD LTR, no further review of MELLLA+ is necessary to evaluate the adequacy of the 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 GGNS confirm that the BSP approach is adequate as a part of the reload analysis. [[

]]

no further review of 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. Automated BSP (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.

[[

]]

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	GGNS Result
Scram Time Response	[[	Meets M+LTR Disposition
CRD Positioning and Cooling		Meets M+LTR Disposition
CRD Integrity	]]	Meets M+LTR Disposition

2.5.1 Control Rod Scram

For GGNS, a BWR/6, at normal operating conditions, the Hydraulic Control Unit accumulators supply all of the pressure to complete the scram. The GGNS dome pressure for MELLLA+ operating domain expansion does not change. [[

]] GGNS retains its current TS scram requirements.

[[

]]

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

2.5.2 Control Rod Drive Positioning and Cooling

The 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+.

For GGNS, the reactor coolant temperature does not increase. [[

]]

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

2.5.3 Control Rod Drive Integrity

The 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 ASME reactor overpressure limit. [[

]] no further evaluation of CRD integrity is required as result of MELLLA+.

The GGNS 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 is unchanged and remains less than the limit of 1,375 psig. [[

]] and no further evaluation of CRD integrity is required as result of MELLLA+.

Therefore, GGNS 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 3) limitation and condition to which it relates.

2.6.1 TGBLA/PANAC Version

In developing the GGNS equilibrium core, the latest versions of TGBLA and PANAC were used. Refer to Table 1-1 for the latest revisions to TGBLA and PANAC. Cycle-specific analyses will include the most recent TGBLA and PANAC versions. As required by Methods LTR SER Limitation and Condition 9.1, the most recent versions of TGBLA and PANAC are used.

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 13) and implemented in GESTAR II in September 2010 (Reference 4). The GGNS M+SAR is based on the GNF2 fuel product line, which has a PRIME T-M basis. PRIME fuel parameters were used in all analyses requiring fuel performance parameters.

The T-M evaluation performed in support of the GGNS 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 3) 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 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	Equilibrium – 120% OLTP	51.174
GGNS PUSAR	Equilibrium – 115% OLTP	55.264
GGNS M+SAR	Equilibrium – 115% OLTP	54.272

Table 2-2 Steady State Bypass Voiding

Statepoint on Power/Flow Map	Core Power (% of Rated)	CF (% of Rated)	Hot Channel Void Fraction in Bypass Region at Instrumentation D Level (ISCOR Node 21)
"F"	100.0	100.0	0.00
"E"	100.0	92.8	0.00
"D"	100.0	80.0	0.00

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

Statepoint on Power/Flow Map	Core Power MWt (% of rated)	CF Mlbm/hr (% of rated)	Power-to-Flow Ratio (MWt / Mlbm/hr)
"F"	4,408 (100.0)	112.5 (100.0)	39.18
"E"	4,408 (100.0)	104.4 (92.8)	42.22
"D"	4,408 (100.0)	90.0 (80.0)	48.98
"C"	3,552.8 (80.6)	61.875 (55.0)	57.42
"B"	3,142.9 (71.3)	61.875 (55.0)	50.79

Table 2-4 [[ ]]

[[	
	]]

[[

]]

Table 2-5 [[ ]]

[[	
	]]

[[

]]

Table 2-6 [[ ]]

[[			
			]]

[[

]]

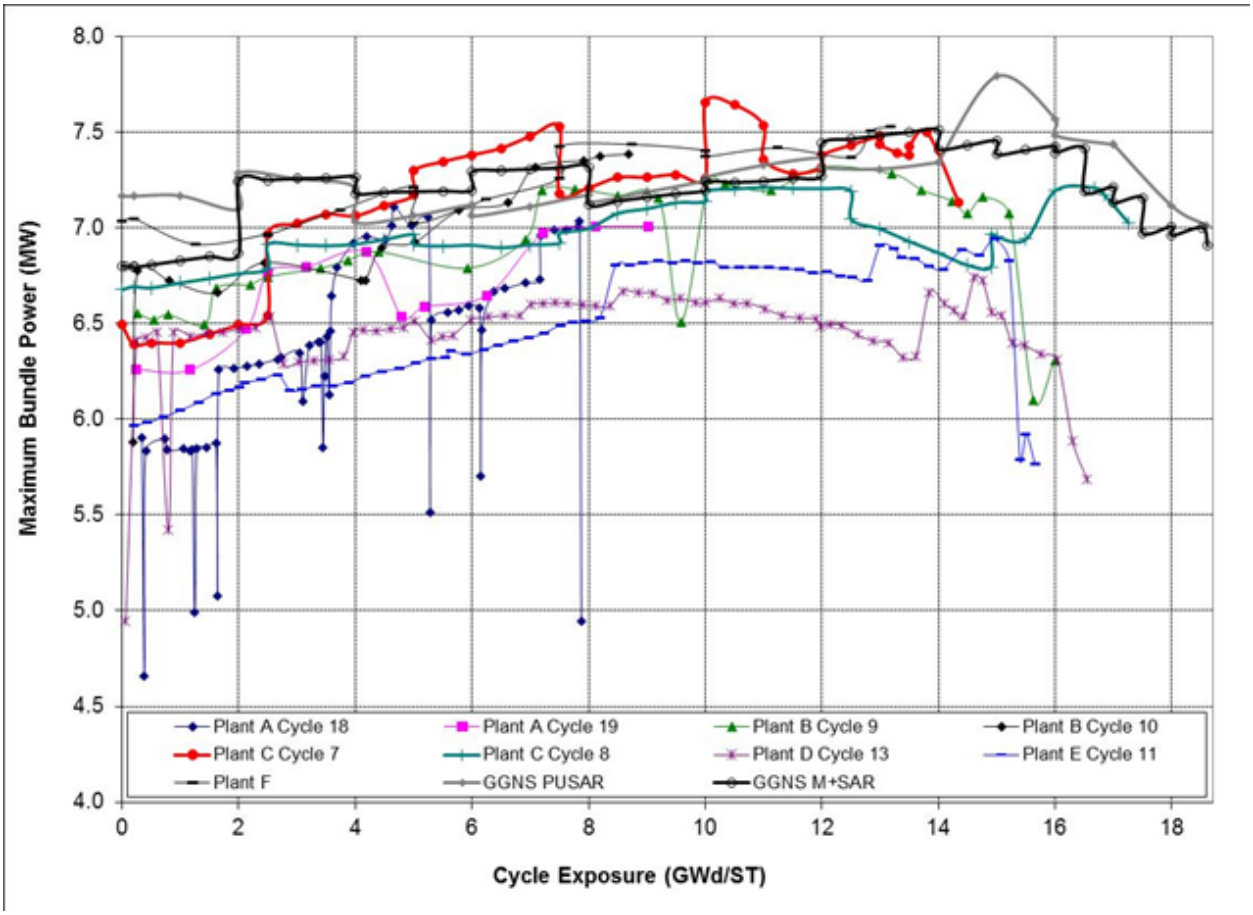

Figure 2-1 Power of Peak Bundle versus Cycle Exposure

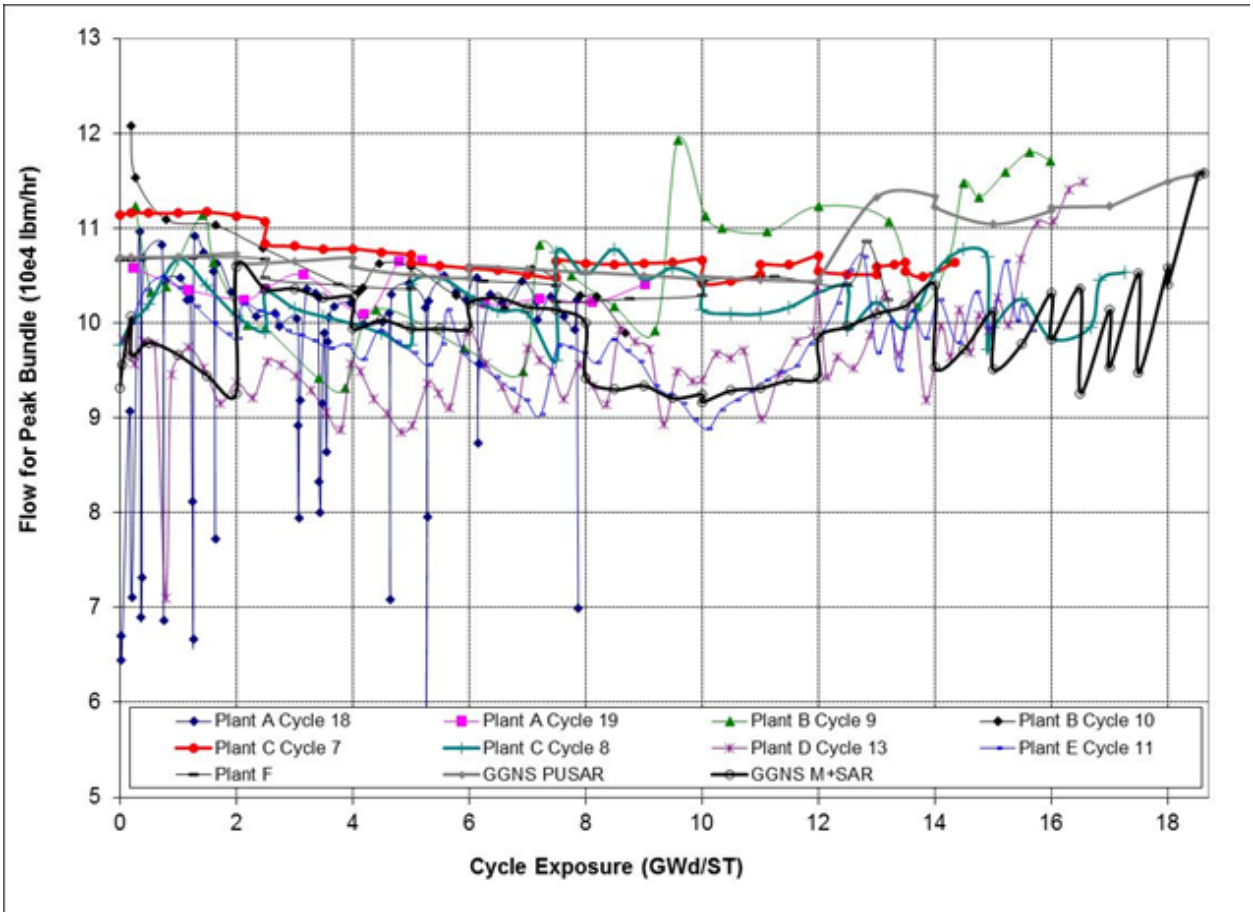

Figure 2-2 Coolant Flow for Peak Bundle versus Cycle Exposure

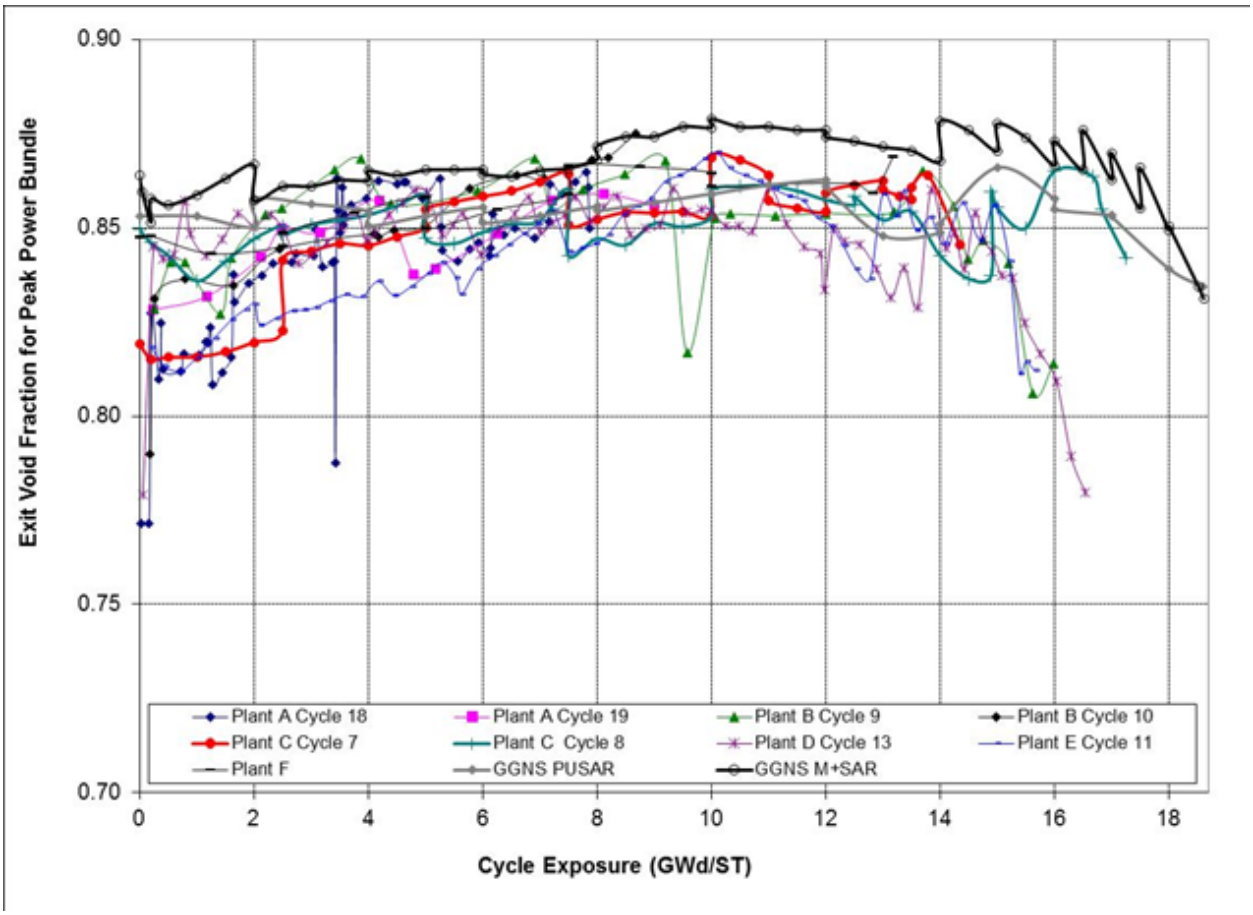

Figure 2-3 Exit Void Fraction for Peak Power Bundle versus Cycle Exposure

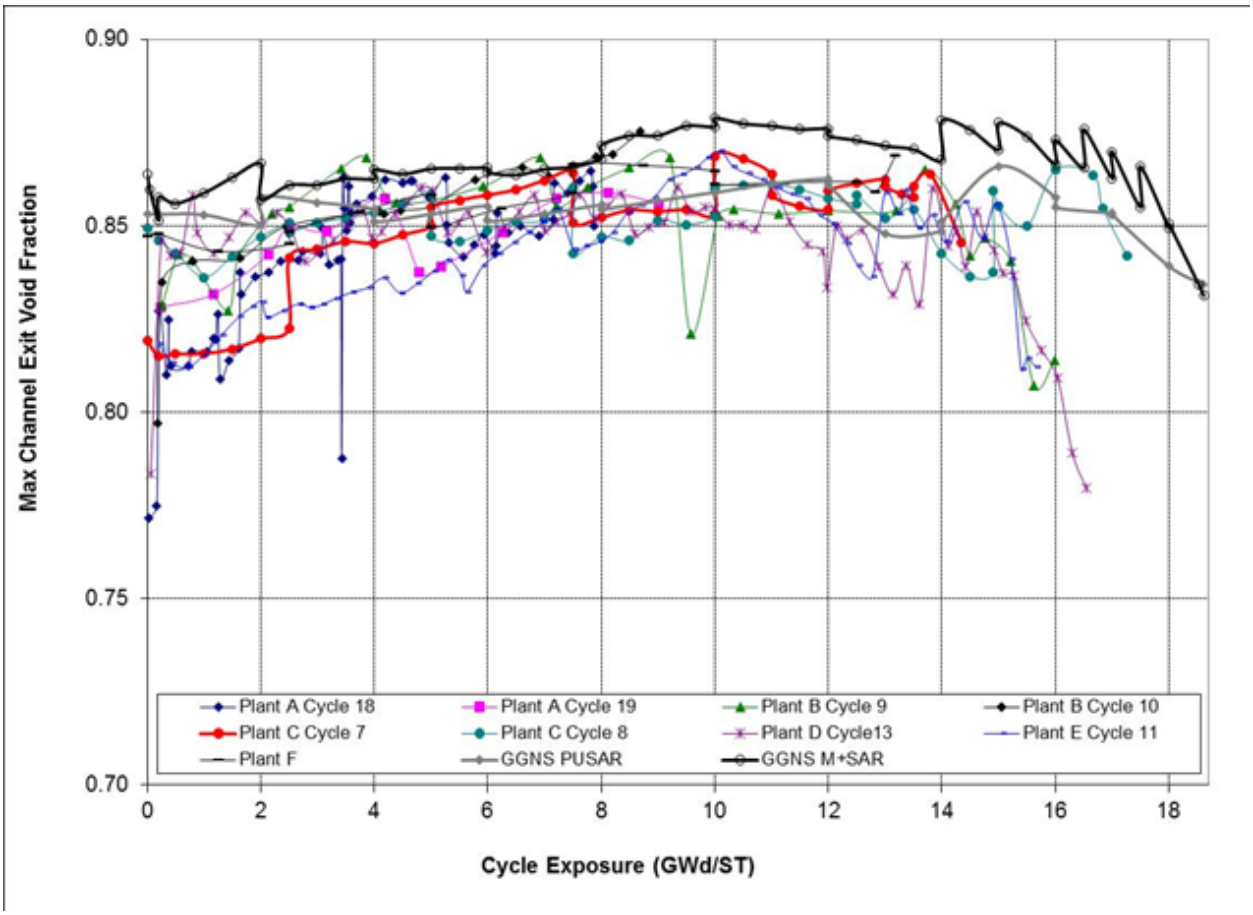

Figure 2-4 Maximum Channel Exit Void Fraction versus Cycle Exposure

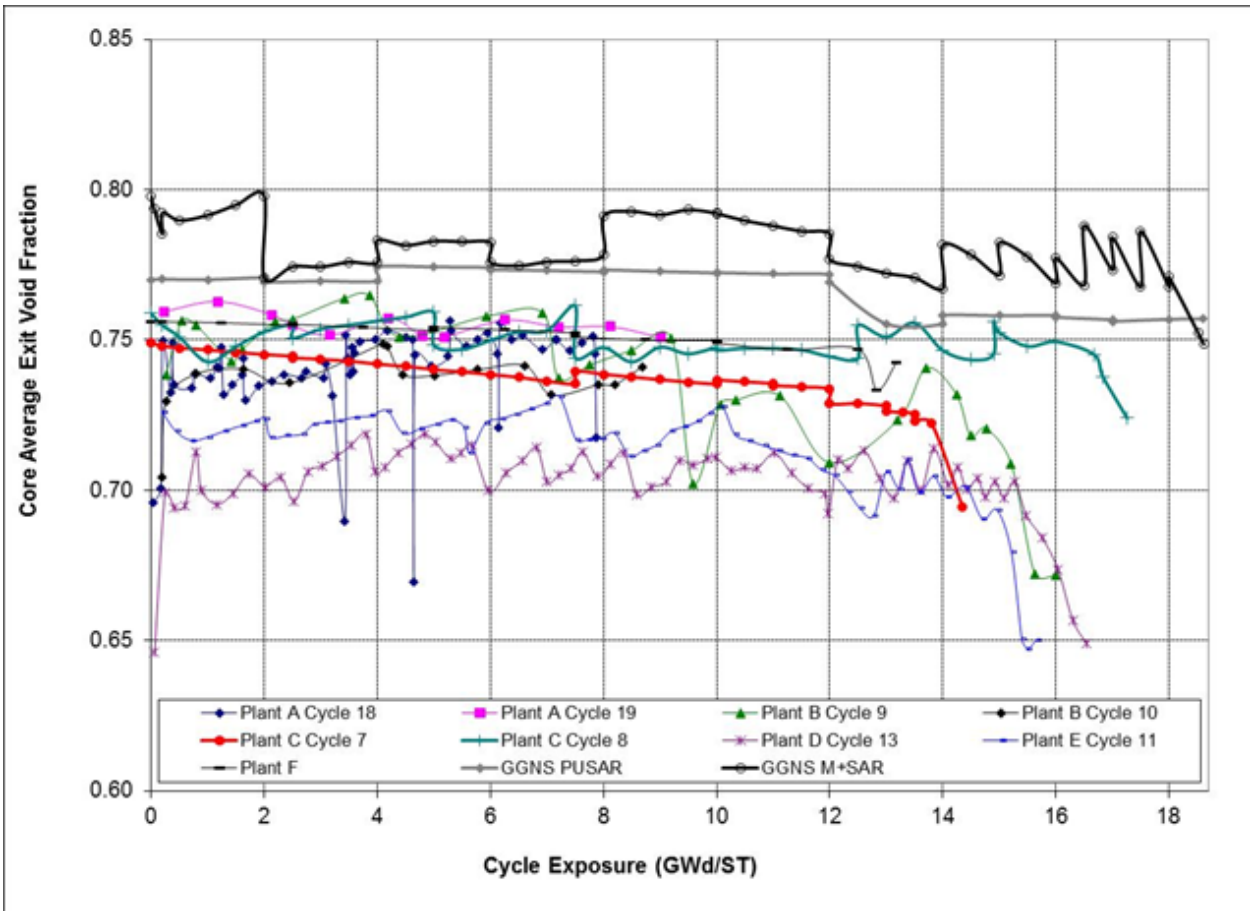

Figure 2-5 Core Average Exit Void Fraction versus Cycle Exposure

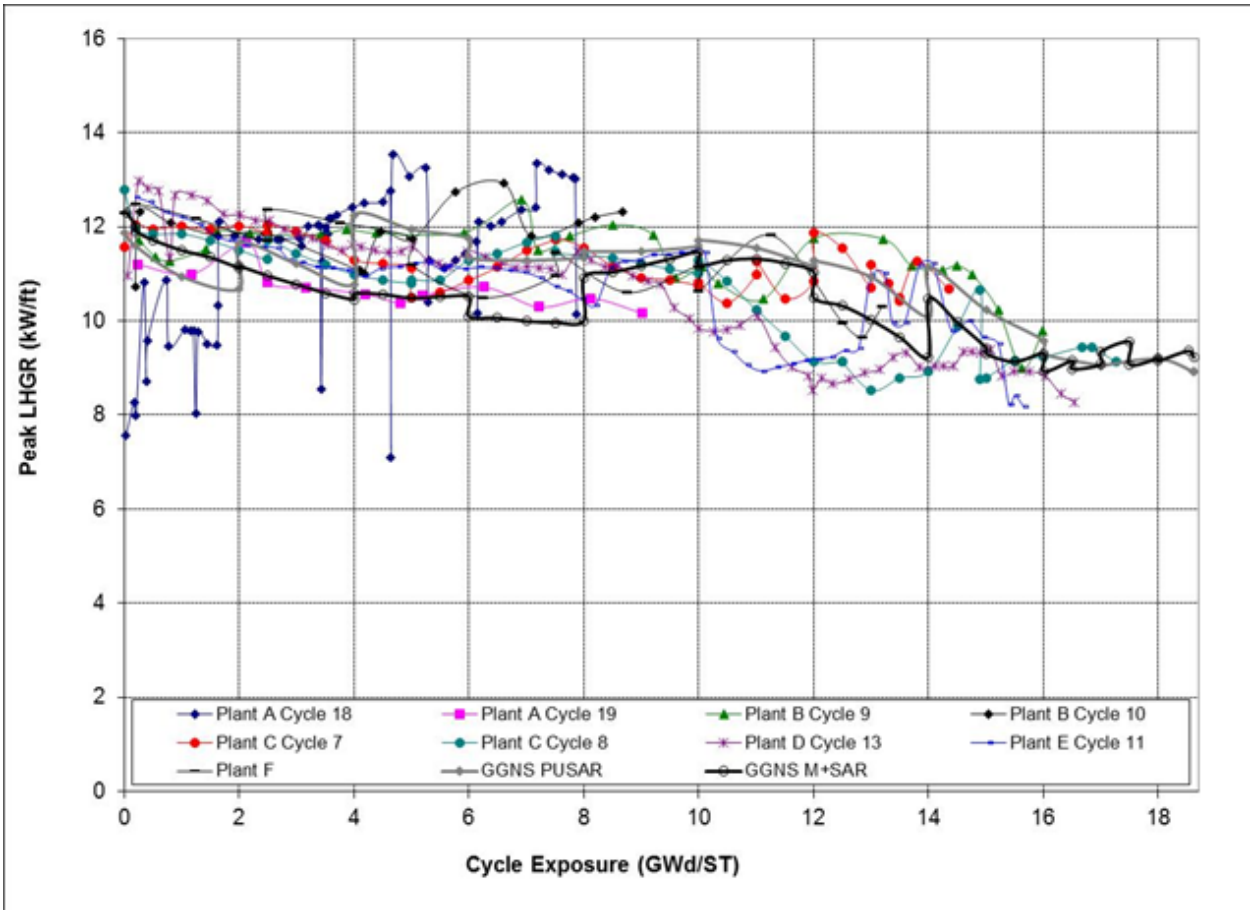

Figure 2-6 Peak LHGR versus Cycle Exposure

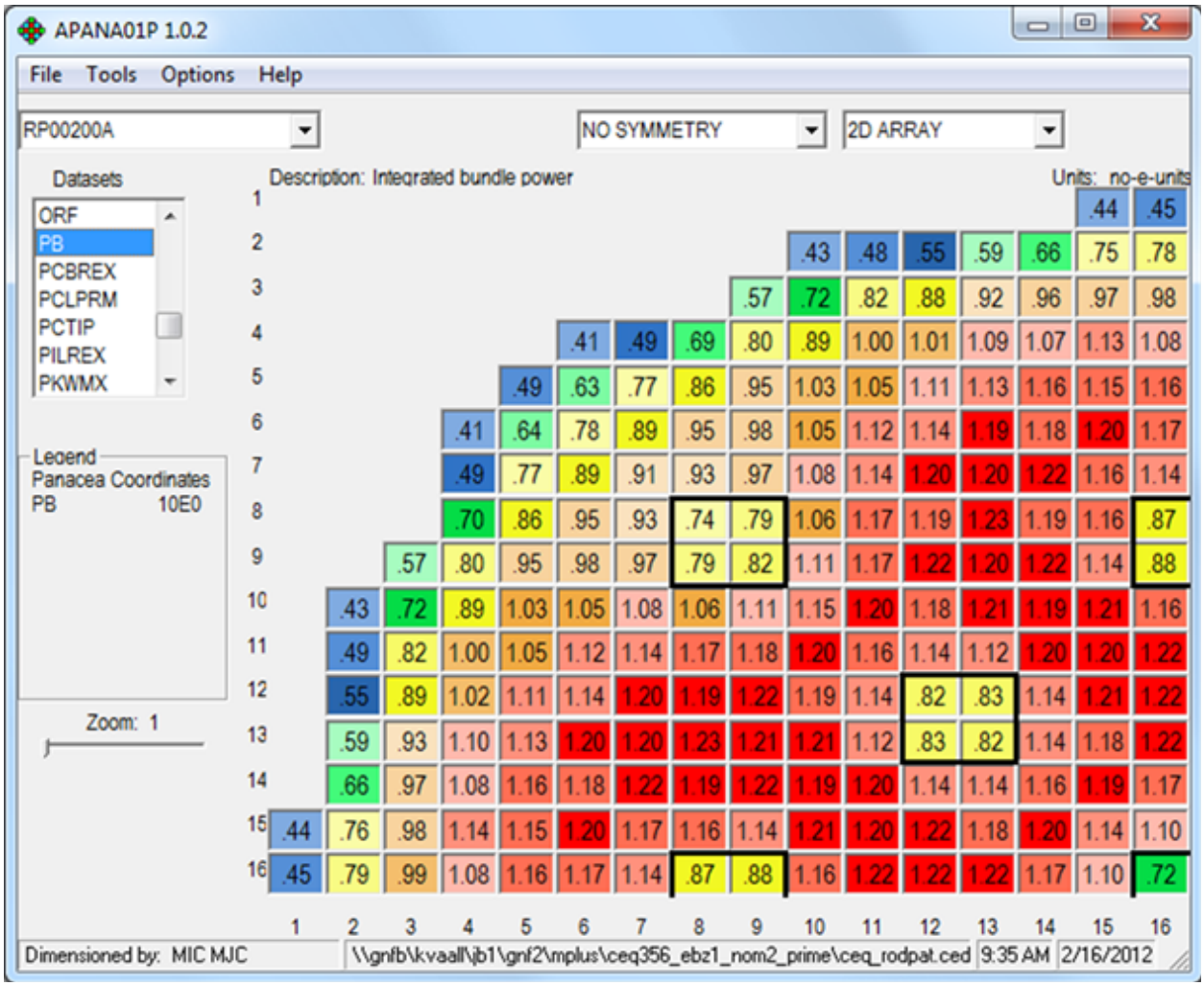

Figure 2-7 Dimensionless Bundle Power at BOC (200 MWd/ST)

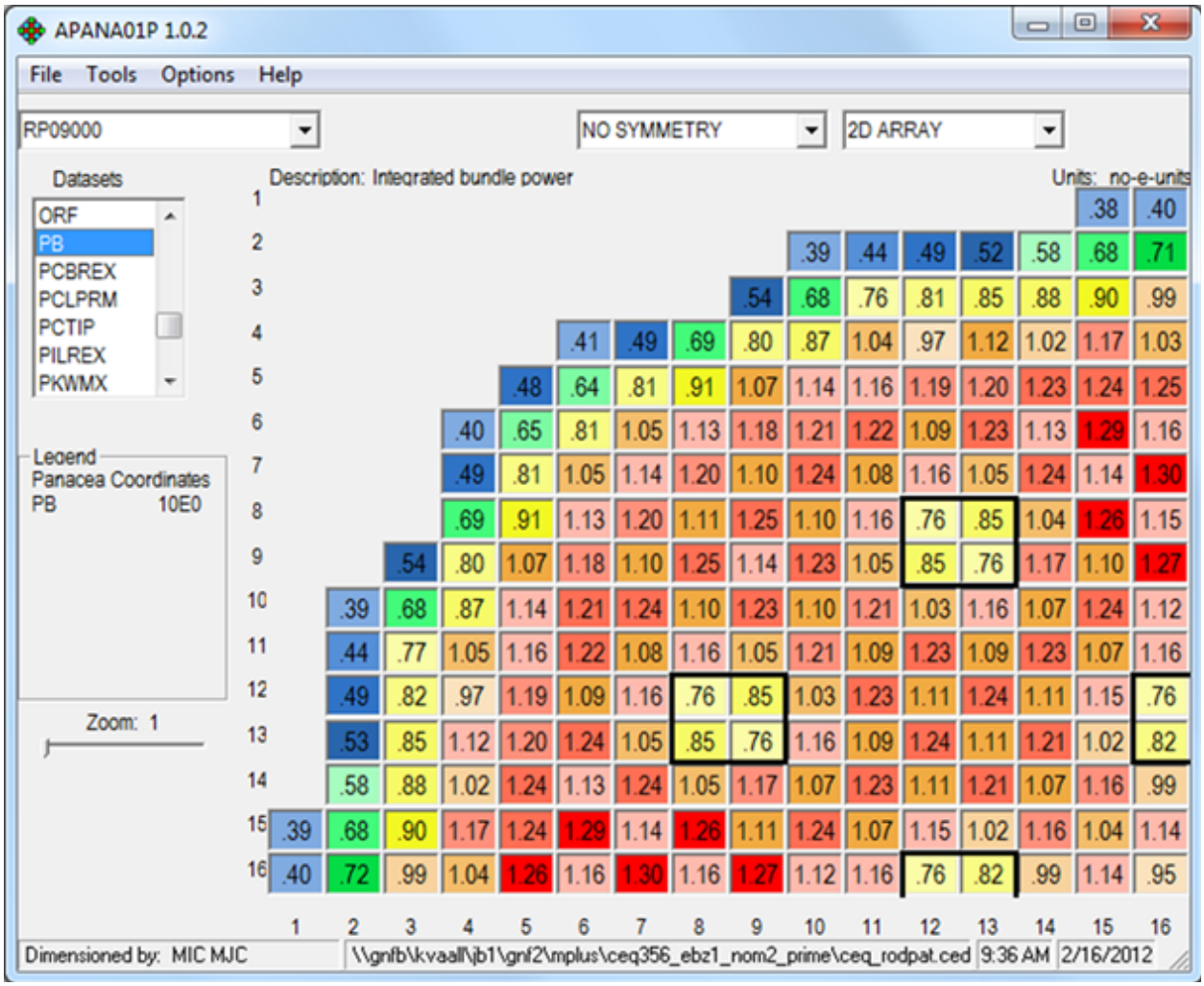

Figure 2-8 Dimensionless Bundle Power at MOC (9,000 MWd/ST)

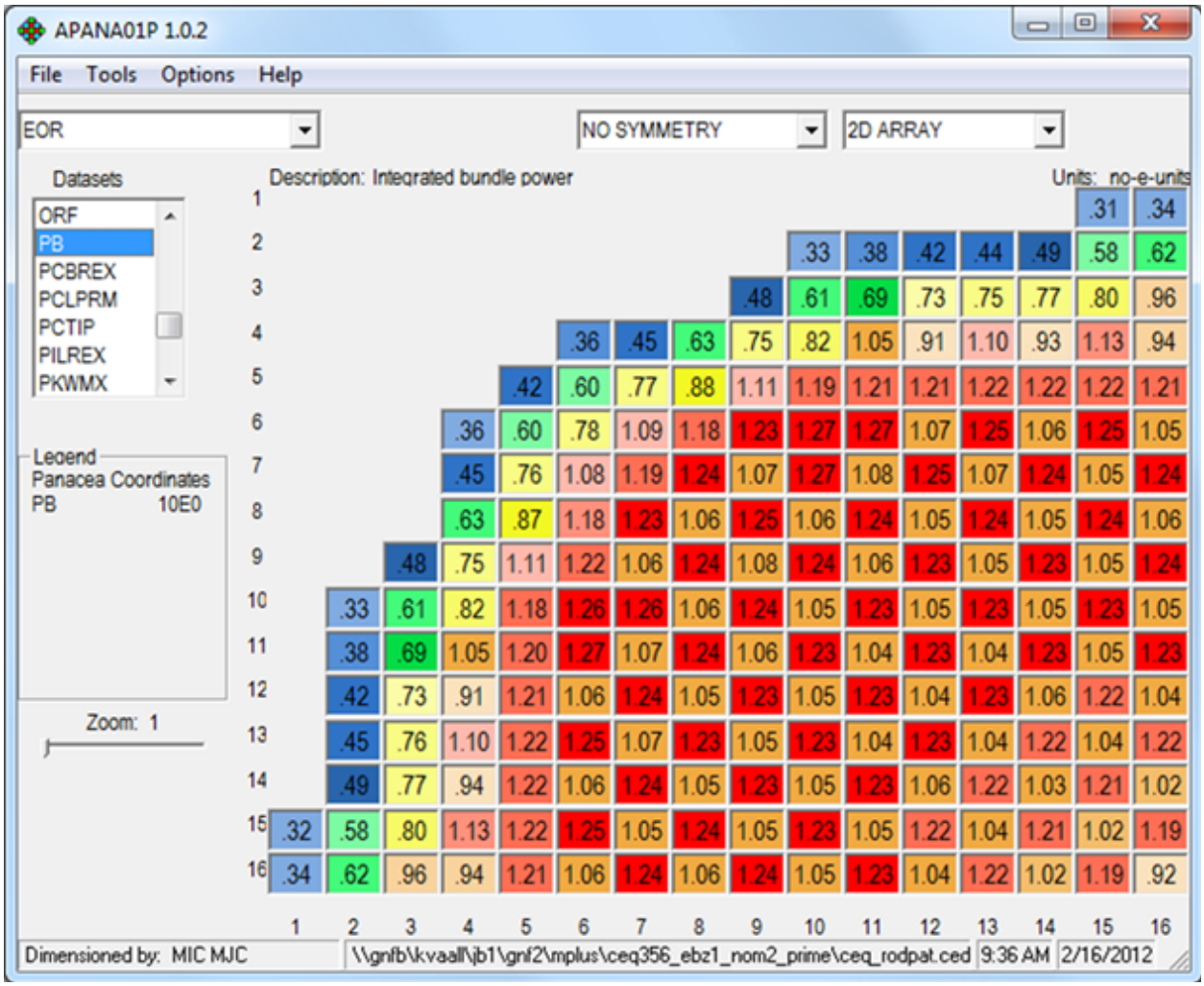

Figure 2-9 Dimensionless Bundle Power at EOR (18,520 MWd/ST)

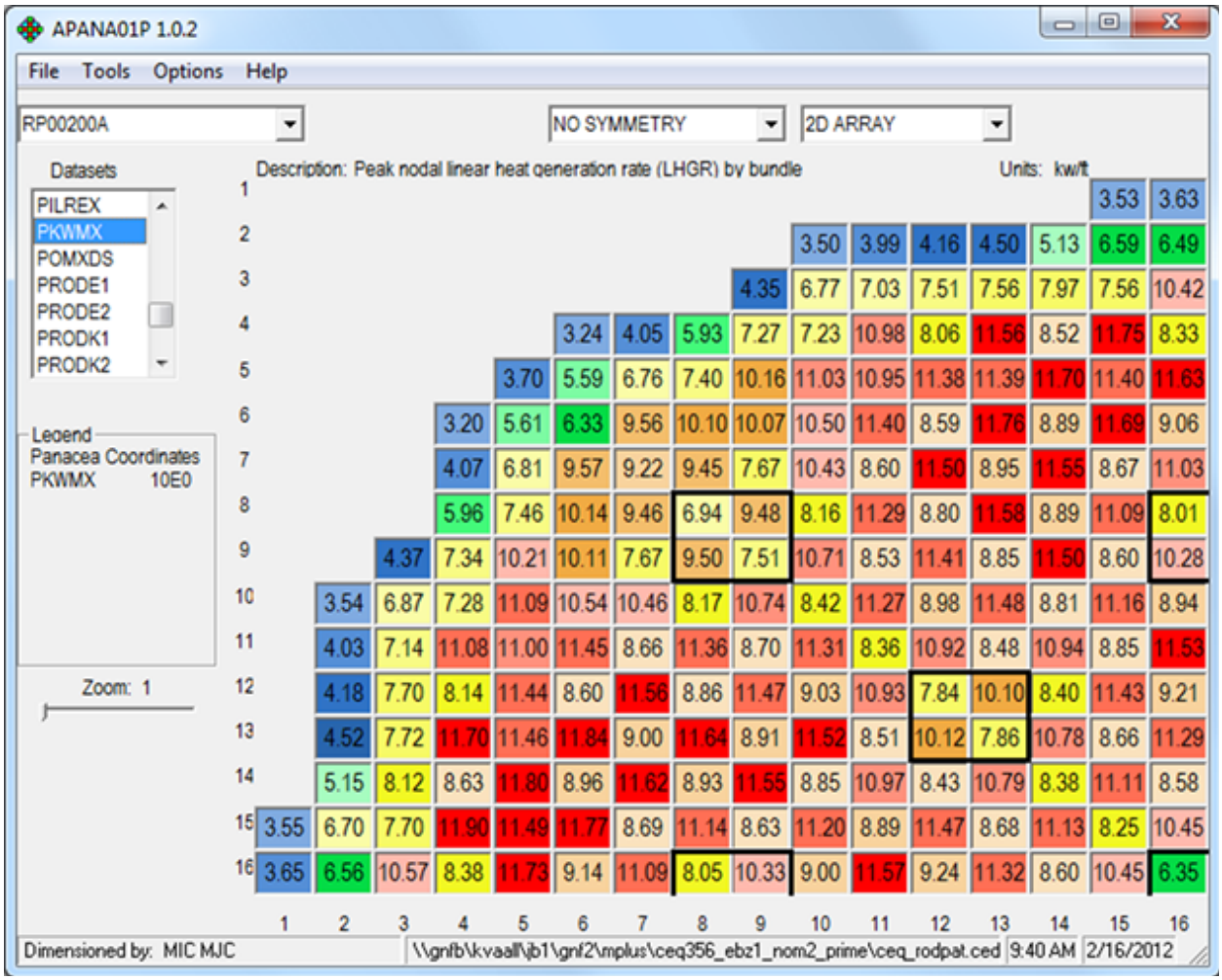

Figure 2-10 Bundle Operating LHGR (kW/ft) at BOC (200 MWd/ST)

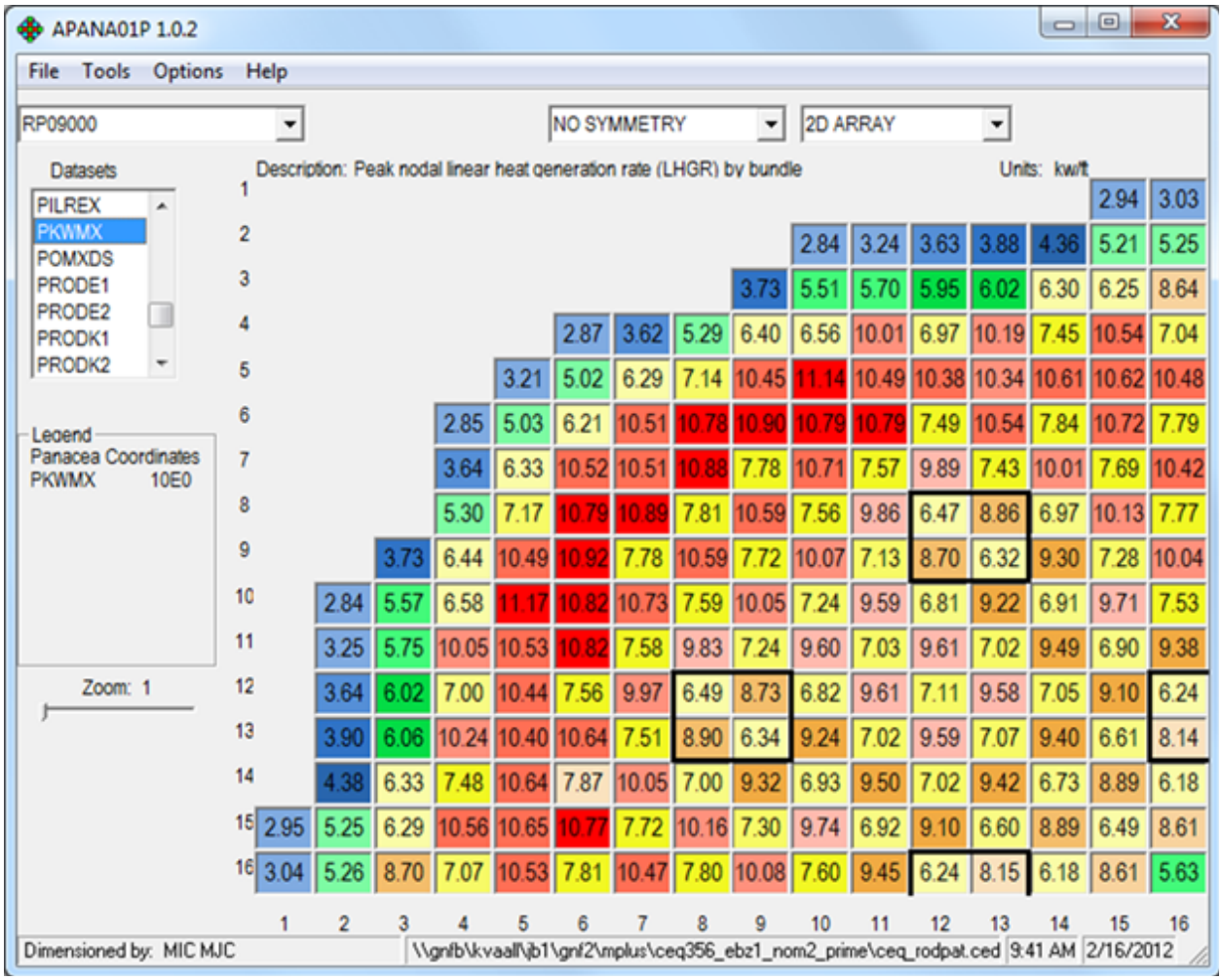

Figure 2-11 Bundle Operating LHGR (kW/ft) at MOC (9,000 MWd/ST)

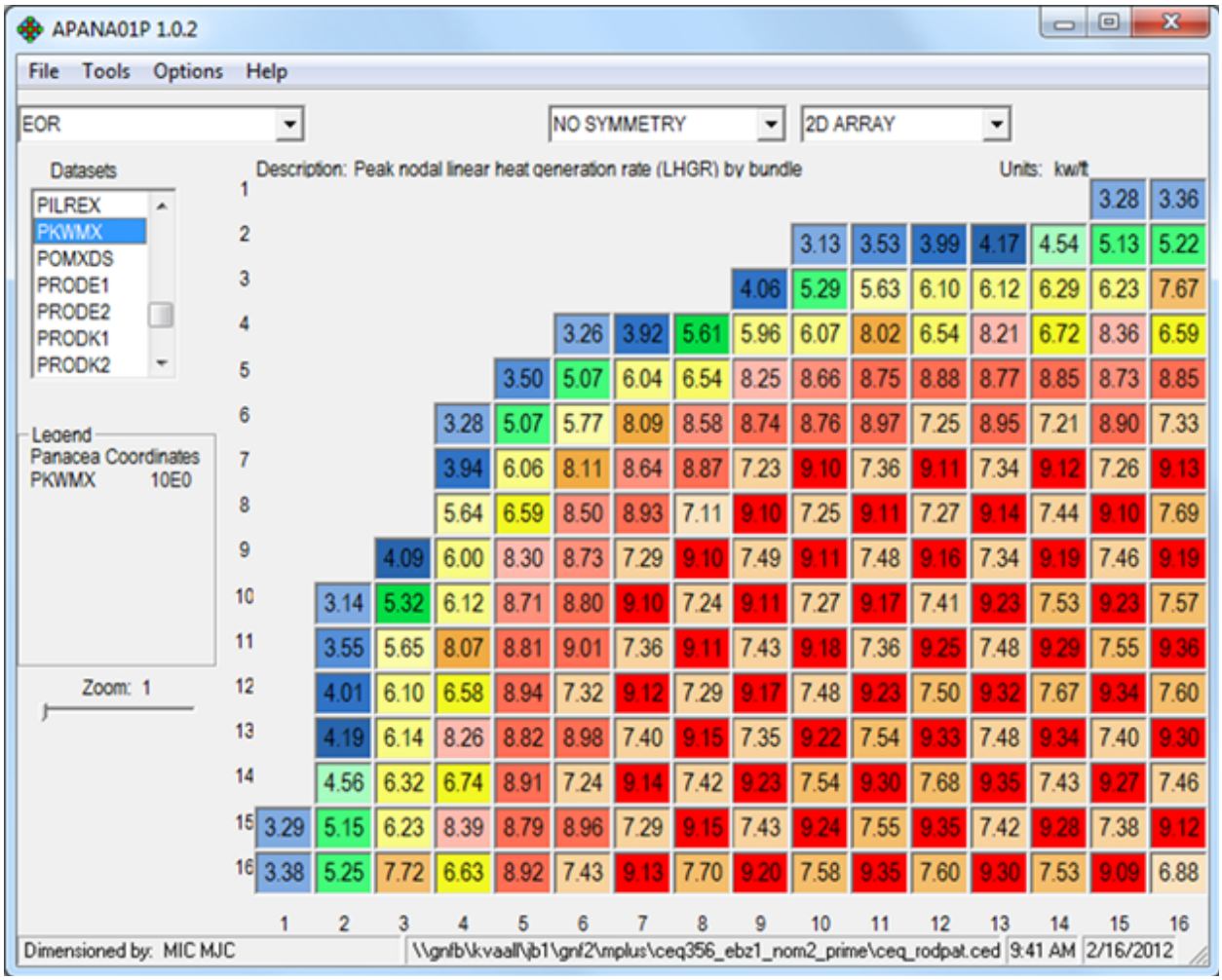

Figure 2-12 Bundle Operating LHGR (kW/ft) at EOR (18,520 MWd/ST) [Peak MFLPD Point]

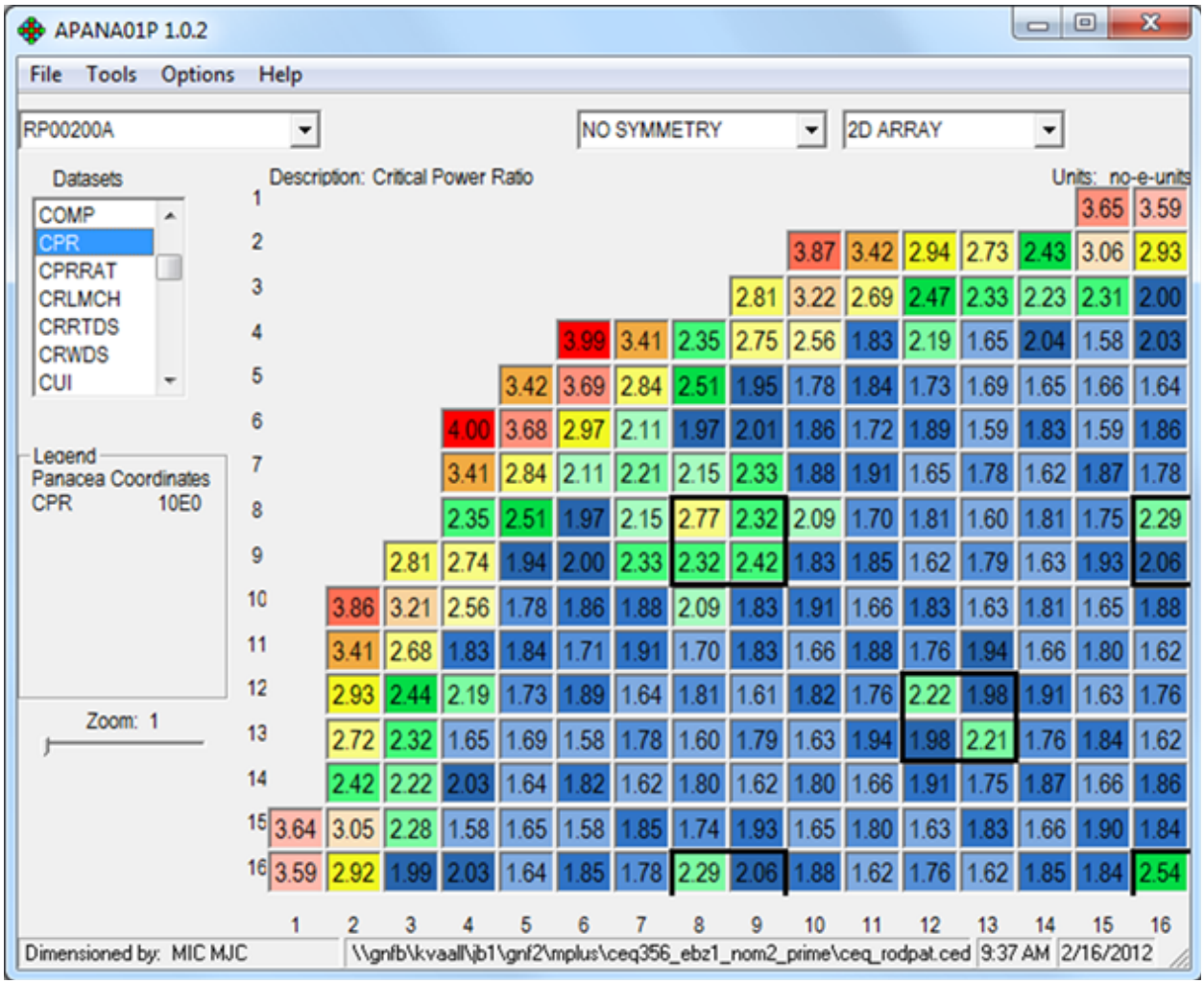

Figure 2-13 Bundle Operating MCPR at BOC (200 MWd/ST)

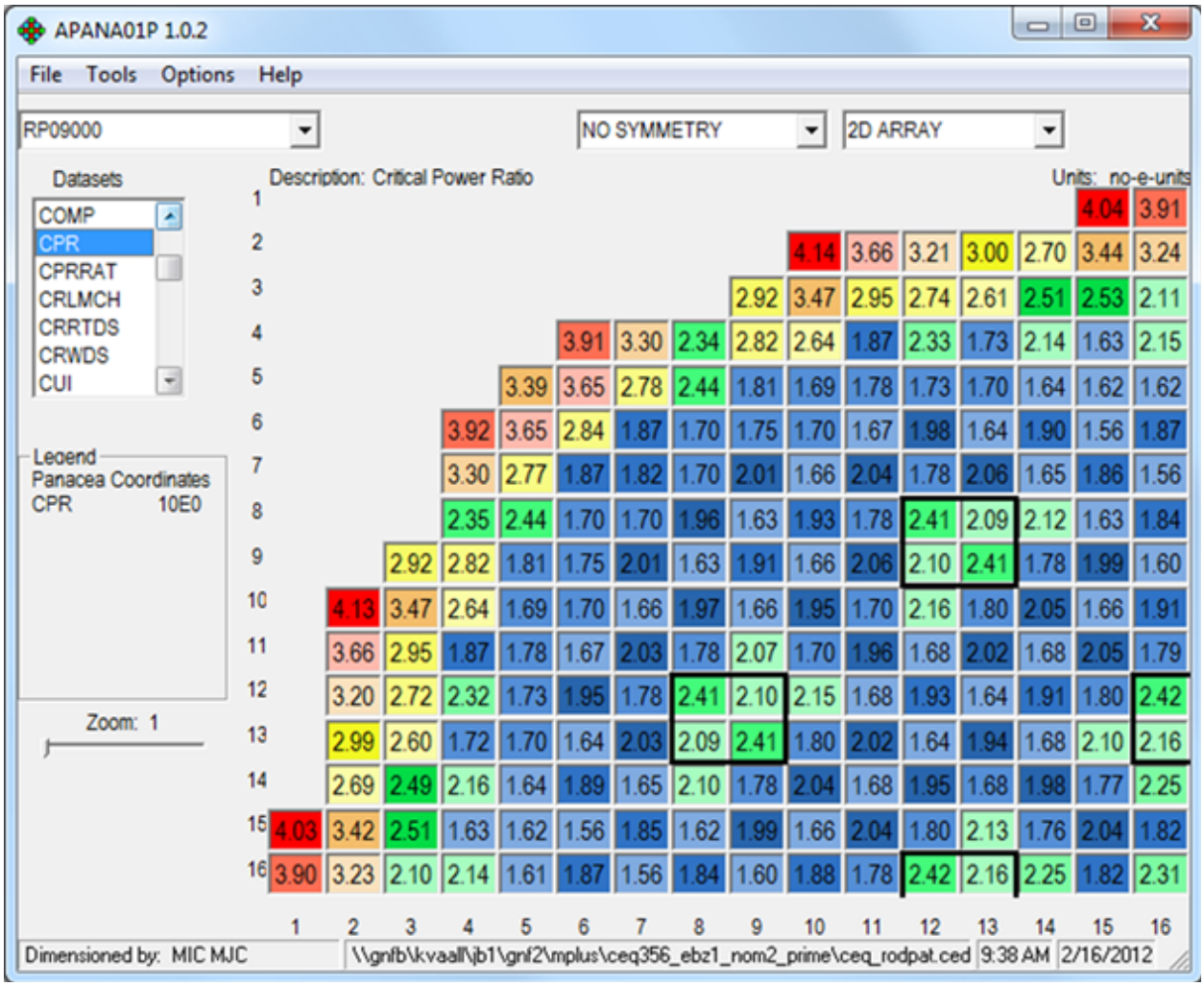

Figure 2-14 Bundle Operating MCPR at MOC (9,000 MWd/ST)

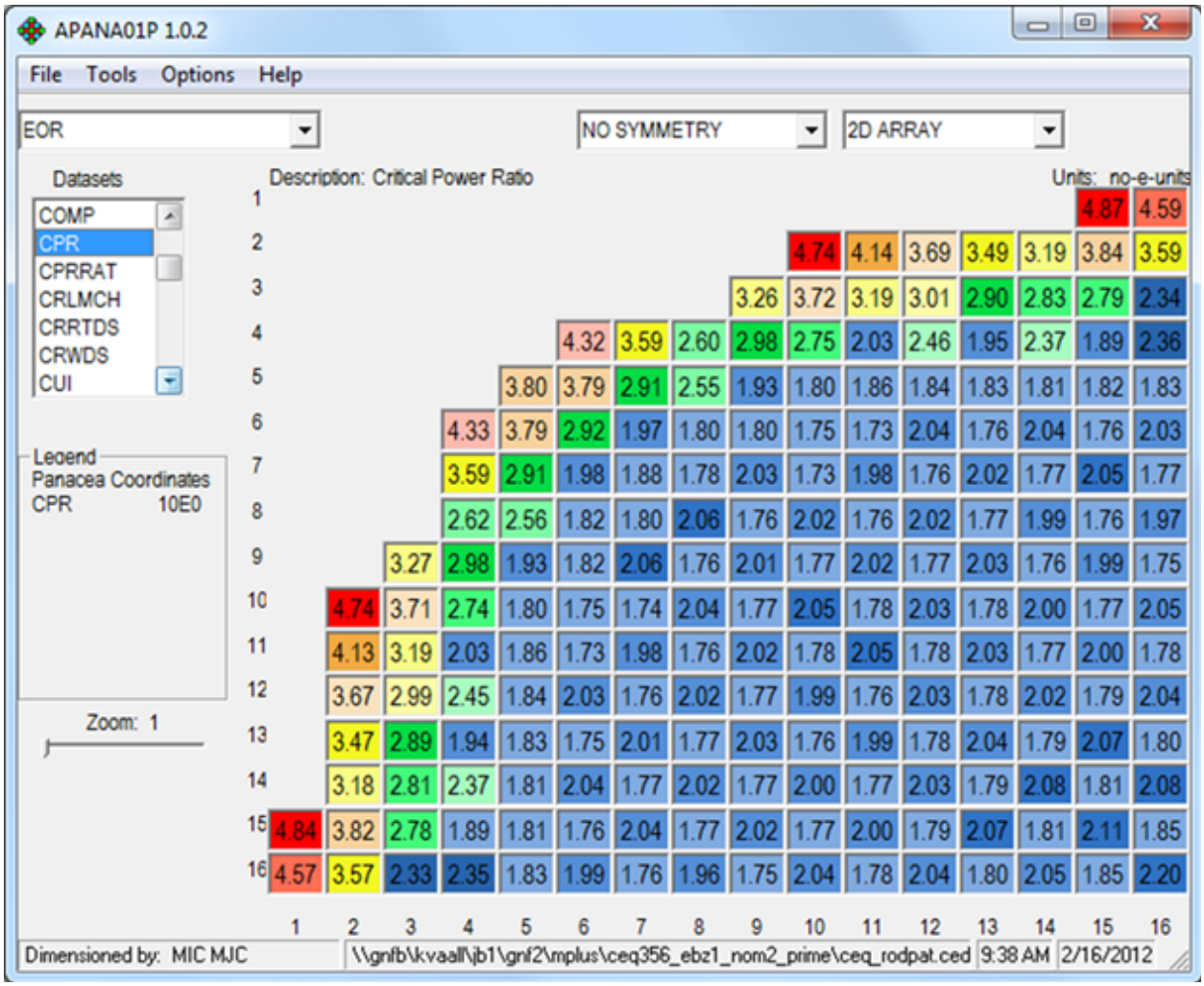

Figure 2-15 Bundle Operating MCPR at EOR (18,520 MWd/ST)

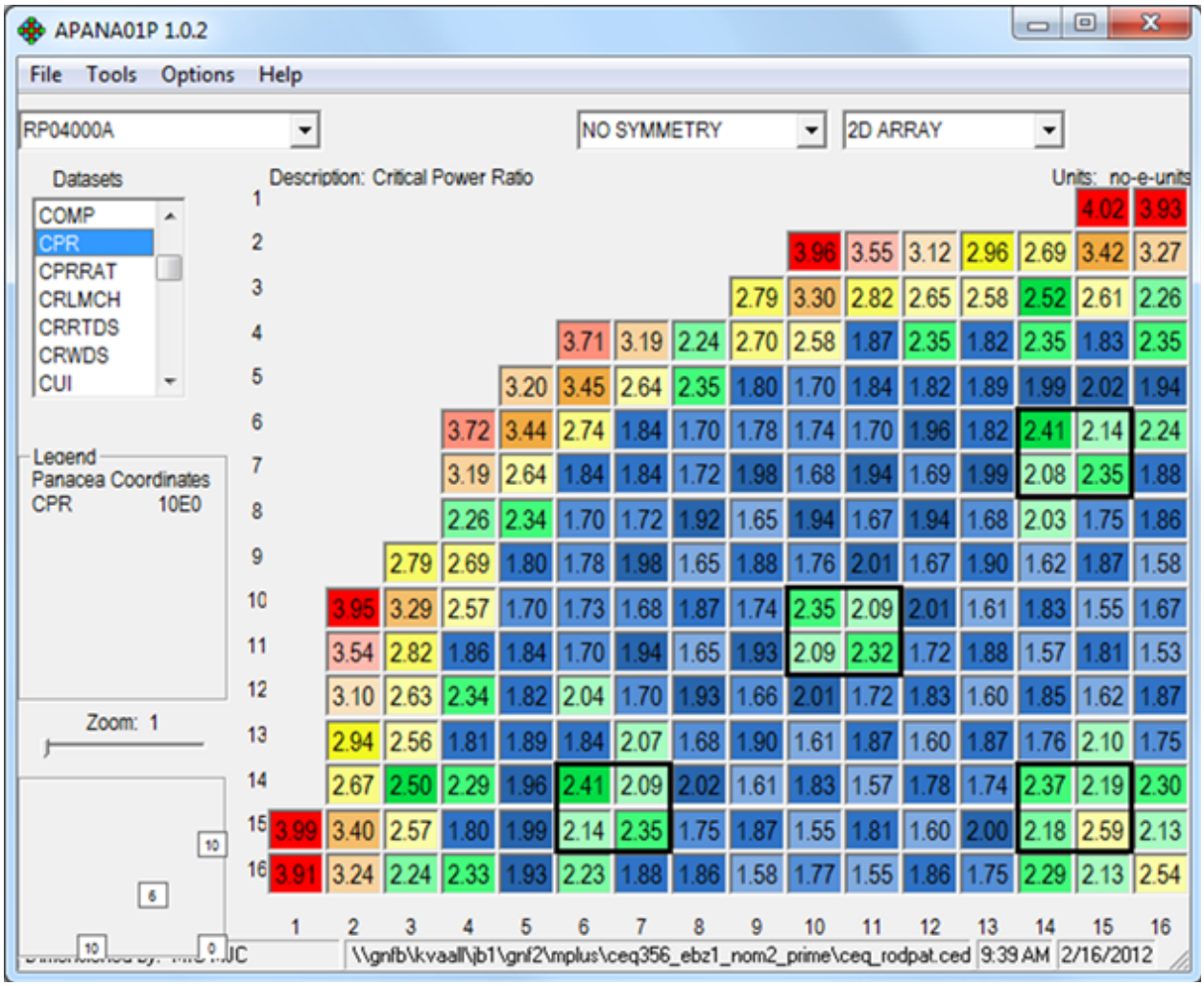

Figure 2-16 Bundle Operating MCPR at 4,000 MWd/ST (Peak MFLCPR Point)

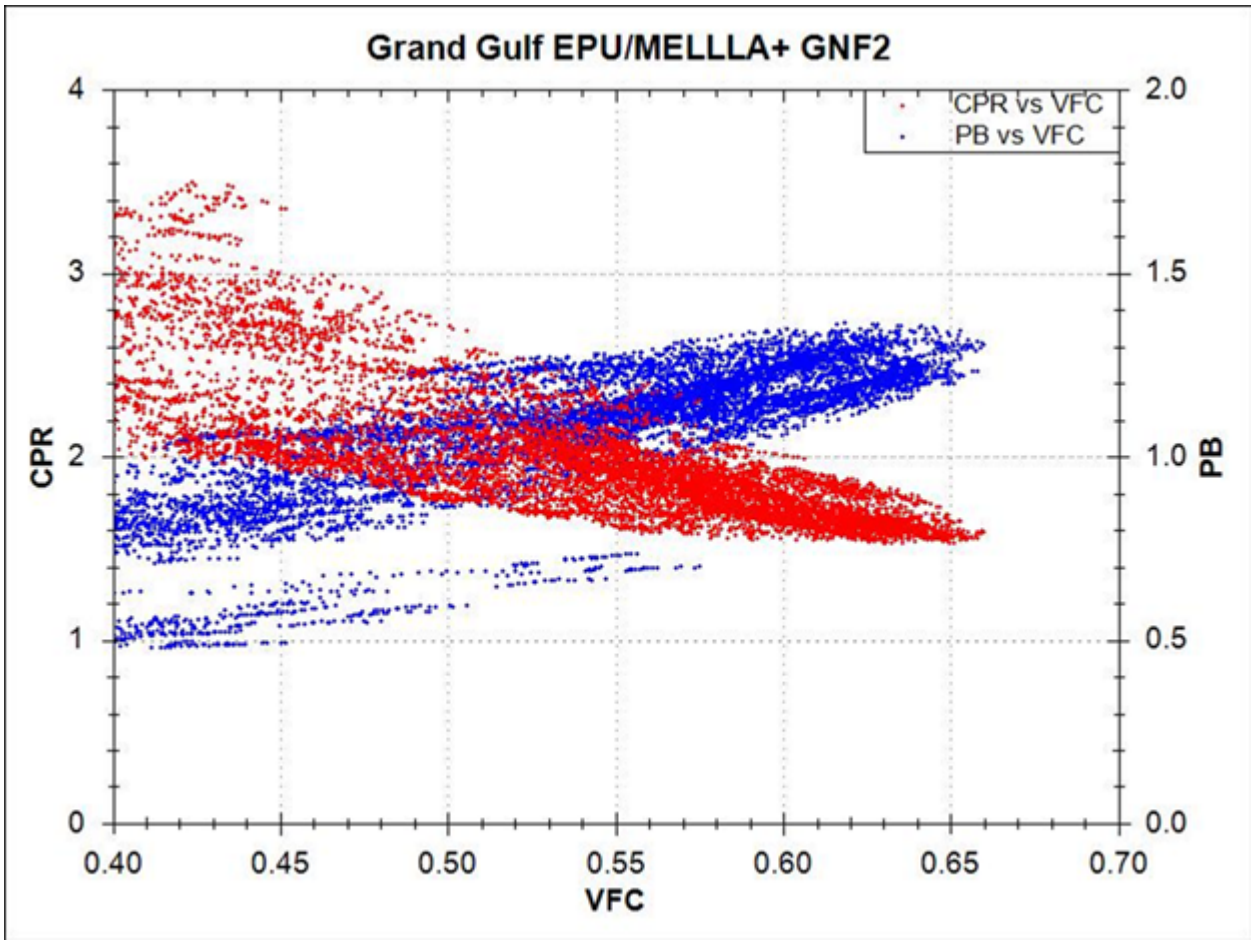

Figure 2-17 Bundle Average Void Fraction versus Critical Power and Bundle Power

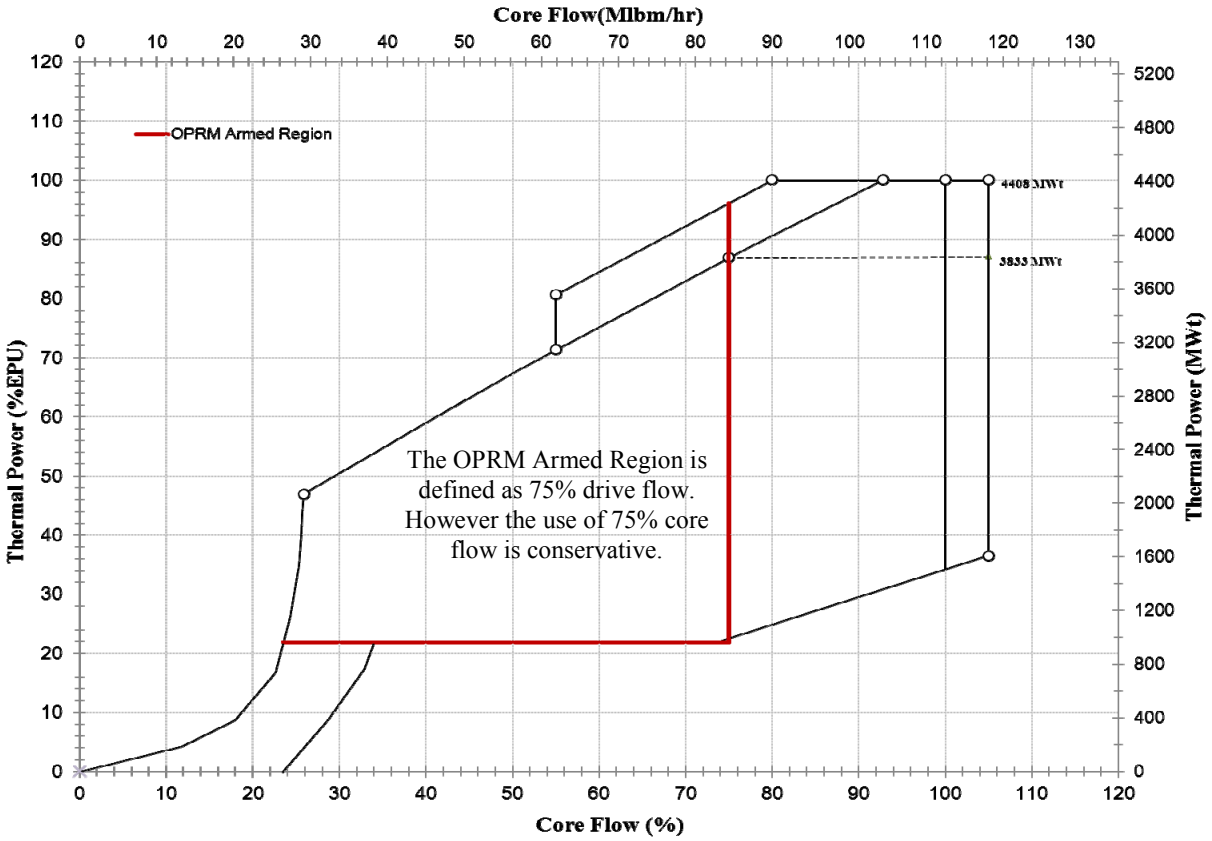

Figure 2-18 Required OPRM Armed Region

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	GGNS Result
Flow-Induced Vibration	[[	Meets M+LTR Disposition
Overpressure Relief Capacity	]]	Meets M+LTR Disposition

3.1.1 Flow-Induced Vibration

The M+LTR describes that because there is no increase in the maximum main steam line (MSL) flow for the MELLLA+ operating domain expansion, there is no effect on the flow-induced vibration (FIV) of the piping and SRVs during normal operation. [[
]]

For GGNS, maximum 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 GGNS maximum MSL flow, and there is no effect on the FIV experienced by the SRVs or piping during normal operation. [[
]]

Therefore, GGNS 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 along with other functions provide this protection. For GGNS, 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 limit of 1,375 psig.

The SRV setpoint tolerance is independent of the MELLLA+ operating domain expansion. The AOO, ASME overpressure, and ATWS response evaluations for MELLLA+ are performed using existing GGNS SRV setpoint tolerances. The SRV setpoint tolerances are monitored at GGNS for compliance to the TS requirements.

[[
]] There are no changes made to the GGNS licensing basis for the ASME overpressure event.

[[
]] The SRV tolerance assumed in the GGNS ASME overpressure event

analysis is 3%. The tolerance is consistent with the actual SRV performance testing conducted on the GGNS SRVs per TS Surveillance Requirement 3.4.4.1.

[[

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

The ASME overpressure analysis for GGNS was performed at the 105% ICF CF statepoint, and at the 80% minimum CF statepoint using a representative MELLLA+ equilibrium core. The analysis of the limiting overpressure event for GGNS demonstrates that no change in overpressure relief capacity is required. The ATWS analysis discussed in Section 9.3.1 concludes that [[

]] No other changes in the pressure relief system or SRV setpoints are required for MELLLA+. [[

]] 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	GGNS Result
Fracture Toughness	[[	Meets M+LTR Disposition
Reactor Vessel Structural Evaluation	]]	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. However, the introduction of GNF2 EBZ fuel bundles masks the MELLLA+ expected results. The EBZ fuel bundles contribute to a more bottom-peaked core. Therefore, a higher flux occurs towards the bottom of the core causing a lower flux towards the top of the MELLLA+ core. The MELLLA+ flux results indicate that the introduction of EBZ fuel constitutes a notable effect on fast neutron flux distributions near the bottom of active fuel. Components in this region such as the core plate, core plate bolts, and various nozzles experience elevated fast flux levels as a result of EBZ fuel introduction. 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 14), which is consistent with Regulatory Guide (RG) 1.190 and

was approved by the NRC in November 2005. The pre-EPU fluence values were calculated using the current GGNS fluence methodology developed by MPM Technologies. 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 GGNS 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 GGNS 35 EFPY vessel ID peak fluence as a result of MELLLA+, there is a negligible change to the beltline adjusted reference temperature (ART). Therefore, the pressure/temperature curves do not require revision as a result of MELLLA+ operating domain expansion.

Because there is a negligible change to the GGNS 35 EFPY vessel ID peak fluence as a result of MELLLA+, there is a negligible change to the upper shelf energy (USE). GGNS continues to meet the 50 ft-lb requirement in 10 CFR 50, Appendix G.

Because there is a negligible change to the GGNS 35 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 GGNS 35 EFPY vessel ID peak fluence. Therefore, no changes to the GGNS ART, USE, or weld inspection relief values are required as a result of MELLLA+.

Therefore, GGNS 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 describes that there are no changes in the reactor operating pressure, FW flow rate, or steam flow rates for the MELLLA+ operating domain expansion. Other applicable mechanical loads do not increase for the MELLLA+ operating domain expansion. 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 GGNS, 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 GGNS 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 GGNS reactor vessel components and no further evaluation of GGNS reactor vessel structural integrity is required.

Therefore, GGNS meets all M+LTR dispositions for the reactor vessel structural evaluation.

3.3 REACTOR INTERNALS

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

Topic	M+LTR Disposition	GGNS Result
Fuel Assembly and Control Rod Guide Tube Lift Forces	[[	Meets M+LTR Disposition
Reactor Internals Pressure Differences for Normal, Upset, Emergency and Faulted Conditions		Meets M+LTR Disposition
Reactor Internals Pressure Differences (Acoustic and Flow-Induced Loads) for Faulted Conditions		Meets M+LTR Disposition
Reactor Internals Structural Evaluation for Normal, Upset, and Emergency Conditions		Meets M+LTR Disposition
Reactor Internals Structural Evaluation for Faulted Conditions		Meets M+LTR Disposition
Steam Dryer Separator Performance	]]	Meets M+LTR Disposition

3.3.1 Reactor Internal Pressure Differences

3.3.1.1 Fuel Assembly and Control Rod Guide Tube Lift Forces

The M+LTR describes that fuel assembly and control rod guide tube (CRGT) lift forces are calculated for normal, upset, emergency, and faulted conditions consistent with the existing plant design basis. There are no increases 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, the only remaining variable affecting the forces on the fuel assemblies and CRGTs 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 or CRGT lift forces is required.

For GGNS, the difference between the 100% CLTP / 105% CF ICF operation point core exit steam flow and the 100% CLTP / 80% CF MELLLA+ operation point core exit steam flow is a 0.38% increase. The differences between the vessel steam flow and FW flow rates for the two power-flow points are both less than a 0.03% 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 and

CRGT lift forces calculated for normal, upset, emergency and faulted conditions. Therefore, because the GGNS CF at the MELLLA+ statepoint at 80% CF is less than the current licensed operating domain statepoint at 105% CF, the normal, upset, emergency and faulted fuel assembly and CRGT lift forces for the MELLLA+ operating domain [[

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

Therefore, GGNS meets all M+LTR dispositions for the fuel assembly and CRGT lift forces.

3.3.1.2 Reactor Internals 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 GGNS, the difference between the 100% CLTP / 105% CF ICF operation point core exit steam flow and the 100% CLTP / 80% CF MELLLA+ operation point core exit steam flow is a 0.38% increase. The differences between the vessel steam flow and FW flow rates for the two power-flow points are both less than a 0.03% 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 GGNS CF at the MELLLA+ statepoint at 80% CF is less than the current licensed operating domain statepoint at 105% CF, the normal, upset, emergency and faulted condition RIPDs for the MELLLA+ operating domain [[ ]] which includes ICF up to 105% of RCF. [[

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

Therefore, GGNS 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 GGNS evaluation. [[

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

Therefore, GGNS 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	
Fuel Assembly and CRGT Lift Forces	

Hydrodynamic Containment Dynamic Loads - (LOCA and SRV)	
Fuel Lift Loads	
Thermal Effects	
Flow	]]

Therefore, GGNS 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	
Fuel Assembly and CRGT Lift Forces	
Hydrodynamic Containment Dynamic Loads - (LOCA and SRV)	

AP	
Jet Reaction	
Thermal Effects	
Fuel Lift Loads	
Flow	
Acoustic and Flow-Induced Loads Due To Recirculation Line Break	]]

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

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

Therefore, GGNS 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 GGNS 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 statepoint), 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 80% RCF to assess their capability to provide the quality of steam necessary to meet operational criteria at MELLLA+ operating conditions.

The evaluation of steam separator and dryer performance at MELLLA+ conditions indicates an increase in MCO will occur. This increase resulted in an MCO value above the original moisture performance specification of 0.10 wt %. Section 3.3.4 identifies a plant-specific moisture performance specification based on as-installed hardware.

3.3.4 Steam Line Moisture Performance Specification

The effect of increased MCO on plant operation has been analyzed to verify acceptable steam separator-dryer performance under MELLLA+ operating conditions. The highest MCO predicted under MELLLA+ conditions is less than 0.2 wt %; however, analyses were performed to support a maximum moisture content of 0.33 wt %. MCO is monitored during operation to ensure adequate operating limitations are implemented as required to maintain MCO within analyzed conditions. The amount of time GGNS is operated with higher than the original design moisture content (0.10 wt %) is minimized by operations. MCO monitoring periodicity is based upon results of startup testing, operating experience, and core peaking pattern.

The maximum permissible MCO leaving the RPV, above which MSL components could begin to degrade as a result of the high moisture content in the steam, was found to be 0.33 wt %. A number of evaluations in the M+SAR were performed assuming a conservatively high bounding MCO of 0.35 wt %.

The ability of the steam dryer and separator to perform their design functions during MELLLA+ operation was evaluated. The GGNS plant-specific evaluation concluded that the performance of the steam dryer and separator remains acceptable and the dryer skirt remains covered at L4, the low water level alarm in the MELLLA+ region.

MELLLA+ operation decreases the CF rate, resulting in an increase in separator inlet quality for constant reactor thermal power. These factors, in addition to core radial power distribution, influence steam separator-dryer performance. GGNS's steam separator/dryer performance was evaluated on a plant-specific basis to determine the influence of MELLLA+ on the steam dryer and separator operating conditions: (a) the entrained steam (i.e., carryunder) in the water returning from the separators to the reactor annulus region; (b) the moisture content in the steam leaving the RPV into the MSLs; and (c) the margin to dryer skirt uncovery.

The moisture content of the steam leaving the RPV increases in the MELLLA+ domain. The effect of increasing steam moisture content has been analyzed in the tasks that use the MCO value from Sections 3.3.3 and 3.3.4. The effects of increased moisture are discussed in the following sections:

a. 3.4.1 Piping Components with FIV - Safety Related

Adequate margin exists to FIV of the sample probes and thermowells due to the large margin available in the design.

b. 3.5.1 Reactor Coolant Pressure Boundary Piping

As discussed in Section 3.3.3, the MCO may increase during the cycle when a plant is operating at or near the MELLLA+ minimum CF rate.

The MCO for GGNS may increase to a maximum of 0.33 wt % during the cycle when GGNS is operating at or near the MELLLA+ minimum CF rate.

c. 5.2.4 Main Steam Flow - FW Flow Mismatch

Operation at the higher MCO performance specification is acceptable. With a reactor outlet MCO performance specification of 0.33 wt %, the additional coolant removed from the RPV must be returned to the reactor in order to maintain the correct water level. The FW system will be required to provide a slightly higher flow rate. The effect of the increased MSL MCO is to cause a slight imbalance in the FW control system control point. With a typical plant bias of 0.60 inches per percent this translates to approximately 0.14 inches of bias in the water level, which is negligible.

d. 8.1 Liquid and Solid Waste Management

Due to the very small increase in reactor MCO reaching the condenser, the condensate full flow filtration (CFFF) filter backwash frequency and volume are not changed, and the disposal frequency of the condensate demineralizer resins is not changed. Additionally, because the reactor water cleanup (RWCU) system is not affected by operation in the MELLLA+ operating domain, the RWCU filter demineralizer backwash frequency is not changed. Therefore, the GGNS waste volumes will not be affected by operation in the MELLLA+ operating domain.

e. 8.4.2 Fission and Activated Corrosion Products

Steam separator and dryer performance for MELLLA+ operation is discussed in Section 3.3.3. The moisture content of the main steam (MS) leaving the vessel may increase while operating near the minimum CF in the MELLLA+ operating domain. The distribution of the fission and activated corrosion product activity between the reactor water and steam is affected by the increased moisture content. With increased MCO, additional activity is carried over from the reactor water with the steam. The maximum allowable moisture content leaving the reactor vessel is 0.33 wt %.

f. 8.5 Radiation Levels

As discussed in Section 8.4, the moisture content of the MS leaving the vessel may increase at certain times while operating in the MELLLA+ operating domain. This increase in moisture content would increase the radiation source in the condensate demineralizers and in the FW and liquid radwaste systems by approximately 30%. The activity inventory in the condensate demineralizers is small compared to the RWCU demineralizers, thus the overall effect of the radiation source in the solid waste system will be small. The overall radiological effect of the increased moisture content is a function of the plant water radiochemistry and the levels of activated corrosion products maintained.

g. 8.6.1 Plant Gaseous Emissions

The increase in MCO results in an increase in potential iodines and particulates in airborne releases and their contribution to off-site doses by approximately 20%. However, 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.

h. 10.7.2 Flow Accelerated Corrosion

In addition to the MELLLA+ startup testing described in Section 10.4.1, GGNS routinely monitors the moisture content of reactor steam. MCO monitoring periodicity is based upon results of startup testing, operating experience, and core peaking pattern. Any increases above the design limit of 0.10 wt % will be evaluated for effect on the FAC monitoring program.

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	GGNS Result
Piping FIV Evaluation Recirculation Piping Main Steam Piping FW Piping Safety Related Thermowells and Probes	[[	Meets M+LTR Disposition
RPV Internals FIV Evaluation	]]	Meets M+LTR Disposition

3.4.1 FIV Influence on Piping

[[

]] 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.

[[

]] For GGNS, 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.

[[

]] 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, [[

]]

For GGNS, 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, GGNS 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 disposition of the FIV Influence on Reactor Internals topic in the M+LTR describes that [[

]] The disposition evaluates the effect of the MELLLA+ operating domain expansion on the following components: shroud, shroud head and steam separator-dryer, low pressure core spray (LPCS) line, low pressure coolant injection (LPCI) coupling, 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 as well as no increase in the MS and FW flow rates.

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	[[
LPCS Line LPCI Coupling CRGT In-Core Guide Tubes	

Component(s)	MELLLA+ Results
Fuel Channel LPRM/IRM Tubes	
Jet Pumps	
JPSLs	
FW Sparger	]]

For GGNS, the MELLLA+ operating domain expansion results in decreased core and recirculation flow as well as no increase in the MS and FW flow rates. The numerical values showing a decrease in core and recirculation flow as well as 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 GGNS MELLLA+ operating domain expansion.

[[

]]

Therefore, GGNS 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	GGNS Result
Main Steam and Feedwater (Inside Containment)	[[	Meets M+LTR Disposition
Recirculation and Control Rod Drive		Meets M+LTR Disposition

Topic	M+LTR Disposition	GGNS Result
Reactor Core Isolation Cooling (RCIC) High Pressure Core Spray (HPCS) Reactor Water Cleanup (RWCU) Low Pressure Core Spray (LPCS) Line Standby Liquid Control (SLC) Residual Heat Removal (RHR) RPV Head Vent Line SRV Discharge Line (SRVDL) Safety Related Thermowells	]]	Meets M+LTR Disposition

The piping systems are required to comply with the structural requirements of the ASME Boiler and Pressure Vessel (BPV) 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 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 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.

For GGNS, the MS and connected branch piping (i.e., RCIC steam line) and FW temperatures, pressures and flow 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. GGNS MS and FW piping inside containment is designed in accordance with the codes identified in UFSAR Table 3.2-1. [[

]] The temperatures, pressures, and flows in GGNS 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 GGNS RCPB piping for MS and FW inside containment.

As discussed in Section 3.3.4, 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 M+LTR 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.

The MCO for GGNS may increase to a maximum of 0.33 wt % for a period of time during the cycle when GGNS is operating at or near the MELLLA+ minimum CF rate. GGNS implements programs adequate to manage this change in the erosion/corrosion rate as described in Section 10.7.

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

3.5.1.2 Reactor Recirculation and Control Rod Drive Systems

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, no further evaluation of the RCPB Piping - Reactor Recirculation and CRD systems is required for MELLLA+ operating domain expansion.

For GGNS, 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, GGNS 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 – HPCS, LPCS, RHR/LPCI, and SLCS

The M+LTR describes that [[

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

MELLLA+ operating domain expansion for GGNS does not change the maximum operating temperature, pressure, or flow rate of any of the following systems: HPCS, LPCS, RHR/LPCI and SLCS.

HPCS, LPCS, 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 GGNS systems: [[

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

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.

MELLLA+ operating domain expansion for GGNS does not change the maximum operating temperature, pressure, or flow rate of any of the following piping systems: RPV head vent line and SRVDL.

RPV head vent line and SRVDL 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. 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. Their susceptibility to erosion/corrosion does not increase, and no further evaluation of these Other RCPB Piping Systems is required for GGNS.

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.

MELLLA+ operating domain expansion for GGNS does not change the maximum operating temperature, pressure, or flow rate of the RWCU system. RWCU 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 GGNS RWCU system is unaffected by MELLLA+ operating domain expansion. 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

[[

]]. 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 GGNS.

The GGNS 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 GGNS.

Because all of the piping systems in Section 3.5.1.3 meet the criteria listed [[

]] their susceptibility to erosion/corrosion does not increase, and no further evaluation of these other RCPB piping systems is required.

Therefore, GGNS 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 other than Category "A" materials that exist in the RCPB Piping.

The following other than Category "A" materials exist in the RCPB piping:

Category "A" is assumed to mean intergranular stress corrosion cracking (IGSCC) Category "A" that is a resistant material to IGSCC for BWR piping weldments in accordance with NUREG-0313 (Reference 16). "Other than Category A" is assumed to mean non-resistant or cracked materials for IGSCC BWR weldments in accordance with NUREG-0313 (IGSCC Categories B through G).

UFSAR Section 5.2.3.5.3 provides a general summary of RCPB weldments, by category with total numbers of welds in that category.

The GGNS in-service inspection (ISI) program for RCPB piping is in accordance with ASME Section XI coupled with the augmented program for reactor coolant piping based on Generic Letter (GL) 88-01 (Reference 17), NUREG-0313 (Reference 16) and Boiling Water Reactor Vessel Internals Project (BWRVIP)-75-A (Reference 18). The inspection techniques utilized are

in full conformance with ASME Section XI, Appendix VIII, Supplement 10 for the detection and characterization of service-induced, surface-connected planar discontinuities, such as IGSCC.

Continued implementation of the current program ensures the prompt identification of any degradation of RCPB components experienced during MELLLA+ operating conditions.

The augmented inspection program is designed to detect potential degradation from IGSCC. For IGSCC to occur, three conditions must be present: (1) a susceptible material (for a list of materials in the RCPB, see Section 5.2.2.7 of the UFSAR); (2) the presence of residual or applied tensile stress (such as from welding); and (3) an aggressive environment.

The GGNS augmented inspection program frequency is based on BWRVIP-75-A normal water chemistry. While GGNS has implemented HWC, the augmented program includes more frequent inspections than those required by BWRVIP-75-A at this time for HWC. GGNS does not have any Category D, E, F, or G weldments.

Several IGSCC mitigation processes have been applied to GGNS to reduce the RCPB components' susceptibility to IGSCC. GGNS was 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. Stress improvement processes and original construction processes used for IGSCC resistance are not affected by MELLLA+. Also, GGNS has implemented HWC, which reduces the potential for IGSCC of RCPB components.

Therefore, the augmented inspection program at GGNS is adequate to address concerns related to other than Category "A" materials in the RCPB.

Therefore, GGNS meets all M+LTR dispositions for Other Than Category "A" materials in the RCPB.

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	GGNS Result
Main Steam and Feedwater (Outside Containment)	[[	Meets M+LTR Disposition
Reactor Core Isolation Cooling (RCIC) HPCS Low Pressure Core Spray (LPCS) Residual Heat Removal (RHR)		Meets M+LTR Disposition
Offgas System Neutron Monitoring System	]]	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 GGNS 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 GGNS MS and FW piping outside containment is unaffected by the MELLLA+ operating domain expansion. GGNS 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 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 MSLs, outside of containment, may experience a slight increase in the erosion/corrosion rates as a result of increased MCO. GGNS implements programs adequate to manage this change in the erosion/corrosion rate as described in Section 10.7.

Therefore, GGNS meets all M+LTR dispositions for MS and FW piping outside containment.

3.5.2.2 Other BOP Piping Systems

3.5.2.2.1 Other BOP Piping Systems - RCIC, HPCS, LPCS, and RHR

The M+LTR describes that the loads and temperatures used in the analyses of the other BOP piping systems (RCIC, HPCS, LPCS, 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. 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 GGNS does not change the maximum operating temperature, pressure, or flow rate, or increase mechanical loads for any of the following systems: RCIC, HPCS, LPCS, and RHR.

RCIC, HPCS, LPCS, 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 GGNS 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 GGNS 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 GGNS 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 GGNS 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, GGNS 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	GGNS Result
System Evaluation	[[	Meets M+LTR Disposition
Net Positive Suction Head (NPSH)		Meets M+LTR Disposition
Single Loop Operation		Meets M+LTR Disposition
Flow Mismatch		]]

3.6.1 System Evaluation

The M+LTR describes that all of the reactor recirculation system (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.

The GGNS RRS operating conditions in the MELLLA+ operating domain are within the operating conditions in the current licensed operating domain. For GGNS, there are no increases in the RRS temperature or flow rates as a result of MELLLA+ operating domain expansion as compared to the current licensed operating domain. For BWR/6 plants, with a constant dome pressure, the RRS system pressure will increase at MELLLA+ operating conditions due to flow control valve closure. However, this pressure increase is within the system design parameters. RRS system temperature for the current licensed operating domain is 530.1°F and in the MELLLA+ operating domain is 526.6°F. The numerical values showing no increases in RRS system flow rates and RPV dome pressures are presented in Table 1-2. For GGNS, SLO is not allowed in the MELLLA+ operating domain. [[

]] and no further evaluation of this topic is required.

Therefore, GGNS meets all M+LTR dispositions for the RRS system evaluation.

3.6.2 Net Positive Suction Head

[[

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

[[

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

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

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

3.6.3 Single Loop Operation

The M+LTR states that SLO is not allowed in the MELLLA+ operating domain.

SLO is not allowed in the MELLLA+ operating domain. SLO is limited to the MELLLA region of the power/flow map as shown in Figure 4-3 of the COLR as directed per TS 3.4.1. Section 1.2.1 confirms that this region does not change for MELLLA+. Therefore, SLO is not allowed in the MELLLA+ operating range and is not affected by the MELLLA+ domain expansion. The GGNS MELLLA+ LAR proposes a change to TS 3.4.1 prohibiting SLO while in the MELLLA+ operating domain.

Therefore, GGNS 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	GGNS Result
Structural Integrity	[[ ]]	Meets M+LTR Disposition

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.

There is no increase in GGNS 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. [[

]] and no further evaluation of this topic is required.

Therefore, GGNS 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	GGNS Result
Isolation Performance	[[	Meets M+LTR Disposition
Valve Pressure Drop	]]	Meets M+LTR Disposition

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.

There is no significant increase in GGNS MS pressure, flow, or pressure drop as a result of MELLLA+ operating domain expansion. The MS pressure (dome pressure) for the current licensed operating domain and in the MELLLA+ operating domain is 1,040 psia. The numerical values showing that MS flow does not increase as a result of MELLLA+ are presented in Table 1-2. The total MSL pressure drop at the TSVs is not significantly changed for MELLLA+; the MSIV pressure drop is also not significantly changed. [[

]] and no further evaluation of this topic is required.

Therefore, GGNS meets all M+LTR dispositions for the MSIV structural and operational effects.

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	GGNS Result
System Hardware	[[	Meets M+LTR Disposition
System Initiation		Meets M+LTR Disposition
Net Positive Suction Head	]]	Meets M+LTR Disposition
Inventory Makeup Level Margin to Top of Active Fuel (TAF)	[[ ]]	

3.9.1 System Hardware

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

There are no changes to the GGNS RCIC system hardware as a result of MELLLA+.

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

3.9.2 System Initiation

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 M+LTR concludes [[

]] No further evaluation of this topic is required.

There are no changes to the normal reactor operating pressure, decay heat, or SRV setpoints as a result of MELLLA+ operating domain expansion. The GGNS reactor operating pressure for the current licensed operating domain and in the MELLLA+ operating domain remains unchanged. 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, 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 GGNS [[

]] No further evaluation of this topic is required.

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

3.9.3 Net Positive Suction Head

The M+LTR states that the NPSH available for the RCIC pump [[

]] For ATWS (Section 9.3) and Fire Protection (Section 6.7), operation of the RCIC system at suppression pool temperatures greater than the operational limit may be accomplished by using the CST volume as the source of water. Therefore, 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.

For GGNS, there are no physical changes to the pump suction configuration. The GGNS RCIC flow rate for the current licensed operating domain and in the MELLLA+ operating domain is 800 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. GGNS calculations demonstrate that the RCIC pump would have adequate NPSH and low suction pressure trip margins 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 CLTP evaluation is not affected and remains bounding for the MELLLA+ operating domain expansion.

The NPSH required by the GGNS RCIC pump [[

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

Therefore, GGNS 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	GGNS Result
Low Pressure Coolant Injection Mode	[[ ]]	
Suppression Pool and Containment Spray Cooling Modes	[[	Meets M+LTR Disposition
Shutdown Cooling Mode	]]	Meets M+LTR Disposition
Steam Condensing Mode	[[	
Fuel Pool Cooling Assist	]]	

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 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. [[

]]

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

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

3.10.3 Shutdown Cooling Mode

The M+LTR describes that the shutdown cooling (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. [[

]]

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

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

3.10.4 Steam Condensing Mode

The Steam Condensing mode is not applicable to GGNS.

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 (FPCCS). [[

]] 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	GGNS Result
System Performance	[[	Meets M+LTR Disposition
Containment Isolation	]]	Meets M+LTR Disposition

3.11.1 System Performance

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.

For GGNS, 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). For GGNS, 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 420.0°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 doesn't 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 adverse 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, [[

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

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

3.11.2 Containment Isolation

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.

For GGNS, 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 420.0°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 doesn't change for RWCU return lines. As discussed in Section 3.11.1 above, there is no change to RWCU inlet conditions. [[

]]

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

Table 3-1 Key Results for MELLLA+ Fluence Evaluation

Item	Parameter	Unit	CLTP Value	M+ Value	CLTP to M+ 115% OLTP Comparison
1	Azimuthal Flux Distribution at RPV ID	n/cm^2-s	2.90E9	2.76E9	Ratio of M+/CLTP peak flux is 0.95
2	Relative Axial Flux Distribution at RPV ID	N/A			No significant changes; however, increased axial flux towards BAF is attributed to the introduction of GNF2 EBZ fuel and not M+.
3	Azimuthal Flux Distribution at Shroud ID	n/cm^2-s	1.60E12	1.60E12	Ratio of M+/CLTP peak flux is 1.00
4	Relative Axial Flux Distribution at Shroud ID	N/A			No significant changes; however, increased axial flux towards BAF is attributed to the introduction of GNF2 EBZ fuel and not M+.
5	54-EFPY Axial Fluence Distribution at RPV ID	n/cm^2	4.44E18	4.30E18	Ratio of M+/CLTP peak fluence at 54 EFPY is 0.97
6	54-EFPY Axial Fluence at Shroud H4 Weld	n/cm^2	2.88E21	2.89E21	Ratio of M+/CLTP peak fluence is 1.00
7	Capsule (3° Azimuth) Flux	n/cm^2-s	N/A	1.18E9	EPU capsule flux not calculated
8	Capsule Lead Factor	N/A	N/A	0.427	EPU lead factor not calculated
9	Peak Flux at Top Guide	n/cm^2-s	3.40E12	3.19E12	Ratio of M+/CLTP peak flux is 0.94
10	Peak Flux at Core Plate	n/cm^2-s	4.25E11	8.46E11	Ratio of M+/CLTP peak flux is 1.99
11	54-EFPY Peak Fluence at Top Guide	n/cm^2	5.26E21	4.93E21	Ratio of M+/CLTP 54 EFPY peak fluence is 0.94
12	54-EFPY Peak Fluence at Core Plate	n/cm^2	6.57E20	1.31E21	Ratio of M+/CLTP 54 EFPY peak fluence is 1.99. Increased core plate fluence is attributed to the introduction of GNF2 EBZ fuel and not M+.

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	GGNS Result
Short-Term Pressure and Temperature Response	[[	Meets M+LTR Disposition
Long-Term Suppression Pool Temperature Response		Meets M+LTR Disposition
Containment Dynamic Loads Loss-of-Coolant Accident Loads Subcompartment Pressurization		 Meets M+LTR Disposition Meets M+LTR Disposition
Safety Relief Valve Loads SRV Containment Dynamic Loads Safety-Relief Valve Piping Loads		 Meets M+LTR Disposition Meets M+LTR Disposition
Containment Isolation		Meets M+LTR Disposition
Generic Letter 89-10	]]	Meets M+LTR Disposition
Generic Letter 89-16	[[ ]]	
Generic Letter 95-07	[[	Meets M+LTR Disposition
Generic Letter 96-06	]]	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 GGNS short-term RSLB containment temperature and pressure responses are affected by the change in enthalpy as a result of MELLLA+ operating domain expansion. The short-term RSLB

and MSLB analysis inputs are consistent with those previously reported in Reference 19 for CLTP operation, with the exception of the wetwell airspace volume values at low water level (LWL) and high water level (HWL), which have been updated as shown in Table 4-1. The revised volume inputs more accurately capture the available airspace in the wetwell below the HCU floor than those reported in Reference 19. The short-term RSLB analysis cases at MELLLA+ demonstrate 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 19 which remain below the design limit of 330°F. The peak short-term RSLB pressures for the MELLLA+ operating domain are bounded by peak pressures obtained for the updated CLTP MSLB in Table 4-2 and are below the design limit of 30 psig. As a result of the revised volume inputs, the peak containment pressure decreased to 12.1 psig from the 14.8 psig value reported in Reference 19. The limiting time-dependent drywell, wetwell, and containment pressure responses are presented in Figure 4-1, while the limiting differential pressure response is presented in Figure 4-2. The peak drywell-to-wetwell differential pressures for operation in the MELLLA+ operating domain are bounded by those previously reported in Reference 19 for CLTP operation. [[

]]

[[

]]

Therefore, GGNS meets all M+LTR dispositions for short-term drywell temperature and pressure response.

4.1.1.1 Long-Term Suppression Pool Cooling Temperature Response

[[

]]

Therefore, no further evaluation of this topic is required.

For GGNS, 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, GGNS 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, a [[ ]] 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 LOCA containment dynamic loads include vent clearing jet loads, pool swell, CO, and chugging. These loads have been defined in the GGNS Containment Load Report (CLR). UFSAR Appendix 6A and 6D represent the GGNS CLR. The hydrodynamic loads defined for GGNS are based on the methods and assumptions recommended in Appendix 3B of General Electric Standard Safety Analysis Report (GESSAR II, Reference 20).

The results of the [[ ]] LOCA containment dynamic loads evaluation demonstrate that existing vent clearing jet loads, 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.

Therefore, GGNS meets all M+LTR dispositions for LOCA containment dynamic loads.

4.1.2.2 Subcompartment Pressurization

As described in the M+LTR (Reference 1), a [[ ]] 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 LOCA containment dynamic loads include vent clearing jet loads, pool swell, CO, and chugging.

These loads have been defined generically for Mark III plants as part of the Mark III containment program. For GGNS, the LOCA hydrodynamic loads are defined in the GGNS CLR. UFSAR Appendices 6A and 6D represent the GGNS CLR. The LOCA hydrodynamic loads defined for GGNS are based on the methods and assumptions recommended in Appendix 3B of GESSAR II (Reference 20). The specific application of these loads to GGNS is described in Section 6A.4 of the GGNS UFSAR.

Annulus Pressurization Load Evaluation

The results from the MELLLA+ dynamic analyses were compared against the results from the EPU dynamic analysis and the values used as input to the component structural analyses of record. The effect of the increase in AP loads on the total component stresses is reduced when the AP loads are combined with the safe shutdown earthquake (SSE) seismic loads by the square root of the sum of the squares in the faulted load combination. The SSE seismic loads in the faulted load combination are not affected by MELLLA+. The results of these evaluations show that all reactor vessel and internals, and associated vessel attachments and supports, remain within design basis faulted allowable limits.

The containment structures, systems, and components (SSCs) important to safety will continue to be protected from the dynamic effects resulting from pipe breaks, and the subcompartments will continue to have sufficient margins to prevent fracture of the structure due to pressure difference across the walls following implementation of the proposed MELLLA+.

Subcompartment Pressurization Evaluation

The pressure loading on the drywell head refueling bulkhead plate due to a postulated break in the RCIC head spray line in the drywell head subcompartment is not affected by MELLLA+ because the steam dome pressure is constant with CLTP and is bounded by the EPU analysis. Therefore, the drywell head refueling bulkhead plate design remains adequate.

The differential pressure loading on the biological shield wall (BSW) is not significantly affected by MELLLA+. The peak BSW asymmetric pressure load resulting from the limiting recirculation pump discharge line break at CLTP and MELLLA+ conditions remains below the BSW design differential pressure. The original BSW design used conservative asymmetric and uniform pressure loads.

The results of the [[ ]] subcompartment pressurization loads evaluation demonstrate that existing vent clearing jet loads, pool swell, CO, and chugging load definitions remain bounding for operation in the MELLLA+ operating domain. Therefore, the sub-compartment pressurization loads are not affected by the MELLLA+ operating domain expansion.

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

4.1.2.3 SRV Piping – Containment Dynamic Loads

[[

]]

[[ ]] This response is discussed in Section 1.2.3. Also, there is no change to the GGNS 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 GGNS SRV loads. No further evaluation of this topic is required.

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

4.1.2.4 SRV Containment Dynamic Loads

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

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:

[[

]]

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

4.1.3 Containment Isolation

[[

]] evaluation is required to demonstrate the adequacy of the containment isolation system.

[[

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

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

4.1.4 Generic Letter 89-10

[[

]] 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 GGNS current licensed operating domain. Therefore, a GL 89-10 MOV program evaluation is not required.

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

4.1.5 Generic Letter 89-16

Generic Letter 89-16 is not applicable to GGNS.

4.1.6 Generic Letter 95-07

[[

]] evaluation of the GL 95-07 program is required.

[[

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

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

4.1.7 Generic Letter 96-06

[[

]] evaluation of the GL 96-06 program is required.

[[

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

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

4.2 EMERGENCY CORE COOLING SYSTEMS

The ECCS includes HPCS, the LPCS system, the LPCI mode of the RHR system, and the ADS. The topics addressed in this evaluation are:

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

4.2.1 High Pressure Coolant Injection

The high pressure coolant injection system is not applicable to GGNS.

4.2.2 High Pressure Core Spray

The M+LTR describes that the HPCS system is designed to spray water into the reactor vessel over a wide range of operating pressures. In the event of a small break LOCA that does not immediately depressurize the reactor vessel, the HPCS system provides reactor vessel coolant inventory makeup to maintain reactor water level and help depressurize the reactor vessel. This system also provides spray cooling for long-term core cooling after a LOCA. In addition, the HPCS system serves as a backup to the RCIC system to provide makeup water in the event of a loss of FW flow transient. [[

]] Provided that the above criteria are met, no further evaluation of the HPCS system is required.

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 GGNS SRV setpoints as a result of MELLLA+ operating domain expansion. This topic is discussed in Section 3.1.2. [[

]] and no further evaluation of the HPCS system is required.

Therefore, GGNS meets all M+LTR dispositions for HPCS.

4.2.3 Low Pressure Core Spray

The M+LTR describes that the LPCS system is automatically initiated in the event of a LOCA. The primary purpose of the LPCS 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, no further evaluation of the LPCS system for MELLLA+ is required.

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. [[

]] and no further evaluation of the LPCS system is required.

Therefore, GGNS meets all M+LTR dispositions for LPCS.

4.2.4 Low Pressure Coolant Injection

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, no further evaluation of the LPCI system is required for MELLLA+.

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. [[

]] and no further evaluation of the LPCI system is required. In the event of a design basis Appendix R event discussed in Section 6.7, the LPCI system injects water into the reactor vessel to restore inventory and maintain core cooling following vessel depressurization.

Therefore, GGNS meets all M+LTR dispositions for LPCI.

4.2.5 Automatic Depressurization System

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 LPCS and LPCI systems to inject coolant into the reactor vessel. [[

]] Provided that the above criteria are met, no further evaluation of the ADS is required.

[[

]] and no further evaluation of the ADS is required.

Therefore, GGNS 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 an ATWS, LOCA, station blackout (SBO), or Appendix R event. [[

]] There are no physical changes in the piping or system arrangement.

There is no increase in the heat addition to the suppression pool following an ATWS, LOCA, SBO, or Appendix R event (see Sections 9.3.1, 4.1.2, 9.3.2, and 6.7, respectively). For GGNS, 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 GGNS 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.

Consistent with M+LTR SER Limitation and Condition 12.23.9, the GGNS plant-specific ATWS analysis, in Section 9.3, contains information relevant to the licensing bases in terms of NPSH and system performance for the duration of the event.

Consistent with M+LTR SER Limitation and Condition 12.23.10, the GGNS plant-specific ATWS analysis, in Section 9.3, contains information relevant to any increase in containment pressure during the event. GGNS does not credit containment accident pressure in the ECCS NPSH analyses and therefore the maximum suppression pool temperature cannot exceed the saturation temperature of water (212°F).

The suppression pool temperature following an ATWS event at MELLLA+ conditions is bound by the design limit, and therefore, does not affect the NPSH available for the ECCS pumps.

Therefore, GGNS meets all M+LTR dispositions for the ECCS NPSH.

4.3 EMERGENCY CORE COOLING SYSTEM PERFORMANCE

The GGNS 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	GGNS Result
Large Break Peak Clad Temperature	[[	Meets M+LTR Disposition
Small Break Peak Clad Temperature		Meets M+LTR Disposition
Local Cladding Oxidation		Meets M+LTR Disposition
Core-Wide Metal Water Reaction		Meets M+LTR Disposition
Coolable Geometry		Meets M+LTR Disposition
Long-Term Cooling		Meets M+LTR Disposition
Flow Mismatch Limits	]]	Meets M+LTR Disposition

These topics are described in Sections 4.3.2 through 4.3.8.

4.3.1 Break Spectrum Response and Limiting Single Failure

[[

]] The break spectrum response is determined by the ECCS network design and is

common to all BWRs. SAFER evaluation experience shows that the basic break spectrum response is not affected by changes in CF (Reference 24). [[

]]

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. [[

]]

The factors influencing the selection of the limiting single failure for GGNS 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 GGNS. [[

]]

The factors influencing the selection of the large break limiting single failure for GGNS are consistent with the discussion and disposition in the M+LTR. [[

]] The GGNS PCT, local cladding oxidation, and core-wide metal water reaction results were calculated with SAFER using the PRIME T-M performance methodology.

4.3.2 Large Break Peak Clad Temperature

The effect of MELLLA+ operating domain expansion on the GGNS 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 GGNS 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.

Effect of MELLLA+ at Rated Power

The large break PCT results are shown in Table 4-3. [[

]] The GNF2 Licensing Basis PCT is projected to be 1,730°F based on that limiting case. [[

]]

Effect of MELLLA+ at Less Than Rated Power

M+LTR SER Limitation and Condition 12.10.a requires that 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 4-3 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 (Reference 1) and Methods LTR SER Limitation and Condition 9.7 (Reference 3), 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 Bases PCT and the Upper Bound PCT. The plant-specific applications should report the limiting small and large break Licensing Basis and Upper Bound PCTs. [[

]]

Large Break Licensing Basis PCT

Reference 25 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 25 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, and Methods LTR SER Limitation and Condition 9.8, also require that the ECCS-LOCA evaluation be performed for all statepoints in the upper boundary of the expanded operating domains. [[

]]

4.3.3 Small Break Peak Clad Temperature

[[

]]

Effect of MELLLA+ at Rated Power

The small break PCT results are shown in Table 4-4. [[

]]

M+LTR SER Limitation and Condition 12.13 requires that the MELLLA+ plant-specific safety analysis report (SAR) include calculations for the limiting small break at rated power/RCF and rated power/MELLLA+ boundary, if the small break PCT at rated power/RCF is within [[ ]] of the limiting Appendix K PCT. For GGNS, the large break PCT is limiting and greater than the small break PCT by more than [[ ]]. Therefore, the small break PCT calculations were not performed for MELLLA+ flow. The small break PCT results for rated power/RCF are shown in Table 4-4.

Effect of MELLLA+ at Less Than Rated Power

M+LTR SER Limitation and Condition 12.10 requires that the M+SAR provide a justification why the transition statepoint ECCS-LOCA response bounds the 55% CF statepoint. [[

]] The PCT results summarized in Table 4-4 show that there are no unusual trends in PCT 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 Bases PCT and the Upper Bound PCT. The plant-specific applications have confirmed that the limiting small and large break with [[

]]

4.3.4 Local Cladding Oxidation

[[

]] Sections 4.3.2 and 4.3.3 that determine the effect on the PCT. [[

]] and no further evaluation of this topic is required.

For GGNS, Sections 4.3.2 and 4.3.3 show acceptable PCT results that meet the 2,200°F limit. [[

]]

and no further evaluation of this topic is required.

Therefore, GGNS 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. [[

]] and no further evaluation of this topic is required.

For GGNS, Sections 4.3.2 and 4.3.3 show acceptable PCT results that meet the 2,200°F limit. [[

]] and no further evaluation of this topic is required.

Therefore, GGNS meets all M+LTR dispositions for the core-wide metal water reaction.

4.3.6 Coolable Geometry

[[

]]

GGNS compliance with the coolable geometry acceptance criteria was [[

]]

Therefore, GGNS meets all M+LTR dispositions for coolable geometry.

4.3.7 Long-Term Cooling

[[

]]

GGNS compliance with the long-term cooling acceptance criteria was [[

]]

Therefore, GGNS 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 GGNS. [[

]]

Therefore, GGNS 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	GGNS Result
Iodine Intake	[[	]]

Except for the Liquid Radwaste Tank Failure, there is no change in the GGNS DBA source term or release rates as a result of MELLLA+ operating domain expansion; releases from the Liquid Radwaste Tank Failure increase slightly. The operator exposure from this accident was evaluated and found to be within regulatory limits with no change to the Main Control Room (MCR) atmosphere control system. Refer to Section 9.2 for a discussion of this accident.

[[

]] The Liquid Radwaste Tank Failure was evaluated and found to be within regulatory limits. No further evaluation of the MCR atmosphere control system is required.

Therefore, the MCR atmosphere control system remains acceptable for the MELLLA+ operating domain.

4.5 STANDBY GAS TREATMENT SYSTEM

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
Flow Capacity	[[	Meets M+LTR Disposition
Iodine Removal Capability	]]	Meets M+LTR Disposition

4.5.1 Flow Capacity

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.

The design flow capacity of the GGNS 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, GGNS meets all M+LTR dispositions for the SGTS flow capacity.

4.5.2 Iodine Removal Capability

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. [[

]]

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 don't change, so no change occurs in the SGTS adsorber iodine loading, decay heat rates, or iodine removal efficiency. [[ ]] No further evaluation of this topic is required.

Therefore, GGNS meets all M+LTR dispositions for the SGTS iodine removal capability.

4.6 MAIN STEAM ISOLATION VALVE LEAKAGE CONTROL SYSTEM

The MSIV leakage control system (LCS) controls the release of fission products that leak through the MSIVs following a LOCA. The leakage is directed to the SGTS. Pressure in the MSLs between the inboard and outboard isolation valves and between the outboard isolation valves and the downstream shutoff valves is maintained slightly negative with respect to atmosphere, with the outboard portion of the LCS negative pressure aided by blowers.

The conditions in the steam lines and in the containment following a LOCA are not changed significantly by MELLLA+ operating domain expansion. [[
]]

4.7 POST-LOCA COMBUSTIBLE GAS CONTROL SYSTEM

10 CFR 50.44 was revised in September 2003 and no longer defines a design basis LOCA hydrogen release and eliminates the requirements for hydrogen control systems to mitigate such releases. GGNS has adopted the revised ruling per GGNS License Amendment Number 166, issued in June 2004 (Reference 26), which eliminated the requirements for hydrogen recombiners, although GGNS has chosen to leave the recombiners in place and remain functional. 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. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
Post-LOCA Combustible Gas Control System	[[ ]]	Meets M+LTR Disposition

The M+LTR describes that the Combustible Gas Control system is designed to maintain the post-LOCA concentration of oxygen or hydrogen in the containment atmosphere below the lower flammability limit. [[

]] Provided these criteria are met, no further evaluation of the Combustible Gas Control system is required.

There is no change in core power as a result of MELLLA+ operating domain expansion. There is no change in decay heat as discussed in Section 1.2.3. There is also no change to the fuel design as a result of MELLLA+ operating domain expansion as discussed in Section 2.1.1. As discussed in the introduction to Section 4.7, GGNS does continue to have a Combustible Gas Control system which [[
]] and no further evaluation is required.

Therefore, GGNS meets all M+LTR dispositions for the control of combustible gas.

Table 4-1 Short-Term Containment Response Key Analysis Updated Input Values

Parameter	Unit	DBA LOCA Input from AOR[1]	Updated DBA LOCA Input
Initial WW Airspace Volume			
1. HWL	ft^3	136,786	149,978
2. LWL	ft^3	139,933	153,125

Note:

1. AOR = Analysis of Record

Table 4-2 GGNS Short-Term Containment Performance Results

Parameter	DBA LOCA CLTP from AOR	DBA LOCA CLTP – With Updated CLTP Model	Limit
Short-Term Peak Drywell Pressure (psig)	27.0 [1]	25.2 [3]	30.0
Short-Term Peak Containment Pressure (psig)	14.8 [1]	12.1 [3]	15.0
Short-Term Peak DW-to-Containment ΔP (psid)	24.2 [2]	23.6 [3]	30.0

Notes:

1. Most limiting value obtained from short-term MSLB analysis at CLTP conditions in Reference 19.
2. Most limiting value obtained from short-term RSLB analysis at CLTP conditions in Reference 19.
3. Most limiting value obtained from short-term MSLB analysis at CLTP conditions.

Table 4-3 Large Break PCT Sensitivity to Axial Power Shape

Power/ Flow [1]	Nominal PCT (°F) [2,3]		Appendix K PCT (°F) [2,3]	
	1st Peak	2nd Peak	1st Peak	2nd Peak
[[				
				]]

Notes:
1. Power level shown is percent of CLTP. Flow level shown is percent of RCF.
2. Results are for GNF2 DBA large break.
3. NC = Not Calculated

Table 4-4 Small Break PCT Sensitivity to Axial Power Shape

Power/ Flow [1]	Nominal PCT (°F) [2]		Appendix K PCT (°F) [2]	
	1st Peak	2nd Peak	1st Peak	2nd Peak
[[				]]

Notes:
1. Power level shown is percent of CLTP. Flow level shown is percent of RCF.
2. Results are for GNF2 limiting small break.

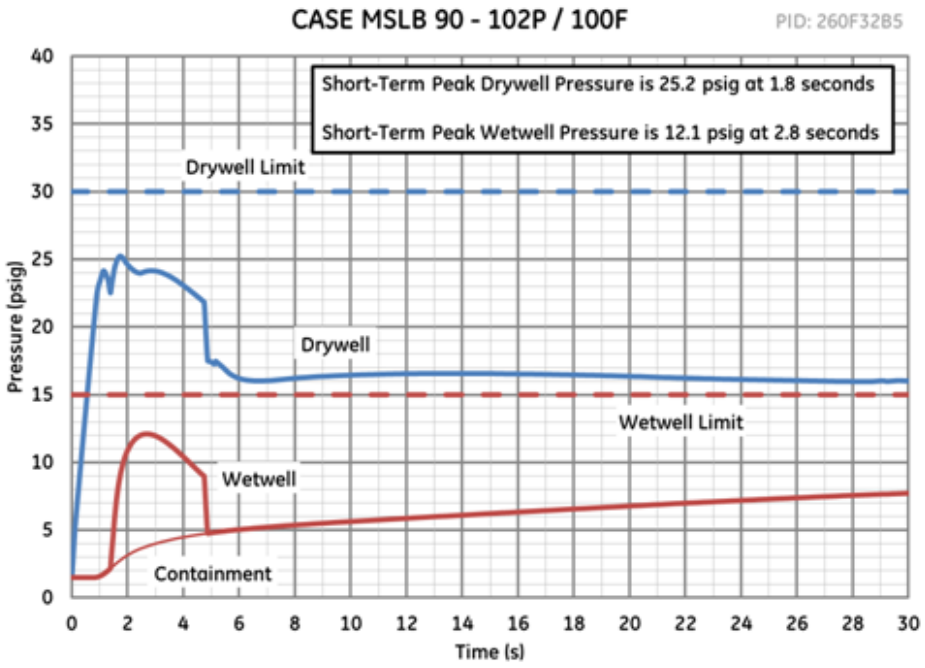

Figure 4-1 Updated Short-Term DBA LOCA MSLB Pressure Response at CLTP

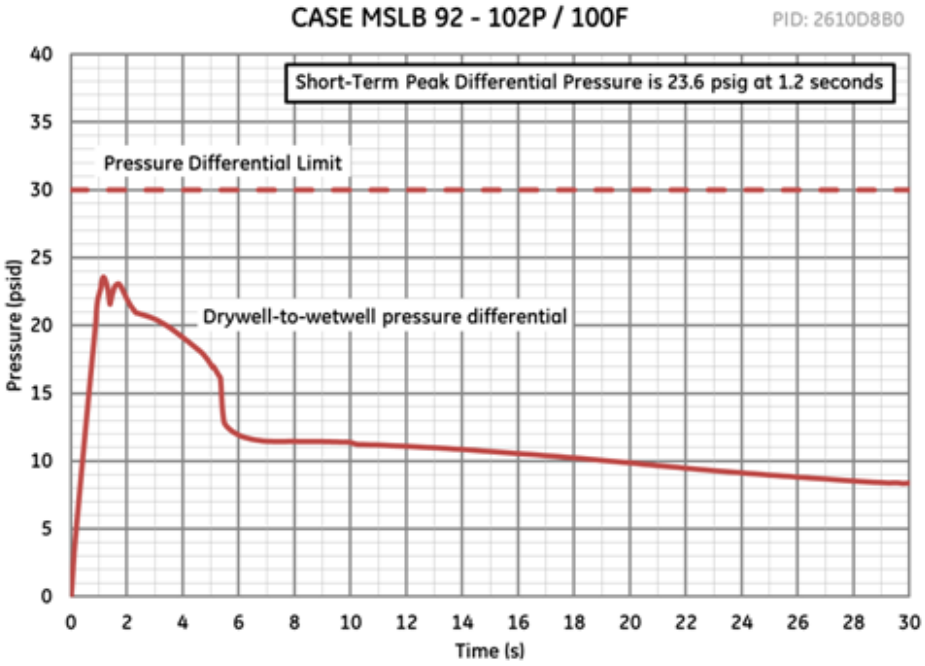

Figure 4-2 Updated Short-Term DBA LOCA MSLB Differential Pressure Response at CLTP

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 effect of the MELLLA+ operating domain expansion on the TSs is addressed in Section 11.1 and the effect on the allowable values (AVs) in Section 5.3. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
Average Power Range, Intermediate Range, and Source Range Monitors	[[	Meets M+LTR Disposition
Local Power Range Monitors	]]	Meets M+LTR Disposition
Rod Block Monitor (RBM)	[[ ]]	
Rod Control and Information System	[[	Meets M+LTR Disposition
Traversing Incore Probes (TIPs)	]]	[[ ]]

5.1.1 Average Power Range, Intermediate Range, and Source Range Monitors

The disposition of the 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. [[

]] Using normal plant surveillance procedures, the IRMs may be adjusted to ensure adequate overlap with the SRMs and APRMs. Therefore, no further evaluation of the APRMs, IRMs, or SRMs is required for MELLLA+.

There is no change in GGNS core power as a result of MELLLA+ operating domain expansion. [[

]] The APRMs, IRMs, and SRMs are installed at GGNS in accordance with the requirements established by the GEH design specifications. GGNS uses normal plant procedures to adjust the IRMs to ensure adequate overlap with the SRMs and APRMs. Therefore, no further evaluation is required.

Therefore, GGNS meets all M+LTR dispositions for the APRMs, IRMs, and SRMs.

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. [[ ]] No further evaluation of these topics is required for MELLLA+.

There is no change in the neutron flux experienced by the GGNS LPRMs resulting from the MELLLA+ operating domain expansion. The [[ ]] The LPRMs are installed at GGNS in accordance with the requirements established by the GEH design specifications. No further evaluation of these topics is required for MELLLA+.

Therefore, GGNS meets all M+LTR dispositions for the LPRMs.

5.1.3 Rod Block Monitors

Not applicable to GGNS.

5.1.4 Rod Control and Information System

The M+LTR describes that the rod control and information system (RCIS) supports the operator in making control rod movements. The RCIS provides rod position information to the operator and limits rod movements to ensure that fuel design limits are not exceeded. The rod pattern controller (RPC) and rod withdrawal limiter (RWL) are functions of the RCIS. The low power setpoint (LPSP) is the point at which rod control makes the transition between RPC and RWL control. The LPSP has upper and lower bounding ALs. The high power setpoint (HPSP) is the point where the RWL changes allowable control rod withdrawal distances. No changes in the LPSP upper and lower ALs or the HPSP are required for the MELLLA+ operating domain expansion.

The GGNS RCIS system supports the operator in making control rod movements. There are no changes to the LPSP upper and lower ALs or the HPSP as a result of MELLLA+ operating domain expansion. [[ ]]
Therefore, no further evaluation is required.

Therefore, GGNS meets all M+LTR dispositions for the RCIS system, including the LPSP and HPSP.

5.1.5 Traversing Incore Probes

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 GGNS in accordance with the requirements established by the GEH design specifications. No further evaluation of these topics 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 GGNS, 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 hot channel exit void in the bypass region exceeds [[ ]] at the 80.6% of CLTP / 55.0% of flow point as shown in Table 5-1.

Because thermal TIPs are affected by bypass voiding above the D-level LPRMs in excess of [[ ]], operator actions and procedures that mitigate the effect of bypass voiding on the thermal TIPs and the core simulator used to monitor the fuel performance is requested in M+LTR SER Limitation and Condition 12.15 for operation. These items are not required for GGNS because hot channel bypass voiding at the TIP exit elevation is not in excess of [[ ]] for the entire MELLLA+ operating domain as shown in Table 5-1.

Therefore, TIPs remain acceptable for the MELLLA+ operating domain.

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	GGNS Result
Pressure Control System	[[	Meets M+LTR Disposition
Turbine Steam Bypass System (Normal Operation)		Meets M+LTR Disposition
Turbine Steam Bypass System (Safety Analysis)		Meets M+LTR Disposition
Feedwater Control System (Normal Operation)		Meets M+LTR Disposition
Feedwater Control System (Safety Analysis)		Meets M+LTR Disposition
Leak Detection System	]]	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 GGNS, 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 GGNS pressure control system are not changed. [[

]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

Therefore, GGNS 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 GGNS, 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 GGNS 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, GGNS 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 GGNS, 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 GGNS 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, GGNS 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 GGNS, 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 GGNS FW control system under normal operation are not changed. [[

]]

Therefore, no further evaluation of this system is required as a result of MELLLA+.

Therefore, GGNS 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 GGNS, 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 GGNS 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, GGNS 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 GGNS, there are no increases in reactor operating pressure, MS flow rate, or FW flow rate. In addition, RWCU, RHR, HPCS, 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 GGNS leak detection system are not changed. [[

]] Therefore, no further evaluation of this system is required as a result of MELLLA+.

Therefore, GGNS 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 these values are derived from the AL. Standard GEH setpoint methodology (References 7 and 27) is used to generate the AVs and NTSPs from the related ALs, where applicable.

The MELLLA+ operating domain expansion results in the development of two AVs.

GEH uses the approved simplified process to determine the instrument NTSPs for MELLLA+ applications. The NRC staff has previously reviewed and accepted the simplified approach in the review of NEDC-33004P-A (Reference 7). Consistent with that approval, for GGNS the following criteria are satisfied for using the simplified process:

1. [[
   ]]
2. NRC approved GEH or plant-specific methodologies are used (Reference 27).
3. [[
   ]]

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
APRM Flow-Biased Scram	[[ ]]	Meets M+LTR Disposition
Rod Block Monitor	[[ ]]	

5.3.1 APRM Flow-Biased Scram

This function is referred to in the GGNS TSs as the APRM Flow Biased Simulated Thermal Power (STP) – High function. The APRM Flow Biased STP – High function is not associated with a limiting safety system setting and consequently does not have an AL.

The MELLLA+ APRM flow-biased scram AV line is established to [[

]]

The MELLLA+ APRM flow-biased AV expressions are:

$AV_{M+ROD\ BLOCK}$ = 0.64W + 58.8%, for the Rod Block, and

$AV_{M+SCRAM}$ = 0.64W + 61.8%, for the Scram.

SLO is not applicable to the MELLLA+ operating domain as discussed in Section 3.6.3. Therefore, the SLO AVs are unchanged.

The evaluation of APRM flow-biased scram setpoints is consistent with the methods described for [[ ]] this topic in the M+LTR. The APRM flow-biased scram setpoints for the GGNS [[ ]] are therefore acceptable.

5.3.2 Rod Block Monitor

The RBM is not applicable to GGNS.

Table 5-1 Hot Channel Bypass Voiding at Steady-State and Off-Rated Conditions

Statepoint on Power / Flow Map	Core Power (% rated)	CF (% rated)	Hot Channel Void Fraction in Bypass Region at Core Exit (ISCOR)	Hot Channel Void Fraction in Bypass Region at TIP Exit (ISCOR Nodes 22 & 23 Average)	Hot Channel Void Fraction in Bypass Region at Instrumentation D-level (ISCOR Node 21)
"E"	100.0	92.8	0.018	0.005	0.000
"D"	100.0	80.0	0.035	0.019	0.000
"C"	80.6	55.0	0.064	0.047	0.024
"B"	71.3	55.0	0.050	0.035	0.014

6.0 ELECTRICAL POWER AND AUXILIARY SYSTEMS

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

]]

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 D/Gs. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
AC Power (Normal or Degraded Voltage)	[[ ]]	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 GGNS 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, GGNS 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	GGNS Result
DC Power	[[ ]]	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, GGNS 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	GGNS Result
Fuel Pool Cooling	[[	[[ ]]
Crud Activity and Corrosion Products		Meets M+LTR Disposition
Radiation Levels		Meets M+LTR Disposition
Fuel Racks	]]	[[ ]]

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 is required for MELLLA+ operating domain expansion.

For GGNS, [[

]] is well within the capacity of the existing fuel pool cooling system.

Therefore, the FPCCS remains capable of meeting its design criteria and is acceptable for the MELLLA+ operating domain.

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 GGNS MELLLA+ operating domain expansion.

Therefore, GGNS 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 GGNS MELLLA+ operating domain expansion.

Therefore, GGNS 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.

For GGNS, as described in Section 6.3.1, there could be a small increase in the calculated bounding decay heat for a full-core offload with MELLLA+ and GNF2 EBZ fuel. The fuel pool cooling system remains capable of removing this small increase in decay heat so the SFP temperature response for a full-core offload will not be affected. [[

]] no further evaluation of the fuel racks is required for MELLLA+ operating domain expansion.

Therefore, GGNS fuel racks remain acceptable for the MELLLA+ operating domain.

6.3.4.1 Spent Fuel Storage Criticality Review

The wet fuel storage facilities (SFP and upper containment pool (UCP)) continue to rely on a neutron absorber (poison) to maintain sub criticality. GGNS has Boraflex fuel storage racks in both the SFP and UCP. These racks are monitored and evaluated to verify their acceptability. The racks are categorized into two regions based on the program results, which consider dose and boron carbide loss. Each assessment includes projections to confirm acceptable performance through the subsequent evaluation period. This program is described in GGNS UFSAR Section 9.1.2.3.

Fuel assemblies are evaluated every cycle for storage in wet fuel storage racks. The evaluation confirms the reload fuel is less reactive than the bounding fuel assembly assumed in the criticality safety analysis of record. The evaluation considers a range of void fraction histories and exposures that cover MELLLA+ operations, and any changes in fuel enrichment, gadolinia, or fuel geometry. Therefore, the criticality safety analysis of record bounds the MELLLA+ fuel that will be stored in the wet fuel storage racks.

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	GGNS Result
Water Systems	[[ ]]	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 GGNS, the MELLLA+ operating domain expansion does not affect the performance of the safety-related Service Water Systems during and following the most limiting design basis event, the LOCA, as discussed in Section 4.3. [[

]] No further evaluation of the GGNS water systems is required for MELLLA+ operating domain expansion.

Therefore, GGNS 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 none of the control rods can be inserted. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
Shutdown Margin	[[	Meets M+LTR Disposition
System Hardware		Meets M+LTR Disposition
ATWS Requirements	]]	Meets M+LTR Disposition

6.5.1 Shutdown Margin

[[

]] 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 B^{10} in the stored neutron absorber solution. In order to account for reactivity variations between cycles, the UFSAR Section 9.3.5 limit for SLCS boron concentration has sufficient margin to accommodate most core design variations.

The SLCS shutdown margin for GGNS is calculated as a part of the standard reload process. Because no new fuel product line designs are introduced for the MELLLA+ operating domain expansion, the UFSAR Section 9.3.5 limit for minimum SLCS natural boron equivalent concentration of 780 ppm does not change as a result of MELLLA+ operating domain expansion. GGNS calculates SLCS shutdown margin as a part of the core reload analysis. Therefore, no further evaluation of SLCS shutdown margin is required for MELLLA+.

Therefore, GGNS 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. [[

]]

The GGNS 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 GGNS SRV setpoints as a result of MELLLA+ operating domain expansion. Because the reactor dome pressure and SRV setpoints are unchanged for MELLLA+, the SLCS process parameters do not change. Therefore, the capability of the SLCS to perform its shutdown function is not affected by MELLLA+. As the reactor operating pressure and the SRV setpoints are unchanged, the GGNS SLCS remains capable of performing its shutdown function.

Therefore, GGNS 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 in Section 9.3.1 also demonstrates that there is no increase in the peak vessel dome pressure during the time the SLCS is in operation.

Using the GGNS plant-specific ATWS analysis, the maximum expected SLCS pump discharge pressure for the limiting ATWS event is 1,369.3 psig, based on a reactor upper plenum pressure of 1,222.3 psig and a SLCS pressure drop of 147 psi. The pressure margin for the pump discharge relief valves remains above the minimum value needed to ensure that the SLC relief

valves remain closed during system injection. The minimum reactor pressure, just prior to the time when SLCS initiates, remains low enough to ensure SLC 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. Consequently, the current GGNS SLCS pump discharge pressure will increase to ensure ATWS requirements are met.

Therefore, GGNS 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 consist mainly of heating, cooling supply, exhaust and recirculation units in the Turbine Building, Containment Building and the drywell, Auxiliary Building, Fuel Handling Building, Control Building, and the Radwaste Building. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
Heating, Ventilation, and Air Conditioning	[[ ]]	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 GGNS 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 GGNS HVAC systems are required for MELLLA+ operating domain expansion.

Therefore, GGNS 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	GGNS Result
Fire Protection	[[ ]]	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. [[

]] Provided the above criteria are met, no further evaluation of fire protection is required for MELLLA+ operating domain expansion.

For GGNS, 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: [[

]] The effect of MELLLA+ operating domain expansion on PCTs is evaluated to be acceptable in Section 4.3. The effect of MELLLA+ operating domain expansion on peak suppression pool temperatures and containment pressure response are evaluated to be acceptable in Section 4.1. [[

]], and no further evaluation of fire protection is required for MELLLA+ operating domain expansion.

Therefore, GGNS 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	GGNS Result
Other Systems	[[ ]]	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 GGNS 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, GGNS 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 rates, 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	GGNS Result
Turbine-Generator	[[ ]]	Meets M+LTR Disposition

[[ ]] 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 GGNS, there are no increases in reactor operating pressure or MS flow rates. The turbine is designed to accommodate the increased MCO predicted during operation in the MELLLA+ operating domain. 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 and in the MELLLA+ operating domain is approximately 1,523.5 MWe. Therefore, there is no change to the GGNS missile avoidance and protection analysis for the current licensed operating domain. No further evaluation of this topic is required.

Therefore, GGNS 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	GGNS Result
Condenser and Steam Jet Air Ejectors	[[ ]]	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 GGNS, 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 GGNS condenser and steam jet air ejectors, and no further evaluation is required.

Therefore, GGNS 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	GGNS Result
Turbine Steam Bypass	[[ ]]	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 GGNS, 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 GGNS turbine steam bypass system, and no further evaluation is required.

Therefore, GGNS 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	GGNS Result
Feedwater and Condensate Systems	[[ ]]	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 GGNS 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 GGNS FW and condensate systems, and no further evaluation is required.

Therefore, GGNS 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	GGNS Result
Coolant Fission and Corrosion Product Levels	[[	
Waste Volumes		]]

8.1.1 Coolant Fission and Corrosion Product Levels

A discussion of the coolant activation products as well as fission and activated corrosion product 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 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 GGNS, 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 GGNS, an evaluation was performed using a conservatively high MCO of 0.35 wt %. This value bounds the expected MCO as a result of operating in the MELLLA+ operating domain. The GGNS evaluation indicated that most of the fission and corrosion products carried over are removed in the moisture separator reheater (MSR) 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. Due to the very small 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 GGNS 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	GGNS Result
Off-Site Release Rate	[[	Meets M+LTR Disposition
Recombiner Performance	]]	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 GGNS 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. [[

]], and no further evaluation is required.

Therefore, GGNS meets all M+LTR dispositions for the off-site release rate from the offgas system.

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 GGNS-specific value for radiolytic gas flow rate is 0.044 cfm/MWt, which does not change as a result of MELLLA+ operating domain expansion. Therefore, the GGNS recombiner performance is unaffected by the MELLLA+ operating domain expansion, and no further evaluation is required.

Therefore, GGNS meets all M+LTR dispositions for the recombiner performance.

Therefore, GGNS 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	GGNS Result
Post Operational Radiation Sources for Radiological and Shielding Analysis	[[ ]]	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. GGNS core average exposure for MELLLA+ is [[

]]

No further evaluation of radiation sources in the reactor core is required.

Therefore, GGNS 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, activated corrosion products, and fission products. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
Coolant Activation Products	[[	Meets M+LTR Disposition
Fission and Activated Corrosion Products	]]	Meets M+LTR Disposition

8.4.1 Coolant Activation Products

The M+LTR describes that during reactor operation, the coolant passing through the core region becomes radioactive as a result of nuclear reactions. The coolant activation process is the dominant source resulting in the production of short-lived radionuclides of N-16 and other activation products. These coolant activation products are the primary source of radiation in the turbines during operation. 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 GGNS 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, GGNS meets all M+LTR dispositions for the coolant activation products in the reactor core.

8.4.2 Fission and Activated Corrosion Products

The reactor coolant contains fission products and activated corrosion products. For the MELLLA+ operating domain there is no change in the FW flow, steam flow, or power. However, [[

]]

For GGNS, reactor power does not change as a result of the MELLLA+ operating domain expansion. The GGNS MS and FW flow rates do not change as a result of the MELLLA+ operating domain expansion. Numerical values demonstrating that the MS and FW flow rates do not increase are provided in Table 1-2. 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 conservatively assumed to increase up to 0.35 wt % at times while operating near the minimum CF in the MELLLA+ operating domain. The distribution of the fission and activated corrosion product activity between the reactor water and steam is affected by the increased moisture content. With increased MCO, additional activity is carried over from the reactor water with the steam.

Therefore, GGNS meets all M+LTR dispositions for the fission and activated corrosion products.

8.5 RADIATION LEVELS

Radiation levels during operation are derived from coolant sources. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
Normal Operational Radiation Levels	[[	Meets M+LTR Disposition
Post-Shutdown Radiation Levels		Meets M+LTR Disposition
Post-Accident Radiation Levels	]]	Meets M+LTR Disposition

8.5.1 Normal Operational Radiation Levels

The M+LTR describes that plant radiation levels for normal 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 GGNS, reactor power does not change as a result of the MELLLA+ operating domain expansion. The nominal GGNS MS flow rate does not change as a result of the MELLLA+ operating domain expansion. Numerical values demonstrating that the nominal MS flow rate does not increase are provided in Table 1-2. The implementation of MELLLA+ may result in a greater MCO in reactor steam, with a consequential effect on selected plant radiation sources. Because there is no change in power and essentially no change in steam flow rate for the MELLLA+ expanded operating domain, the change in radionuclide concentrations in the coolant and in the BOP is mainly due to an increase in the MCO, which affects the equilibrium concentrations in the coolant and steam. As discussed in Section 8.4, the moisture content of the MS leaving the vessel may increase at certain times while operating in the MELLLA+ operating domain. For GGNS, an evaluation was performed using a conservatively high MCO of 0.35 wt %. This value bounds the expected MCO as a result of operating in the MELLLA+ operating domain. This bounding increase in moisture content would increase the radiation source in the condensate demineralizers and in the FW and liquid radwaste systems by approximately 30%. The activity inventory in the condensate demineralizers is small compared to the RWCU demineralizers, thus the overall effect of the radiation source in the solid waste system will be small. The overall radiological effect of the increased moisture content is a function of the plant water radiochemistry and the levels of activated corrosion products maintained. GGNS had operated with hydrogen water chemistry (HWC) since 1998 to control stress corrosion cracking. Noble metal chemical addition (NMCA) was implemented in November 2010, resulting in a significant reduction in the hydrogen flow rate required to be injected into the FW and a corresponding reduction of Nitrogen-16 (N-16) in the steam. With the implementation of NMCA, the N-16 activity concentration in the steam is bounded by the N-16 source used in the plant shielding design.

Thus, except as noted below, the normal operation radiation levels in the plant are expected to remain unchanged. Radiation levels are expected to increase adjacent to the condensate demineralizers, and components in the FW, liquid and solid waste systems up to a maximum of approximately 30%. Because of the increase in the MCO, and due to the potential for steam leakage, the radiation levels adjacent to the Turbine Building ventilation charcoal and HEPA filters may also be increased. However, there is sufficient margin to ensure that shielding is adequate. The existing normal operation radiation zoning will not be affected as a result of the estimated increase in radiation levels associated with MELLLA+ operation. GGNS maintains

appropriate health physics and ALARA controls to address any increase in the normal operation levels.

8.5.2 Post-Shutdown Radiation Levels

The M+LTR describes that plant radiation levels for 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 GGNS, post-operational or shutdown radiation levels depend on the decay of the fission and corrosion products in plant radioactive systems. The deposited corrosion material depends primarily on the reactor coolant system (RCS) water chemistry and the cobalt impurity in the RCS. The RCS water chemistry, which is controlled by plant procedures, will remain unchanged following MELLLA+ operation. Consequently, and as discussed in Section 8.5.1, shutdown dose rates for GGNS will reflect slight increases in areas adjacent to the condensate demineralizers, the FW, liquid and solid waste system components, and near the Turbine Building ventilation filters, but will otherwise remain unaffected by operation in the MELLLA+ domain. GGNS maintains appropriate health physics and ALARA controls to address any increase 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	GGNS Result
Plant Gaseous Emissions	[[	[[ ]]
Gamma Shine from the Turbine	]]	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 GGNS 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, MCO in the MS can increase; therefore, an evaluation was performed for GGNS using a conservatively high MCO of 0.35 wt %. The increase in MCO results in an increase in potential iodines and particulates in airborne releases and their contribution to offsite doses by approximately 20%. However, 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 GGNS 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. The increased moisture content in the reactor steam for MELLLA+ operation will not significantly 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, GGNS 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 GGNS 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 4 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	GGNS Result
Fuel Thermal Margins Events	[[	Meets M+LTR Disposition
Power and Flow Dependent Limits		Meets M+LTR Disposition
Non-Limiting Events	]]	Meets M+LTR Disposition

9.1.1 Fuel Thermal Margin Events

[[

]] The limiting thermal margin events defined in Reference 4 include:

- Generator Load Rejection Without Bypass (LRNBP) or Turbine Trip Without Bypass (TTNBP)
- Feedwater Controller Failure (Maximum Demand) (FWCF)
- Pressure Regulator Failure Downscale (PRFDS)
- Loss of Feedwater Heater (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 4), the fuel loading error event would be analyzed as an AOO. GGNS meets the requirements of Reference 4. Therefore, the fuel loading error event is categorized as an Infrequent Incident and is not analyzed as an AOO. [[

]]

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, [[

]] In accordance with Methods LTR SER Limitation and Condition 9.19, an additional 0.01 will be added to the OLMCPR for conditions above the stretch power uprate power level or above the maximum extended load line limit analysis (MELLLA) boundary (MELLLA+ conditions), until such time that GEH 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.

In accordance with M+LTR SER Limitation and Condition 12.16, an RWE analysis was performed to confirm the adequacy of the generic RWL OLMCPR. The RWE was simulated using the three-dimensional core simulator PANACEA. The analysis was performed with a representative equilibrium core at the MELLLA+ 100% power, 80% CF statepoint. The results of this RWE analysis confirmed the validity of the generic RWL OLMCPR. The RWE results also meet the 1% cladding circumferential plastic strain acceptance criterion.

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 at least 10% margin to the fuel centerline melt and the 1% cladding circumferential plastic strain acceptance criteria. The minimum calculated margin to the fuel centerline melt criterion was 55.0%. The minimum calculated margin to the cladding strain criterion was 56.0%. The GGNS T-M analyses were performed with the PRIME methodology. Fuel rod T-M performance will be evaluated as part of the RLAs performed for the cycle-specific core. Documentation of acceptable fuel rod T-M response will be included in the SRLR.

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 factor ($MCPR_f$) and the LHGR flow factor ($LHGRFAC_f$) are primarily based upon an evaluation of the slow recirculation flow increase event. [[

]] Table 9-2 summarizes the results of the slow recirculation flow increase analysis and compares them with the MCPR flow limit. The reference limits bound the slow recirculation flow results performed for the MELLLA+ operating domain. [[

]]

Similarly, the thermal limits are modified by a MCPR power factor ($MCPR_p$) when the plant is operating at less than 100% power. [[

]]

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 4 limiting AOO events and key non-limiting events. Provided these evaluations are applicable to GGNS, no further evaluations are required for non-limiting events. The results of the M+LTR assessment are presented in Table 9-3.

[[

]]

Therefore, GGNS 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	GGNS Result
Control Rod Drop Accident (CRDA)	[[	Meets M+LTR Disposition
Main Steam Line Break Accident (MSLBA) (Outside Containment)		Meets M+LTR Disposition
Loss-of-Coolant Accident (Inside Containment)		Meets M+LTR Disposition
Liquid Radwaste Tank Failure		Meets M+LTR Disposition
Fuel Handling Accident (FHA)		Meets M+LTR Disposition
Offgas System Failure	]]	Meets M+LTR Disposition

9.2.1.1 Control Rod Drop Accident

The M+LTR describes that the radiological consequences of a CRDA 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 GGNS, the postulated CRDA event involves a sudden control rod drop from the core, resulting in the failure of 16 fuel bundles and the release of noble gases, halogens, and alkali metals in the melted/failed fuel into the RCS. The release path is via the condenser.

The CRDA release is dependent on the source terms and maximum peaking factor. Operation in the MELLLA+ operating domain does not affect the CRDA source terms and the peaking factor remains bounding. There are no changes to removal, transport, or dose conversion assumptions for this event. Therefore, the GGNS 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, GGNS meets all M+LTR dispositions for the CRDA.

9.2.1.2 Main Steam Line Break Accident (Outside Containment)

The M+LTR describes that the radiological consequences of a MSLBA (outside containment) 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 event. [[

]] then no further review is required.

For GGNS, the source terms for the MSLBA are dependent on the relative amount of water and steam released. There are no changes to removal, transport, or dose conversion assumptions for this event. 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 approximately 45 times that of steam. The increase in steam and decrease in water results in lower releases such that the current analysis is bounding. Therefore, the GGNS MSLBA evaluation is not affected by the MELLLA+ operating domain expansion and no further evaluation is required.

Therefore, GGNS meets all M+LTR dispositions for the MSLBA.

9.2.1.3 Loss-of-Coolant Accident (Inside Containment)

The M+LTR describes that the radiological consequences of a LOCA (inside containment) 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 15.6.5.5.2 continues to be appropriate.

[[

]] Therefore, the GGNS LOCA evaluation is not affected by the MELLLA+ operating domain expansion and no further evaluation is required.

Therefore, GGNS meets all M+LTR dispositions for the LOCA.

9.2.1.4 Liquid Radwaste Tank Failure

The M+LTR discussion of the Liquid Radwaste Tank Failure describes, in Table 9-4 of the M+LTR, [[

]]

For GGNS, the limiting radwaste system failure for airborne releases is the failure of the equipment drain collector tank (EDCT).

The increase in MCO, conservatively evaluated to increase to 0.35 wt %, is expected to increase the fission/corrosion product concentrations in the reactor steam from 0.1% to 0.35 wt % and to increase the iodine concentrations in the reactor steam from 2% to 2.245%. The activity concentrations in the condensate system and in the related waste streams will also increase proportionally.

The conservatively evaluated increase in MCO to 0.35 wt % is also expected to increase the composite iodine concentrations in the EDCT by 3%. Thus, MELLLA+ operation is expected to result in a 3% increase in the dose consequences. As shown in Table 9-4, the MELLLA+ accident doses for the liquid radwaste tank failure were determined to be within the applicable regulatory limits.

The radiological consequence due to the liquid release pathway of a liquid radwaste tank failure is addressed in Section 15.7.3 of the GGNS UFSAR. The limiting event for this pathway is the RWCU system phase separator decay tank.

The radionuclide inventory in the radwaste tanks, adjusted for higher MCO, is bounded by the inventory used in the liquid radwaste tank failure analysis currently presented in the UFSAR. Therefore, the dose calculation described in the UFSAR for the liquid release pathway of a liquid radwaste tank failure remains bounding.

Therefore, GGNS meets all M+LTR dispositions for the liquid radwaste tank failure.

9.2.1.5 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 GGNS 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, GGNS meets all M+LTR dispositions for the FHA.

9.2.1.6 Offgas System Failure

The M+LTR describes that the radiological consequences of an Offgas System Failure are evaluated to determine off-site doses as well as control room operator doses. DBA calculations are generally based upon core inventory sources or TS source terms, [[

]]

Table 9-4 of the M+LTR provides a detailed evaluation of the Offgas System Failure event. [[

]] then no further review is required.

[[

]]

Therefore the GGNS offgas system failure evaluation is not affected by the MELLLA+ operating domain expansion and no further evaluation is required.

Therefore, GGNS meets all M+LTR dispositions for the offgas system failure.

9.2.1.7 Additional Review Areas

As discussed in the UFSAR, a temporary departure from nucleate boiling and the subsequent assumption of fuel failure may occur for infrequent events. This fuel failure is currently assumed for the pressure controller failure (conservatively estimated to be core-wide), misplaced fuel

bundle (five bundles - the misplaced bundle and the four surrounding bundles), and the recirculation pump seizure event (conservatively estimated to be core-wide). The source terms for the above accidents are based on the gap inventory and peaking factors as applicable. There are no changes to removal, transport, or dose conversion assumptions for these events. As a result of the MELLLA+ operating domain expansion, the rod inventories are not changed and the peaking factor remains bounding. Therefore, the GGNS evaluation for the MELLLA+ operating domain is bounded by the analyses for the current licensed operating domain, and no further evaluation is required.

The MSIV closure event is analyzed based on reactor coolant and steam releases assuming maximum iodine spiking permitted by the plant TSs and is unaffected by MELLLA+ operating domain expansion. There are no changes to removal, transport, or dose conversion assumptions for this event. Therefore the GGNS MSIV closure evaluation is not affected by the MELLLA+ operating domain expansion and no further evaluation is required.

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	GGNS Result
Instrument Line Break Accident (ILBA)	[[	Meets M+LTR Disposition
Large Line Break (Feedwater or Reactor Water Cleanup)		Meets M+LTR Disposition
Cask Drop	]]	Meets M+LTR Disposition

9.2.2.1 Instrument Line Break Accident

This topic is not applicable to GGNS because there are no small lines such as instrument lines or sample lines connected to the RCPB which penetrate the primary containment; therefore, the ILBA is not applicable to GGNS.

9.2.2.2 Large Line Break (Feedwater or Reactor Water Cleanup)

In accordance with the GGNS licensing basis, the dose consequences of a Large Line Break are enveloped by the MSL break. Coolant concentrations are based on TS levels, which are unaffected by MELLLA+. Mass flows are based upon TS valve closure time and flow rates, both of which are unaffected by MELLLA+. Therefore, the dose consequences of a large line break are not changed under MELLLA+.

9.2.2.3 Cask Drop

This topic is not applicable to GGNS because the spent fuel storage cask crane is prohibited from travelling over the SFP, and the spent fuel storage cask crane has been designed to be

single-failure proof; therefore, the Cask Drop is not an evaluated accident per the GGNS UFSAR.

9.3 SPECIAL EVENTS

This section considers three special events: ATWS, SBO, and ATWS with Core Instability. 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	GGNS Result
ATWS (Overpressure)	[[	Meets M+LTR Disposition
ATWS (Suppression Pool Temperature and Containment Pressure)		Meets M+LTR Disposition
ATWS (Peak Cladding Temperature and Oxidation)		Meets M+LTR Disposition
Station Blackout		Meets M+LTR Disposition
ATWS with Core Instability	]]	[[ ]]

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. GGNS 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.

In accordance with M+LTR SER Limitations and Conditions 12.18.e and 12.18.f, the key input parameters to the plant-specific ATWS analyses are provided in Table 9-5. For key input parameters that are important to simulating the ATWS analysis and are specified in the TSs

(e.g., SLCS parameters, ATWS-RPT), the calculation assumptions are consistent with the allowed GGNS TS values and plant configuration. Although conservative inputs consistent with the GGNS TS values were used, in some instances, nominal input parameters are used consistent with the approach in Reference 28. Reference 28 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 GGNS, the plant automatic settings, which include the ATWS-RPT, low steam line pressure isolation, and SRV actuation, are modeled based on the input parameters in Table 9-5. 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.

9.3.1.1 Anticipated Transients Without Scram (Licensing Basis)

The plant-specific ATWS analysis is performed using the approved ODYN methodology documented in Section 5.3.4 of ELTR1 (Reference 5). The ATWS analysis using the ODYN methodology is the plant's licensing basis for this application.

[[

]]

A licensing basis ODYN ATWS analysis was performed to demonstrate the effect of MELLLA+ on the ATWS acceptance criteria. [[

]]

The results of the licensing basis ODYN ATWS analysis are provided in Tables 9-6 and 9-7. The tabulated peak value and time trace for reactor power, reactor dome pressure, PCT, and suppression pool temperature is provided in Table 9-7 for the limiting event in the ODYN ATWS analysis.

[[

]] 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, [[

]] GGNS 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.

[[

]] 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. [[

]] Consistent with M+SER Limitation and Condition 12.18.b, a best-estimate TRACG analysis was performed in Section 9.3.1.2 to confirm the ODYN calculations.

[[

]]

A coolable core geometry is ensured 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 ODYN ATWS analysis meet the ATWS acceptance criteria. Therefore, the GGNS 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 determined from GGNS EOPs. The HCTL is a function of operating reactor pressure and suppression pool water level. For normal initial suppression pool water level, the HCTL is approximately 151.4°F near the SRV opening pressure. This pool temperature was applied as a conservative value for initiating operator action to start depressurization. Figure 9-3 shows the HCTL at various reactor pressures and suppression pool levels.

GGNS EOPs require depressurization during an ATWS event when the suppression pool temperature reaches the HCTL. As a result, M+LTR SER Limitation and Condition 12.18.a requires that a best-estimate TRACG ATWS analysis must be performed for GGNS because hot shutdown was not achieved prior to reaching the HCTL based on the licensing basis ODYN calculation.

The best-estimate TRACG ATWS analysis was performed to demonstrate that the ATWS acceptance criteria are met for an ATWS event initiated in the MELLLA+ operating domain with depressurization explicitly modeled. The best-estimate TRACG ATWS analysis accounts for plant parameters and GGNS EOP actions, including water level control strategy and emergency depressurization. The best-estimate TRACG ATWS analysis modeled in-channel water rod flow in accordance with M+LTR SER Limitation and Condition 12.24.1. The calculation was performed using the latest NRC-approved neutronic and thermal-hydraulic codes TGBLA06/PANAC11 and TRACG04 (Reference 29).

[[

]]

For the best-estimate ATWS TRACG analysis, [[

]]

The results of the best-estimate TRACG ATWS analysis are provided in Tables 9-8 and 9-9. The tabulated peak value and time trace for reactor power, reactor dome pressure, PCT, and suppression pool temperature is provided in Table 9-9 for the best-estimate TRACG ATWS MSIVC at EOC with a HCTL of 139°F and water level strategy at TAF. An HCTL of 139°F corresponds to the HCTL at a pressure near the SRV lift pressure and normal suppression pool water level minus 12.4°F to ensure depressurization.

Figures 9-8 and 9-9 show the plant response following a MSIVC event at EOC with [[

]]

The results of the best-estimate TRACG ATWS analysis meet the ATWS acceptance criteria. Therefore, the GGNS response to an ATWS event initiated in the MELLLA+ operating domain is acceptable when accounting for plant parameters and GGNS EOP actions, including water level control strategy and emergency depressurization.

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 GGNS, there are no increases in reactor operating pressure as result of MELLLA+ operating domain expansion. For GGNS, 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, GGNS 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, which is presented in NEDO-32047-A (Reference 30). The companion report, NEDO-32164 (Reference 31) 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 the ATWS criteria listed below were 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 ATWS instability calculation be performed to demonstrate that GGNS 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 ATWS instability calculation: (1) was based on the limiting exposure condition (BOC, peak reactivity, and EOC exposures were analyzed); (2) modeled the plant-specific configuration important to the ATWS instability

response; and (3) used the limiting mode nodalization scheme (regional and core-wide modes were analyzed). M+LTR SER Limitation and Condition 12.23.5 requires that the power density be less than 52.5 MWt/Mlbm/hr at rated power. For GGNS, the plant-specific maximum power-to-flow ratio at rated power and minimum CF is 49.0 MWt/Mlbm/hr, which 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 ATWS instability calculation was performed using the latest NRC-approved neutronic and thermal-hydraulic codes TGBLA06/PANAC11 and TRACG04 (Reference 29).

[[

]]

The results of the plant-specific TRACG ATWS instability calculation are provided in Table 9-10. Figures 9-12 and 9-13 show the mitigating effect of decreasing water level.

[[

]]

The results of the plant-specific TRACG ATWS instability calculation meet the ATWS acceptance criteria. Therefore, the GGNS response to an ATWS with core instability event initiated in the MELLLA+ operating domain is acceptable. GGNS 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

Event	Parameter	Unit	CLTP ICF (105%) RCF	CLTP 80% RCF
LRNBP	Peak Neutron Flux	% Initial	162.3	123.9
	Peak Heat Flux	% Initial	102.8	100.0
	Peak Vessel Pressure	psig	1,253.7	1,250.4
	ΔCPR Option B	N/A	0.236	0.252
TTNBP	Peak Neutron Flux	% Initial	147.1	112.4
	Peak Heat Flux	% Initial	100.9	100.1
	Peak Vessel Pressure	psig	1,251.4	1,247.8
	ΔCPR Option B	N/A	0.223	0.237
FWCF	Peak Neutron Flux	% Initial	119.3	105.5
	Peak Heat Flux	% Initial	104.0	103.4
	Peak Vessel Pressure	psig	1,242.8	1,238.1
	ΔCPR Option B	N/A	0.202	0.192
All Pressurization Transients Including EOOS	Minimum Margin to the TOP Limit	% Margin to the Limit	55.0	--- (ICF More Limiting)
All Pressurization Transients Including EOOS	Minimum Margin to the MOP Limit	% Margin to the Limit	56.0	--- (ICF More Limiting)
LFWH	ΔCPR	N/A	0.16 @ 92.8% RCF	0.13

Table 9-2 Comparison Slow Recirculation Flow Increase Results and MCPR Flow Limit

Flow (%)	Slow Recirculation Flow Increase MCPR	MCPR Flow Limit
110.0	1.19	1.32
100.0	1.24	1.32
80.0	1.31	1.34
70.0	1.28	1.36
60.0	1.28	1.38
55.0	1.27	1.39

Table 9-3 Non-Limiting Events Assessment Results

Event	Discussion
Fuel Thermal Margin Events	
Slow Recirculation Increase (K_f, $MCPR_f$) (Reference 4 event – bounds recirculation event AOOs)	[[
Fast Recirculation Increase	
Generator Load Rejection	
Main Steam Isolation Valve Closure (MSIVC), All Valves	
MSIVC, One Valve	]]
Transient Overpressure Events	
Turbine Trip, Bypass Failure, with Scram on High Flux (Failure of Direct Scram)	[[ ]]

Table 9-4 Radioactive Liquid Waste System Leak or Failure Radiological Consequences

	EAB (REM)	
Parameter	**Thyroid**	**Whole Body**
Calculated Dose CLTP	2.90E-01	5.56E-03
Calculated Dose MELLLA+	2.99E-01	5.74E-03
Dose Limit	30 (10 CFR 100)	2.5 (10 CFR 100)

Table 9-5 Key Input Parameters for ATWS Analyses

Parameter	CLTP	MELLLA+	Basis
Reactor Power (MWt)	4,408	4,408	[[
Analyzed Power (MWt)	4,408	4,408	
Analyzed CF (Mlbm/hr / % Rated)	104.4 / 92.8	90.0 / 80.0	
Reactor Dome Pressure (psia)	1,040	1,040	
MSIV Closure Time (sec)	4.0	4.0	
High Pressure ATWS-RPT Setpoint (psig)	1,139	1,139	
Low Pressure Isolation Setpoint (psig)	837	837	
RCIC Flow Rate (gpm)	800	800	
HPCS Flow Rate (gpm)	1,485	1,485	
Number of SRVs / SRVs Out-of-Service (OOS)	20 / 5	20 / 5	
Each SRV Capacity at 1,205 psig (Mlbm/hr)	0.925	0.925	
SRV Analytical Opening Setpoints (psig)	1,163 – 1,183	1,163 – 1,246	
SLCS Injection Location	HPCS	HPCS	
SLCS Injection Rate (gpm)	82.4	82.4	
Boron-10 Enrichment x Sodium Pentaborate Concentration (%)	269	269	
SLCS Liquid Transport Time (sec)	125	125	
SLCS Initiation Delay (sec)	120	300	
Initial Suppression Pool Liquid Volume (ft^3)	135,291	133,750	
Initial Suppression Pool Temperature (°F)	95	95	
Number of RHR SPC Loops	2	2	
RHR Heat Exchanger Effectiveness Per Loop (BTU/sec-°F)	486	486	
RHR Heat Exchanger Effectiveness Per Loop during LOOP Event (BTU/sec-°F)	486	486	
RHR Service Water Temperature (°F)	90	90	]]

Table 9-6 Key Results for Licensing Basis ODYN ATWS Analysis

ATWS Acceptance Criteria	CLTP	MELLLA+	Design Limit
Peak Vessel Pressure (psig)	[[		1,500
Peak Suppression Pool Temperature (°F)			210
Peak Containment Pressure (psig)			15
PCT (°F)			2,200
Peak Local Cladding Oxidation (%) [2]		]]	17

Notes:
1. [[ ]]
2. [[

]]

Table 9-7 ODYN ATWS Analysis Limiting Event Results

Parameter	Limiting Event	Peak Value	Time Trace
Reactor Power (Neutron Flux)	PRFO at EOC	141% Rated	Figure 9-4
Reactor Dome Pressure	MSIVC at BOC	1,493 psia	Figure 9-5
Suppression Pool Temperature	MSIVC at EOC	197.5°F	Figure 9-6
PCT	PRFO at EOC	1,507°F	Figure 9-7

Table 9-8 Key Results for Best-Estimate TRACG ATWS Analysis from MELLLA+ Operating Domain

ATWS Acceptance Criteria	[[		Design Limit
Peak Vessel Pressure (psig)			1,500
Peak Suppression Pool Temperature (°F)			210
Peak Containment Pressure (psig)			15.0
PCT (°F)			2,200
Peak Local Cladding Oxidation (%)		]]	17

Notes:

1. [[

   ]]

2. [[

   ]]

Table 9-9 TRACG ATWS Analysis Limiting Event Results

Parameter	Limiting Event	Peak Value	Time Trace
Reactor Power	MSIVC at EOC	245% Rated	Figures 9-8 and 9-9
Reactor Vessel Pressure	MSIVC at BOC	1,300 psig	Figures 9-10 and 9-11
Suppression Pool Temperature	MSIVC at BOC	163.2°F	Figures 9-10 and 9-11
PCT	MSIVC at EOC	< 2,200°F	Figures 9-8 and 9-9

Table 9-10 Key Results for ATWS with Core Instability Analysis from MELLLA+ Operating Domain

ATWS Acceptance Criteria	MELLLA+	Design Limit
Peak Vessel Pressure (psig)	[[	1,500
Peak Suppression Pool Temperature (°F) [1]		210
Peak Containment Pressure (psig) [1]		15.0
PCT (°F)		2,200
Peak Local Cladding Oxidation (%) [2]	]]	17

Notes:

1. Suppression pool temperature and containment pressure for ATWS with core instability are less than for MSIVC (Table 9-8) and are not calculated.
2. [[

]]

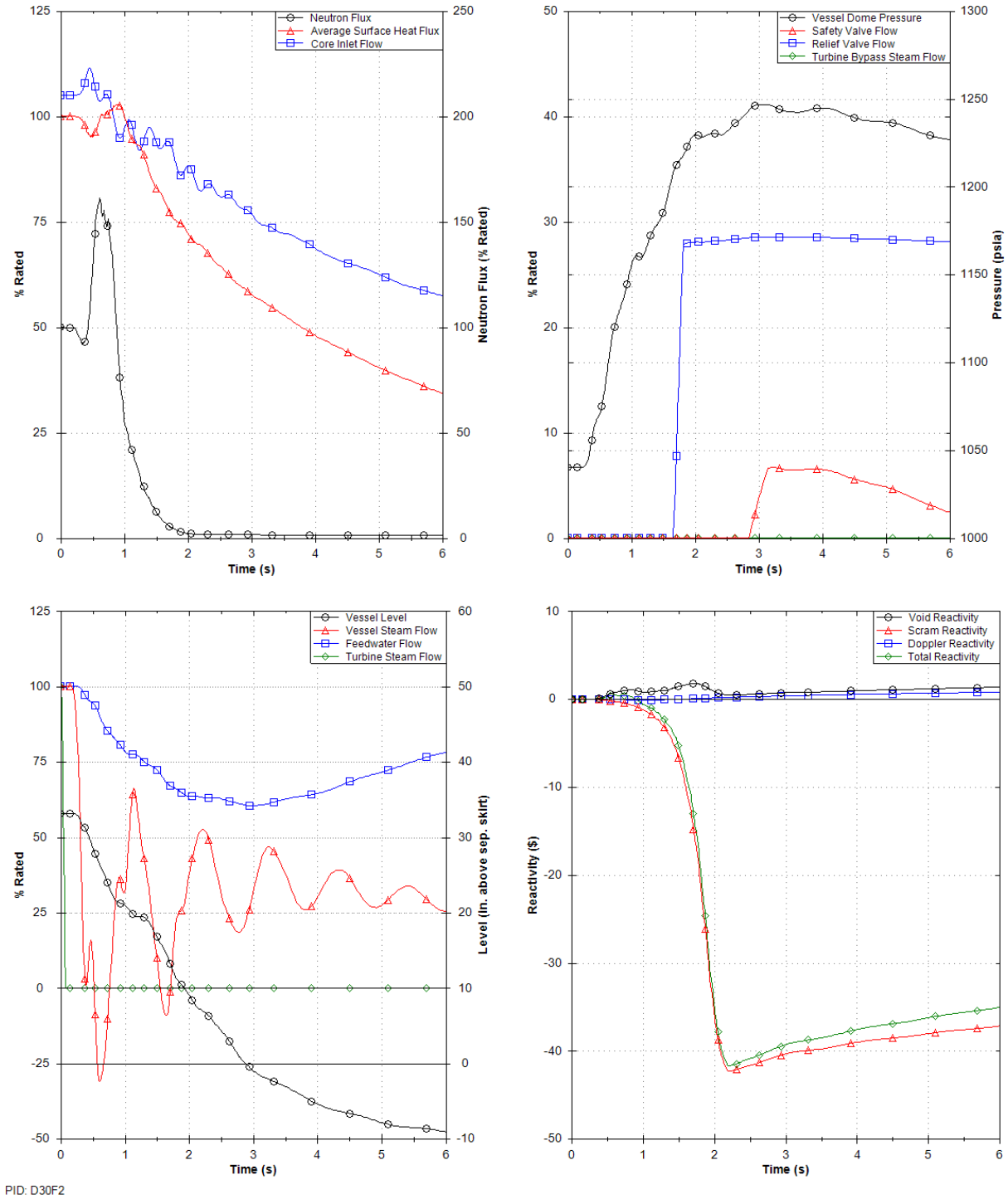

Figure 9-1 LRNBP Current Licensed Operating Domain with 105% CF

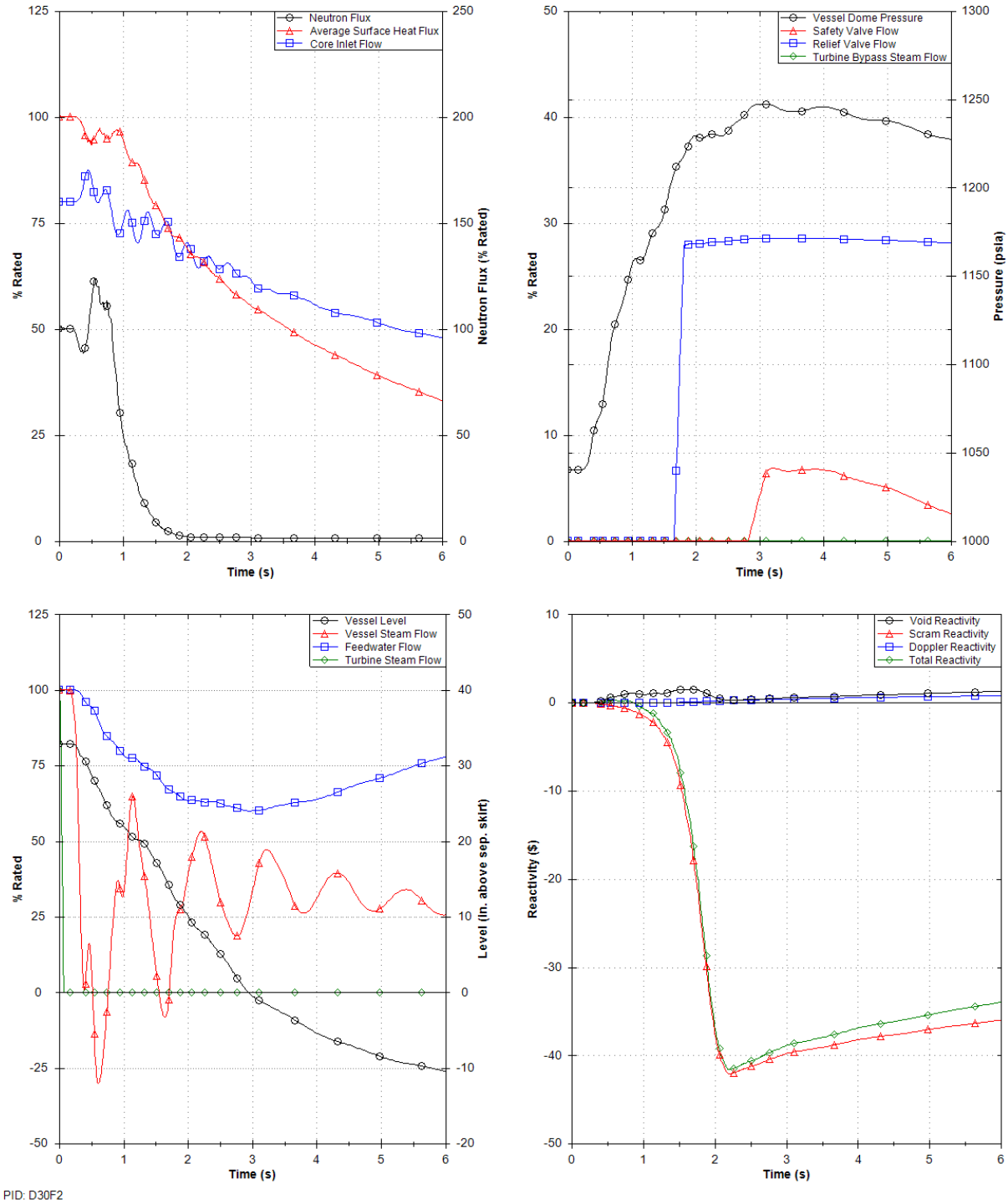

Figure 9-2 LRNBP MELLLA+ Operating Domain with 80% CF

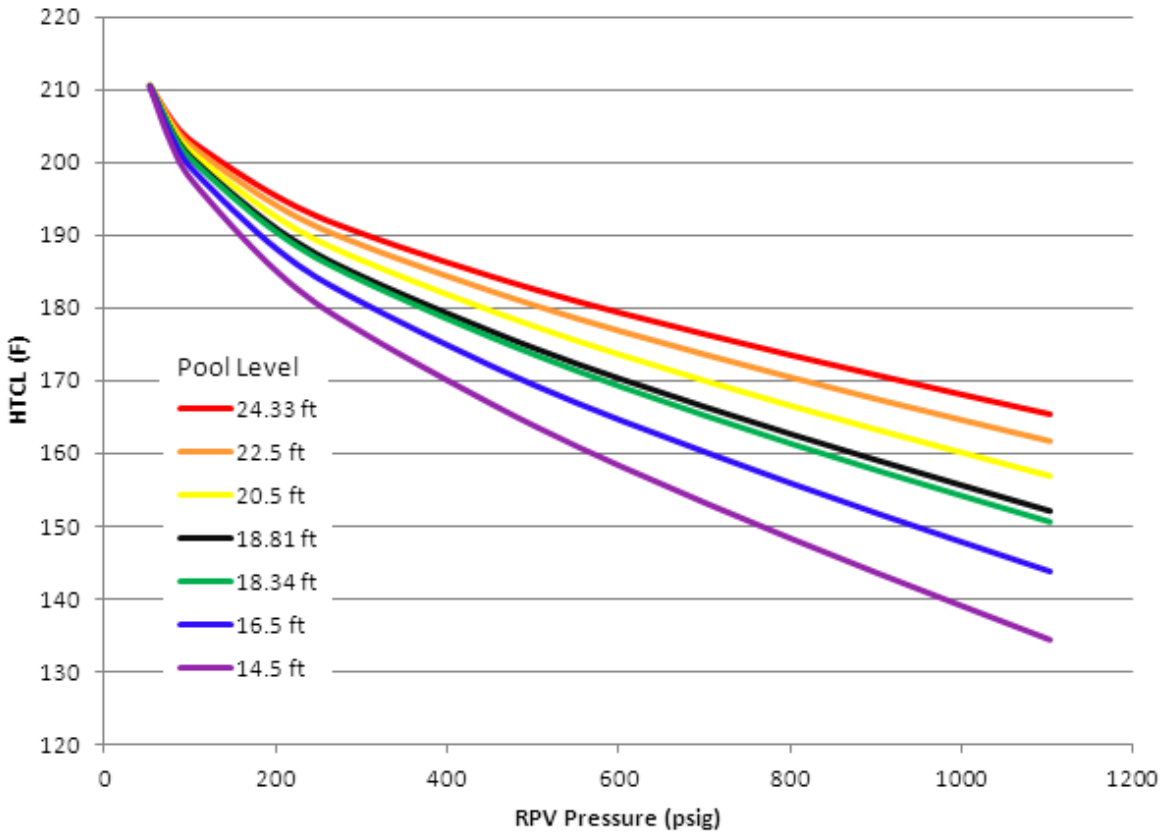

Figure 9-3 HCTL as a Function of Reactor Pressure

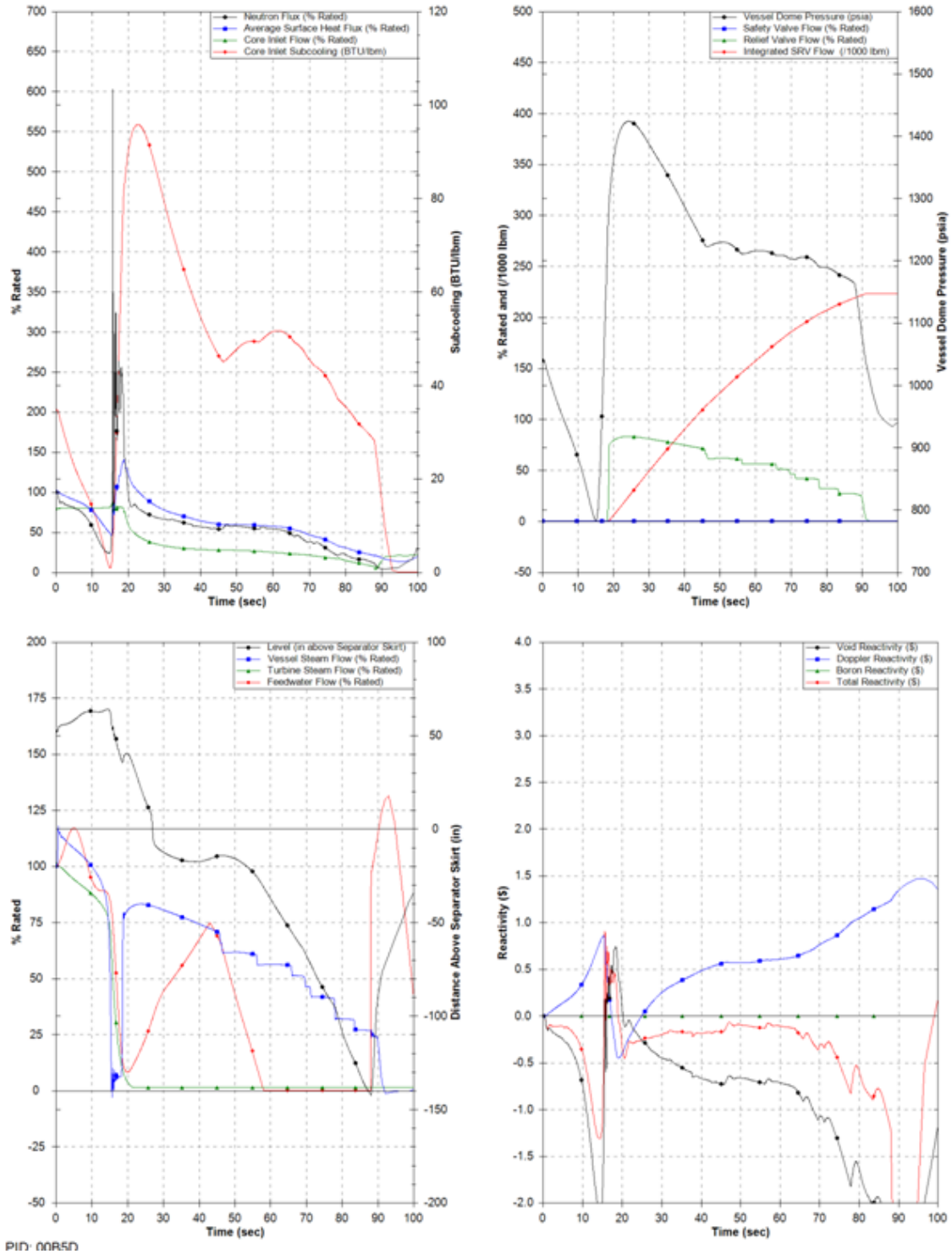

Figure 9-4 ODYN ATWS Analysis – PRFO at EOC Reactor Power (Neutron Flux)

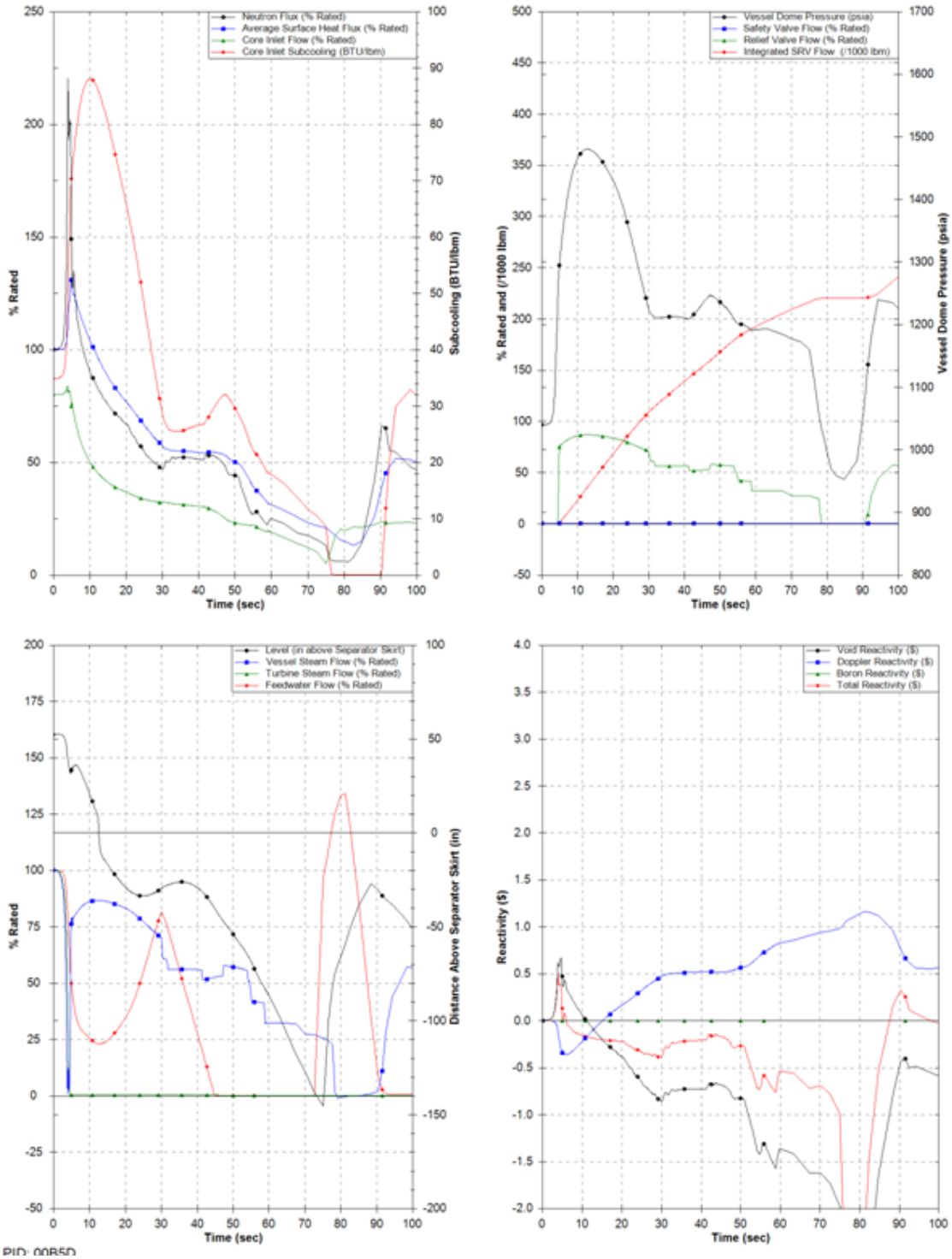

Figure 9-5 ODYN ATWS Analysis – MSIVC at BOC Reactor Dome Pressure

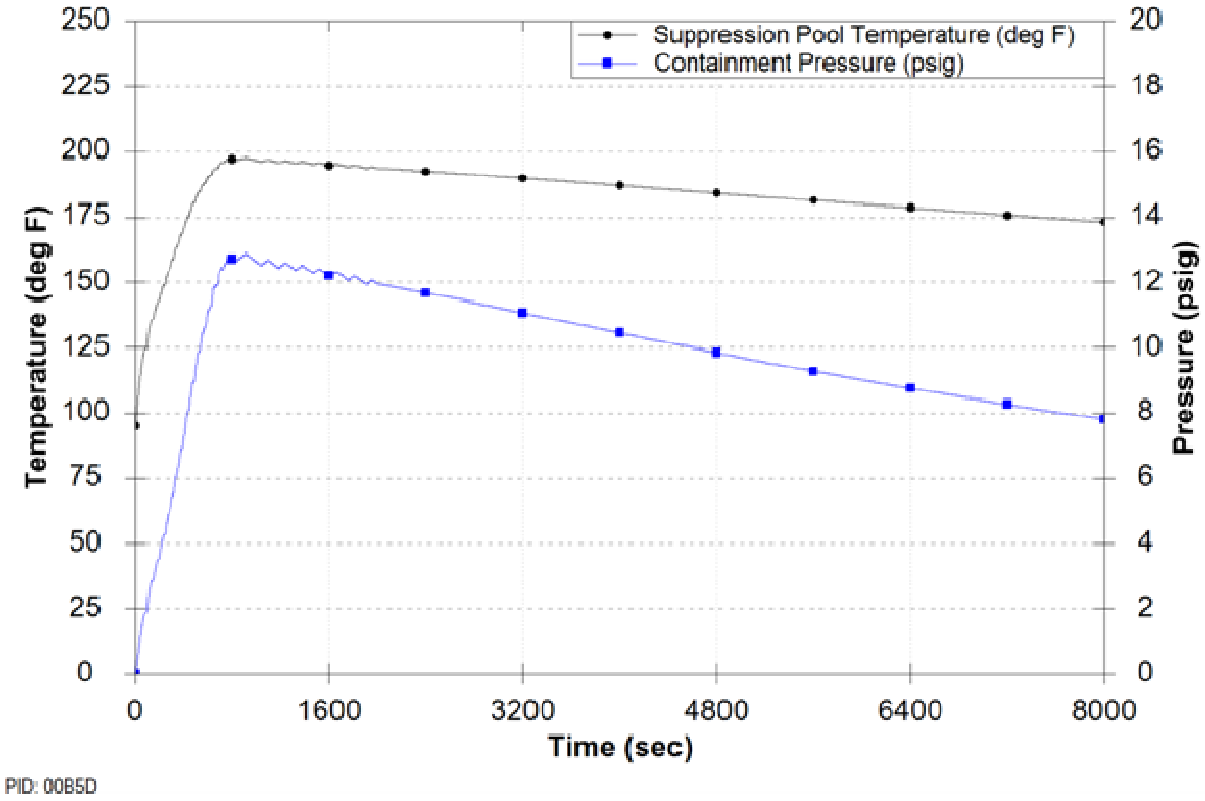

Figure 9-6 ODYN ATWS Analysis – MSIVC at EOC Suppression Pool Temperature

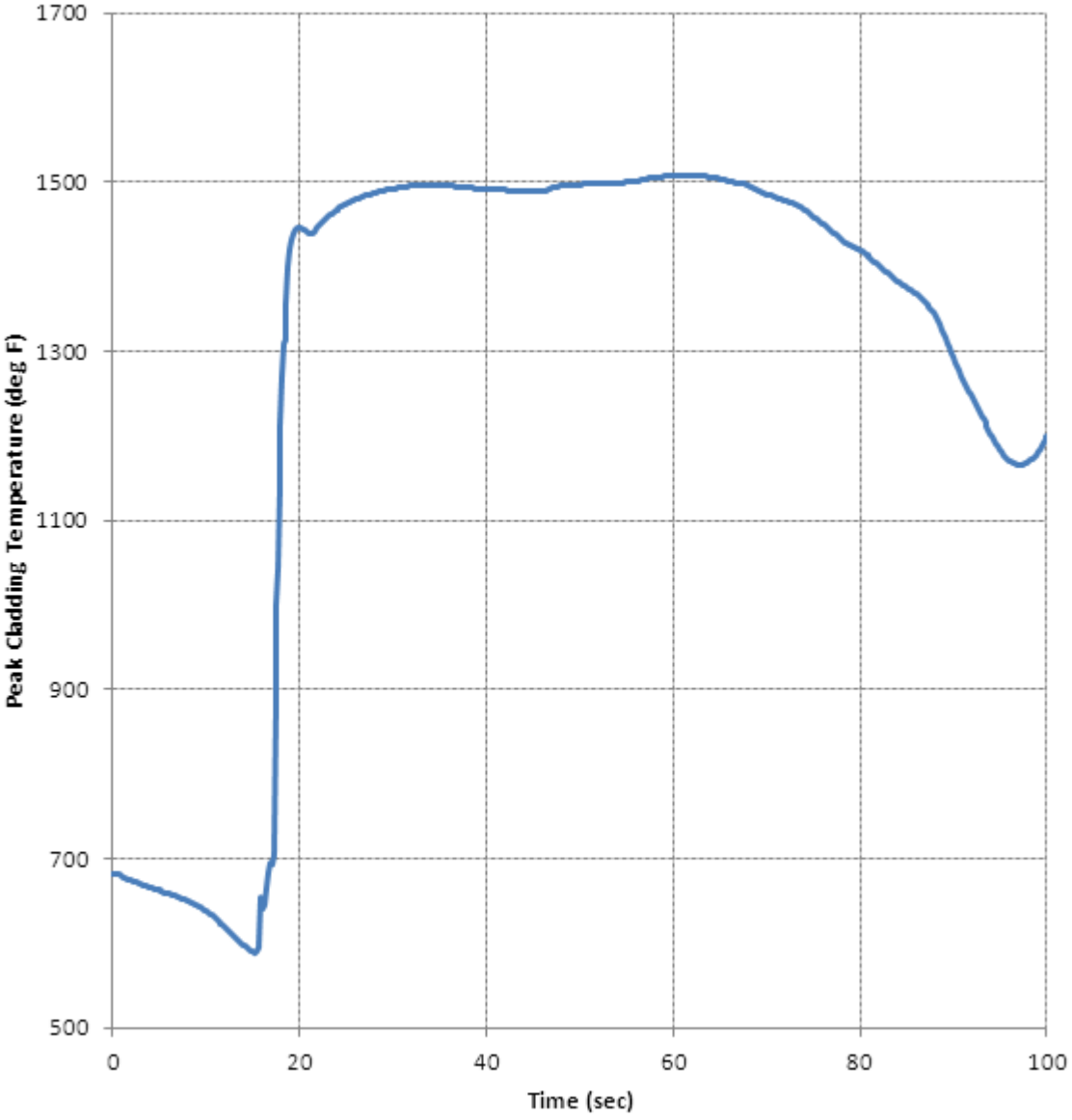

Figure 9-7 ODYN ATWS Analysis – PRFO at EOC PCT

[[

]]

Figure 9-8 Best-Estimate TRACG ATWS Analysis in MELLLA+ Operating Domain – MSIVC at 120% OLTP / 80% CF Initial Condition – EOC, Hard-Bottom Burn

[[

]]

Figure 9-9 Best-Estimate TRACG ATWS Analysis in MELLLA+ Operating Domain – MSIVC at 120% OLTP / 80% CF Initial Condition – EOC, Hard-Bottom Burn

[[

]]

Figure 9-10 Best-Estimate TRACG ATWS Analysis in MELLLA+ Operating Domain – MSIVC at 120% OLTP / 80% CF Initial Condition – BOC

[[

]]

Figure 9-11 Best-Estimate TRACG ATWS Analysis in MELLLA+ Operating Domain – MSIVC at 120% OLTP / 80% CF Initial Condition – BOC

[[

]]

Figure 9-12 Best-Estimate TRACG ATWS Analysis in MELLLA+ Operating Domain – TTWBP at 120% OLTP / 80% CF Initial Condition – BOC with Regional Instability

[[

]]

Figure 9-13 Best-Estimate TRACG ATWS Analysis in MELLLA+ Operating Domain – TTWBP at 120% OLTP / 80% CF Initial Condition – BOC with Regional Instability

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	GGNS Result
Steam Lines	[[	Meets M+LTR Disposition
Balance-of-Plant Liquid Lines		Meets M+LTR Disposition
Other Liquid Lines	]]	Meets M+LTR Disposition

10.1.1 Steam Lines

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. [[

]]

A review of the heat balances produced for GGNS MELLLA+ operating domain expansion confirms that there is no effect on the steam pressure or enthalpy at the postulated break locations (e.g., MS and RCIC). [[

]]

Therefore, GGNS 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. [[

]]

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 FWHOOS. [[

]]

Therefore, GGNS 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 heat balances produced for the GGNS MELLLA+ operating domain confirms that there is no effect on the liquid line conditions (excluding FW addressed in Section 10.1.2) at the postulated break locations. [[

]] 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, GGNS 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	GGNS Result
Flooding	[[	Meets M+LTR Disposition
Environmental Qualification	]]	Meets M+LTR Disposition

10.2.1 Flooding

The disposition of the Flooding topic in the M+LTR describes that [[

]]

A review of the GGNS 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 GGNS, no operational modes evaluated for MELB are affected by MELLLA+ operating domain expansion. [[

]]

Therefore, GGNS 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 GGNS 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 GGNS, no operational modes evaluated for MELB are affected by MELLLA+ operating domain expansion. [[

]]

Therefore, GGNS 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	GGNS Result
Electrical Equipment	[[	Meets M+LTR Disposition
Mechanical Equipment with Non-Metallic Components		Meets M+LTR Disposition
Mechanical Component Design Qualification	]]	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 GGNS, 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, GGNS 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 GGNS, 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, GGNS 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 GGNS, 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, GGNS 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	GGNS Result
Steam Separator-Dryer Performance	[[	Meets M+LTR Disposition
APRM Calibration		Meets M+LTR Disposition
Core Performance		Meets M+LTR Disposition
Pressure Regulator		Meets M+LTR Disposition
Water Level Setpoint Changes		Meets M+LTR Disposition
Neutron Flux Noise Surveillance	]]	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 near the CLTP and the MELLLA+ minimum CF statepoint of 80% as well as other statepoints that may be deemed valuable 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 confirms 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 evaluates 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 the calculated margins evaluated against projected values and operational limits.

10.4.4 Pressure Regulator

The pressure regulator test confirms 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	GGNS Result
Initiating Event Categories and Frequency	[[	Meets M+LTR Disposition
Component Reliability		Meets M+LTR Disposition
Operator Response		Meets M+LTR Disposition
Success Criteria		Meets M+LTR Disposition
External Events		Meets M+LTR Disposition
Shutdown Risk		Meets M+LTR Disposition
Probabilistic Risk Assessment (PRA) Quality	]]	Meets M+LTR Disposition

In accordance with M+LTR SER Limitation and Condition 12.21, a plant-specific 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 best estimate of the CDF risk increase for at-power internal events due to MELLLA+ is a delta CDF of 2.0E-8/yr. The best estimate of the LERF increase for at-power internal events due to MELLLA+ is a delta LERF of 1.0E-9/yr. Using the NRC guidelines established in RG 1.174 and the calculated results from the Level 1 and 2 PRA, the best estimate for the CDF risk increase (2.0E-8/yr) and the best estimate for the LERF increase (1.0E-9/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 GGNS MELLLA+ operating domain is acceptable.

10.5.1 Initiating Event Categories and Frequency

The MELLLA+ core operating range expansion involves changes to the operating power/CF map and a small number of setpoints and alarms. There is no change in the operating pressure, power, steam flow rate, and FW flow rate. 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.

No direct or significant effect on plant transient frequencies was identified from MELLLA+ operation. However, a quantitative sensitivity case was investigated to determine the effect on the risk results if the frequency of transient initiators was conservatively postulated to increase due to the proposed changes. Data used in the GGNS EPU PRA for estimating initiating event

frequencies remains applicable to the MELLLA+ condition. Therefore, there are no changes to initiators due to MELLLA+ that can be postulated.

[[

]]

As noted in Section 2.4, BSP, which is considered a part of the DSS-CD stability solution, will be used when the OPRM system is temporarily inoperable. [[

]]

[[

]]

10.5.2 Component and System Reliability

[[

]] There is no change in the operating pressure, power, steam flow rate, and FW flow rate. The MELLLA+ core operating range expansion does not require major plant hardware modifications. Physical changes to the plant are limited to implementing the DSS-CD stability solution and updates to the Main Control Room displays and plant computer to reflect the new operating region. [[

]] The TSs 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. [[

]]

10.5.3 Operator Response

The operator responses to anticipated occurrences, accidents, and special events for EPU with MELLLA+ conditions are basically the same as for EPU conditions. [[

]]

Because decay heat is unchanged, the time for boil-off is unchanged. Therefore, long-term core cooling is not affected by the MELLLA+ operating range expansion.

[[

]] The minimum operator action time to initiate SLC is five minutes, and the minimum operator action time to inhibit ADS and start water level reduction, if necessary, is 120 seconds in ATWS analyses (Section 9.3.1).

Although there are no new operator actions, the higher core power after a RPT may reduce operator action timing for ATWS level/power control and potential increased SRV cycling. The effects of these changes were evaluated with the GGNS PRA and are included in the results reported 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 operating range expansion involves changes to the operating power/CF map and a small number of setpoints and alarms. There is no change in the operating pressure, power, steam flow rate, and FW flow rate. The MELLLA+ operating range expansion does not impose any additional requirements on any of the safety, BOP, electrical, or auxiliary systems.

The MELLLA+ operating region is postulated to result in higher potential ATWS power, thus reducing operator action timing during ATWS scenarios which can affect the human error probability calculations. This increase in potential ATWS power does not affect the injection systems credited for initial level/power control in the PRA. Adequate SRV capacity is provided to ensure that the ATWS overpressure requirement for MELLLA+ is satisfied. [[

]]

10.5.5 External Events

The frequencies of external event initiators (e.g., seismic events, extreme winds, fires) are not linked to reactor power/operation issues; as such, no effect on external event initiator frequencies due to MELLLA+ can be postulated. Therefore, there is no effect on the external events PRA.

10.5.6 Shutdown Risks

The operating range expansion does not change the shutdown conditions, including core decay heat load; therefore, it has no effect on the plant PRA shutdown risks.

10.5.7 PRA Quality

The GGNS EPU PRA is of sufficient quality and scope for this application. The GGNS PRA modeling is highly detailed, including a wide variety of initiating events (e.g., transients, internal floods, LOCAs inside and outside containment, support system failure initiators), modeled systems, extensive level of detail, operator actions, and common cause events. The GGNS EPU PRA model and documentation has been updated to reflect the current plant configuration and to reflect the accumulation of additional plant operating history and component failure data. The base reference model used in this risk assessment is the GGNS Level 1 and Level 2 EPU PRA

average maintenance model, which includes the recent EPU plant modifications. The Level 1 and Level 2 GGNS PRA analyses were originally developed and submitted to the NRC in December 1992 as the Grand Gulf IPE submittal. The NRC subsequently provided a SE of the IPE in March 1996. This revision underwent a BWROG probabilistic safety analysis (PSA) peer review certification review. Therefore, the GGNS Level 1 and Level 2 PRAs provide the necessary and sufficient scope and level of detail to allow the calculation of CDF and LERF changes due to MELLLA+.

10.6 OPERATOR TRAINING AND HUMAN FACTORS

Some additional training is required to prepare for GGNS operation in the MELLLA+ operating domain. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
Operator Training and Human Factors	[[ ]]	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 TSs, EOPs, and plant systems.

The operator responses to anticipated occurrences, accidents, and special events are not significantly 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, and containment cooling) do not change for MELLLA+ operating domain expansion.

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. Other than the changes to the computer display for 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. 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 GGNS-approved change control procedures. The change 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. The confirmation density stability solution is included in the existing PRNMS hardware and will be enabled for operation in the MELLLA+ domain. 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 GGNS following the MELLLA+ operating domain expansion will be conducted prior to operation in the MELLLA+ domain. Training for the MELLLA+ startup testing program will be performed using "just in time" training of plant operation personnel where appropriate. 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 TSs, changes to the power/flow map, changes to important setpoints, changes associated with the confirmation density stability solution, 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 GGNS 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	GGNS Result
Irradiation Assisted Stress Corrosion Cracking	[[	Meets M+LTR Disposition
Flow Accelerated Corrosion	]]	Meets M+LTR Disposition

10.7.1 Irradiation Assisted Stress Corrosion Cracking

With regard to irradiation assisted stress corrosion cracking (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. Therefore, 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. The change in fluence results in an insignificant change in the potential for IASCC. Therefore, the current inspection strategy based on the BWRVIP (Reference 33) is sufficient to address the small increase in fluence.

Fluence calculations performed at MELLLA+ conditions as required by M+LTR SER Limitation and Condition 12.22 indicate that the top guide, core plate, and shroud exceed the 5E20 n/cm^2 threshold value for IASCC. The top guide fluence was calculated to be 4.93E21 n/cm^2. The core plate fluence was calculated to be 1.31E21 n/cm^2. The shroud fluence was calculated to be 2.89E21 n/cm^2.

The increase in fluence due to MELLLA+ does cause an increased potential for IASCC. However, the inspection strategies and inspections recommended by BWRVIP-25, 26-A, and 76 (References 34, 35, and 33, 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.

The BWRVIP evaluated the failure modes and effects of reactor vessel internals and published the results in BWRVIP-06 (Reference 36). This evaluation for the shroud concluded that the inspections and evaluations performed in response to GL 94-03 (Reference 37) provided conservative assurance that the shroud is able to perform its safety function. The inspections of the top guide, core plate, and shroud are conducted using the guidance of BWRVIP-25, 26-A, 76, and 183 (References 34, 35, 33, and 38, respectively). These guidelines in the areas of detection, inspection, repair, or mitigation ensure the long-term function of these components.

10.7.2 Flow Accelerated Corrosion

The M+LTR describes that for MELLLA+, there is no increase in the MS flow rate and temperature, or the FW flow rate and temperature. As described in Section 3.3.4, the MCO may increase in the MSLs. If this occurs, it may slightly increase the FAC rates for a small period of time during the cycle when the plant is operating at or near the MELLLA+ minimum CF. [[

]] 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 GGNS, 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 39). The requirements of GL 89-08 are implemented at GGNS by utilization of the

Electric Power Research Institute (EPRI) generic program, CHECWORKS™. GGNS-specific parameters are entered into this program to develop requirements for monitoring and maintenance of specific system components. The FAC monitoring programs are adequate to manage potential effects of MELLLA+ operating domain expansion.

For GGNS, there are no significant changes in MS or FW temperatures or MS or FW flow rates in the MELLLA+ operating domain compared to the current licensed operating domain. As discussed in Section 3.3.4, there is a small increase in average moisture content of the MS leaving the reactor during short periods of the cycle. In addition to the MELLLA+ startup testing described in Section 10.4.1, GGNS routinely monitors the moisture content of reactor steam. Any increases in MCO above the current design limit of 0.1 wt % will be evaluated for the effect on the FAC monitoring program. Therefore, there is no change in the potential for unrecognized erosion/corrosion due to FAC.

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 GGNS equipment is not affected by the MELLLA+ operating domain expansion.

Therefore, GGNS meets all M+LTR dispositions for FAC.

10.8 NRC AND INDUSTRY COMMUNICATIONS

The topic addressed in this evaluation is:

Topic	M+LTR Disposition	GGNS Result
Plant Disposition of NRC and Industry Communications	[[ ]]	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, GGNS meets all M+LTR dispositions for NRC and industry communications.

10.9 EMERGENCY AND ABNORMAL OPERATING PROCEDURES

EOPs and abnormal operating procedures (AOPs) can be affected by MELLLA+ operating domain expansion. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	GGNS Result
Emergency Operating Procedures	[[	Meets M+LTR Disposition
Abnormal Operating Procedures	]]	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 and thus the operator actions remain unchanged. MELLLA+ operating domain expansion is not expected to affect the GGNS EOPs. However, in accordance with M+LTR SER Limitation and Condition 12.23.4, 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+. The ATWS calculation performed for MELLLA+ was based on the GGNS operator actions from the EOPs.

10.9.2 Abnormal Operating Procedures

AOPs include event-based operator actions. No significant AOP revisions are expected as a result of MELLLA+ operating domain expansion. However, 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 licensing evaluations addressed in this section include:

- Effect on TSs
- Environmental Assessment
- Significant Hazards Consideration Assessment

11.1 EFFECT ON TECHNICAL SPECIFICATIONS

The TSs that are affected by a MELLLA+ operating domain expansion are provided in the Entergy MELLLA+ LAR package. In contrast to a power uprate, the CLTP does not change as a result of MELLLA+ operating domain expansion. Therefore, the implementation of MELLLA+ requires revision of a limited number of the TSs. In addition, changes required for the DSS-CD stability solution option, as described in Section 11.3.3, are included.

11.2 ENVIRONMENTAL ASSESSMENT

The radiological environmental effects of MELLLA+ operating domain expansion are controlled at the same limits as the current analyses. Therefore, none of the present limits for plant environmental releases to the environment are increased as a consequence of MELLLA+ operating domain expansion. In addition, 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 GGNS'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. This section indicates that the offsite doses from airborne releases of iodine and particulates could potentially increase by approximately 20% due to the increased MCO predicted during operation in the MELLLA+ domain. With this increase, the normal effluents and doses continue to remain well within the 10 CFR 20 limits and the 10 CFR 50, Appendix I guidance. Due to the potential increase in MCO, the postulated doses from the radwaste tank failure accident increased 3% but remain well within the regulatory limits. There is no change to the predicted doses from other 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.

As addressed in Footnote 3 to 10 CFR 51, Appendix B, Table B-1, for the purposes of assessing radiological effects, the NRC has concluded that those effects that do not exceed permissible levels in the NRC regulations are considered SMALL. Therefore, because GGNS will continue to remain well within the 10 CFR 20 limits and the 10 CFR 50, Appendix I guidance, Entergy has concluded that the environmental effects of operation in the MELLLA+ domain would be SMALL.

11.3 SIGNIFICANT HAZARDS CONSIDERATION ASSESSMENT

Increasing the operating domain can be done safely within plant-specific limits, and is a highly cost effective way to provide needed flexibility in the generating capacity. The M+SAR provides the safety analyses and evaluations to justify expanding the CF rate operating domain.

DSS-CD introduces an enhanced detection algorithm, the CDA, which reliably detects the inception of power oscillations and generates an early power suppression trip signal prior to any significant oscillation amplitude growth and MCPR degradation.

A complete Significant Hazards Consideration Assessment is provided with the LAR accompanying this M+SAR.

11.3.1 Modification Summary

The MELLLA+ core operating domain expansion does not require major plant hardware modifications. The core operating domain expansion involves changes to the core power/flow map and a small number of setpoints and alarms. Because there is no significant change in the operating pressure, power, steam flow rate, and FW flow rate, there are no major modifications to other plant equipment.

The stability solution is being changed from Option III to the DSS-CD solution. The DSS-CD solution algorithm, licensing basis, and application procedures are generically described in NEDC-33075P-A (Reference 2), and are applicable to GGNS. The DSS-CD solution uses the same hardware as the current Option III solution.

11.3.2 Discussion of MELLLA+ Issues

Plant performance and responses to hypothetical accidents and transients have been evaluated for the MELLLA+ operating domain expansion license amendment. This section summarizes the plant reactions to events evaluated for licensing the plant, and the potential effects on various margins of safety, and thereby concludes that no significant hazards consideration will be involved.

11.3.2.1 MELLLA+ Analysis Basis

The MELLLA+ safety analyses are based on a RG 1.49 power factor times the rated power level, except for some analyses that are performed at nominal rated power, either because the RG 1.49 power factor is already accounted for in the analysis methods or RG 1.49 does not apply.

11.3.2.2 Fuel Thermal Limits

No change is required in the mechanical fuel design to meet the plant licensing limits while operating in the MELLLA+ domain. No increase in allowable peak bundle power is needed and fuel thermal design limits will be met in the MELLLA+ domain. The analyses for each fuel reload are required to meet the criteria accepted by the NRC as specified in Reference 4. In addition, future fuel designs will meet acceptance criteria approved by the NRC.

11.3.2.3 Makeup Water Sources

The BWR design concept includes a variety of ways to pump water into the reactor vessel to deal with all types of events. There are numerous safety-related and non-safety related cooling water sources. The safety-related cooling water sources alone can maintain core integrity for all postulated events by providing adequate cooling water. There are high and low pressure, high and low volume, safety and non-safety grade means of delivering water to the vessel. These means include at least:

- FW and condensate system pumps
- Low pressure ECCS (LPCS) pumps
- High pressure ECCS (HPCS) pump
- RCIC pump
- SLC pumps
- CRD pumps

Many of these diverse water supply means are redundant in both equipment and systems.

The MELLLA+ operating domain expansion does not result in an increase or decrease in the available water sources, nor does it change the selection of those assumed to function in the safety analyses. NRC-approved methods were used to evaluate the performance of the ECCS during postulated LOCAs.

11.3.2.4 Design Basis Accidents

DBAs are very low probability hypothetical events whose characteristics and consequences are used in the design of the plant, so that the plant can mitigate their consequences to within acceptable regulatory limits. For BWR licensing evaluations, capability is demonstrated for coping with: (1) the range of hypothetical pipe break sizes in the largest recirculation, steam, and FW lines; (2) a postulated break in one of the ECCS lines; and (3) the most limiting small lines. This break range bounds the full spectrum of large and small, high and low energy line breaks and demonstrates the ability of plant systems to mitigate the accidents while accommodating a single active equipment failure in addition to the postulated LOCA. Several of the significant licensing assessments are based on the LOCA and include:

- Challenges to Fuel (ECCS Performance Analyses) (UFSAR Section 6.3) in accordance with the rules and criteria of 10 CFR 50.46 and Appendix K where the limiting criterion is the fuel PCT.
- Challenges to the Containment (UFSAR Section 6.2) wherein the primary criteria of merit are the maximum containment pressure calculated during the course of the LOCA and maximum suppression (cooling) pool temperature for long-term cooling.
- DBA Radiological Consequences (UFSAR Section 15) calculated and compared to the criteria of 10 CFR 50.67.

11.3.2.5 Challenges to Fuel

ECCS are described in Section 6.3 of the plant UFSAR. With MAPLHGR setdowns as indicated for low flow conditions, the PCT calculated for a LOCA from the MELLLA+ domain is bounded by the licensing basis PCT that was calculated based on rated flow. However, the ECCS performance evaluation (Section 4.3) demonstrates significant margin to criteria of 10 CFR 50.46 at the reduced flow in the MELLLA+ domain. Therefore, the ECCS safety margin is not significantly affected by MELLLA+ operating domain expansion.

11.3.2.6 Challenges to the Containment

The peak values for containment pressure and temperature for events initiated in the MELLLA+ domain meet design requirements and confirm the suitability of the plant for operation in the MELLLA+ domain. The containment dynamic and structural loads for events initiated in the MELLLA+ domain continue to meet design requirements. As discussed in Section 4.1, the short-term containment response is bounded by the current AOR due to revised volume inputs. There is no change in the long-term response because there is no change in decay heat. The containment pressure and temperature remains below the design limits following any DBA. Therefore, the containment and its cooling systems are satisfactory for operation in the MELLLA+ domain.

11.3.2.7 Design Basis Accident Radiological Consequences

The magnitude of the potential radiological consequences depends on the quantity of fission products released to the environment, the atmospheric dispersion factors, and the dose exposure pathways. The atmospheric dispersion factors and the dose exposure pathways do not change. The quantity of activity released to the environment is a function of the activity released from the core and the transport mechanisms between the core and the effluent release point. The radiological releases for events initiated in the MELLLA+ domain do not increase.

The radiological consequences of LOCA inside containment, MSLBA, ILBA, CRDA and FHA are bounded by the evaluation at the current licensed operating domain and need not be reevaluated for the MELLLA+ domain. The radiological results for all accidents remain below the applicable regulatory limits for the plant.

11.3.2.8 Anticipated Operational Occurrence Analyses

AOOs are evaluated to demonstrate consequences that meet the SLMCPR. The SLMCPR is determined using NRC-approved methods. The limiting transients are core specific and are analyzed for each reload fuel cycle to meet the licensing acceptance criteria (Section 2.2.1). Therefore, the margin of safety to the SLMCPR is not affected by operation in the MELLLA+ domain.

11.3.2.9 Combined Effects

DBAs are postulated using deterministic regulatory criteria to evaluate challenges to the fuel, containment, and off-site radiation dose limits. The off-site dose evaluation performed in accordance with RG 1.183 and Standard Review Plan (SRP) 15.6.5 calculates more severe radiological consequences than the combined effects of bounding DBAs that produce the greatest

challenge to the fuel and containment. In contrast, the DBA that produces the highest PCT does not result in damage to the fuel equivalent to the assumptions used in the off-site dose evaluation, and the DBA that produces the maximum containment pressure, does not result in leak rates to the atmosphere equivalent to the assumptions used in the off-site dose evaluation. Thus, the off-site doses calculated in conformance with RG 1.183 and SRP 15.6.5 are conservative compared to the combined effect of the bounding DBA evaluations.

11.3.2.10 Non-LOCA Radiological Release Accidents

All of the limiting non-LOCA events discussed in UFSAR Chapter 15 were reviewed for the effect of MELLLA+. The dose consequences for all of the non-LOCA radiological release accident events are shown in Section 9.0 to remain below regulatory limits.

11.3.2.11 Equipment Qualification

Plant equipment and instrumentation have been evaluated against the applicable criteria. The qualification envelope either does not change due to the MELLLA+ operating domain expansion or is bounded by the current licensed operating domain.

11.3.2.12 Balance-of-Plant

Because the power, pressure, steam and FW flow rate, and FW temperature do not change for MELLLA+ operating domain expansion, there are no changes to the BOP systems/equipment.

11.3.2.13 Environmental Consequences

For operation in the MELLLA+ domain, the environmental effects will be controlled to the same limits as for the current operating power/flow map. None of the present environmental release limits are increased as a result of MELLLA+ operating domain expansion.

As a result of MELLLA+ operating domain expansion, there will be no change in the quantity of radioactivity released to the environment through liquid effluents. As reported in Section 8.0, the off-site doses from airborne releases of iodine and particulates could potentially increase by approximately 20% due to the increased MCO predicted during operation in the MELLLA+ domain. With this increase, the normal effluents and doses continue to remain well within the 10 CFR 20 limits and the 10 CFR 50, Appendix I guidance. All off-site radiation doses will be small and within 10 CFR 20 and 10 CFR 50, Appendix I guidance.

As addressed in Footnote 3 to 10 CFR 51, Appendix B, Table B-1, for the purposes of assessing radiological effects, the NRC has concluded that those effects that do not exceed permissible levels in the NRC regulations are considered SMALL. Therefore, because GGNS will continue to remain well within the 10 CFR 20 limits and the 10 CFR 50, Appendix I guidance, the environmental effects of operation in the MELLLA+ domain would be SMALL.

11.3.2.14 Technical Specifications Changes

The TSs 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. GGNS TS changes are provided in the Entergy MELLLA+ LAR package.

Instrument uncertainties were properly considered for the setpoint changes associated with MELLLA+ operating domain expansion.

The TSs also address equipment operability (availability) and put limits on EOOS (not available for use) times such that the plant can be expected to have the complement of equipment available to mitigate abnormal plant events assumed in the safety analyses. Because the safety analyses for the MELLLA+ operating domain expansion show that the results are within regulatory limits, there is no undue risk to public health and safety. TS changes are made in accordance with methodology approved for the plant, and provide a level of protection comparable to previously issued TSs.

11.3.2.15 Assessment of 10 CFR 50.92 Criteria

The assessment of significant hazards consideration is included in the licensee submittal.

11.3.3 Discussion of DSS-CD Stability Solution Issues

For the GGNS MELLLA+ operating domain expansion, the long-term stability solution is being changed from the currently approved Option III solution to DSS-CD. The DSS-CD solution algorithm, licensing basis, and application procedures are generically described in NEDC-33075P-A (Reference 2) and NEDE-33147P-A (Reference 11), and are applicable to GGNS including any limitations and conditions associated with their use and approval.

The DSS-CD solution is designed to identify the power oscillation upon inception and initiate control rod insertion to terminate the oscillations prior to any significant amplitude growth. DSS-CD provides protection against violation of the SLMCPR for anticipated oscillations. 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 earlier power suppression trip signal exclusively based on successive period confirmation recognition. The existing Option III algorithms are retained (with generic setpoints) to provide defense-in-depth protection for unanticipated reactor instability events.

The assessment of significant hazards consideration is included in the licensee submittal.

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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 this 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 GGNS 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)
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	This Limitation has been removed according to Appendix I of this SE.	N/A	(3)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
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	Section 2.2.1
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

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
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
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 4.3.2 (2)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
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 rods.	Comply	Section 9.1.1
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

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
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 GGNS 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 13). 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)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
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 TOP and 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.	N/A	Section 2.0 (5)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
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)
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	Section 2.2 (7)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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 29). 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 29). This limitation applies until the new TRACG/PANAC methodology is approved by the NRC staff.	N/A	(7)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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 *(sic)* 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 GGNS 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.	Comply	Sections 2.2.2 and 9.1.1 (2)
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 29). 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 29) will be applicable as approved.	N/A	(7)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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 3) for mixed core application.	N/A	Section 2.0 (8)
9.22	Mixed Core Method 2	This Limitation has been revised according to Appendix K of this SE. For any plant-specific applications of TGBLA06 with fuel type characteristics not covered in this review, GEH 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	N/A	Section 2.0 (8)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
		• 11x11 lattices • MOX fuel The acceptability of the modified epithermal 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	Comply	(9)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
		calculated TIP comparison), • Bundle power distribution (measured and calculated TIP comparison), • Thermal margin, • Core flow and pressure drop uncertainties, and • The 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 GGNS 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. Since 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 GGNS M+SAR is based on TGBLA06/PANAC11, not TGBLA 04/PANAC10.
2. Correspondence concerning implementation of this limitation and condition is docketed in the letter from James F. Harrison (GEH) to NRC, "Implementation of Methods Limitations - NEDC-33173P," MFN 08-693, September 18, 2008 (Reference 3).
3. This limitation was removed as noted in NEDC-33173P-A Revision 4 (Reference 3).
4. The PRIME LTR and its application (Reference 13) was approved on January 22, 2010 and implemented in GESTAR II in September 2010 (Reference 4). The GGNS 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. GGNS 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 GGNS 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 GGNS M+SAR licensing basis uses TRACG for DSS-CD and ATWS-I analysis. 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 GGNS M+SAR analysis uses ODYN as the licensing basis code for transient analysis.
8. The GGNS M+SAR is based on a GNF2 equilibrium core design. Therefore, the mixed core limitations are not applicable.
9. If GGNS 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 GGNS 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.

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 52 limitations and conditions listed in Section 12 of the M+LTR SER. The table below lists each of the 52 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 GGNS 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	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 GGNS M+SAR which addresses the Limitation and Condition
		approved the associated CPR 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 GGNS 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 GGNS 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 GGNS 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 GGNS 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 (4)
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 (5)

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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 LCO for any equipment out-of-service (i.e., SLO) or operating flexibilities prohibited in the plant-specific MELLLA+ application.	Comply	Sections 1.1.1 and 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	Section 1.2.4

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
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
12.6	SLMCPR Statepoints and CF Uncertainty	Until such time when the SLMCPR methodology (References 40 and 41) 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

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
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 (6)
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 GGNS 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

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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
12.10.c		Off-rated limits will not be applied to the minimum CF statepoint.	N/A	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 GGNS 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
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 4.3.2
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 4.3.2
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

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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	Section 9.1.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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	Section 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.	Comply	Section 9.3.1.2

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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.	Comply	Section 9.3.1.1 (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.	Comply	Section 9.3.1.2

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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.	Comply	Section 9.3.1.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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.	Comply	Section 9.3.1
12.18.f		The plant-specific application will include tabulation and discussion of the key input parameters and the associated uncertainty treatment.	Comply	Section 9.3.1
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	Comply	Section 9.3.3

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
		plant-specific calculations should be based on latest NRC-approved neutronic and thermal-hydraulic codes such as TGBLA06/PANAC11 and TRACG04.		
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)
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	Comply	Section 10.5

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
		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.		
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
12.23.1	Limitations from the ATWS RAI Evaluations	See limitation 12.18.d.	Comply	Section 9.3.1.1
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

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS M+SAR which addresses the Limitation and Condition
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, 9.3.1.2, and 10.9.1

Limitation and Condition Number from NRC SER	Limitation and Condition Title	Limitation and Condition Description	Disposition	Section of GGNS 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 GGNS 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	Section 4.2.6
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	Section 4.2.6
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 GGNS 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, 9.3.1.2, 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	Section 2.2.1
12.24.4		See limitation 12.18.d.	Comply	Section 9.3.1.1

Notes:

1. Because GGNS takes credit for off-rated limits at the minimum CF statepoint, the M+LTR requires implementation of Limitation and Condition 12.10.d. Therefore, Limitation and Condition 12.10.c is not applicable.
2. This requirement relates to implementation of a generic ATWS instability solution, which is not yet approved by the NRC. GGNS MELLLA+ is based on a plant-specific ATWS instability analysis.
3. GGNS MELLLA+ employs a best-estimate TRACG analysis to confirm ODYN calculations.
4. 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.
5. The primary stability protection system is DSS-CD, which was implemented per Reference 2. The BSP solution is implemented at GGNS if the primary stability protection system is declared inoperable, per Reference 2.
6. The ABSP solution is provided to GGNS if the primary stability protection system is declared inoperable, per Reference 2.

Appendix C - Limitations from Safety Evaluation for LTR NEDC-33075P

Disposition of additional limitations and conditions related to the revised draft 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 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 GGNS 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 42), 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 the NRC for the Option III solution.
2. The subject TR, or GESTAR II, is referenced in the GGNS 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.

ATTACHMENT 6

GRAND GULF NUCLEAR STATION

GNRO-2013/00012

LIST OF REGULATORY COMMITMENTS

LIST OF REGULATORY COMMITMENTS

This table identifies actions discussed in this letter for which Entergy commits to perform. Any other actions discussed in this submittal are described for the NRC's information and are **not** commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
Upon implementation of the TS amendment associated with approval of the MELLLA+ LAR, the DSS-CD algorithm will be enabled.	✓		90 days from receiving approval of the MELLLA+ LAR.
GGNS will include the power/flow map in the COLR after the MELLLA+ operating domain expansion is approved.		✓	90 days from receiving approval of the MELLLA+ LAR.
Any increase of moisture content above the design limit of 0.10 wt. % will be evaluated for effect on the FAC monitoring program.		✓	90 days from receiving approval of the MELLLA+ LAR.
Testing will be performed near the CLTP and the MELLLA+ minimum core flow state point of 80% as well as other state points that may be deemed valuable for the purpose of defining the MCO magnitude and trend.	✓		90 days from receiving approval of the MELLLA+ LAR.
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.	✓		90 days from receiving approval of the MELLLA+ LAR.
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.	✓		90 days from receiving approval of the MELLLA+ LAR.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
Training required to operate GGNS following the MELLLA+ operating domain expansion will be conducted prior to operation in the MELLLA+ domain.	✓		90 days from receiving approval of the MELLLA+ LAR.
Training for the MELLLA+ startup testing program will be performed using "just in time" training of plant operation personnel where appropriate.	✓		90 days from receiving approval of the MELLLA+ LAR.
Enhanced training on ATWS event mitigation in the MELLLA+ domain will be conducted.	✓		90 days from receiving approval of the MELLLA+ LAR.
In accordance with M+LTR SER Limitation and Condition 12.23.4, 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+.	✓		90 days from receiving approval of the MELLLA+ LAR.
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+.	✓		90 days from receiving approval of the MELLLA+ LAR.