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Enclosure 3

GE Nuclear Energy Report NEDO-33063
Safety Analysis Report For Brunswick Steam Electric Plant Units 1 and 2
Maximum Extended Load Line Limit Analysis Plus
Dated November 2002

NON-PROPRIETARY

GE Nuclear Energy

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SAFETY ANALYSIS REPORT FOR BRUNSWICK STEAM ELECTRIC PLANT UNITS 1 AND 2 MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS

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INFORMATION NOTICE

This is a non-proprietary version of the document NEDC-33063P, which has the proprietary information removed. Portions of the document that have been removed are indicated by an open and closed bracket as shown here [ ].

The General Electric Company has applied for a patent for the Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operating range expansion. The review and approval process is ongoing and the patent is pending.

IMPORTANT NOTICE REGARDING CONTENTS OF THIS REPORT

PLEASE READ CAREFULLY

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EXECUTIVE SUMMARY

This report summarizes the results of all significant safety evaluations performed that justify the expansion of the core flow operating range for Brunswick Steam Electric Plant, Units 1 and 2 (BSEP 1 and 2). The changes expand the operating range in the region of operation with less than rated core flow, but do not increase the licensed power level or the maximum core flow. The expanded operating range is identified as Maximum Extended Load Line Limit Analysis Plus (MELLLA+).

The scope of evaluations required to support the expansion of the core flow operating range to the MELLLA+ boundary is contained in the Licensing Topical Report (LTR) NEDC-33006P, "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 BSEP 1 and 2, including performance of plant specific assessments and confirmation of the applicability of generic assessments to support a MELLLA+ core flow operating range expansion.

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

The MELLLA+ operating range expansion is applied as an incremental change to the previously approved licensed power uprate. With respect to the power flow map, there are no changes other than the increase in core flow range. This report supports operation of the BSEP 1 and 2 at CLTP with core flow as low as 85% of rated. The MELLLA+ core operating range expansion does not require major plant hardware modifications. The core operating range expansion involves changes to the operating power/core flow map and a small number of setpoints and alarms. Because there is no change in the operating pressure, power, steam flow rate, and feedwater flow rate, there are no effects on the plant hardware outside of the Nuclear Steam Supply System (NSSS). The MELLLA+ operating range expansion does not cause additional requirements to be imposed on any of the safety, balance-of-plant, electrical, or auxiliary systems. No significant changes to the power generation and electrical distribution systems are required due to the introduction of MELLLA+.

Evaluations of the reactor, engineered safety features, power conversion, emergency power, support systems, environmental issues, design basis accidents, and previous licensing evaluations 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+ were evaluated.
- There is no change in the existing design basis and licensing basis acceptance criteria of the plant as defined in 10 CFR 50.2.

- Evaluations are performed using NRC-approved or industry-accepted analytical methods.
- Where applicable, more recent industry codes and standards are 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+. 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+ are reviewed to ensure that there is no significant challenge to any safety system.
- Compliance with existing plant environmental regulations is maintained.
- Potentially affected commitments to the NRC are reviewed.
- Changes presently identified but not yet implemented have also been reviewed for the effects of MELLLA+.

This report summarizes the results of the safety evaluations needed to justify a licensing amendment to allow the MELLLA+ core flow rate operating range expansion to a minimum core flow rate of 85% of rated with reactor power at 100% of CLTP. It has been demonstrated that this MELLLA+ operating range 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 range expansion does not involve a significant hazards consideration.

The environmental evaluation demonstrates that MELLLA+ does not involve environmental effects that differ significantly from those evaluated for the presently authorized CLTP level.

REVISIONS

Revisions may be prepared and submitted to address corrections, NRC Staff feedback, or following the initial NRC staff review. The changes will be identified in each revision.

ACRONYMS

Term	Definition
AC	Alternating Current
ADS	Automatic Depressurization System
AOO	Anticipated Operational Occurrence
AOP	Abnormal Operating Procedure
AP	Annulus Pressurization
APRM	Average Power Range Monitor
ARO	All Rods Out
ARTS	Average Power Range Monitor, Rod Block Monitor, Technical Specifications Improvement Program
ASME	American Society Of Mechanical Engineers
ATWS	Anticipated Transient Without Scram
AV	Allowable Value
BOP	Balance Of Plant
BWR	Boiling Water Reactor
CFR	Code Of Federal Regulations
CLTP	Current Licensed Thermal Power
CO	Condensation Oscillation
COLR	Core Operating Limits Report
CPR	Critical Power Ratio
ΔCPR	Change in Critical Power Ratio
CRD	Control Rod Drive
CS	Core Spray
CSC	Containment Spray Cooling
DBA	Design Basis Accident
DC	Direct Current
DSS-CD	Detect and Suppress Solution–Confirmation Density
ECCS	Emergency Core Cooling System
EOP	Emergency Operating Procedure
EPU	Extended Power Uprate
FIV	Flow-Induced Vibration
FW	Feedwater
FWT	Feedwater Temperature
GE	General Electric Company
HELB	High Energy Line Break
HPCI	High Pressure Coolant Injection
HVAC	Heating, Ventilation And Air Conditioning

Term	Definition
IASCC	Irradiation Assisted Stress Corrosion Cracking
ICF	Increased Core Flow
IEEE	Institute Of Electrical And Electronics Engineers
IRM	Intermediate Range Monitor
LHGR	Linear Heat Generation Rate
LOCA	Loss Of Coolant Accident
LPCI	Low Pressure Coolant Injection
LPRM	Local Power Range Monitor
MAPLHGR	Maximum Average Planar Linear Heat Generation Rate
MCPR	Minimum Critical Power Ratio
$MCPR_f$	Flow-dependent Minimum Critical Power Ratio
$MCPR_p$	Power-dependent Minimum Critical Power Ratio
MELLLA	Maximum Extended Load Line Limit Analysis
MELLLA+	Maximum Extended Load Line Limit Analysis Plus
M+LTR	Maximum Extended Load Line Limit Analysis Plus Licensing Topical Report NEDC-33006P (Reference 1)
M+SAR	MELLLA+ Safety Analysis Report (Plant Specific Safety Analysis Report)
Mlb	Millions Of Pounds
MS	Main Steam
MSIV	Main Steam Isolation Valve
MSIVC	Main Steam Isolation Valve Closure
MSIVF	Main Steam Isolation Valve Closure With Scram On High Neutron Flux
MWt	Megawatt-Thermal
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
OLMCPR	Operating Limit Minimum Critical Power Ratio
OLTP	Original Licensed Thermal Power
OPRM	Oscillation Power Range Monitor
PCT	Peak Cladding Temperature
PRA	Probabilistic Risk Assessment
Psi	Pounds Per Square Inch
Psia	Pounds Per Square Inch - Absolute
Psig	Pounds Per Square Inch - Gauge
RBM	Rod Block Monitor
RCIC	Reactor Core Isolation Cooling
RCPB	Reactor Coolant Pressure Boundary
RHR	Residual Heat Removal

Term	Definition
RIPD	Reactor Internal Pressure Difference
RPS	Reactor Protection System
RPT	Recirculation Pump Trip
RPV	Reactor Pressure Vessel
RRS	Reactor Recirculation System
RSLB	Recirculation Suction Line Break
RWCU	Reactor Water Cleanup
RWM	Rod Worth Minimizer
SAR	Safety Analysis Report
SBO	Station Blackout
SER	Safety Evaluation Report
SGTS	Standby Gas Treatment System
SLCS	Standby Liquid Control System
SLMCPR	Safety Limit Minimum Critical Power Ratio
SLO	Single (Recirculation) Loop Operation
SRLR	Supplemental Reload Licensing Report
SRM	Source Range Monitor
SRP	Standard Review Plan
SRV	Safety Relief Valve
TAF	Top Of Active Fuel
TIP	Traversing In-Core Probe
TLO	Two (Recirculation) Loop Operation
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report

1.0 INTRODUCTION

This report summarizes the results of all significant safety evaluations performed that justify the expansion of the operating boundary that would permit BSEP 1 and 2 operation at CLTP (2923 MWt, 120% OLTP) with core flow as low as 85% of rated. The changes expand the operating range in the region of operation with less than rated core flow, but do not increase the licensed power level or the maximum core flow. The expanded operating range is identified as Maximum Extended Load Line Limit Analysis Plus (MELLLA+).

The scope of evaluations required to support the expansion of the core flow operating range to the MELLLA+ boundary is contained in the Licensing Topical Report (LTR) NEDC-33006P, "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 BSEP 1 and 2, including performance of plant specific assessments and confirmation of the applicability of generic assessments to support a MELLLA+ core flow operating range expansion. With respect to the power-flow map, there are no changes other than the increase in core flow range.

The MELLLA+ core operating range expansion does not require major plant hardware modifications. BSEP 1 and 2 will implement the Detect and Suppress Solution–Confirmation Density (DSS-CD) solution (Reference 6) consistent with the M+LTR. The operating range expansion involves changes to the operating power/core flow map and a small number of setpoints and alarms. Because there is no change in the operating pressure, power, steam flow rate, and feedwater flow rate, there are no effects on the plant hardware outside of the Nuclear Steam Supply System (NSSS). The MELLLA+ operating range expansion does not cause additional requirements to be imposed on any of the safety, balance-of-plant, electrical, or auxiliary systems. No significant changes to the power generation and electrical distribution systems are required due to the introduction of MELLLA+.

1.1 REPORT APPROACH

The evaluations provided in this report demonstrate that the MELLLA+ operating range expansion can be accomplished within the applicable safety design criteria. Many of the safety evaluations and equipment assessments previously performed for the BSEP 1 and 2 extended power uprate are unaffected.

The BSEP 1 and 2 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:

- Generic, and
- Plant Specific.

1.1.1 Generic Assessments

Generic assessments are those safety evaluations 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 range 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 (as defined in GESTAR, Reference 5).

The applicability of the generic assessments to BSEP is identified and confirmed in the applicable sections.

1.1.2 Plant Specific Evaluation

A BSEP evaluation is provided for all safety evaluations not categorized as Generic. Where applicable, the approved assessment methodology in References 1-5 is referenced. The plant specific evaluations are reported consistent with the contents, structure, and level of detail indicated in the M+LTR.

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 range. The computer codes used for the BSEP evaluations are listed Table 1-1.

1.1.4 Scope of Evaluations

Sections **2.0** through **11.0** provide evaluations of MELLLA+ 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 Supplemental Reload Licensing Report (SRLR) and Core Operating Limit Report (COLR) for each fuel cycle that implements MELLLA+.
- **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 core flow are not increased by MELLLA+, the effects on the Reactor Coolant and Connected Systems are minor. These evaluations confirm the acceptability of the MELLLA+ changes in process variables in the NSSS.
- **Section 4.0 Engineered Safety Features:** The effects of MELLLA+ on the containment, ECCS, Standby Gas Treatment, and other Engineered Safety Features (ESF) are

evaluated. The operating pressure for ESF equipment is not increased because operating pressure and safety/relief valve setpoints are unchanged by MELLLA+.

- **Section 5.0 Instrumentation and Control:** The instrumentation and control systems and analytical limits for setpoints are evaluated to establish the effects of MELLLA+ changes in process parameters.
- **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 Standby Liquid Control System (SLCS) is the only auxiliary system that may be affected by MELLLA+.
- **Section 7.0 Power Conversion Systems:** Because the pressure, steam flow, and feedwater flow do not change with MELLLA+, 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 range changes. The radiological consequences are evaluated to show that applicable regulations are met.
- **Section 9.0 Reactor Safety Performance Evaluations:** The Updated Final Safety Analysis Report (UFSAR) Anticipated Operational Occurrence (AOO) events are reviewed as part of the MELLLA+ evaluation.
- **Section 10.0 Other Evaluations:** High energy line break and environmental qualification evaluations for the MELLLA+ range are confirmed to demonstrate the operability of plant equipment. The effects on the Individual Plant Evaluation (IPE) are evaluated to demonstrate there is no change on the BSEP 1 and 2 vulnerability to severe accidents.
- **Section 11.0 Licensing Evaluations:** This section includes the: effect on Technical Specifications, the Environmental Assessment, and the Significant Hazards Consideration Assessment.

1.1.5 Product Line Applicability

The processes, evaluations, and dispositions in the M+LTR are applicable to the BSEP BWR/4 Units 1 and 2.

1.2 OPERATING CONDITIONS AND CONSTRAINTS

1.2.1 Power / Flow Map

The BSEP power/flow map including the MELLLA+ operating region 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 range expansion are unchanged by MELLLA+.

The MELLLA+ region extends down to 55% core flow. Normal core performance characteristics for plant power/flow maneuvers at near full power can be accomplished above 55% core flow. Operation at high power and low core flow can be difficult due to stability considerations. Therefore, the MELLLA+ region was not extended below 55% core flow. If the reactor operating conditions following an unplanned event stabilize at a power/flow point outside the allowed operating domain, the operator must maneuver the plant back into the allowed operating domain in accordance with plant procedures.

1.2.2 Reactor Heat Balance

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 core flow.

1.2.3 Core and Reactor Conditions

The changes resulting from the MELLLA+ operating range expansion are limited to the core and reactor. Table 1-2 compares MELLLA and MELLLA+ thermal-hydraulic operating conditions for BSEP. There are no temperature changes in the steam and feedwater piping. The small temperature decrease in the recirculation loops (relative to the rated core flow condition) is within current MELLLA ranges. The core void fractions increase from previous MELLLA conditions. The reduced feedwater temperature (FWT) heat balance for the MELLLA condition, which is based on a feedwater reduction of 110.3°F, demonstrates that the MELLLA core inlet enthalpy is lower than the MELLLA+ value at CLTP with normal feedwater temperature.

The decay heat is principally a function of the reactor power level and the irradiation time. MELLLA+ does not alter either of these two parameters, and therefore there is no first order effect on decay heat. Additional parameters that have a second order impact on decay heat include: enrichment, exposure, void fraction, power history, cycle length, and refueling batch fraction. With the exception of void fraction, these parameters are unaffected by MELLLA+. Table 1-2 shows a small increase in the BSEP core average void fraction at the MELLLA+ statepoints. This will have a negligible effect on decay heat.

1.2.4 Operational Enhancements

The following table provides the performance improvement and/or equipment out-of-service features allowed in the BSEP 1 and 2 MELLLA+ operating range expansion:

Operational Enhancements	MELLLA	MELLLA+
Feedwater Heater out-of-service (FWHOOS)	Allowed	Not Allowed
Single-Loop Operation (SLO)	Allowed	Not Allowed
Final Feedwater Temperature Reduction (FFWTR)	Allowed	Not Allowed
1 SRV out-of-service	Allowed	Not Allowed
1 ADS valve out-of-service	Allowed	Allowed (Note 1)
Average Power Range Monitor (APRM) / Rod Block Monitor (RBM) / Technical Specifications (ARTS)	Allowed	Allowed
Turbine Bypass Valve OOS	Allowed	Allowed
Main Steam Isolation Valve OOS	Allowed	Not Allowed
Operation With Either Startup Auxiliary Transformer Or Unit Auxiliary Transformer For Recirculation Pump Power Source	Allowed	Allowed

Note 1: Logic Only – SRV function must still be available

1.3 SUMMARY AND CONCLUSIONS

The M+SAR demonstrates that the MELLLA+ range 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 existing regulatory limits or design allowable limits applicable to the plant which might cause a reduction in a margin of safety.

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	04 10 09	Y Y Y (1)	NEDE-30130-P-A NEDE-30130-P-A NEDE-24011P Rev. 0 SER
Stability Analysis	PANAC ODYSY ISCOR TRACG	10 10 09 02	Y Y Y (1) (2)	NEDE-30130-P-A (5) NEDC-32992P-A NEDE-24011P Rev. 0 SER NEDO-32465-A NEDE-32906P, Jan 2000
Reactor Internal Pressure Differences	LAMB TRACG ISCOR	07 02 09	(3) (4) Y (1)	NEDE-20566P-A NEDE-32176P, Rev 2, Dec 1999 NEDC-32177P, Rev 2, Jan 2000 NRC TAC No M90270, Sep 1994 NEDE-24011P Rev. 0 SER
Transient Analysis	PANAC ODYN ISCOR	10 10 (6) 09	Y Y Y (1)	NEDE-30130-P-A (5) NEDE-24154P-A NEDC-24154P-A, Vol 4, Sup 1 NEDE-24011P Rev. 0 SER
Anticipated Transient Without Scram	PANAC ODYN STEMP	10 10 (6) 04	Y Y (8)	NEDE-30130-P-A (5) NEDC-24154P-A, Vol 4, Sup 1
Containment System Response	M3CPT LAMB	05 08	Y (3)	NUREG-0661 NEDE-20566P-A,
Reactor Recirculation System	BILBO	04V	(9)	NEDE-23504, Feb. 1977
ECCS-LOCA	LAMB GESTR SAFER ISCOR TASC	08 08 04 09 03	Y Y Y Y (1) Y	NEDE-20566P-A NEDE-23785-1P-A, Rev. 1, NEDC-32950P (10), NEDC-23785, Vol III, Supp 1, Rev 1, Oct 2001 NEDE-23785-1P-A, Rev. 1, NEDC-32950P (10), NEDC-23785, Vol III, Supp 1, Rev 1, Oct 2001 NEDE-24011P Rev. 0 SER NEDC-32084P (7)

NA – Not Applicable

Notes For Table 1-1:

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

(2) TRACG has been used for many years (NEDO-32465-A, August 1996) for the analysis of coupled neutronic and thermal-hydraulic instabilities to support the design of long term detect and suppress solutions. The code is clearly one of the primary tools in the design and analysis process, but has not received a specific SER for this purpose. The use of TRACG for stability applications is also supported by NEDE-32906P for Anticipated Operational Occurrences, as well as, NEDE-32176P, Rev 2, Model Description, and NEDE-32177P, Rev 2 TRACG Qualification.

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

(4) 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.

(5) The physics code PANACEA (PANAC) provides inputs to the transient code ODYN. The improvements to PANACEA that were documented in NEDE-30130-P-A were incorporated into ODYN by way of Amendment 11 of GESTAR II (NEDE-24011-P-A). The use of PANAC Version 10 in this application was initiated following approval of Amendment 13 of GESTAR II by letter from G.C. Lainas (NRC) to J S. Charnley (GE), MFN 028-086, Subject. "Acceptance for Referencing of Licensing Topical Report NEDE-24011-P-A Amendment 13, Rev. 6 General Electric Standard Application for Reactor Fuel," March 26, 1998.

(6) Version 10 of ODYN is applicable to plants that use recirculation pump motor-generator speed for recirculation flow control.

(7) The NRC approved the TASC-03A code by letter from S. A. Richards, NRC, to J. F. Klapproth, GE Nuclear Energy, Subject: Review of NEDC-32084P, "TASC-03A, A computer Code for Transient Analysis of a Single Fuel Channel," TAC NO. MB0564, March 13, 2002. The acceptance version has not yet been published.

(8) 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.

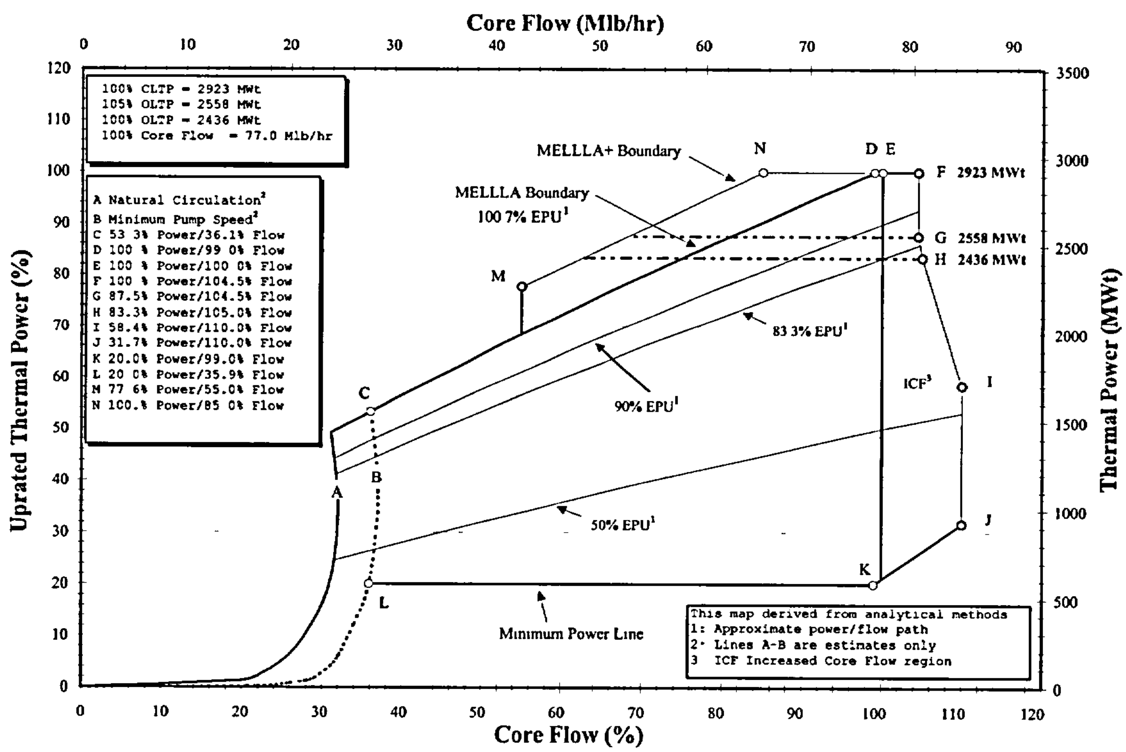
(9) Not a safety analysis code that requires NRC approval. The code application is reviewed and approved by GENE for "Level-2" application and is part of GENE's standard design process. Also, the application of this code has been used in previous power uprate submittals.

(10) "Compilation of Improvements to GENE's SAFER ECCS-LOCA Evaluation Model," NEDC-32950P, January 2000. Approved for use by letter from S.A. Richards (NRC) to J.F. Klapproth (GE), "General Electric Nuclear Energy Topical Reports NEDC-32950P and NEDC-32084P Acceptability Review," May 24, 2000.

Table 1-2 Comparison of Thermal-Hydraulic Parameters

Parameter	MELLLA 120% OLTP, 99% Core Flow Normal FWT	MELLLA 120% OLTP, 99% Core Flow Reduced FWT	MELLLA+ 120% OLTP, 85% Core Flow Normal FWT	MELLLA+ 93% OLTP, 55% Core Flow Normal FWT
Thermal Power (MWt)	2923	2923	2923	2268
Steam Flow rate (Mlb/Hr)	12.780	11.120	12.765	9.500
Dome Pressure (psia)	1045	1045	1045	1010
Feedwater Temperature (°F) (upstream of RWCU return)	431.4	321.1	431.3	403.0
Feedwater Enthalpy (BTU/lbm) (upstream of RWCU return)	410.1	293.3	409.9	379 3
Core Flow (Mlb/Hr)	76 23	76.23	65.45	42.35
Core Inlet Enthalpy (BTU/lbm)	528 0	514.1	524.7	508 4
RWCU Enthalpy (BTU/lbm)	527.8	513.9	523.9	508.7
RWCU Temperature (°F)	533.0	521 8	529.9	517.5
Core Average Void Fraction	0.51	0 45	0.54	0.54
Average Core Exit Void Fraction	0.72	0.69	0.76	0.77

Figure 1-1 BSEP 1 and 2 MELLLA+ Operating Range Power-Flow Map



2.0 REACTOR CORE AND FUEL PERFORMANCE

This section addresses the evaluations in Regulatory Guide 1.70 Chapter 4 that are applicable to MELLLA+.

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:

[

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No new fuel product line designs are introduced and there are no changes to fuel design limits required by the MELLLA+ introduction at BSEP 1 and 2. The fuel design limits are established for all new fuel product line designs as a part of the fuel introduction and reload analyses. [ ]

The range of void fraction, axial and radial power shape, and rod positions may change slightly in the MELLLA+ range. The average bundle power and maximum allowable peak bundle power are not changed. The change in power distribution in the core is achieved, while limiting the MCPR, LHGR, and MAPLHGR in any individual fuel bundle to be within its allowable value as defined in the Core Operating Limits Report (COLR). Because there is no change to the average power density, there is no change to the fuel thermal margin monitoring threshold.

[

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2.2 THERMAL LIMITS ASSESSMENT

The effect of MELLLA+ on the MCPR safety and operating limits, MAPLHGR, and LHGR limits is described below. The topics addressed in this evaluation are:

[

]

2.2.1 Safety Limit Minimum Critical Power Ratio

The Safety Limit Minimum Critical Power Ratio (SLMCPR) analysis reflects the actual plant core loading pattern and is performed for each reload core. The cycle specific SLMCPR will be determined, using the methods defined in Reference 5. A Technical Specification (TS) change will be requested if the current value is not bounding.

[ ]

2.2.2 Operating Limit Minimum Critical Power Ratio

The Operating Limit Minimum Critical Power Ratio (OLMCPR) is calculated by adding the change in MCPR due to the limiting Anticipated Operational Occurrence (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 5. The cycle specific analysis results are documented in the Supplemental Reload Licensing Report (SRLR) and included in the COLR. The MELLLA+ operating conditions do not change the methods used to determine this limit.

[ ]

2.2.3 MAPLHGR and Linear Heat Generation Rate Operating Limits

The Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) limits ensure that the plant does not exceed regulatory limits established in 10CFR50.46. Section 4.3, Emergency Core Cooling System Performance, presents the evaluation to demonstrate that the plant meets the regulatory limits in the MELLLA+ operating domain. The reload analysis determines the MAPLHGR operating limit for each reload fuel bundle design and the limits are documented in the cycle specific COLR.

The Linear Heat Generation Rate (LHGR) limits ensure that the plant does not exceed the fuel thermal-mechanical design limits. The LHGR limit is determined by the fuel rod thermal-mechanical design and is not affected by MELLLA+. The reload analysis confirms that the LHGR limits for each reload fuel bundle design are acceptable and the appropriate thermal limits are documented in the cycle specific COLR.

[ ]

2.3 REACTIVITY CHARACTERISTICS

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

[

]

Operation in the MELLLA+ core flow range may change the hot excess reactivity during the cycle. This change in reactivity does not affect safety. Sufficient excess reactivity can be obtained to match the desired cycle length through fuel cycle redesign.

Higher core average void fraction, higher plutonium production, increased hot reactivity later in the operational cycle, decreased hot-to-cold reactivity differences, and smaller cold shutdown margins may result from cores designed for operation with the MELLLA+ operating range expansion. However, this potential loss in margin can be accommodated through core design within 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. In order to account for reactivity uncertainties, including the effects of temperature and analysis methods, margin well in excess of the TS limits are included in the design requirements.

All minimum SLCS shutdown margin requirements apply to most reactive SLCS condition, and are maintained without change. In order to account for reactivity uncertainties, including the effects of temperature and analysis methods margin well in excess of the TS limits are included in the design requirements.

The plant SRO and SLCS shutdown margins must meet NRC approved limits established in Reference 5 on a cycle specific basis. The margins are evaluated for each plant reload core and documented in the SRLR.

[

]

2.4 STABILITY

BSEP 1 and 2 will implement the Detect and Suppress Solution–Confirmation Density (DSS-CD) solution (Reference 6) consistent with the M+LTR.

[

]

The applicability checklist provided in the DSS-CD LTR is used to confirm that the generic basis is applicable to a plant-specific reload design. The applicability is incorporated into the reload evaluation process and is documented in the SRLR. If necessary, additional plant specific analyses will be performed in accordance with the DSS-CD LTR plant specific applicability extension evaluation procedure.

For BSEP 1 and 2, the Armed Region boundaries are defined per the DSS-CD LTR. The DSS-CD LTR generically specifies the Armed Region for MELLLA+ operation below 75% rated core flow and above 25% OLTP. For BSEP 1 and 2, which have been uprated to 120% OLTP, the setpoint in %CLTP is scaled to 23% consistent with the current thermal limit monitoring threshold used in BSEP Technical Specifications.

An alternate stability protection approach (e.g., BSP) may be used when the OPRM system is temporarily inoperable. The definition of the base BSP regions and associated operator actions and the plant specific confirmation process are established on a generic basis. The alternate stability protection approach is confirmed on a cycle-specific basis to demonstrate adequacy to the reload cycle design.

[ ] the generic DSS-CD setpoints are applicable to BSEP 1 and 2. The generic armed region is rescaled consistent with the approach stated in the DSS-CD LTR. The applicability checklist and the BSP regions and associated operator actions will be evaluated and confirmed for the reload core prior to MELLLA+ implementation.

2.5 REACTIVITY CONTROL

The Control Rod Drive (CRD) System is used to control core reactivity by positioning neutron absorbing control rods within the reactor and to scram 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:

[

]

2.5.1 Control Rod Scram

At normal operating conditions, the Hydraulic Control Unit accumulators supply the initial scram pressure and, as the scram continues, the reactor becomes the primary source of pressure to complete the scram. Because the normal reactor dome pressure for MELLLA+ does not change, the scram time performance relative to the current plant operation is the same.

[

]

2.5.2 Control Rod Drive Positioning and Cooling

For MELLLA+, there is a slight decrease in the pressure above the core plate relative to the pressure for CLTP, maximum core flow. Therefore, the CRD positioning and cooling functions are not affected by MELLLA+.

[ ]

2.5.3 Control Rod Drive Integrity Assessment

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. The reactor operating conditions for MELLLA+ do not affect the CRD pump discharge pressure, and the stresses for the limiting CRD component do not change for MELLLA+. There is no change in other mechanical loads.

[ ]

3.0 REACTOR COOLANT AND CONNECTED SYSTEMS

This section addresses the evaluations in Regulatory Guide 1.70, Chapter 5 and part of Chapter 3 that are applicable to MELLLA+.

3.1 NUCLEAR SYSTEM PRESSURE RELIEF AND OVERPRESSURE PROTECTION

The topics addressed in this evaluation are:

[

]

Because there is no change in the maximum main steam line flow for the MELLLA+ operating range expansion, there is no effect on the flow-induced vibration of the piping and safety/relief valves during normal operation.

[

]

The pressure relief system prevents overpressurization of the nuclear system during abnormal operational transients, the plant ASME Upset overpressure protection event, and postulated ATWS events. The plant safety relief valves (SRVs) along with other functions provide this protection. For BSEP 1 and 2, the limiting overpressure event is the Main Steam Isolation Valve Closure with Scram on High Flux (MSIVF). The M+LTR establishes that the MSIVF is limiting at the 1.02*120% OLTP, maximum core flow statepoint. The SRV setpoint tolerance is independent of the MELLLA+ operating range expansion. The SRV setpoint tolerances are monitored at BSEP 1 and 2 for compliance to the TS requirements. Therefore, no changes in the BSEP 1 and 2 pressure relief system or SRV setpoints are required for MELLLA+. The ATWS analysis required that additional pressure relief capacity be assumed, see Section 9.3.1 for the discussion.

[

]

3.2 REACTOR VESSEL

The Reactor Pressure Vessel (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:

[

]

3.2.1 Fracture Toughness

The MELLLA+ operating range expansion results in a slightly higher operating neutron flux in the upper portion of the core due to the decreased water density. The effect of this water density reduction is [ ] peak vessel flux and peak shroud flux. [

]

An assumed increase of [ ] in the peak vessel fluence would result in change in the adjusted reference temperature of approximately 0.4 °F. A change of this magnitude is negligible and does not require a revision of the BSEP 1 and 2 reactor vessel pressure/temperature curves.

3.2.2 Reactor Vessel Structural Evaluation

There are no changes in reactor operating pressure and feedwater or steam flow rate in the MELLLA+ operating range. Other applicable mechanical loads do not increase for MELLLA+. Consequently, there is no change in stress or fatigue for the reactor vessel components.

[

]

3.3 REACTOR INTERNALS

The topics addressed in this evaluation are:

[

]

3.3.1 Reactor Internal Pressure Differences

The core exit steam flow, operating pressure, and feedwater and steam flow at the CLTP, 85% core flow MELLLA+ statepoint are the same as at the CLTP, 104.5% core flow statepoint. Because the core flow is significantly less at the MELLLA+ statepoint, the normal, upset, and emergency RIPDs are less than the values at the BSEP 1 and 2 licensed 104.5% core flow rate. The fuel lift margin is bounded by the margin in the MELLLA operating domain.

[ ]

Because the pressure and steam flow are unchanged in the MELLLA+ range, the faulted loads resulting from main steam line breaks inside or outside containment are the same as at the CLTP. The faulted acoustic and flow induced loads in the RPV annulus resulting from the recirculation line break LOCA have been considered in the BSEP 1 and 2 evaluation. [ ] The BSEP 1 and 2 faulted acoustic and flow induced loads in the MELLLA+ region [ ] are bounded by the loads in the MELLLA operating domain [ ]

3.3.2 Reactor Internals Structural Evaluation

The structural integrity evaluations supporting the MELLLA+ operating range expansion are performed consistent with the current design basis of the components. The following loads and their dispositions are considered in the MELLLA+ structural evaluation.

Load Category	MELLLA+ Results
Dead Weight	Dead weight loads are unchanged by MELLLA+
RIPDs	Section 3.3.1 concludes that the RIPDs for the MELLLA+ operating domain are bounded by the MELLLA conditions
Seismic	The seismic response is unaffected by MELLLA+.
Hydrodynamic Containment Dynamic Loads - (LOCA and SRV)	Not part of the BSEP licensing basis.
Annulus Pressurization (AP)	The AP loads in the MELLLA+ operating domain are bounded by the loads in the MELLLA domain. (Section 4.1.2)
Jet Reaction and Impingement	Not part of the original BSEP design basis for the internals. However, not affected by MELLLA+, because the pressure is unchanged.
Thermal Effects	The temperature ranges for the MELLLA+ operating domain are bounded by the MELLLA design basis. (Table 1-2)
Flow	The MELLLA+ mass flow rates are bounded by the MELLLA domain. (Table 1-2)
Acoustic and Flow-Induced Loads Due To Recirculation Line Break	Section 3.3.1 concludes that the acoustic and flow-induced loads in the MELLLA+ domain are bounded by the MELLLA domain.
Fuel Lift Margin	Section 3.3.1 concludes that the fuel lift margins for the MELLLA+ operating domain are bounded by the MELLLA conditions.

Applicable loads, load combinations, and service conditions have been evaluated consistent with the plant design basis for each component. As shown in the above table, the load conditions do not increase due to MELLLA+, and no further evaluation is required.

[

]

The faulted condition loads for the BSEP 1 and 2 reactor internal components resulting from the MELLLA+ operating domain conditions are bounded by the loads in the MELLLA domain.

3.3.3 Steam Separator and Dryer Performance

The performance of the BSEP 1 and 2 steam separators and dryer has been evaluated to determine the moisture content of the steam leaving the reactor pressure vessel. Compared to the CLTP, 100% (or ICF) core flow 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. Assuming CLTP equilibrium cycle limiting conditions of high radial power peaking and 85% rated core flow, with the downcomer water level at the high level alarm point, the predicted steam moisture content is 0.14wt%.

The predicted steam moisture content is acceptable based on a revised moisture content limit. The operation and performance of the NSSS components with moisture content up to the revised limit was evaluated and determined to be acceptable. The effect of increasing steam moisture content on the radiation source terms is addressed in Section 8.0.

3.4 FLOW INDUCED VIBRATION

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

[

]

3.4.1 FIV Influence on Piping

The main steam (MS), feedwater (FW), and the reactor recirculation piping and suspension systems within the containment were evaluated. Branch lines attached to the MS or FW piping were also considered.

[

]

3.4.2 FIV Influence on Reactor Internals

The flow rate range in the MELLLA+ operating domain (85% to 104.5%) is bounded by the MELLLA flow range (75% to 104.5%). The MELLLA+ operating domain does not result in new flow rate conditions inside the reactor vessel. The following table presents the effect on the reactor internals components for the MELLLA+ operating domain.

Component(s)	MELLLA+ Results
Shroud Shroud Head and Separator Steam Dryer	Maximum core flow is unchanged, core flow is reduced, and steam flow is unchanged by MELLLA+
Core Spray Line LPCI Coupling Control Rod Guide Tube In-Core Guide Tubes	Maximum core flow is unchanged
Fuel Channel LPRM/IRM Tubes	Maximum core flow is unchanged
Jet Pumps	Maximum jet pump flow is unchanged for MELLLA+
Jet Pump Sensing Lines	No new recirculation pump speed ranges relative to previously analyzed MELLLA conditions, therefore, no change in vane passing frequency of recirculation pumps
Feedwater Sparger	Feedwater flow is unchanged by MELLLA+

[

]

3.5 PIPING EVALUATION

3.5.1 Reactor Coolant Pressure Boundary Piping

The Reactor Coolant Pressure Boundary (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:

[

]

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

Main Steam and Feedwater Inside Containment - For MELLLA+, the system temperatures, pressure, and flows are within the range of rated operating parameters for the MS and FW piping system (inside containment). [

] The existing structural evaluation is bounding for compliance with ASME criteria and for the effects of thermal expansion displacements on the piping snubbers, hangers, struts, and pipe whip restraints. Piping interfaces with RPV nozzles, penetrations, flanges, pumps and valves also need not be evaluated.

For MELLLA+, there is no change in the feedwater flow rate and temperature. Therefore, there is no change in the characteristics of erosion/corrosion in the FW and attached piping. Although the main steam flow rate and temperature does not increase with MELLLA+, the moisture content of the main steam leaving the vessel may increase to as high as 0.14 wt% while operating in the MELLLA+ domain. This slight change in moisture carryover in the main steam piping was reviewed and the impact on piping wear rates is insignificant (< 1mil/yr). No changes are required to the existing programs discussed in Section 10.7.

[

]

Reactor Recirculation and Control Rod Drive - For MELLLA+, there is no change in the maximum operating pressure, temperature and flow rate for the recirculation piping system and attached RHR piping system. Therefore, pipe stress, pipe support loads (snubbers, hangers, and struts), RPV nozzles, penetrations, pump and valve-to-pipe welds are not affected. This conclusion is also applicable for the Control Rod Drive System.

[

]

Other RCPB Piping - The following Piping System segments from the RPV to the normally closed containment isolation valve are unaffected by MELLLA+ because (1) they are directly connected to the vessel, (2) the maximum pressure and temperature are unchanged, and (3) the containment isolation valve is closed, resulting in zero flow during normal plant operation:

- RHR Low Pressure Coolant Injection lines
- High Pressure Coolant Injection lines
- Standby Liquid Control System Injection line
- Core Spray
- RPV Bottom Head Drain line (The RPV bottom head drain line is a portion of the suction flow path for RWCU and is normally open.)

Safety related thermowells are unaffected by the MELLLA+ operating range expansion.

MELLLA+ does not change the operating pressure or flow rate of any of these systems and the inlet temperature to the RWCU system is within the same range as for MELLLA operation. Therefore, the susceptibility of these systems to erosion/corrosion does not change as a result of the MELLLA+ operating range expansion.

[

]

3.5.2 Balance of Plant Piping

The Balance-of-Plant (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:

[

]

Main Steam and Feedwater Outside Containment - For all MS and FW piping systems, including the associated branch piping, the flow, pressure, temperature, and mechanical loads do not increase due to the MELLLA+ operating range expansion. Consequently, there is no change in stress and fatigue evaluations for the piping or associated supports. The susceptibility of these piping systems to erosion/corrosion as a result of the MELLLA+ operating range expansion is discussed above in Section 3.5.1.

[

]

Other BOP Piping - For some BOP piping, the loads and temperatures used in the analyses depend on the containment hydrodynamic loads and temperature evaluation results (Section 4.1). Section 4.1 shows that the BSEP 1 and 2 LOCA dynamic loads including the pool swell loads, vent thrust loads, condensation oscillation (CO) loads, and chugging loads have been evaluated and are bounded by the current design basis. The BSEP 1 and 2 suppression pool temperatures due to a design basis LOCA are also bounded by the current design basis. Therefore, there is no effect on the following piping systems and support structures:

- RHR Low Pressure Coolant Injection lines
- High Pressure Coolant Injection lines (beyond the closed valve)
- Core Spray
- RCIC (water segment beyond the isolation valve)

Because there is no change to the reactor operating pressure and power level, the piping for the Off Gas System, Containment Air Monitoring, and the Neutron Monitoring System are also unaffected by MELLLA+.

[

]

3.6 REACTOR RECIRCULATION SYSTEM

The topics addressed in this evaluation are:

[

]

All of the Reactor Recirculation System (RRS) operating conditions for MELLLA+ are within the MELLLA RRS operating range. Therefore, the RRS and its components are unaffected by the MELLLA+ operating range expansion. Single loop operation is not allowed in the MELLLA+ operating range.

An evaluation of the net positive suction head (NPSH) for the recirculation pumps and jet pumps shows that MELLLA+ does not increase the NPSH required and increases the NPSH margin. The cavitation protection interlock for the recirculation pumps and jet pumps is expressed in terms of feedwater flow, which does not change for MELLLA+. The interlocks are based on sub-cooling and thus are a function of flow rate and feedwater temperature and are not changed by MELLLA+. The cavitation protection interlock does not change for MELLLA+.

The affect on the TS for Recirculation Flow Mismatch Requirements is included in Section 4.3.

[

]

3.7 MAIN STEAM LINE FLOW RESTRICTORS

The topics addressed in this evaluation are:

[

]

There is no increase in steam flow rate for the MELLLA+ operating range expansion. Therefore, there is no effect on the structural integrity of the main steam flow element (restrictor).

[

]

3.8 MAIN STEAM ISOLATION VALVES

The topics addressed in this evaluation are:

[

]

There is no increase in pressure, steam flow rate, and pressure drop for the MELLLA+ operating range expansion. Therefore, there are no structural or operational effects on the Main Steam Isolation Valves (MSIVs).

[

]

3.9 REACTOR CORE ISOLATION COOLING

The Reactor Core Isolation Cooling (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:

[

]

For the MELLLA+ operating domain, there is no change to the normal reactor operating pressure, decay heat, and the SRV setpoints remain the same. [

]

The NPSH available for the RCIC pump [

] For Anticipated Transients without Scram (Section 9.3.1) 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 dedicated Condensate Storage Tank 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 [

]

The RCIC System maintains sufficient water inventory in the reactor to permit adequate core cooling following a reactor vessel isolation event accompanied by loss of coolant flow from the Feedwater System. The system design injection rate is sufficient for compliance with the system limiting criteria to maintain the reactor water level above TAF at the MELLLA+ conditions. The RCIC System is designed to pump water into the reactor vessel over a wide range of operating pressures.

For many plants, including BSEP 1 and 2, that elected to elevate the nominal low water level, LL3/L1, setpoint to compensate for postulated instrument level inaccuracies due to reference leg heating effects during LOCAs, compliance with the operational criteria for LL3/L1 setpoint margin is not achieved either for EPU or MELLLA+ conditions. The minimum sensed water level outside the shroud decreased with EPU, and the resultant level was not high enough to ensure avoidance of the LL3/L1 instrument setpoint for Automatic Depressurization System (ADS) timer initiation and MSIV closure activation. Operator action to inhibit ADS actuation following transient events will preclude reactor depressurization, thus allowing the RCIC system to perform its design basis function. There is no change in these actions resulting from MELLLA+.

[

]

3.10 Residual Heat Removal System

The Residual Heat Removal (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:

[

]

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 operating modes as assumed in accident analyses. [

]

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

The Suppression Pool Cooling mode is manually initiated to maintain the containment pressure and suppression pool temperature within design limits following isolation transients or a postulated LOCA. The Containment Spray Cooling (CSC) mode reduces the containment pressure and suppression pool water temperature following an accident where steam bypass of the suppression pool occurs. [

]

The pool temperatures are increased for the ATWS event (Section 9.3.1), but remain bounded by the DBA LOCA result.

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 will not become a critical path during refueling operations. Because MELLLA+ does not change the reactor sensible and decay heat, there is no change in the SDC time for the reactor cool down.

The Steam Condensing (SC) mode is designed to maintain the reactor at a hot shutdown condition without depressurizing during reactor isolation, while the equipment failure that caused the isolation is repaired. The SC mode, which is not safety related, has been disabled at BSEP 1 and 2.

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. Because there is no change in the decay heat deposited in the fuel pool, there is no effect on the Fuel Pool Cooling Assist mode.

[

]

3.11 Reactor Water Cleanup System

The topics addressed in this evaluation are:

[

]

The MELLLA+ operating range expansion does not change the pressure or fluid thermal conditions experienced by the Reactor Water Cleanup (RWCU) System. Operation in the MELLLA+ operating range will not increase the quantity of fission products, corrosion products, and other soluble and insoluble impurities in the reactor water. Reactor water chemistry is well within fuel warranty and Technical Specification limits on effluent conductivity and particulate concentration, and thus, no changes will be made in water quality requirements.

The RWCU is a normally operating system with no safety related functions other than containment isolation. [ ] there is no effect on the containment isolation function.

[

]

4.0 ENGINEERED SAFETY FEATURES

This section addresses the evaluations in Regulatory Guide 1.70, Chapter 6 that are applicable to MELLLA+.

4.1 CONTAINMENT SYSTEM PERFORMANCE

The topics addressed in this evaluation are:

[

]

Because the sensible and decay heat do not change in the MELLLA+ operating domain, the long-term suppression pool temperature response does not change. The safety-relief valve loads also do not change because SRV setpoints, and the capacity of vacuum breakers installed on the SRV discharge lines do not change.

[

]

4.1.1 Short Term Temperature and Pressure Response

Operation in the MELLLA+ range may change the break energy for the design basis accident (DBA) recirculation suction line break (RSLB). The plant specific BSEP 1 and 2 short term temperature and pressure response for the RSLB at MELLLA+ conditions has been evaluated and is bounded by the results at the ICF flow rate, which was found to be acceptable (Reference 7). The following table shows the peak drywell pressure for BSEP.

Plant Condition	Peak Drywell Pressure (psig)
102% Power at 80% Flow (MELLLA+)	45.8
102% Power at Maximum Core Flow	46.4

[

]

4.1.2 Containment Dynamic Loads

Results from the short-term containment response evaluation were used to evaluate the affect of MELLLA+ on the LOCA containment dynamic loads. The key parameters are drywell and wetwell pressure, vent flow rates, and suppression pool temperature. The LOCA dynamic loads include pool swell, vent thrust, condensation oscillation (CO) and chugging. The short-term containment response at MELLLA+ conditions is bounded by the results at the ICF flow rate, which was found to be acceptable (Reference 7). Therefore, the LOCA containment dynamic load definitions are not affected by the MELLLA+ operating domain.

Because the maximum normal operating reactor pressure, steam flow, and feedwater flow do not increase, there is no change in annulus pressurization due to the feedwater and steam line breaks. Reduced feedwater temperature operational enhancement options are not allowed in the MELLLA+ operating domain. [

] the MELLLA+ annulus pressurization loads are bounded by the current evaluations.

4.1.3 Containment Isolation

Section 4.1.1 confirms that the containment pressure and temperature response at MELLLA+ conditions is bounded by the current design basis analysis. Therefore, evaluations of containment isolation systems are not required.

[

]

4.1.4 Generic Letter 89-10

Section 4.1.1 confirms that the containment pressure and temperature response at MELLLA+ conditions is bounded by the current design basis analysis. Therefore, a Generic Letter (GL) 89-10 motor-operated-valve (MOV) program evaluation is not required.

[

]

4.1.5 Generic Letter 89-16

Because the power level does not change for the MELLLA+ operating range expansion, the design of the hardened wetwell vent continues to be acceptable for preventing containment overpressure conditions.

[

]

4.1.6 Generic Letter 95-07

Section 4.1.1 confirms that the containment pressure and temperature response at MELLLA+ conditions is bounded by the current design basis analysis. Therefore, a GL 95-07 "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," program evaluation is not required.

[

]

4.1.7 Generic Letter 96-06

Section 4.1.1 confirms that the containment pressure and temperature response at MELLLA+ conditions is bounded by the current design basis analysis. Therefore, a GL 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," evaluation is not required.

[

]

4.2 EMERGENCY CORE COOLING SYSTEMS

The emergency core cooling systems (ECCS) include the High Pressure Coolant Injection (HPCI), the Core Spray (CS) system, the Low Pressure Coolant Injection (LPCI) mode of the RHR System, and the Automatic Depressurization System (ADS). The topics addressed in this evaluation are:

[

]

4.2.1 High Pressure Coolant Injection

The HPCI System is a turbine driven system designed to pump water into the reactor vessel over a wide range of operating pressures. Originally, the HPCI system was primarily for the mitigation of small break LOCAs where the Automatic Depressurization System (ADS) was assumed to fail. For BSEP, the depressurization function is fully redundant, and no accident mitigation credit is taken for the HPCI system. The primary remaining purpose of the HPCI system is to maintain reactor level above the top of the active fuel (TAF) and prevent ADS actuation for line breaks up to 1" in diameter. The HPCI system also serves as a backup to the Reactor Core Isolation Cooling (RCIC) system to provide makeup water in the event of a loss of feedwater flow transient. The HPCI flow rate capacity was confirmed to be adequate for the increased makeup assumed during ATWS operation. The assumed HPCI makeup requirements for all other events are unchanged.

For MELLLA+ operating range expansion, there is no change to the normal reactor operating pressure, decay heat, and the SRV setpoints remain the same. [

]

The NPSH available for the HPCI pump [

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

]

[

]

4.2.2 High Pressure Core Spray

Not applicable to BSEP 1 and 2.

4.2.3 Core Spray

The Core Spray (CS) System is automatically initiated in the event of a LOCA. When operating in conjunction with other ECCS, the CS system is designed to provide adequate core cooling for any applicable LOCA event.

The MELLLA+ operating range expansion does not change the reactor pressures at which CS operation is required. [

] Because the CS is a part of the model used in the LOCA analysis, the adequacy of the CS System performance is confirmed by the analysis in Section 4.3.

[

]

4.2.4 Low Pressure Coolant Injection

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.

The MELLLA+ operating range expansion does not change the reactor pressures at which the RHR LPCI mode operation is required. [

] Because LPCI is a part of the model used in the LOCA analysis, the adequacy of the LPCI mode performance is confirmed by the analysis discussed in Section 4.3.

[

]

4.2.5 Automatic Depressurization System

The ADS uses safety relief valves to reduce the reactor pressure following a small break LOCA, when it is assumed that the high pressure systems have failed. This allows the CS and LPCI to inject coolant into the reactor vessel. [

] The MELLLA+ operating range expansion does not change the conditions at which the ADS must function and the control and initiation logic do not change.

[

]

4.2.6 ECCS Net Positive Suction Head

The MELLLA+ operating range expansion does not result in an increase in the heat addition to the suppression pool following a LOCA, Station Blackout, or Appendix R event. The long-term peak suppression pool water temperature and long-term peak containment pressure do not change. The most limiting case for NPSH occurs at the peak long-term suppression pool temperature, which is not affected by MELLLA+.

There are no changes in the operator actions to throttle the RHR and CS pumps, or the containment overpressure that is credited to ensure adequate NPSH. Long-term post-LOCA NPSH concerns are not applicable to the HPCI system. The available NPSH and required NPSH for the HPCI pump are not changed for MELLLA+. The NPSH results for the Appendix R, ATWS, and SBO continue to be less limiting than for the DBA-LOCA evaluation.

The NPSH values for BSEP 1 and 2 in the MELLLA+ operating domain are bounded by the current plant specific evaluation.

4.3 EMERGENCY CORE COOLING SYSTEM PERFORMANCE

The BSEP 1 and 2 Emergency Core Cooling System (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 range expansion. The topics addressed in this evaluation are:

[

]

Break Spectrum Response - [

] 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 core flow (Reference 8). [

]

Large Break Peak Clad Temperature - [

] The peak cladding temperature response following a large recirculation line break has two peaks. The first peak is determined by the boiling transition during core flow coastdown early in the event. The second peak is determined by the core uncovery and reflooding. MELLLA+ has two effects on the boiling transition and first peak PCT. First, the reduced core flow causes the boiling transition to occur earlier and possibly lower in the bundle. Second, the reduced core flow 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. At any given power level, the early boiling transition times (boiling transitions that occur before jet pump uncovery) occur earlier in the event and may penetrate lower in the fuel bundle as the core flow is reduced, but the impact of the earlier boiling transition on the LOCA PCT depends on the particular conditions. [

] The Licensing Basis PCT is usually determined by the second peak PCT, even at the low core flows of MELLLA+. The effect of MELLLA+ on the second peak PCT depends on how much the first peak PCT is affected. If the flow reduction has a small effect on the first peak PCT, there is little effect of the first peak on the second peak. The first peak affects the second peak PCT if the cladding superheat prevents the cladding from rewetting after the first peak. If the cladding does not rewet after the first peak, the heatup after uncovery starts at a much higher temperature than it would if the cladding rewetted; this is reflected in a higher second peak PCT.

The PCT for the limiting large break LOCA is determined primarily by the hot bundle and peak fuel node powers. [

] The local fuel conditions do not significantly change with MELLLA+ because the hot bundle power is constrained by the same thermal limits for the purposes of the BSEP analysis. [

]

[

] The Licensing Basis PCT is based on the Appendix K PCT. [

] The PCT results summarized below show that there are no unusual trends in PCT in the MELLLA+ region and that there is significant margin to the 2200°F PCT limit.

[

]

(1) PCT results shown are for GE14 fuel.

(2) Power level shown is percent of OLTP. Flow level shown is percent of rated core flow.

Reference 9 provides justification for the elimination of the 1600°F 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 10 accepted this position by noting that, since 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 BSEP MELLLA+ demonstrate that this plant configuration change does not invalidate the existing Upper Bound PCT calculation. After the implementation of MELLLA+, the Licensing

Basis PCT will continue to bound the Upper Bound PCT. Therefore, the Licensing Basis PCT is sufficiently conservative.

Small Break Peak Clad Temperature- The behavior of the PCT during small breaks for the BSEP 1 and 2 plants [ ] The trends discussed in the M+LTR regarding the blowdown rates from both subcooled and saturated breaks are applicable to the BSEP plants. [ ]

Single Failure Evaluation- The factors influencing the selection of the limiting single failure for the BSEP 1 and 2 plants [ ] The trends discussed in the M+LTR regarding the first and second clad temperature peaks are applicable to the BSEP plants. [ ]

10CFR50.46 Acceptance Criteria- The PCT discussion above shows that BSEP 1 and 2 at MELLLA+ conditions have significant margins to the 2200°F acceptance criterion of 10CFR50.46. Jet pump BWRs have significant margin to the local cladding oxidation and core-wide metal-water reaction acceptance criteria, even for peak cladding temperatures at the 2200°F limit. Since the cladding oxidation is determined by the PCT, MELLLA+ will affect the amount of cladding oxidation; however, compliance with the 2200°F limit ensures compliance with the local cladding oxidation and core-wide metal-water reaction acceptance criteria. Compliance with the coolable geometry and long-term cooling acceptance criteria were demonstrated generically for GE BWRs (Reference 8). These generic dispositions are applicable to the BSEP plants for operation in the MELLLA+ operating range and there is a negligible effect on compliance with the other acceptance criteria of 10CFR50.46.

Recirculation Drive Flow Mismatch Limits- Limits have been placed on recirculation drive flow mismatch over a range of core flow. For BSEP, the limits on flow mismatch are more relaxed at lower core flow rates. The discussion and trends in the M+LTR are applicable to the BSEP plants. [ ]

[ ]

4.4 MAIN CONTROL ROOM ATMOSPHERE CONTROL SYSTEM

The topics addressed in this evaluation are:

[ ]

The MELLLA+ operating range expansion does not result in a change in the source terms or the release rates (Section 8.0). Therefore, there is no effect on the control room atmosphere control system or operator exposure due to postulated accident conditions.

[

]

4.5 STANDBY GAS TREATMENT SYSTEM

The topics addressed in this evaluation are:

[

]

The Standby Gas Treatment System (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 design basis accident.

The design flow capacity of the BSEP 1 and 2 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. [

] the system design flow requirement is unaffected. [

] there is no effect on the SGTS.

[

]

4.6 MAIN STEAM ISOLATION VALVE LEAKAGE CONTROL SYSTEM

BSEP 1 and 2 do not use a Main Steam Isolation Valve Leakage Control System (MSIV-LCS).

4.7 POST-LOCA COMBUSTIBLE GAS CONTROL SYSTEM

The topics addressed in this evaluation are:

[

]

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. [

] there is no change in the production of hydrogen or oxygen.

[

]

5.0 INSTRUMENTATION AND CONTROL

This section addresses the evaluations in Regulatory Guide 1.70, Chapter 7 that are applicable to MELLLA+.

5.1 NSSS MONITORING AND CONTROL

Changes in process parameters resulting from the MELLLA+ operating range expansion and their effects on instrument performance and setpoints are evaluated in the following sections. Technical Specifications address those instrument allowable values and setpoints for those parameters that initiate protective actions. The effect on the setpoints is addressed in Section 5.3. The topics addressed in this evaluation are:

[

]

5.1.1 Neutron Monitoring System

Because the maximum power does not increase, the effects on the performance of the Neutron Monitoring System (NMS) are insignificant.

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

The Average Power Range Monitor (APRM) output signals are calibrated to read 100% at the CLTP. Because there is no change in the maximum core power for the MELLLA+ operating range expansion, the APRMs are unaffected. The MELLLA+ operating range expansion has no effect on the Intermediate Range Monitors (IRMs) overlap with the Source Range Monitors (SRMs) and APRMs, because overlap occurs at a lower power level than the MELLLA+ region. Using normal plant surveillance procedures, the IRMs may be adjusted to ensure adequate overlap with the SRMs and APRMs.

The SRM, IRM and APRM systems are installed at BSEP 1 and 2 in accordance with the requirements established by the GE design specifications. [

]

5.1.1.2 Local Power Range Monitors

There is no change in the neutron flux experienced by the LPRMs and traversing incore probes (TIPs) resulting from the MELLLA+ operating range expansion. Therefore, the operability, neutronic life, and accuracy of the LPRM detectors will be unchanged by MELLLA+. Similarly, the radiation levels of the TIPs will be unchanged.

The LPRMs and TIPs are installed at BSEP 1 and 2 in accordance with the requirements established by the GE design specifications. [

]

5.1.1.3 Rod Block Monitor

The Rod Block Monitor (RBM) uses LPRM instrumentation inputs that are combined and referenced to an APRM channel. Because the LPRM and APRM are unaffected by the MELLLA+ operating range expansion, there is no change in the RBM performance.

[

]

5.1.2 Rod Worth Minimizer

The function of the Rod Worth Minimizer (RWM) is to support the operator by enforcing rod patterns until reactor power has reached appropriate levels. The RWM satisfies Criteria 3 of 10CFR50.36 and functions to limit the local power in the core to control the effects of the postulated Control Rod Drop Accident at low power. There is no change in the performance of this system resulting from MELLLA+.

[

]

5.2 BOP MONITORING AND CONTROL

Operation of the plant in the MELLLA+ region has no effect on the Balance-of-Plant (BOP) System instrumentation and control devices. The topics addressed in this evaluation are:

[

]

For the BSEP 1 and 2 MELLLA+ operating range expansion there is no change in the pressure, steam flow, feedwater flow, or system dynamic characteristics. Therefore, no safety or non-safety related changes are required as a result of MELLLA+.

[

]

5.3 TECHNICAL SPECIFICATION INSTRUMENT SETPOINTS

Technical Specifications (TS) instrument allowable values and nominal trip setpoints are those sensed variables, which initiate protective actions and are generally associated with the safety analysis. The determination of the allowable value (AV) and nominal trip setpoint includes consideration of measurement uncertainty and is derived from the analytical limit (AL). Standard setpoint methodologies (References 15 and 16) are used to generate the AVs and nominal trip setpoints (NTSP) related to the ALs. The MELLLA+ operating range expansion results in the development of one AL.

The topics addressed in this evaluation are:

[

]

5.3.1 APRM Flow-Biased Scram

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

] The MELLLA+ APRM Flow Biased scram AV expressions are:

$AV_{M+ROD\ BLOCK} = 0.61\ W_d + 57.6\ \%$

$AV_{M+SCRAM} = 0.61\ W_d + 65.2\ \%$

MELLLA+ does not apply to single loop operation (SLO). Therefore, no SLO flow-biased expressions are provided.

5.3.2 Rod Block Monitor

There are no RBM setpoint changes resulting from the MELLLA+ operating range expansion. [ ]

6.0 ELECTRICAL POWER AND AUXILIARY SYSTEMS

This section addresses the evaluations in Regulatory Guide 1.70, Chapters 8 and 9 that are applicable to MELLLA+. Because there is no change in power output, most of the topics in this section are unaffected by the MELLLA+ operating range expansion.

6.1 AC POWER

The alternating current (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 onsite Diesel Generators. The topics addressed in this evaluation are:

[

]

There is no change in the thermal power from the reactor or the electrical output from the station that results from the MELLLA+ operating range expansion. The normal operating and safety related electrical loads do not change. No increase in flow or pressure is required of any AC-powered ECCS equipment for MELLLA+.. Therefore, the amount of power required to perform safety related functions (pump and valve loads) is not changed, and the current emergency power system remains adequate.

[

]

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:

[

]

The MELLLA+ operating range expansion does not change system requirements for control or motive power loads. There is no change in the DC power requirements.

[

]

6.3 FUEL POOL

The topics addressed in this evaluation are:

[

]

Fuel Pool Cooling: The MELLLA+ operating range expansion does not increase the core power level. Therefore, the spent fuel pool heat load due to the decay heat generation does not change as a result of MELLLA+. The fuel pool coolıng systems are not affected by MELLLA+.

Crud Activity and Corrosion Products: Crud activity and corrosion products associated with spent fuel do not change due to MELLLA+.

Radiation Levels: The normal radiation levels around the pool do not change due to the MELLLA+ operating range expansion.

Fuel Racks: The MELLLA+ operating range expansion does not change the spent fuel pool heat load.

[

]

6.4 WATER SYSTEMS

The water systems are designed to provide a reliable supply of cooling water for normal operation and design basis accident conditions. The topics addressed in this evaluation are:

[

]

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 range expansion. MELLLA+ does not change the cooling requirements on the RHR System or the heat load discharged to the environment. Therefore, no changes to the Service Water System are required and the ultimate heat sink (UHS) temperature is not affected by MELLLA+.

[

]

6.5 STANDBY LIQUID CONTROL SYSTEM

The Standby Liquid Control System (SLCS) 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:

[

]

Because the boron concentration for core shutdown margin depends on the fuel design and core loading, the boron requirement is evaluated for each BSEP 1 and 2 fuel reload (Section 2.3). If necessary, an increase in the reactor boron concentration may be achieved by increasing, either individually or collectively, (1) the minimum solution volume, (2) the minimum solution concentration, or (3) the isotopic enrichment of the B^{10} in the neutron absorber solution.

[

]

The SLCS is designed for injection at a maximum reactor pressure equal to the nominal setpoint for the lowest group of safety relief valve (SRV) operating in the safety relief mode, which is 1130 psig. Because the reactor dome pressure and SRV setpoints are unchanged for MELLLA+, the current SLCS process parameters do not change. Therefore, the capability of the SLCS to perform its backup shutdown function is not affected by MELLLA+.

The SLCS ATWS performance is evaluated in Section 9.3.1 [

] The 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 demonstrates that there is no increase in the peak vessel dome pressure during the time the SLCS is in operation. Consequently, there is no increase in the pump discharge pressure and no decrease in the pressure margin to the SLCS pump discharge relief valve setpoint. Therefore, SLCS operation during an ATWS is acceptable for the MELLLA+ operating range expansion.

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, reactor building and the drywell, which support normal plant operation. The topics addressed in this evaluation are:

[

]

The process temperatures and heat load from motors and cables do not change due to MELLLA+. Therefore, there are no changes in the heating, cooling supply, exhaust and recirculation units in the turbine building, reactor building and the drywell, which support normal plant operation.

[

]

6.7 FIRE PROTECTION

This section addresses the fire protection program, fire suppression and detection systems, safe shutdown system responses to postulated fire events. The topics addressed in this evaluation are:

[

]

Operation in the MELLLA+ operating domain does not affect the fire suppression or detection systems. There are no changes in physical plant or combustible loading as a result of MELLLA+. The safe shutdown systems and equipment used to achieve and maintain cold shutdown conditions do not change as a result of MELLLA+ conditions. The operator actions required to mitigate the consequences of a fire are not affected. Therefore, the fire protection systems and analyses are not affected by MELLLA+.

Because the decay heat does not change for the MELLLA+ operating range expansion, there are no changes in the reactor and containment responses to postulated fire events. MELLLA+ does not affect any features of the fire protection design and does not change the BSEP 1 and 2 design requirements of fire events or requirements for operator actions and safe shutdown systems.

[

]

6.8 OTHER SYSTEMS AFFECTED

An evaluation has been performed to confirm that the BSEP 1 and 2 systems affected by the MELLLA+ operating range expansion have been identified. The topics addressed in this evaluation are:

[

]

Those systems that are significantly affected by the MELLLA+ operating range expansion are addressed in this report. Other systems not addressed by this report are not significantly affected by the MELLLA+ operating range expansion.

[

]

7.0 POWER CONVERSION SYSTEMS

This section addresses the evaluations in Regulatory Guide 1.70, Chapter 10 that are applicable to MELLLA+. Because the pressure, steam and feedwater flow rate, and feedwater fluid temperature ranges are unchanged by the operating range 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:

[

]

The MELLLA+ operating range 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. There is no change in the previous missile avoidance and protection analysis.

[

]

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 feedwater systems. The steam jet air ejectors remove non-condensable gases from the condenser to improve thermal performance. The topics addressed in this evaluation are:

[

]

The MELLLA+ operating range expansion does not change the steam flow rate or power level. Neither the heat removal requirement for the condenser or the quantity of non-condensable gases generated by the reactor changes.

[

]

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:

[

]

There is no change in the power level, pressure or steam flow for the MELLLA+ operating range expansion. The Turbine Steam Bypass System is required for normal plant maneuvering and transients, and is not safety related. The turbine bypass system capacity is an input to the cycle specific reload analysis.

[

]

7.4 FEEDWATER AND CONDENSATE SYSTEMS

The Feedwater and Condensate Systems provide the source of makeup water to the reactor to support normal plant operation. The topics addressed in this evaluation are:

[

]

There is no change in the feedwater pressure, temperature, or flow for the MELLLA+ operating range expansion. The Feedwater and Condensate Systems are not safety related. The performance requirements for the Feedwater and Condensate Systems are not changed by MELLLA+.

[

]

8.0 RADWASTE SYSTEMS AND RADIATION SOURCES

This section addresses the evaluations in Regulatory Guide 1.70, Chapter 11 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:

[

]

As discussed in Section 3.3.3, the moisture content of the main steam leaving the vessel may be as high as 0.14 wt% while operating in the MELLLA+ domain. Because this higher moisture content is predicted only under the limiting conditions of high radial power peaking, 85% rated core flow, and downcomer water level at the high level alarm point, the lower steam quality may occur only for short periods during the operating cycle.

Because the power level, feedwater flow, and steam flow do not change for the MELLLA+ operating range expansion, the volume of liquid radwaste and the coolant concentrations of fission and corrosion products will be unchanged. The fission and corrosion products that are generated are typically processed by the condensate filters/demineralizers or the reactor water cleanup (RWCU) demineralizers. Although the volume of waste generated is not expected to increase, a potentially higher moisture content of the reactor steam could result in slightly higher loading on the condensate filters/demineralizers. Since the conditions where a higher moisture content is experienced will occur infrequently, the backwash and change out frequencies for the condensate and RWCU filters/demineralizers is not expected to change significantly as a result of MELLLA+.

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 offsite areas is as low as reasonably achievable and does not exceed applicable guidelines. The topics addressed in this evaluation are:

[

]

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. None of these parameters is affected by the MELLLA+ operating range expansion. Because the MELLLA+ operating range expansion does not change the flow rate of radiolytic hydrogen and oxygen to the Offgas System, the catalytic recombiner temperature and offgas condenser heat load, as well as components downstream of the offgas condenser, are unaffected.

[

]

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:

[

]

The post-operation radiation sources in the core are primarily the result of accumulated fission products. Because there is no change in core power and no significant change in core average exposure for the MELLLA+ operating range expansion, the source terms are unaffected.

[

]

8.4 Radiation Sources in Reactor Coolant

Radiation sources in the reactor coolant include activation products, activation corrosion products, and fission products. The topics addressed in this evaluation are:

[

]

Coolant Activation Products: 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, which result in the primary source of radiation in the turbines during operation. The production of activation products is proportional to neutron flux and steam flow, which remain unchanged for the MELLLA+ operating range expansion. Therefore, there is no change in the coolant activation products in the MELLLA+ operating domain.

[

]

Fission and Activated Corrosion Products: The reactor coolant contains activated corrosion products, which are the result of metallic materials entering the water and being activated in the reactor region. For the MELLLA+ operating range there is no change in the feedwater flow, steam flow, or power.

The fission products in the reactor coolant are separable into the products in the steam and the products in the reactor water. The activity in the steam consists of noble gases released from the core plus activity from the reactor water carryover. The noble gases released during plant operation result from the escape of minute fractions of the fission products from the fuel rods. The fission product activity in the reactor water, like the activity in the steam, is the result of minute releases from the fuel rods. The core power level and fuel thermal limits are not changed for the MELLLA+ operating range expansion. Therefore, the releases from the fuel do not change.

As discussed in Section 3.3.3, the moisture content of the main steam leaving the vessel may be as high as 0.14 wt% while operating in the MELLLA+ domain. Because this higher moisture content is predicted only under the limiting conditions of high radial power peaking, 85% rated core flow, and downcomer water level at the high level alarm point, the lower steam quality may occur only for short periods during the operating cycle. A slightly higher moisture carryover increases the fission products in the steam proportionally, and decreases the fission products in the reactor water.

8.5 RADIATION LEVELS

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

[

]

Plant radiation levels for normal and post-shutdown operation are directly dependent upon radiation levels and radionuclide species in the reactor coolant (steam and water) except where the core is directly involved. Because there is no change in power or flow rate under MELLLA+, the radionuclide concentrations in the coolant do not vary significantly unless the moisture carryover from the vessel increases, which affects the equilibrium concentrations in the coolant. As discussed in Section 3.3.3, the moisture content of the main steam leaving the vessel may be as high as 0.14 wt% (versus 0.1 wt% design) while operating in the MELLLA+ domain. Since normal radiation levels are dominated by the short-lived radionuclides of N-16, the potentially higher fission products in the steam due to a higher carryover are expected to have a negligible effect on normal radiation levels.

Post-shutdown radiation levels in BOP systems could potentially increase due to the higher predicted moisture carryover. However, individual worker exposures will be maintained within acceptable limits by the site ALARA program, which controls access to radiation areas. Administrative and procedural controls compensate for potentially higher post shutdown radiation levels.

The post-accident radiation levels depend primarily upon the core inventory of fission products and technical specification levels of radionuclides in the coolant. As such, they are not significantly affected by MELLLA+. As discussed in Section 3.3.3, the moisture content of the main steam leaving the vessel may be as high as 0.14 wt% while operating in the MELLLA+ domain. Fission products in the coolant are typically processed by the condensate filters/demineralizers or the RWCU demineralizers. A change in the moisture carryover would only result in a slight change in the percentage of the total fission products processed by each system. For those areas requiring post-accident occupancy (per NUREG-0737 Item II.B), the access needed for accident mitigation is unaffected by MELLLA+.

Section 9.2 discusses off-site doses for post-accident calculations.

8.6 NORMAL OPERATION OFF-SITE DOSES

The primary source of normal operation offsite doses is (1) airborne releases from the Offgas System and (2) gamma shine from the plant turbines. The topics addressed in this evaluation are:

[

]

For the MELLLA+ operating range expansion, there is no change in the core power and the steam flow rate. Therefore, there is no change in the offsite dose from noble gases. Similarly, the gamma shine dose from the turbine does not change because there is no change in the neutron flux level and the steam flow rate which control the level of activation products in the steam and are responsible for the gamma shine dose.

[

]

9.0 REACTOR SAFETY PERFORMANCE EVALUATIONS

This section addresses the evaluations in Regulatory Guide 1.70, Chapter 15 that are applicable to MELLLA+.

9.1 ANTICIPATED OPERATIONAL OCCURRENCES

The BSEP 1 and 2 UFSAR defines the licensing basis Anticipated Operational Occurrences (AOOs). Table 9-1 of the M+LTR provides an assessment of the effect of the MELLLA+ operating range expansion on each of the Reference 5 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:

[

]

9.1.1 Fuel Thermal Margin Events

[

] The limiting thermal margin events defined in Reference 5 include:

- Generator Load Rejection Without Bypass Or Turbine Trip Without Bypass,
- Loss Of Feedwater Heating Or Inadvertent HPCI Startup,
- Control Rod Withdrawal Error,
- Feedwater Controller Failure (Maximum Demand), and
- Pressure Regulator Downscale Failure (BWR/6 Only).

[

]

The following events have been analyzed generically to confirm that the ΔCPR is not significantly different when the event is initiated from the MELLLA+ minimum flow statepoint:

- Load Rejection Without Bypass,
- Feedwater Controller Failure (Maximum Demand), and
- Loss of Feedwater Heater.

[ ]

[ ] The limiting thermal margin events are analyzed for each reload core and documented in the Supplemental Reload Licensing Report (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% core flow. The MCPR flow factor ($MCPR_f$) is primarily based upon an evaluation of the slow recirculation increase event. The slow recirculation increase has been analyzed from the maximum MELLLA+ core power at the MELLLA+ minimum core flow of 55%. [ ]

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

[ ] The power and flow dependent limits are confirmed as part of the reload process for each reload core and documented in the Supplemental Reload Licensing Report (SRLR).

9.1.3 Non-Limiting Events

Table 9-1 of the M+LTR provides an assessment of the effect of the MELLLA+ operating range expansion on each of the Reference 5 limiting AOO events and key non-limiting events.

[ ]

9.2 DESIGN BASIS ACCIDENTS

This section addresses the radiological consequences of the following accidents. The topics addressed in this evaluation are:

[

]

The radiological consequences of a DBA are evaluated to determine offsite doses as well as control room operator doses. DBA calculations are generally based upon core inventory sources or technical specification source terms, which do not change as a result of MELLLA+. Given that the source term is constant, unless MELLLA+ changes the evaluations of contamination transport through the plant systems, no change in the DBA analysis occurs from the application of MELLLA+ to plant operations.

[

]

As discussed in Section 3.3.3, the moisture content of the main steam leaving the vessel may be as high as 0.14 wt% while operating in the MELLLA+ domain. Fission products in the coolant are typically processed by the condensate filters/demineralizers or the RWCU demineralizers. A change in the moisture carryover would only result in a slight change in the percentage of the total fission products processed by each system. The filters and resins for each of these systems are processed in the radwaste building. The maximum radwaste tank inventory is not changed by MELLLA+. Additionally, the radwaste building at BSEP is designed to contain a simultaneous rupture of all radwaste tanks. Therefore, operation in the MELLLA+ operating domain does not increase the consequences of a liquid radwaste tank failure.

9.3 SPECIAL EVENTS

This section considers three special events: Anticipated Transients without Scram (ATWS), Station Blackout, and ATWS with Core Instability. The topics addressed in this evaluation are:

[

]

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. However, operation at the higher MELLLA+ power-flow boundary results in a less effective power reduction from the RPT. The ATWS evaluation criteria are to:

- Maintain reactor vessel integrity (i.e., peak vessel bottom pressure less than the ASME service level C limit of 1500 psig),
- Maintain containment integrity (i.e., maximum containment pressure and temperature lower than the design pressure and temperature of the containment structure), and
- Maintain coolable core geometry.

For BSEP 1 and 2, the limiting ATWS events are the Main Steam Isolation Valve Closure (MSIVC) and Pressure Regulator Failure-Open (PRFO). The limiting event for the containment response depends on the RHR cooling capability following a Loss Of Offsite Power (LOOP). The LOOP for BSEP 1 and 2 does not result in a reduction in the RHR pool cooling capability relative to the MSIVC and PRFO. Therefore, the containment response for the MSIVC and PRFO bound the LOOP case. The evaluation includes the effect of RPV pressure response during the time the SLCS is required to inject into the reactor to mitigate an ATWS event. Effects on the SLCS process parameters and design requirements are addressed as part of the system evaluation (Section 6.5).

The ATWS analysis results in the following table demonstrate that the acceptance criteria are met for events initiated in the MELLLA+ operating domain. The peak vessel pressure corresponding to the MELLLA+ condition is based on no SRVs out of service, where the result at CLTP is based on 1 SRV out of service. For the one additional SRV assumed to be in service, the MELLLA+ analysis was performed with a 10% tolerance versus the normally assumed 3% tolerance. The MELLLA+ ATWS analysis was performed with bounding assumptions to address differences between the units, such as turbine bypass capacity and core orifice sizes.

ATWS Acceptance Criteria	CLTP Result	MELLLA+ Result	Limit
Peak Vessel Bottom Pressure (psig)	1487	1457	1500
Peak Suppression Pool Temperature (°F)	195.5	197.7	207.7*
Peak Containment Pressure (psig)	12.9	13 5	62

* The design limit is 220 °F. The 207.7 °F limit is based on the CLTP DBA LOCA analysis. (Reference 7)

A coolable core geometry is assured by meeting the 2200°F peak cladding temperature and the 17% local cladding oxidation acceptance criteria of 10CFR50.46. [

]

9.3.2 Station Blackout

There is no change in core power, decay heat, pressure, or steam flow as a result of the MELLLA+ operating range expansion. Therefore, the plant response to and coping capabilities for the SBO event are not affected by operation in the MELLLA+ core flow range and there is no need to re-analyze the event in the MELLLA+ operating range.

[

]

9.3.3 ATWS with Core Instability

The NRC has reviewed and accepted GE's disposition of the impact of large coupled thermal-hydraulic/neutronic core oscillations during a postulated ATWS event, presented in NEDO-32047-A, "ATWS Rule Issues Relative to BWR Core Thermal-Hydraulic Stability" (Reference 12). The companion report, NEDO-32164, "Mitigation of BWR Core Thermal-Hydraulic Instabilities in ATWS," (Reference 13) was approved by the same SER. The NRC review concluded that the GE 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 severity of the event indicates that core coolable geometry and containment integrity can be maintained, and specified operator actions are sufficient to mitigate the consequences of an ATWS event with large core power oscillations.

The evaluation of ATWS with core instability in the M+LTR [

] The analysis conditions and assumptions used in the analysis bound the BSEP 1 and 2 conditions. [

]

[

]

10.0 OTHER EVALUATIONS

This section addresses the evaluations in Section 10 of the M+LTR.

10.1 HIGH ENERGY LINE BREAK

High energy line breaks (HELBs) are evaluated for their effects on equipment qualification. The topics addressed in this evaluation are:

[

]

MELLLA+ has no effect on the steam pressure or enthalpy at the postulated steam or feedwater line break locations. Therefore, MELLLA+ has no effect on the mass and energy releases from a HELB in a steam or feedwater line.

[

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] the break flow rates for liquid line breaks, such as the Reactor Water Cleanup System (RWCU) line, are bounded by current MELLLA evaluations. These evaluations include MELLLA+ effects on subcompartment pressures and temperatures, pipe whip and jet impingement, and flooding, consistent with the licensing basis.

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10.2 MODERATE ENERGY LINE BREAK

Moderate energy line breaks are not included in the BSEP Licensing Basis.

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:

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10.3.1 Electrical Equipment

The safety-related electrical equipment was reviewed to assure the existing qualification for the normal and accident conditions expected in the area where the equipment is located remain adequate. There is no change in core power, radiation levels, decay heat, pressure, steam flow, or feedwater flow as a result of the MELLLA+ operating range expansion. Section 4.1 confirms that the containment pressure and temperature for MELLLA+ is bounded by the current analysis. Similarly, Section 10.1 confirms that the response for pipe breaks outside containment is bounded by current MELLLA evaluations. Section 9.2 concludes that MELLLA+ does not effect the radiological consequences of the limiting events at BSEP 1 and 2.

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10.3.2 Mechanical Equipment With Non-Metallic Components

Operation in the MELLLA+ operating range does not increase any of the normal process temperatures. Furthermore, the normal and accident radiation levels do not increase due to MELLLA+. Therefore, there is no change to the Environmental Qualification for safety related mechanical equipment with non-metallic components located inside or outside of containment.

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10.3.3 Mechanical Component Design Qualification

Operation in the MELLLA+ operating range does not increase any of the normal process temperatures, pressures, or flow rates. Furthermore, the normal and accident radiation levels do not increase due to MELLLA+. The mechanical design of equipment/components (e.g., heat exchangers) is not affected by operation in the MELLLA+ operating range. Furthermore, the cumulative usage fatigue factors of mechanical components are not affected by operation in the MELLLA+ region.

The nozzle loads and component support loads do not change due operation in the MELLLA+ range. Therefore, the mechanical components and component supports are adequately designed for the MELLLA+ operating range.

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10.4 TESTING

When the MELLLA+ operating range expansion is implemented, testing will be performed to confirm operational performance and control aspects of the MELLLA+ changes. The topics addressed in this evaluation are:

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Steam Separator-Dryer Performance: The steam separator-dryer performance testing will be performed near the CLTP, MELLLA+ minimum core flow statepoint and other statepoints that may be deemed valuable for the purpose of defining the moisture carryover magnitude and trend. This test does not involve safety related considerations.

Average Power Range Monitor (APRM) Calibration: The APRM system is calibrated and functionally tested. The APRM flow-biased scram and rod block setpoints will be calibrated with the MELLLA+ setpoints and APRM trips and alarms tested. This test will confirm that the required APRM trips, alarms, and rod blocks perform as intended in the MELLLA+ region.

Core Performance: This test will evaluate the core thermal power, fuel thermal margin, and core flow performance to ensure a monitored approach to CLTP in the MELLLA+ region. Measurements of reactor parameters are taken in the MELLLA+ region. Core thermal power and fuel thermal margin are calculated using accepted methods. After steady-state conditions are established, measurements will be taken, core thermal power and fuel thermal margin calculated, and evaluated against projected values and operational limits.

Pressure Regulator: This test will confirm that the pressure control system settings established for operation with the current power/flow upper boundary at CLTP are adequate in the MELLLA+ region. The pressure regulator should not require any changes from the settings established for the CLTP. 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. When testing is completed for one pressure regulator, the other pressure regulator is selected and the pressure setpoint step tests are repeated.

Water Level Setpoint Changes: This test verifies that the feedwater control system can provide acceptable reactor water level control in the MELLLA+ region. Reactor water level setpoint step changes are introduced into the feedwater control system, while the plant response is monitored.

Neutron Flux Noise Surveillance: This test verifies that the neutron flux noise level in the reactor is within expectations in the MELLLA+ region. The noise will be recorded by monitoring the LPRMs and APRMs at steady state conditions in the MELLLA+ region.

10.5 INDIVIDUAL PLANT EVALUATION

An assessment of the risk increase has been performed, 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:

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PSA analyses performed for BSEP, using best estimate assumptions, indicate that minor risk increases occur due to the change in SRV overpressure success criteria used in the model for ATWS scenarios. For BSEP, the net increase in risk does not affect the conclusion of risk documented in the EPU submittal. The key inputs to the BSEP 1 and 2 Individual Plant Evaluation (IPE) that support the Generic disposition are confirmed in the sections below.

10.5.1 Initiating Event Categories and Frequency

Section 1.0 states that the MELLLA+ core operating range expansion involves changes to the operating power-flow map and a few setpoints and alarms. There is no change in the operating pressure, power, steam flow rate, and feedwater flow rate. As such, 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.

Internal initiating event categories for BSEP 1 and 2 were qualitatively reviewed to assess the effects of MELLLA+. As demonstrated below, no new BSEP initiating event categories or impact on initiating event frequencies were identified.

It is expected that changes in setpoints have an insignificant impact on initiating frequencies. The MELLLA+ operating range expansion requires changes to the flow-biased rod block and trip functions. These setpoints were developed, using appropriate methodologies and design inputs, to ensure adequate operational flexibility is maintained throughout the MELLLA+ operating range (Section 5.3). In addition, testing will be performed at BSEP 1 and 2 to confirm the operational performance and control aspects of the MELLLA+ changes, including the setpoint changes (Section 10.4).

The BSEP PSA models the long-term likelihood of different categories of trips such as turbine trips, LOCAs, or isolation events. It is very unlikely that changes in setpoints, introduced by implementation of MELLLA+, impact the long-term average frequency of the initiating events included in the model, or introduce new categories of initiating events. It is also very unlikely that changes caused by the MELLLA+ operating range expansion will have a significant impact on operational challenges, or equipment faults leading to plant trips such as likelihood of tripping both recirculation pumps, or recirculation flow runback. However, should this occur, MELLLA+ requires a revised detect and suppress stability solution DSS-CD such that the potential for an instability event challenging fuel or plant design limits is decreased. DSS-CD should not result in any significant increase in plant trips, but only an earlier OPRM trip as an instability event develops. As noted in Section 2.4, the Backup Stability Protection, which is a part of the DSS-CD stability solution, may be used when the OPRM system is temporarily inoperable. Therefore, the effect of the stability region modifications on the PRA is negligible.

The MELLLA+ operating range expansion at BSEP 1 and 2 will not change the likelihood of initiating events or probability of failure of RPS (i.e., ATWS initiating events). MELLLA+ implementation does not involve any changes to reactivity control systems and does not increase the scram demand frequency.

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10.5.2 Component and System Reliability

There is no change in the operating pressure, power, steam flow rate, and feedwater flow rate. The MELLLA+ operating range expansion does not require major plant hardware modifications. No additional requirements are imposed on any of the safety, balance-of-plant, electrical, or auxiliary systems. As discussed in Section 3.5.1, the susceptibility of ECCS system to erosion/corrosion does not change as a result of MELLLA+ operating range expansion. 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 range expansion. The process temperatures and heat load from motors and cables do not change due to MELLLA+ (Section 6.6). Based on review of Sections 3.0, 4.0 and 6.0, it is concluded there are no identified changes in the environmental qualification envelope that could impact equipment or system reliability caused by MELLLA+.

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10.5.3 Operator Response

The operator responses to anticipated occurrences, accidents and special events within the MELLLA+ operating domain are the same as from within the MELLLA operating domain. MELLLA+ does not cause changes in automatic safety actions. After automatic responses have initiated, the post-event operator actions for plant safety (e.g., maintaining safe shutdown, core cooling, containment cooling) remain the same for MELLLA+. Because decay heat is unchanged, the time for boil-off is unchanged. Therefore, operator actions for long term core cooling are not affected by the MELLLA+ operating range expansion. Information supporting the generic M+LTR assessment does not identify any areas where BSEP site-specific characteristics would differ from the assumptions of the generic M+LTR evaluations, or deviate from the conclusion of the generic assessment.

The MELLLA+ operating range expansion does not significantly affect the requirements for operator actions in response to ATWS and ATWS instability events. The BSEP 1 and 2 MELLLA+ ATWS evaluations provided in Section 9.3.1 and 9.3.3 do not result in changes to the boron injection requirements. There are no changes to the operator ATWS response requirements (SLCS initiation, ADS inhibit, and level reduction). No areas were identified where BSEP would differ, or deviate from the generic M+LTR assessment.

Because there are no new operator actions and no significant reduction in the time available for operator actions, operator response for MELLLA+ has no significant impact on the IPE.

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10.5.4 Success Criteria

System success criteria credited to perform the critical safety functions in the BSEP 1 and 2 IPE were evaluated based on the MELLLA+ operating domain. The critical safety functions are:

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 power-flow map and a small number of setpoints and alarms. There is no change in the operating pressure, power, steam flow rate, and feedwater flow rate. The MELLLA+ operating range expansion does not impose any additional requirements on the safety, balance-of-plant, electrical, or auxiliary systems. As demonstrated in Section 9.3.1, the ATWS overpressure requirement for MELLLA+ is satisfied based on no SRVs out of service. PSA analyses performed for BSEP, using best estimate assumptions, indicate that minor risk increases occur due to the change in SRV overpressure success criteria used in the model for ATWS scenarios. However, the net increase in risk does not affect the conclusion of risk documented in Reference 7.

Any increase in external events risk, due to MELLLA+, is not significant because there is little, if any, correlation between the plant changes described in this report and external initiating events. Furthermore, only a subset of external events could lead to a Group 1 isolation with failure of any control rods to insert.

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10.5.5 External Events

The implementation of MELLLA+ does not impact the likelihood of external initiating events, and does not impact the function of equipment available to mitigate an external event.

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10.5.6 Shutdown Risks

The MELLLA+ operating range expansion at BSEP 1 and 2 does not change the shutdown conditions. Therefore, there is no effect on the plant shutdown risk.

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10.5.7 PRA Quality

The PSA quality assessment supporting the BSEP PSA is appropriate for the MELLLA+ evaluation. The quality of the PSA models used in performing the risk assessment for the BSEP MELLLA+ operating range expansion is manifested by the following:

- Sufficient scope and level of detail in PSA.
- Active maintenance of the PSA models and inputs.
- Comprehensive critical reviews.

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10.6 OPERATOR TRAINING AND HUMAN FACTORS

Some additional training may be required to prepare for BSEP 1 and 2 operation in the MELLLA+ region. The topics addressed in this evaluation are:

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The BSEP 1 and 2 operator training program and plant simulator will be evaluated to determine the specific changes required. Any required changes are part of the MELLLA+ implementation plan and will be made consistent with current plant training program requirements. These changes will be made consistent with similar changes made for other plant modifications and include any changes to Technical Specifications, EOPs, and plant systems.

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Training required to operate BSEP 1 and 2 following the MELLLA+ operating range expansion will be conducted prior to operation in the MELLLA+ region. Data obtained during operation in the MELLLA+ region will be incorporated into additional training, as needed. The classroom training will cover various aspects of MELLLA+, including changes to the power-flow map, changes to important setpoints, plant procedures, and startup test procedures. The classroom training may be combined with simulator training for normal operational sequences unique to MELLLA+. Because the plant dynamics will not change substantially for operation in the MELLLA+ region, specific simulator training on transients is not anticipated.

Simulator changes and fidelity validation will be performed in accordance with applicable American National Standards Institute standards currently being used at the training simulator. Section 10.9 addresses the MELLLA+ effects on the Emergency Operating Procedures.

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:

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Section 3.2.1, provides an evaluation of the change in fluence experienced by the reactor internals. The change in fluence is minor resulting in an insignificant change in the potential for IASCC. Therefore, the current inspection programs (based on the BWR Vessel Internals Project (BWRVIP)) for the reactor internal components are adequate to manage any potential effects of MELLLA+.

As discussed in Section 3.5.1, operation in the MELLLA+ domain will not significantly impact the erosion/corrosion of plant piping. The existing Flow Accelerated Corrosion (FAC) monitoring program is adequate[

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10.8 NRC AND INDUSTRY COMMUNICATIONS

The topics addressed in this evaluation are:

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The evaluation of NRC and industry communications is confirmed to be consistent with the [ ] M+LTR and no additional information is required.

10.9 EMERGENCY AND ABNORMAL OPERATING PROCEDURES

Emergency and abnormal operating procedures (EOP, AOP) can be affected by MELLLA+. The topics addressed in this evaluation are:

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EOPs include variables and limit curves, which define conditions where operator actions are indicated. The BSEP 1 and 2 EOPs have been reviewed for any effects of MELLLA+, and it was found that no EOPs were required to be updated.

AOPs include event based operator actions. The BSEP 1 and 2 AOPs have been reviewed for any effects of the MELLLA+ operating range expansion and no changes in operator actions were identified.

11.0 LICENSING EVALUATIONS

The licensing evaluations addressed in this section include:

- Effect on Technical Specifications
- Environmental Assessment
- Significant Hazards Consideration Assessment

11.1 EFFECT ON TECHNICAL SPECIFICATIONS

The Technical Specifications (TS) that are affected by a MELLLA+ operating range expansion is provided in Table 11-1. In contrast to a power uprate, the CLTP, both in relative (%) terms and absolute terms (MWt), does not change. Therefore, the implementation of MELLLA+ requires revision of a limited number of the TS. In addition, changes required for the DSS-CD stability solution option are included.

11.2 ENVIRONMENTAL ASSESSMENT

The environmental effects of MELLLA+ will be controlled at the same limits as for the current analyses. None of the present limits for plant environmental releases will be increased as a consequence of MELLLA+. MELLLA+ has no effect on the non-radiological elements of concern, and the plant will be operated in an environmentally acceptable manner as established by the Environmental Report, as supplemented in June 2001 for the BSEP EPU. Existing Federal, State and local regulatory permits presently in effect will accommodate MELLLA+ without modification. The makeup water sources requirements are not increased beyond the present Environmental Protection Plan.

The evaluation of effects of MELLLA+ on radiological effluents or offsite doses is included in Section 8.0. There will be no change in the radionuclides released to the environment through gaseous and liquid effluents due to the MELLLA+ operating range expansion. For MELLLA+, cycle energy requirements are not increased and fuel design burnups are not decreased. Therefore, the quantity of spent fuel is not expected to increase for MELLLA+. The normal effluents and doses will remain well within 10CFR20 and 10CFR50, Appendix I limits.

The MELLLA+ operating range expansion does not constitute an unreviewed environmental question because it does not involve:

- A significant increase in any adverse environmental effect previously evaluated in the final statement, environmental effect appraisals, or in any decisions of the Atomic Safety and Licensing Board; or
- A significant change in effluents; or
- A matter not previously reviewed and evaluated in the documents specified above which may have a significant adverse environmental effect.

The evaluations also establish that MELLLA+ qualifies for a categorical exclusion not requiring an environmental review in accordance with 10CFR51.22(c)(9) because it does not:

- Involve a significant hazard, or
- Result in a significant increase in the amounts of any effluents that may be released offsite; or
- Result in a significant increase in individual or cumulative occupational radiation exposure.

11.3 SIGNIFICANT HAZARDS CONSIDERATION ASSESSMENT

Increasing the operating range 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 core flow rate operating range.

The DSS-CD introduces an enhanced detection algorithm, the Confirmation Density Algorithm (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 Minimum Critical Power Ratio (MCPR) degradation.

11.3.1 Modification Summary

The MELLLA+ core operating range expansion does not require major plant hardware modifications. The core operating range expansion involves changes to the operating power/core flow map and a small number of setpoints and alarms. Because there is no change in the operating pressure, power, steam flow rate, and feedwater 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 (Reference 6), and are applicable to BSEP 1 and 2. The DSS-CD solution uses the same hardware design as the current Option III solution. The Option III algorithm contained in an OPRM Card and EPROM will be updated to include the enhanced DSS-CD solution algorithm.

11.3.2 Discussion of MELLLA+ Issues

Plant performance and responses to hypothetical accidents and transients have been evaluated for the MELLLA+ operating range 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 Regulatory Guide 1.49 power factor times the rated power level, except for some analyses that are performed at nominal rated power, either because the Regulatory Guide 1.49 power factor is already accounted for in the analysis methods or Regulatory Guide 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+ region. No increase in allowable peak bundle power is needed and fuel thermal design limits will be met in the MELLLA+ region. The analyses for each fuel reload are required to meet the criteria accepted by the NRC as specified in Reference 5 or otherwise approved in the Technical Specification amendment request. 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:

- Feedwater and condensate system pumps
- Low pressure emergency core cooling system (LPCI & CS) pumps
- High pressure emergency core cooling system (HPCI) pump
- Reactor core isolation cooling (RCIC) pump
- Standby liquid control (SLC) pumps
- Control rod drive (CRD) pumps.

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

The MELLLA+ operating range 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 Emergency Core Cooling Systems (ECCS) during postulated Loss Of Coolant Accidents (LOCA).

11.3.2.4 Design Basis Accidents

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 the range of hypothetical pipe break sizes in the largest recirculation, steam, and feedwater lines, a postulated break in one of the ECCS lines, and 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) (Regulatory Guide 1.70 and SAR Section 6.3) in accordance with the rules and criteria of 10CFR50.46 and Appendix K where the limiting criterion is the fuel Peak Clad Temperature (PCT).
- Challenges to the Containment (Regulatory Guide 1.70 and SAR 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 in accordance with 10CFR50 Appendix A Criterion 38.
- DBA Radiological Consequences (Regulatory Guide 1.70 and SAR Section 15) calculated and compared to the criteria of 10CFR50.67.

11.3.2.5 Challenges to Fuel

Emergency Core Cooling Systems are described in Section 6.3 of the plant Updated Final Safety Analysis Report (UFSAR). The PCT calculated for a LOCA from the MELLLA+ region may be higher than the license basis PCT that was calculated based on rated flow; however, the ECCS performance evaluation demonstrates conformance to criteria of 10CFR50.46 at the reduced flow of MELLLA+. Therefore, the ECCS safety margin is not significantly affected by MELLLA+.

11.3.2.6 Challenges to the Containment

The peak values for containment pressure and temperature for events initiated in the MELLLA+ region do not increase, meet design requirements, and confirm the suitability of the plant for operation in the MELLLA+ region. The containment dynamic and structural loads for events initiated in the MELLLA+ region do not increase and continue to meet design requirements. The change in short-term containment response is negligible and, because there is no change in decay heat, there is no change in the long-term response. 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+ region.

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 product 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+ region do not increase.

The radiological consequences of LOCA inside containment, Main Steam Line Break Accident (MSLBA) outside containment, Instrument Line Break Accident (ILBA), Control Rod Drop Accident (CRDA) and Fuel Handling Accident (FHA) are bounded by the evaluation at the current licensed thermal power maximum core flow rate statepoint and need not be reevaluated for the MELLLA+ region. The radiological results for all accidents remain below the applicable regulatory limits for the plant, assuring that all radiological safety margins are maintained.

11.3.2.8 Anticipated Operational Occurrence Analyses

Anticipated Operational Occurrences (AOOs) are evaluated to demonstrate consequences that meet the Safety Limit Minimum Critical Power Ratio (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+ region.

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 specified by Regulatory Guide 1.183 and SRP-15.6.5 provides a more severe DBA radiological consequences scenario than the combined effects of the hypothetical LOCA, which produces the greatest challenge to the fuel and/or containment. That is, the DBA, which produces the highest PCT and/or containment pressure, does not damage large amounts of fuel, and thus, the source terms and doses are much smaller than those postulated in evaluations conforming to Regulatory Guide 1.183. The conservatism associated with combined effects in not reduced by operation in the MELLLA+ region.

11.3.2.10 Non-LOCA Radiological Release Accidents

All of the limiting non-LOCA events discussed in Regulatory Guide 1.70 and 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 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 does not change due to the MELLLA+ operating range expansion or is bounded by the maximum core flow rate statepoint.

11.3.2.12 Balance-of-Plant

Because the power, pressure, steam and feedwater flow rate, and feedwater temperature do not change for MELLLA+, there are no changes to the Balance-Of-Plant (BOP) systems/equipment.

11.3.2.13 Environmental Consequences

For operation in the MELLLA+ region, 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+.

As a result of MELLLA+, there will be no change in the quantity of radioactivity released to the environment through liquid effluents, and no increase in airborne emissions of radioactivity. All offsite radiation doses will be small and within 10 CFR 20 and 10 CFR 50, Appendix I limits.

As a result, it is concluded that the BSEP MELLLA+ operating range expansion does not constitute an unreviewed environmental question and is eligible for categorical exclusion as provided by 10 CFR 51.22(c)(9).

11.3.2.14 Technical Specifications Changes

The Technical Specifications (TS) ensure that plant and system performance parameters are maintained within the values assumed in the safety analyses. The TS setpoints, allowable values, 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. BSEP TS changes are provided in Table 11-1. Instrument uncertainties were properly considered for the setpoint changes associated with MELLLA+. This ensures that the actual plant responses are less severe than those represented by the safety analysis.

The TS also address equipment operability (availability) and put limits on equipment out-of-service (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 MELLLA+ 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 TS.

11.3.2.15 Assessment of 10CFR50.92 Criteria

10CFR50.91(a) states "At the time a licensee requests an amendment, it must provide to the Commission its analysis about the issue of no significant hazards consideration using the standards in §50.92." The following provides this analysis for the MELLLA+ operating range to a minimum core flow rate of 85% of rated with 120% of the original licensed thermal power.

1) Will the change involve a significant increase in the probability or consequences of an accident previously evaluated?

The expansion of the core operating range discussed herein will not significantly increase the probability or consequences of an accident previously evaluated.

The probability (frequency of occurrence) of a DBA occurring is not affected by the operating range expansion, because the plant continues to comply with the regulatory and design basis criteria established for plant equipment (ASME code, IEEE standards, NEMA standards, Regulatory Guides, etc.). An evaluation of the probabilistic safety assessments concludes that the calculated core damage frequencies do not significantly change due to the MELLLA+ operating range expansion. Scram setpoints (equipment settings that initiate automatic plant shutdowns) are established such that there is no significant increase in scram frequency due to the MELLLA+ operating range expansion. No new challenge to safety related equipment results from the MELLLA+ operating range expansion.

The changes in consequences of hypothetical accidents, which occur from operation in the MELLLA+ region, are in all cases insignificant. The MELLLA+ accident evaluations do not exceed any NRC-approved acceptance limits. The spectrum of hypothetical accidents and abnormal operational occurrences has been investigated, and will meet the plant's currently licensed regulatory criteria. In the area of core design, for example, the fuel operating limits such as Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) and Safety Limit Minimum Critical Power Ratio (SLMCPR) are met, and fuel reload analyses will show plant transients meet the criteria accepted by the NRC as specified in Reference 5. Challenges to fuel (ECCS performance) are evaluated, and shown to still meet the criteria of 10CFR50.46, Appendix K, Regulatory Guide 1.70, and UFSAR Section 6.3. Challenges to the containment have been evaluated, and the containment and its associated cooling systems meet 10CFR50 Appendix A Criterion 38, Long Term Cooling, and Criterion 50, Containment. Radiological release events (accidents) have been evaluated, and shown to meet the regulatory limits of 10 CFR 50.67.

2) Will the change create the possibility of a new or different kind of accident from any accident previously evaluated?

The MELLLA+ operating range expansion will not create the possibility of a new or different kind of accident from any accident previously evaluated. Equipment that could be affected by MELLLA+ has been evaluated and no new operating mode, safety related equipment lineup, accident scenario, or equipment failure mode was identified. The full spectrum of accident considerations, defined in the UFSAR, has been evaluated, and no new or different kind of accident has been identified. The MELLLA+ operating range expansion uses fully developed technology, and applies it within the capabilities of existing plant equipment. The technology includes NRC approved codes, standards and methods applied in accordance with existing regulatory criteria.

3) Will the change involve a significant reduction in a margin of safety?

The MELLLA+ operating range expansion will not involve a significant reduction in a margin of safety. The calculated loads on all affected structures, systems and components have been shown to remain within design allowables for all design basis event categories. No NRC acceptance criterion is exceeded. The margins of safety currently included in the design of the plant are not affected by the MELLLA+ operating range expansion. Because the plant configuration and response to transients and hypothetical accidents do not result in exceeding the presently approved NRC acceptance limits, operation in the MELLLA+ region does not involve a significant reduction in a margin of safety.

Conclusion: A MELLLA+ operating range expansion to a minimum core flow rate of 85% of rated with 120% of original licensed thermal power has been investigated. The BSEP licensing requirements have been evaluated and it has been demonstrated that this MELLLA+ operating range 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, which might cause a reduction in a margin of safety.

Having made negative declarations regarding the 10CFR50.92 criteria, this assessment concludes that an operating range expansion to a minimum core flow rate of 85% of rated with 120% of original licensed thermal power does not involve a Significant Hazards Consideration.

11.3.3 Discussion of DSS-CD Stability Solution Issues

For the BSEP 1 and 2 MELLLA+ operating range expansion, the long-term stability solution is being changed from the currently approved Option III solution to the DSS-CD. The DSS-CD solution algorithm, licensing basis, and application procedures are generically described in NEDC-33075P (Reference 6), and are applicable to BSEP 1 and 2.

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. The DSS-CD provides protection against violation of the Safety Limit Minimum Critical Power Ratio (SLMCPR) for anticipated oscillations. Compliance with General Design Criteria (GDC) 10 and 12 of 10CFR50, Appendix A is accomplished via an automatic action. The 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.

10CFR50.91(a) states "At the time a licensee requests an amendment, it must provide to the Commission its analysis about the issue of no significant hazards consideration using the standards in §50.92." The following provides this analysis for the DSS-CD long-term stability solution.

1) Will the change involve a significant increase in the probability or consequences of an accident previously evaluated?

The proposed change will implement DSS-CD as the long-term stability solution. 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. The DSS-CD provides protection against violation of the Safety Limit Minimum Critical Power Ratio (SLMCPR) for anticipated oscillations. Compliance with General Design Criteria (GDC) 10 and 12 of 10CFR50, Appendix A is accomplished via an automatic action. The DSS-CD 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.

A developing instability event is suppressed by the DSS-CD system with substantial margin to the SLMCPR and no clad damage, with the event terminating in a scram and never developing into an accident. In addition, the DSS-CD solution defense-in-depth features incorporate all the backup scram algorithms plus the licensed scram feature of the existing Option III system. The DSS-CD system does not interact with equipment whose failure could cause an accident. Scram setpoints in the DSS-CD will be established so that analytical limits are met. The reliability of the DSS-CD will meet or exceed that of the existing system. No new challenges to safety-related equipment will result from the DSS-CD solution. Because an instability event would reliably terminate in an early scram without impact on other safety systems, there is no significant increase in the probability of an accident.

Proper operation of the DSS-CD system does not affect any fission product barrier or Engineered Safety Feature. Thus, the proposed change cannot change the consequences of any accident previously evaluated. As stated above, the DSS-CD solution meets the requirements of GDC 10 and 12 by automatically detecting and suppressing design basis thermal-hydraulic oscillations prior to exceeding the fuel SLMCPR.

Based on the above, the operation of the DSS-CD solution within the framework of the Option III OPRM hardware will not increase the probability or consequences of an accident previously evaluated.

2) Will the change create the possibility of a new or different kind of accident from any accident previously evaluated?

The DSS-CD solution operates within the existing Option III OPRM hardware. No new operating mode, safety-related equipment lineup, accident scenario, system interaction, or equipment failure mode was identified. Therefore, the DSS-CD solution will not adversely affect plant equipment.

Because there are no hardware design changes (only an EPROM/Card change), there is no change in the possibility or consequences of a failure. The worst case failure of the equipment is a failure to initiate mitigating action (i.e., scram), but no failure can cause an accident of a new or different kind than any previously evaluated.

Based on the above, the proposed change to the DSS-CD solution will not create the possibility of a new or different kind of accident from any accident previously evaluated.

3) Will the change involve a significant reduction in a margin of safety?

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. The DSS-CD solution algorithm will maintain or increase the margin to the SLMCPR for anticipated instability events. The safety analyses in NEDC-33075P (Reference 6) demonstrate the margin to the SLMCPR for postulated bounding stability events. As a result, there is no impact on the MCPR Safety Limit identified for an instability event.

The current Option III algorithms (Period Based Detection, Amplitude Based, and Growth Rate) are retained (with generic setpoints) to provide defense-in-depth protection for unanticipated reactor instability events.

Based on the above, the proposed change will not involve a significant reduction in the margin of safety.

Conclusions: The DSS-CD stability solution has been investigated. The BSEP licensing requirements have been evaluated and it has been demonstrated that the DSS-CD stability solution 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, which might cause a reduction in a margin of safety.

Having made negative declarations regarding the 10CFR50.92 criteria, this assessment concludes that the DSS-CD stability solution does not involve a Significant Hazards Consideration.

Table 11-1 Technical Specification Changes for BSEP Units 1 and 2

Specification	Existing Requirement	Proposed Requirement
TS 3.3.1.1, "Reactor Protection System (RPS) Instrumentation" Table 3.3.1.1-1, Function 2 b (Average Power Range Monitors, Simulated Thermal Power - High) Allowable Value	< 0.55W + 62.6% RTP and < 117.1% RTP	< 0.61W + 65.2% RTP and < 117.1% RTP (Section 5.3.1)
TS 3.3.1.1, "Reactor Protection System (RPS) Instrumentation" SR 3.3.1.1.19	Surveillance requires confirming armed region for OPRM PBDA.	Delete the requirement. (Reference 6)
TS 3.3.1.1, "Reactor Protection System (RPS) Instrumentation" Table 3.3.1.1-1, Function 2.f (Average Power Range Monitors, OPRM Upscale	Includes SR 3.3.1.1.19	Delete the requirement. (Reference 6)
TS 3.4.1 Recirculation Loops Operating LCO 3.4.1	Two recirculation loops with matched recirculation pump speeds shall be in operation, OR One recirculation loop may be in operation provided the following limits are applied when the associated LCO is applicable:	Two recirculation loops with matched recirculation pump speeds shall be in operation, OR One recirculation loop may be in operation provided the plant is not operating in the MELLLA+ region defined in the COLR and provided the following limits are applied when the associated LCO is applicable:
TS 3.4.3, "Safety/Relief Valves (SRVs)" LCO 3.4.3 Actions	The safety function of 10 SRVs shall be OPERABLE. A. One or more required SRVs inoperable. A.1 Be in MODE 3 12 hours AND A.2 Be in MODE 4 36 hours	The safety function of 11 SRVs shall be OPERABLE. A. One required SRV inoperable. A.1 Exit the MELLLA+ operating region as defined in the COLR 12 hours B. Required Action and associated Completion time of Condition A not met OR Two or more required SRVs inoperable B.1 Be in MODE 3. 12 hours AND B.2 Be in MODE 4. 36 hours (Sections 1.2.4, 3.1,and 9.3.1)

Specification	Existing Requirement	Proposed Requirement
TS 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:	3. Provide Specification 3.3.1.1, Function 2.f, PBDA setpoints. No Current Requirement.	Delete the requirement. (Reference 6) 5. The Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operating region for Specification 3.4.1 and 3.4.3.

12.0 REFERENCES

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2. GE Nuclear Energy, "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate," NEDC-32424P-A, February 1999.

3. GE Nuclear Energy, "Generic Evaluations of General Electric Boiling Water Reactor Extended Power Uprate," NEDC-32523P-A, February 2000, Supplement 1, Volume I, February 1999, and Supplement 1, Volume II, April, 1999.

4. GE Nuclear Energy, "Constant Pressure Power Uprate Licensing Topical Report," NEDC-33004P, Rev 1, July 2001, including Errata-Addenda #1 12/21/2001.

5. GE Nuclear Energy, "General Electric Standard Application for Reactor Fuel", NEDE-24011-P-A and NEDE-24011-P-A-US, (latest approved revision).

6. GE Nuclear Energy, "Detect And Suppress Solution–Confirmation Density Licensing Topical Report," NEDC-33075P, Revision 2, November 2002.

7. GE Nuclear Energy, "Safety Analysis Report For Brunswick Steam Electric Plant, Units 1 And 2, Extended Power Uprate," NEDC-33039P, August 2001.

8. GE Nuclear Energy, "Compilation of Improvements to GENE's SAFER ECCS-LOCA Evaluation Model", NEDC-32950P, General Electric Company, January 2000.

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10. Stuart A. Richards (NRC) to James F. Klapproth (GENE), Review of NEDE-23785P, Vol. III, Supplement 1, Revision 1, "GESTR-LOCA and SAFER Models for Evaluation of Loss-of-Coolant Accident Volume III, Supplement 1, Additional Information for Upper Bound PCT Calculation," (TAC No. MB2774), February 1, 2002.

11. GE Nuclear Energy, "TRACG Application for Anticipated Operational Occurrences Transient Analyses," NEDE-32906P, January 2000.

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13. GE Nuclear Energy, "Mitigation of BWR Core Thermal-Hydraulic Instabilities in ATWS," NEDO-32164, December 1992.

14. GE Nuclear Energy, "Assessment of BWR Mitigation of ATWS, Volume II (NUREG-0460 Alternate No. 3)," NEDE-24222, December 1979.

15. GE Nuclear Energy, "General Electric Instrument Setpoint Methodology," NEDC-31336P-A, Class III (Proprietary), September 1996.

16. Carolina Power and Light, "Engineering Instrument Setpoints," EGR-NGCC-0153, Revision 8.