GE Nuclear Energy

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NEDO-33006
Revision 1
Class I
DRF-A12-00159-01
August 2003

LICENSING TOPICAL REPORT

GENERAL ELECTRIC BOILING WATER REACTOR MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS

Approved: [signature]
Ronald S. Dahlin, Program Manager
New Product Introduction

INFORMATION NOTICE

This is a non-proprietary version of the document NEDC-33006P, Revision 1,which has the proprietary information removed. Portions of the document that have been removed are indicated by an open and closed bracket as shown here [[ ]].

IMPORTANT NOTICE REGARDING CONTENTS OF THIS REPORT

PLEASE READ CAREFULLY

The information contained in this document is furnished for the purpose of obtaining NRC approval of the licensing requirements to expand the power/flow operating range to allow operation with the licensed thermal power up to 120% of original thermal power. The only undertakings of General Electric Company with respect to information in this document are contained in contracts between General Electric Company and participating utilities, and nothing contained in this document shall be construed as changing those contracts. The use of this information by anyone other than that for which it is intended is not authorized; and with respect to **any unauthorized use**, General Electric Company makes no representation or warranty, and assumes no liability as to the completeness, accuracy, or usefulness of the information contained in this document.

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EXECUTIVE SUMMARY

This document presents the processes and scope of work required for expansion of the core flow operating range of GE Boiling Water Reactor (BWR) plants. The expanded operating range is designed to enable plants that have increased their licensed power level above the original licensed thermal power (OLTP) to be operated much more effectively. The proposed 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+). MELLLA+ extends the GE BWR licensed operating ranges identified as Extended Load Line Limit Analysis (ELLLA), Maximum Extended Load Line Limit Analysis (MELLLA), and Maximum Extended Operating Domain (MEOD), which includes MELLLA with increased core flow (ICF). The MELLLA/MEOD operating range boundary is characterized by the statepoint of 100% OLTP at 75% of rated core flow. Uprated GE BWRs have restricted their operation consistent with the MELLLA boundary, which reduces the core flow range available for operation at uprated power. For plants that are uprated to 120% OLTP, the MELLLA boundary restricts the core flow to 99% of rated core flow at full power operation.

BWR plants, licensed at uprated power levels, have demonstrated the satisfactory capability of the safety systems and components for operation at the uprate power level with core flow within the MELLLA operating range. Improvements in analytical techniques, plant performance experience, and the latest fuel designs have resulted in availability of operational margins. This available margin, combined with the as-built equipment, system and component capability, provides the potential for expanding the operating range as proposed. No significant Nuclear Steam Supply System (NSSS) or Balance of Plant (BOP) hardware modifications are expected. Setpoint changes for the flow-biased alarm and trip functions will be required.

The MELLLA+ operating range expansion will be applied as an incremental change to previously approved licensed power uprates. [[

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REVISIONS

NEDC-33006P, Revision 1 replaces NEDC-33006P, Revision 0 which was submitted for NRC review on January 15, 2002. Revision 1 replaces Revision 0 in its entirety and should be the sole basis for NRC review and approval.

The following notes summarize the key changes. Editorial and clarification changes are also included.

1. The discussion regarding the constraints that are applicable to the MELLLA+ LTR has been clarified in the Executive Summary and Chapter 1.0.

2. Section 1.2.1, Power / Flow Map, has been updated to expand the basis for the boundaries of the MELLLA+ operating region.

3. Section 2.4, Stability, has been updated to reference the Detect And Suppress Solution–Confirmation Density Licensing Topical Report, NEDC-33075P, Revision 1, August 2002.

4. Section 3.1, Nuclear System Pressure Relief and Overpressure Protection, provides additional discussion regarding the potential effect of the ATWS pressure analysis on the safety/relief valves. Additional support for the maximum overpressure event analysis was also included.

5. Section 3.3.1, Reactor Internal Pressure Differences, is expanded to clarify the inclusion of fuel assembly and control rod guide tube lift forces in the evaluation.

6. Section 4.1.1, Short Term Temperature and Pressure Response, is changed from a generic to plant specific disposition, including the associated discussion.

7. Section 4.3, Emergency Core Cooling System Performance, has been greatly expanded to provide additional basis for the ECCS-LOCA behavior in the MELLLA+ operating region.

8. Section 9.1.1, Fuel Thermal Margin Events, has been expanded to include additional results demonstrating the sensitivity of operation in the MELLLA+ operating region.

9. Section 9.3.3, ATWS with Core Instability, has been expanded to include additional analysis results to support the generic disposition for the MELLLA+ operating region.

The technical content of NEDC-33006P, Revision 1, August 2003 is identical to Revision 1, August 2002. Only the affidavit and proprietary markings have been changed.

ACKNOWLEDGEMENTS

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ACRONYMS

Term	Definition
AC	Alternating Current
ADS	Automatic Depressurization System
ANSI	American National Standards Institute
AOO	Anticipated Operational Occurrence
AOP	Abnormal Operating Procedure
AP	Annulus Pressurization
APRM	Average Power Range Monitor
ARO	All Rods Out
ART	Adjusted Reference Temperature
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
BWROG	BWR Owners Group
CDF	Core Damage Frequency
CFR	Code Of Federal Regulations
CLTP	Current Licensed Thermal Power
CLTR	NEDC-33004P (Reference 3)
CO	Condensation Oscillation
COLR	Core Operating Limits Report
CPPU	Constant Pressure Power Uprate
CPR	Critical Power Ratio
ΔCPR	Change in Critical Power Ratio
CRD	Control Rod Drive
CRDA	Control Rod Drop Accident
CRGT	Control Rod Guide Tube
CS	Core Spray
CS/LPCS	Core Spray or Low Pressure Core Spray
CSC	Containment Spray Cooling
CSS	Core Support Structure
DBA	Design Basis Accident
DC	Direct Current
DSS-CD	Detect And Suppress Solution–Confirmation Density

Term	Definition
ECCS	Emergency Core Cooling System
ELLLA	Extended Load Line Limit Analysis
ELTR1	NEDC-32424P-A (Reference 1)
ELTR2	NEDC-32523P-A (Reference 2)
EOC	End Of Cycle
EOOS	Equipment Out-Of-Service
EOP	Emergency Operating Procedure
EPU	Extended Power Uprate
EQ	Environmental Qualification
FAC	Flow Accelerated Corrosion
FCV	Flow Control Valve
FFWTR	Final Feedwater Temperature Reduction
FHA	Fuel Handling Accident
FIV	Flow-Induced Vibration
FPCC	Fuel Pool Cooling And Cleanup
FW	Feedwater
FWCF	Feedwater Controller Failure
FWHOOS	Feedwater Heater(s) Out-Of-Service
FWT	Feedwater Temperature
GE	General Electric Company
HELB	High Energy Line Break
HPCI	High Pressure Coolant Injection
HPCS	High Pressure Core Spray
HVAC	Heating, Ventilation And Air Conditioning
IASCC	Irradiation Assisted Stress Corrosion Cracking
IC	Isolation Condenser
ICF	Increased Core Flow
IEEE	Institute Of Electrical And Electronics Engineers
ILBA	Instrument Line Break Accident
IORV	Inadvertent Opening Of Relief Valve
IRM	Intermediate Range Monitor
ITS	Improved Technical Specification
LERF	Large Early Release Frequency
LHGR	Linear Heat Generation Rate
LTR	Licensing Topical Report
LOCA	Loss Of Coolant Accident
LOOP	Loss Of Offsite Power

Term	Definition
LPCI	Low Pressure Coolant Injection
LPCS	Low Pressure Core Spray
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
MELB	Moderate Energy Line Break
MELLLA	Maximum Extended Load Line Limit Analysis
MELLLA+	Maximum Extended Load Line Limit Analysis Plus
M+SAR	MELLLA+ Safety Analysis Report (Plant Specific Safety Analysis Report)
MEOD	Maximum Extended Operating Domain (MELLLA and ICF)
Mlb	Millions Of Pounds
MOV	Motor Operated Valve
MS	Main Steam
MSIV	Main Steam Isolation Valve
MSIVC	Main Steam Isolation Valve Closure
MSIVF	Main Steam Isolation Valve Closure With Scram On High Neutron Flux
MSLBA	Main Steam Line Break Accident
MWt	Megawatt-Thermal
NEMA	National Electric Manufacturing Association
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NTSP	Nominal Trip Setpoint
OLMCPR	Operating Limit Minimum Critical Power Ratio
OLTP	Original Licensed Thermal Power
OPRM	Oscillation Power Range Monitor
P/T	Pressure-Temperature
PCT	Peak Cladding Temperature
PRA	Probabilistic Risk Assessment
PRFO	Pressure Regulator Failure Open
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

Term	Definition
RCIS	Rod Control And Information System
RCPB	Reactor Coolant Pressure Boundary
RHR	Residual Heat Removal
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
RWE	Rod Withdrawal Error
RWM	Rod Worth Minimizer
SAR	Safety Analysis Report
SBO	Station Blackout
SDC	Shutdown Cooling
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
SPC	Suppression Pool Cooling
SRLR	Supplemental Reload Licensing Report
SRM	Source Range Monitor
SRP	Standard Review Plan
SRV	Safety Relief Valve
SRVDL	Safety Relief Valve Discharge Line
SW	Service Water
TAF	Top Of Active Fuel
TIP	Traversing In-Core Probe
TLO	Two (Recirculation) Loop Operation
TS	Technical Specification
TSV	Turbine Stop Valve
UFSAR	Updated Final Safety Analysis Report
UHS	Ultimate Heat Sink
USAR	Updated Safety Analysis Report
USE	Upper Shelf Energy

1.0 INTRODUCTION

Power uprates in GE Boiling Water Reactors (BWRs) of up to 120% of original licensed thermal power (OLTP) have been based on the guidelines and approach provided in References 1 and 2 (ELTR1 and ELTR2). A number of extended power uprate (EPU) submittals have been based on these reports. The approach in ELTR1 and ELTR2 allows an increase in the maximum operating reactor pressure, when the reactor power is uprated. Subsequent to the approval of ELTR1 and ELTR2, GE developed an approach to uprate reactor power while maintaining the current reactor maximum operating reactor vessel dome pressure. The power uprate option with no dome pressure increase has been used at several plants, and is expected to be used for most future uprate applications. An improved approach for a Constant Pressure Power Uprate (CPPU) has been submitted in Reference 3 (CLTR).

This Licensing Topical Report (LTR) defines the approach and provides the basis for an expansion of the operating range for plants that have uprated power, either with or without a change in the operating pressure. This core flow rate operating range expansion does not change the current plant vessel dome operating pressure. The improvement in the operating range is identified as Maximum Extended Load Line Limit Analysis Plus (MELLLA+). The current Maximum Extended Load Line Limit Analysis (MELLLA) operating range is characterized by the operating statepoint of reactor thermal power of 100% of OLTP at 75% of rated core flow. Some plants currently combine the MELLLA operating region with Increased Core Flow (ICF) resulting in an operating map called Maximum Extended Operating Domain (MEOD). Uprating to 120% OLTP using the MELLLA or MEOD boundary, restricts the core flow to 99% of rated at full power operation. This results in a reduced core flow range available for flexible operation at the uprated power. [[

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The effects of the MELLLA+ operating range expansion on plant safety evaluations and system assessments are addressed in this LTR. Many systems and evaluations that are part of a power uprate may be dispositioned as unaffected by the MELLLA+ changes. For example, the portions of the plant involved in power generation and electrical distribution experience no changes due to the introduction of the MELLLA+ operating range for the reactor.

1.1 REPORT APPROACH

The evaluations provided in this document demonstrate that the MELLLA+ operating range expansion can be accomplished within the applicable plant safety design criteria. Because the maximum thermal power and maximum core flow rate do not change for MELLLA+, the effects are limited to the NSSS, and primarily within the evaluation of core and reactor internals performance during postulated transient and accident events. In addition, many of the safety evaluations and equipment assessments that have been previously performed for a power uprate are unaffected.

The plant specific MELLLA+ safety analysis report (M+SAR) will follow the same content structure as this document, which is based on the content structure established for the generic power uprate CLTR (Reference 3).

Similar to the CLTR, two dispositions of the evaluation topics are used to characterize the MELLLA+ evaluation scope:

- Generic, and
- Plant Specific.

These two dispositions are discussed in detail below.

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 4).

A phenomenological discussion of the effect of MELLLA+ on the evaluation results is provided in each section of this LTR along with the applicable experience base and references to supporting information. The applicability of the generic assessments for a specific plant application will be evaluated in the plant specific M+SAR. The M+SAR will document confirmation of the generic assessment or provide a plant specific evaluation.

The four different types of generic assessments are discussed further in the following paragraphs.

Bounding Analysis

Bounding analyses may be based upon:

- Demonstration that uprate assessments in CLTR, ELTR1, or ELTR2 are bounding,
- Specific MELLLA+ generic studies provided in this document, or
- Previous studies in generic or plant specific safety analysis report submittals.

Negligible Effect

For those MELLLA+ assessments having a negligible effect, the evaluation of current experience and/or analyses is provided with a discussion of the basis for the assessment. CLTR, ELTR1, or ELTR2 may be referenced if the information in these reports supports the conclusion of negligible effect. Any plant system design that falls outside of the current basis for a "negligible effect" will be addressed in the plant specific submittal.

Unaffected

The MELLLA+ operating range expansion directly affects the core and some aspects of the NSSS. It does not change the thermal power, normal operating pressure, steam flow, feedwater flow, or feedwater temperature. The Power Conversion Systems, Section 7.0, and Electrical Power and Auxiliary Systems, Section 6.0, are examples of subjects where there is no change resulting from the MELLLA+ operating range expansion.

Reload Dependent

Some of the MELLLA+ operating range expansion safety evaluations are fuel operating cycle (reload) dependent. The reload dependent evaluation process requires that the reload fuel design, core loading pattern, and operational plan be established so that analyses can be performed to establish operating limits for the cycle-specific core configuration. The reload analysis process is required to demonstrate that the core design, including the operating limits in the MELLLA+ operating range, will meet all of the applicable NRC evaluation criteria and limits documented in Reference 4. [[

]] The MELLLA+ operating range expansion cannot be implemented unless the appropriate reload core analysis is performed, the core and fuel operating limits are appropriately established, and the criteria and limits in Reference 4 are satisfied. Based upon current requirements, the reload analysis results are documented in the Supplemental Reload Licensing Report (SRLR), and the applicable core operating limits are documented in the plant specific Core Operating Limits Report (COLR).

If the generic assessment is fuel design dependent, this assessment is applicable only to GE/GNF fuel designs through GE14, analyzed with GE methodology. The effect of MELLLA+ on future GE/GNF fuel designs will be addressed during the assessment of the new fuel design consistent with the requirements of Reference 4. If another vendor's fuel design is considered as part of the MELLLA+ operating range expansion, fuel design dependent assessments must be separately evaluated and justified on a plant and fuel specific basis.

1.1.2 Plant Specific Evaluation

All safety evaluations not categorized as Generic will require a plant specific evaluation to be documented in the plant-unique M+SAR submittal. The expected relative effect of MELLLA+ on the plant and the methods used for the performance of the plant specific evaluations are provided in this report. Where applicable, the approved assessment methodology in References 1-4 are referenced rather than redefining the process.

The plant specific evaluations will be reported in the plant specific M+SAR consistent with the contents, structure, and level of detail indicated in this report.

1.1.3 Computer Codes and Methods

NRC-approved or industry-accepted computer codes and calculational techniques are used in the safety analyses for the MELLLA+ operating range. The application range of the methods, models, and computer codes currently used by GE has been reviewed and found adequate for application in the MELLLA+ operating domain. GE continues to develop and license improved computer codes and techniques. The updated methodology, when approved by the NRC, (for example, future use of TRACG for Transient analysis) may be used in future plant specific M+SAR submittals. The computer codes used for each plant evaluation will be listed in the plant specific M+SAR submittal.

1.1.4 Scope of Evaluations

Sections **2.0** through **11.0** provide evaluations of MELLLA+ on the respective topics. This document defines all of the required evaluations for a plant specific application. 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+. Typical MELLLA+ core thermal hydraulic parameters are presented in this section.
- **Section 3.0 Reactor Coolant and Connected Systems:** Evaluations of the NSSS components and systems are performed at the MELLLA+ statepoint conditions. 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+ changes 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 signal ranges and analytical limits for setpoints are evaluated to establish the effects of MELLLA+ changes in process parameters. The scope of the MELLLA+ effects on controls and setpoints is limited because the MELLLA+ parameter variations are limited to the core.
- **Section 6.0 Electrical Power and Auxiliary Systems:** Because the power level is not changed by MELLLA+, the electrical power and distribution systems are not affected. The auxiliary systems have been previously evaluated to ensure that they are capable of supporting safe plant operation at the Current Licensed Thermal Power (CLTP). 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 Safety Analysis Report (USAR) Anticipated Operational Occurrence (AOO) events are reviewed as part of the MELLLA+ evaluation. This section identifies the events that require evaluation in the MELLLA+ operating range.
- **Section 10.0 Other Evaluations:** High energy line break and environmental qualification evaluations for the MELLLA+ range are confirmed to show the continued operability of plant equipment at MELLLA+ conditions. The effects of MELLLA+ on the plant Individual Plant Evaluation (IPE) are evaluated to demonstrate that there is no change on the plant's vulnerability to severe accidents.

- **Section 11.0 Licensing Evaluations:** General information is included to support utility changes to the Technical Specifications, Environmental Assessment, and Significant Hazards Assessment.

1.1.5 Product Line Applicability

The processes, evaluations, and dispositions in this document are applicable to GE BWR/3 through BWR/6 product lines. Where there are differences in the design or characteristics of the product line, the items specific to certain product lines are defined in each section.

1.2 OPERATING CONDITIONS AND CONSTRAINTS

1.2.1 Power / Flow Map

The MELLLA+ operating range expansion is shown in Figure 1-1. The MELLLA+ operating domain is defined above the current MELLLA boundary. The MELLLA upper boundary core power, P (% rated), as a function of core flow, W_T (% rated), is defined as follows:

[[

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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, applying current plant procedures the operator must maneuver the plant back into the allowed operating domain.

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+.

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

As mentioned previously, the changes resulting from the MELLLA+ operating range expansion are related to the core and reactor. There are no temperature changes in the steam and feedwater piping. The small temperature decrease in the recirculation loops (relative to the CLTP, maximum core flow condition) is within current MELLLA ranges.

Table 1-1 compares MELLLA and MELLLA+ thermal-hydraulic operating conditions for a BWR/6 plant. The differences shown in Table 1-1 are typical for other plants, and the core operating conditions listed in Table 1-1 represent the maximum allowed power to flow ratio. The core void fractions are not significantly changed from previous MELLLA conditions. The reduced feedwater temperature (FWT) heat balance for the MELLLA condition, which is based on a feedwater reduction of 50°F, demonstrates that the MELLLA core inlet subcooling is lower than the MELLLA+ value at 120% OLTP and 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 affect 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. [[

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1.2.4 Operational Enhancements

The following table presents performance improvement and/or equipment out-of-service features that are not allowed in the MELLLA+ operating range expansion at this time.

Operational Enhancements Not Allowed in MELLLA+ Operating Region
Feedwater Heater Out-of-Service (FWHOOS)
Single Loop Operation (SLO)

[[

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Single loop operation (SLO) in the MELLLA+ region is not proposed. The present licensing basis for SLO will remain available up to the current licensed SLO power level. The available operating range for SLO in the MELLLA+ region may be considered on a plant specific basis.

The M+SAR will identify applicable existing plant specific operational enhancements for each plant and will provide the basis for their acceptability in the MELLLA+ operating range.

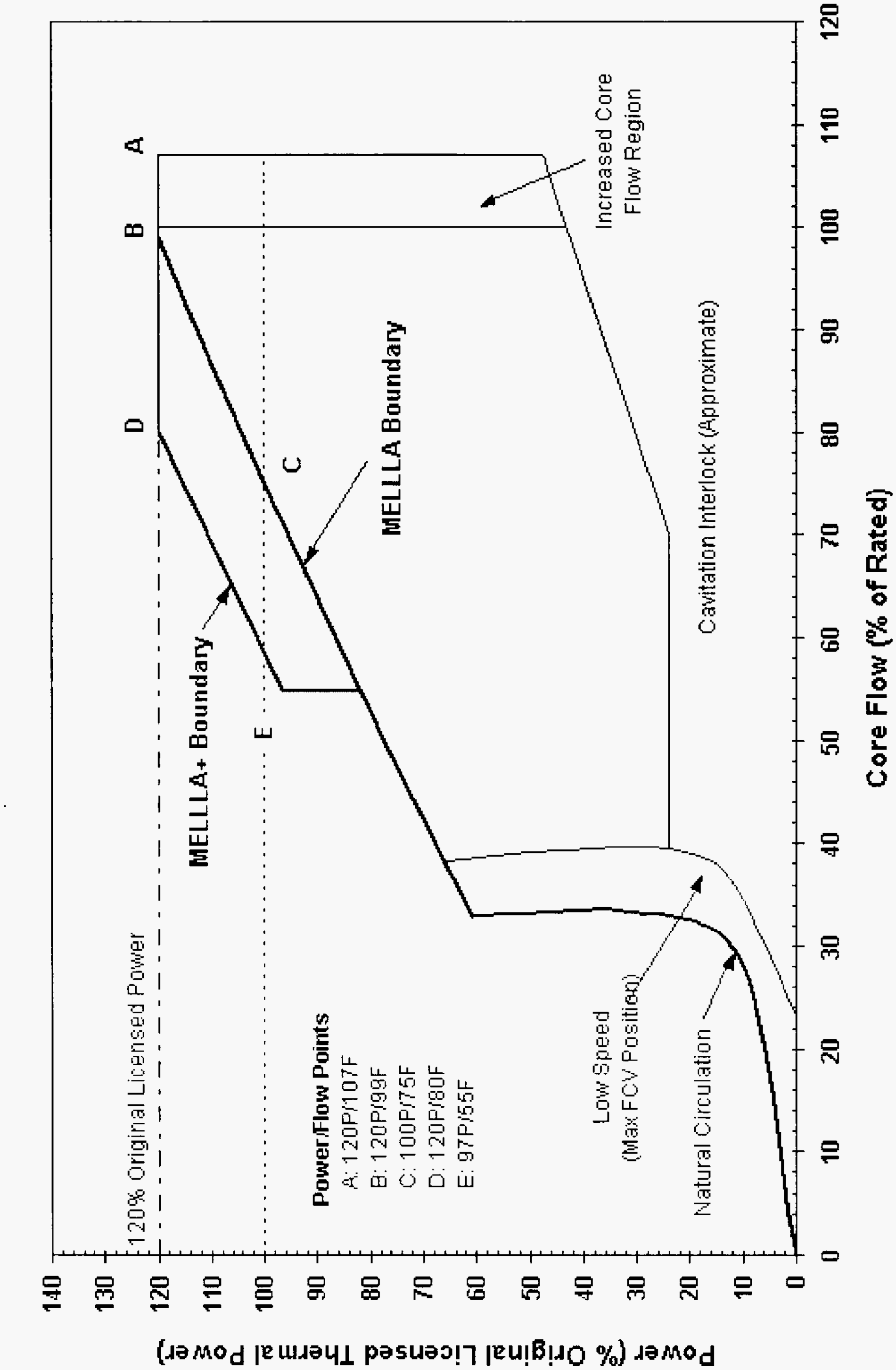
1.3 SUMMARY AND CONCLUSIONS

The plant M+SAR will use the guidelines of this document to demonstrate 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 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, 80% Core Flow Normal FWT	MELLLA+ 97% OLTP, 55% Core Flow Normal FWT
Thermal Power (MWt)	3473	3473	3473	2807
Steam Flow rate (Mlb/Hr)	15.15	14.18	15.15	11.83
Dome Pressure (psia)	1040	1040	1040	1004
Feedwater Temperature (°F)	430	380	430	406
Core Flow (Mlb/Hr)	83.7	83.7	67.6	46.5
Core Inlet Enthalpy (Btu/Lb)	525.2	517.8	519.0	504.1
Core Pressure Drop (psi)	26.1	25.4	19.3	11.2
Core Average Void Fraction	0.52	0.49	0.55	0.56
Average Core Exit Void Fraction	0.73	0.71	0.77	0.78

Figure 1-1 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 documented in the CLTR. The major evaluations and summary disposition of these evaluations are as follows:

Section	Title	Generic	Plant Specific
2.1	Fuel Design and Operation	[[	
2.2	Thermal Limit Assessment		
2.3	Reactivity Characteristics		
2.4	Stability		
2.5	Reactivity Control		]]

The detailed assessment dispositions as outlined in Section 1.1 are provided in the applicable sections. The plant specific evaluations will be reported in the plant specific submittal consistent with the format and level of detail indicated below. The applicability of the generic assessments for a specific plant application will be evaluated. The plant specific submittal will document the confirmation of the generic assessment or provide a plant specific evaluation.

2.1 FUEL DESIGN AND OPERATION

The fuel design limits are established for all new fuel product line designs as a part of the fuel introduction. In general, no additional evaluations are required for MELLLA+. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Fuel product line design	None	[[
Core design	No Change in average power density Axial and radial power distribution in the core may change slightly.	
Fuel thermal margin monitoring threshold	No Change in average power density	]]

[[ ]] The range of void fraction, power shape, and rod positions may change in the MELLLA+ range. MELLLA+ does not change the average bundle power or the maximum allowable peak bundle power. The axial and radial power distribution in the core may change slightly as a result of the design for MELLLA+. Because there is no change to the average power density, there is no change to the fuel thermal margin monitoring threshold.

2.2 THERMAL LIMITS ASSESSMENT

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

Topic	MELLLA+ Effect	Disposition
Safety Limit MCPR	Flatter radial power distribution	[[
Operating Limit MCPR	Insignificant effect (Section 9.1)	
MAPLHGR Limit	Insignificant or no effect (Section 4.3)	
LHGR Limit	No effect	]]

2.2.1 Safety Limit Minimum Critical Power Ratio

[[

]] The SLMCPR analysis reflects the actual plant core loading pattern and is performed for each reload core. Using the methods defined in Reference 4, the cycle specific SLMCPR will be determined and a Technical Specification change will be requested if the current Technical Specification 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 4. The cycle specific analysis results are documented in the Supplemental Reload Safety Report (SRLR) and included in the COLR. The MELLLA+ operating conditions do not change the methods used to determine this limit. [[

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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 included in the plant specific M+SAR to demonstrate that the plant will meet the regulatory limits in the MELLLA+ operating domain. [[

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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+. [[

]]

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:

Topic	MELLLA+ Effect	Disposition
Hot Excess Reactivity	Hot excess reactivity may change	[[
SRO Shutdown Margin	SRO shutdown margin may change	
SLCS Shutdown Margin	SLCS shutdown margin may change	]]

Operation in the MELLLA+ core flow range may change the hot excess reactivity during the cycle. This change in reactivity does not affect safety, and is not expected to significantly affect the ability to manage the power distribution through the cycle to achieve the target power level. Through fuel cycle redesign, sufficient excess reactivity can be obtained to match the desired cycle length.

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 Technical Specifications (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 Technical Specifications (TS) limits are included in the design requirements.

[[

]]

2.4 STABILITY

Four stability long-term solution (LTS) options: Enhanced Option I-A, Option I-D, Option II, and Option III currently apply to various GE BWRs. Information on these, or other viable, stability options may be provided to supplement this report. The information will be provided on a timely basis to support plant applications for MELLLA+.

Plants implementing MELLLA+ with a detect and suppress type LTS may use the Detect and Suppress Solution–Confirmation Density (DSS-CD) solution (Reference 5), or other NRC approved stability long term solution. The DSS-CD consists of hardware and software for the automatic detection and suppression of stability related power oscillations and represents an evolutionary step from the Option III LTS (Reference 6).

Topic	MELLLA+ Effect	Disposition
DSS-CD Setpoints	None.	[[
Armed Region	MELLLA+ generic region.	
Backup Stability Protection (BSP)	A generic BSP methodology applicable to MELLLA+. A cycle specific evaluation is required to confirm the BSP regions.	]]

The DSS-CD solution uses the Confirmation Density Algorithm to detect the inception of power oscillations and generate a power suppression trip signal prior to significant oscillation amplitude growth and MCPR degradation. The DSS-CD LTR provides a generic basis, including the DSS-CD setpoints, for BWR/3-6 product lines, GE14 and earlier GE fuel designs, and operating domains including EPU and MELLLA+.

[[

]]

The trip-enabled region is termed the Armed Region. In the DSS-CD LTR, the Armed Region boundaries are specified to conservatively envelope power and flow conditions potentially susceptible to power oscillation. The trip function is enabled below a specified core flow and above a specified core power. The DSS-CD LTR generically specifies the Armed Region for MELLLA+ operation below 75% rated core flow and above 25% OLTP. For power uprate, the setpoint in %CLTP is scaled to maintain the same power level in MWt.

A Backup Stability Protection (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 BSP regions are confirmed on a cycle-specific basis to demonstrate adequacy to the reload cycle design.

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:

Topic	MELLLA+ Effect	Disposition
Scram Time Response	None	[[
CRD Positioning and Cooling	None	
CRD Integrity	None	]]

2.5.1 Control Rod Scram

For pre-BWR/6 plants 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. [[

]]

For BWR/6 plants at normal operating conditions, the Hydraulic Control Unit accumulators supply all of the pressure to complete the scram. Because the dome pressure for MELLLA+ does not change, BWR/6 plants will retain their current technical specification scram requirements. [[

]]

2.5.2 Control Rod Drive Positioning and Cooling

[[

]] 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. [[

]]

3.0 REACTOR COOLANT AND CONNECTED SYSTEMS

This section addresses the evaluations in Regulatory Guide 1.70, Chapter 5 and part of Chapter 3, documented in the CLTR. These reactor coolant and connected systems evaluations include:

Section	Title	Generic	Plant Specific
3.1	Nuclear System Pressure Relief/Overpressure Protection	[[	
3.2	Reactor Vessel		
3.3	Reactor Internals		
3.4	Flow-Induced Vibration		
3.5	Piping Evaluation		
3.6	Reactor Recirculation System		
3.7	Main Steam Line Flow Restrictors		
3.8	Main Steam Line Isolation Valves		
3.9	Reactor Core Isolation Cooling		
3.10	Residual Heat Removal System		
3.11	Reactor Water Cleanup System		]]

The detailed assessment dispositions as outlined in Section 1.1 are provided in the applicable sections. The plant specific evaluations will be reported in the plant specific submittal consistent with the format and level of detail indicated below. The applicability of the generic assessments for a specific plant application will be evaluated. The plant specific submittal will document the confirmation of the generic assessment or provide a plant specific evaluation.

3.1 NUCLEAR SYSTEM PRESSURE RELIEF AND OVERPRESSURE PROTECTION

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Flow-Induced Vibration	None	[[
Overpressure Relief Capacity	None	]]

Because there is no change in the maximum main steam line flow for the MELLLA+ operating range expansion, there is no affect 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. [[

]]

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:

Topic	MELLLA+ Effect	Disposition
Fracture Toughness	Minor increase in flux at the vessel wall	[[
Reactor Vessel Structural Evaluation	None	]]

3.2.1 Fracture Toughness

The MELLLA+ operating range expansion may result in a higher operating neutron flux at the vessel wall due to the increased void fraction in the core, and a consequent increase of the integrated flux over time (fluence). [[
]]

An increase in fluence will result in an increase in the RPV adjusted reference temperature (ART) and a decrease in upper shelf energy (USE). In the case where the beltline pressure-temperature (P/T) curves are limiting, an increase in ART will also require a revision to the P/T curves. If the fluence increases, then the increase in the ART and decrease in USE will be evaluated according to Regulatory Guide 1.99, Revision 2 (Reference 7).

The USE at end of life must remain greater than the 50 ft-lb criterion of 10CFR50 Appendix G (Reference 8). If the material does not meet the 50 ft-lb criterion, or if the available data is insufficient to determine the USE, then an equivalent margin analysis (EMA) can be performed in accordance with 10CFR50 Appendix G. GE has performed a generic evaluation to demonstrate equivalent margins for BWR material USE (Reference 9). The NRC approved the GE generic EMA evaluation by an NRC SER (Reference 10). A plant specific evaluation is required to demonstrate that the materials meet the limits required for the EMA.

If the P/T curves are beltline limited and the ART increases, then new P/T curves will be required. 10CFR50 Appendix G specifies fracture toughness requirements to provide adequate margins of safety during operation. Appendix G of Section XI of the ASME Code (Reference 11) forms part of the basis for the requirements of 10CFR50 Appendix G. A change to the P/T curves will require a change to the Technical Specification.

[[

]]

3.2.2 Reactor Vessel Structural Evaluation

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

3.3 REACTOR INTERNALS

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

Topic	MELLLA+ Effect	Disposition
Reactor Internals Pressure Differences for Normal, Upset, and Emergency Conditions	None	[[
Reactor Internals Pressure Differences for Faulted Conditions	Possible small increase for some components	
Reactor Internals Structural Evaluation for Normal, Upset, and Emergency Conditions	None	
Reactor Internals Structural Evaluation for Faulted Conditions	Possible small increase in acoustic and flow induced loads due to recirculation line break	

Topic	MELLLA+ Effect	Disposition
Steam Dryer Separator Performance	Possible increase in steam moisture content and separator carryunder	]]

3.3.1 Reactor Internal Pressure Differences

The reactor internal pressure differences (RIPDs) and fuel bundle and Control Rod Guide Tube (CRGT) lift forces are calculated for Normal (steady-state operation), Upset, Emergency, and Faulted conditions, consistent with the existing plant design basis. The process used for calculating the RIPDs for the MELLLA+ operating range is the same as for the power uprate process described in Section 5.5.1.1 of ELTR1.

The core exit steam flow, operating pressure, and feedwater flow and steam flow at the CLTP, 80% core flow MELLLA+ statepoint are all the same as at the CLTP, 100% core flow statepoint. [[

]]

The faulted acoustic and flow induced loads in the RPV annulus resulting from the recirculation line break LOCA are considered in the evaluation. [[

]]

3.3.2 Reactor Internals Structural Evaluation

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

Load Category	MELLLA+ Effect
Dead Weight	[[
RIPDs	
Seismic	

Hydrodynamic Containment Dynamic Loads (LOCA and SRV)	
Annulus Pressurization (AP)	
Jet Reaction	
Thermal Effects	
Flow	
Acoustic and Flow-Induced Loads Due To Recirculation Line Break	
Fuel Assembly and CRGT Lift	]]

The effects on the above loads as a result of the thermal-hydraulic changes due to MELLLA+ are evaluated for the reactor internals. Applicable loads, load combinations, and service conditions are considered consistent with the plant design basis for each component.

[[

]]

The loads for the MELLLA+ conditions are compared to those in the existing design basis analysis. In cases where permanent structural modifications or repairs have been made to the internals, the modified configuration and the corresponding documentation will form the design basis. If the load conditions do not increase due to MELLLA+, then the existing analysis results are bounding, and no further evaluation is required. If the loads increase due to MELLLA+, a reconciliation of the load increase will be performed to confirm that the combined stresses and other stress resultants remain within the allowables for the various service conditions. Quantitative or qualitative assessment will be performed consistent with the existing design basis and the load change.

The evaluation of irradiation-assisted stress corrosion cracking (IASCC) and flow-induced vibration (FIV) are covered in Sections 10.7 and 3.4.2.

3.3.3 Steam Separator and Dryer Performance

The performance of the steam separators and dryer are evaluated to determine the quality of the steam leaving the reactor pressure vessel. Compared to the uprated 100% CLTP, 100% (or ICF) core flow statepoint, the average separator inlet flow decreases and the average separator inlet quality increases at MELLLA+ conditions. The MELLLA+ flow and quality conditions may result in an increase in the moisture content of the steam leaving the RPV. Therefore, the plant specific M+SAR will include a discussion of the steam separator and dryer performance evaluation.

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:

Topic	MELLLA+ Effect	Disposition
Piping FIV Evaluation		
Recirculation Piping	None	[[
Main Steam and Feedwater Piping	None	
Safety Related Thermowells and Probes	None	
RPV Internals FIV Evaluation	None	]]

3.4.1 FIV Influence on Piping

The main steam (MS), feedwater (FW), and the reactor recirculation piping within the containment were evaluated. Applicable structures include the piping and suspension for each of these piping systems. Branch lines attached to the MS or FW piping were also considered. [[

]]

3.4.2 FIV Influence on Reactor Internals

The process for the reactor vessel internals vibration assessment in the MELLLA+ operating region is the same as that described in Section 5.5.1.3 of ELTR1. [[

]] The following table presents the effect on the reactor internals components for the MELLLA+ operating range expansion.

Component(s)	MELLLA+ Effect
Shroud Shroud Head and Separator Steam Dryer	[[
Core Spray Line LPCI Coupling Control Rod Guide Tube In-Core Guide Tubes	
Fuel Channel LPRM/IRM Tubes	
Jet Pumps	
Jet Pump Sensing Lines	
Feedwater Sparger	]]

[[ ]] The MELLLA+ range results in a decreased core and recirculation flow and the steam and feedwater flow is equal to the flow at CLTP. [[ ]]

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:

Topic	MELLLA+ Effect	Disposition
Main Steam and Feedwater (Inside Containment)	None	[[
Recirculation and Control Rod Drive	None	
Reactor Core Isolation Cooling (RCIC) High Pressure Core Spray (HPCS) High Pressure Coolant Injection (HPCI) Reactor Water Cleanup (RWCU) Low Pressure Core Spray (LPCS) Standby Liquid Control (SLC) Residual Heat Removal (RHR) RPV Head Vent line SRV discharge line (SRVDL) Safety related thermowells	None	]]

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). [[

]]

For MELLLA+, there is no change in the main steam flow rate or temperature, and the feedwater flow rate and temperature. The moisture carryover may increase (Section 3.3.3) in the MS lines, which may slightly increase the erosion/corrosion rates for a small period of time during the cycle when the plant is operating at or near the MELLLA+ minimum core flow rate. The change in erosion/corrosion rates will not require changes in the existing programs discussed in Section 10.7. There is no change in the characteristics of erosion/corrosion in the FW and attached piping.

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. [[

]] This conclusion is also applicable for the Control Rod Drive System.

Other RCPB Piping - [[

]]

Safety related thermowells are [[ ]]

MELLLA+ does not change the operating pressure or flow rate of any of these systems and slightly decreases the inlet temperature to the RWCU system. 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:

Topic	MELLLA+ Effect	Disposition
Main Steam and Feedwater (Outside Containment)	None	[[
Reactor Core Isolation Cooling (RCIC) High Pressure Core Spray (HPCS) High Pressure Coolant Injection (HPCI) Low Pressure Core Spray (LPCS) Residual Heat Removal (RHR)	None	
Off Gas System Containment Air Monitoring Neutron Monitoring System.	None	]]

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 will not increase due to the MELLLA+ operating range expansion. [[ ]] 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). [[ ]] The design basis LOCA dynamic loads including the pool swell loads, vent thrust loads, condensation oscillation (CO) loads, and chugging loads have been defined and evaluated for the CLTP, which may include consideration of feedwater temperature reduction. The pool temperatures due to a design basis LOCA were also defined for the CLTP. The M+SAR will confirm that the plant specific values for the MELLLA+ operating range remain within these bounding values. [[

]]

3.6 REACTOR RECIRCULATION SYSTEM

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
System evaluation	None	[[
NPSH	None	
Flow mismatch	None	
Single loop operation	Not Allowed in MELLLA+ Operating Range	]]

All of the Reactor Recirculation System (RRS) operating conditions for MELLLA+ are within the MELLLA RRS operating range. [[ ]] Single loop operation is not allowed in the MELLLA+ operating range.

[[

]]

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:

Topic	MELLLA+ Effect	Disposition
Structural integrity	None	[[ ]]

There is no increase in steam flow rate for the MELLLA+ operating range expansion. [[
]]

3.8 MAIN STEAM ISOLATION VALVES

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Isolation performance	None	[[
Valve pressure drop	None	]]

There is no increase in pressure, steam flow rate, and pressure drop for the MELLLA+ operating range expansion. [[
]]

3.9 REACTOR CORE ISOLATION COOLING/ISOLATION CONDENSER

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. For BWR/3 systems that include an isolation condenser (IC), this equipment removes decay heat from the reactor vessel while maintaining the vessel liquid inventory when the vessel is isolated from the normal heat sink and high pressure makeup systems. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
System hardware	None	[[
System initiation (RCIC and IC)	None	
Net positive suction head	None	]]
Inventory makeup (RCIC) level margin to TAF	See Section 9.1.3	
Heat removal capability (IC)	None	[[ ]]

The RCIC System, used in all BWR/4, 5 and 6 and some BWR/3 plants, is required to maintain 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 must be 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.

An operational requirement is that the RCIC System can restore the reactor water level while avoiding Automatic Depressurization System (ADS) timer initiation and MSIV closure activation functions associated with the low-low-low reactor water level setpoint (Level 1). This requirement is intended to avoid unnecessary initiations of safety systems. Many plants have elected to elevate the nominal ECCS/ADS initiation level setpoint to compensate for indicated instrument level errors resulting from drywell heating effects during a LOCA. Compliance with this operational objective does not change for the MELLLA+ operating range. Any operator action to inhibit ADS actuation following transient events will remain the same for MELLLA+.

For the 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 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 Isolation Condenser (IC) System, used on some BWR/3 plants, provides the equivalent decay heat removal function as the RCIC for isolation events and must satisfy the same requirements. The IC System removes decay heat from the vessel by condensing the steam generated by the decay heat and returning the condensate to the vessel. For MELLLA+, there is no change to the normal reactor operating pressure and the SRV setpoints remain the same. [[

]]

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 both normal, transient, and accident conditions. 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 topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Low Pressure Coolant Injection mode	None	[[
Suppression pool and containment spray cooling modes	None	
Shutdown Cooling mode	None	
Steam Condensing mode	None	
Fuel pool cooling assist	None	]]

[[

]]

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 (SPC) mode is manually initiated to maintain the containment pressure and suppression pool temperature within design limits following isolation transients or a postulated LOCA. [[

]]

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. [[

]]

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 can be repaired. The SC mode, which is not safety related, has been disabled at many BWRs. [[

]]

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 heat removal capability of the Fuel Pool Cooling and Cleanup System. [[

]]

3.11 Reactor Water Cleanup System

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
System performance	None	[[
Containment isolation	None	]]

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 change the quantity of fission products, corrosion products, and other soluble and insoluble impurities in the reactor water. Reactor water chemistry is typically 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.

4.0 ENGINEERED SAFETY FEATURES

This section addresses the evaluations in Regulatory Guide 1.70; Chapter 6 documented in the CLTR. These engineered safety feature evaluations include:

Section	Title	Generic	Plant Specific
4.1	Containment System Performance	[[	
4.2	Emergency Core Cooling Systems		
4.3	Emergency Core Cooling Systems Performance		
4.4	Main Control Room Atmosphere Control System		
4.5	Standby Gas Treatment System		
4.6	Main Steam Isolation Valve Leakage Control System		
4.7	Post-LOCA Combustible Gas Control		]]

The detailed assessment dispositions as outlined in Section 1.1 are provided in the applicable sections. The plant specific evaluations will be reported in the plant specific submittal consistent with the format and level of detail indicated below. The applicability of the generic assessments for a specific plant application will be evaluated. The plant specific submittal will document the confirmation of the generic assessment or provide a plant specific evaluation.

4.1 CONTAINMENT SYSTEM PERFORMANCE

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Short Term Pressure and Temperature Response	Change in break flow and energy due to the differences in thermal hydraulic conditions.	[[
Long-Term Suppression Pool Temperature Response	None	
Containment Dynamic Loads Loss of Coolant Accident Loads Subcompartment Pressurization	Change in break flow and energy due to the differences in thermal hydraulic conditions.	
Containment Dynamic Loads Safety-Relief Valve Loads	None	
Containment Isolation	None	
Generic Letter 89-10	None	
Generic Letter 89-16	None	
Generic Letter 95-07	None	
Generic Letter 96-06	None	]]

[[

]]

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 break energy is derived from the break flow rate and enthalpy. [[

]]

[[

]] The following table shows the peak drywell pressure for the typical Mark I and the peak drywell-to-wetwell pressure for a typical Mark III.

Plant Condition	Mark I Peak Drywell Pressure (psig)	Mark III Peak Drywell-to -Wetwell Pressure (psid)
[[		
		]]

[[
]]

4.1.2 Containment Dynamic Loads

Results from the short-term containment response evaluation are used to evaluate the impact of MELLLA+ on the LOCA containment dynamic loads.

4.1.3 Containment Isolation

[[

]] containment isolation systems evaluations will be performed and reported in the plant specific M+SAR.

4.1.4 Generic Letter 89-10

[[

]] an evaluation of the GL 89-10 program will be performed and reported in the plant specific M+SAR.

4.1.5 Generic Letter 89-16

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

]]

4.1.6 Generic Letter 95-07

[[

]] an evaluation of the GL 95-07 program will be performed and reported in the plant specific M+SAR.

4.1.7 Generic Letter 96-06

[[

]] an evaluation of the GL 96-06 program will be performed and reported in the plant specific M+SAR.

4.2 EMERGENCY CORE COOLING SYSTEMS

The emergency core cooling systems (ECCS) include the high pressure system (either High Pressure Coolant Injection (HPCI) or High Pressure Core Spray (HPCS)), the Core Spray (CS) or Low Pressure Core Spray (LPCS) 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:

Topic	MELLLA+ Effect	Disposition
High Pressure Coolant Injection	None	[[
High Pressure Core Spray	None	

Topic	MELLLA+ Effect	Disposition
Core Spray or Low Pressure Core Spray	None	
Low Pressure Coolant Injection Mode of the RHR System	None	
Automatic Depressurization	None	
ECCS Net Positive Suction Head	None	]]

4.2.1 High Pressure Coolant Injection

The HPCI System, used in all BWR/4 and some BWR/3 plants, is a turbine driven system designed to pump water into the reactor vessel over a wide range of operating pressures. The primary purpose of the HPCI is to maintain reactor vessel coolant inventory in the event of a small break LOCA that does not depressurize the reactor vessel. In this event, the HPCI System maintains reactor water level and helps depressurize the reactor vessel. In addition, the HPCI System serves as a backup to the RCIC System to provide makeup water in the event of a loss of feedwater flow transient.

[[

]]

4.2.2 High Pressure Core Spray

The HPCS System, used in BWR/5 and 6 plants, is designed to spray water into the reactor vessel over a wide range of operating pressures. The HPCS System provides reactor vessel coolant inventory makeup in the event of a small break LOCA that does not immediately depressurize the reactor vessel. In this event, the HPCS System maintains reactor water level and helps depressurize the reactor vessel. This system also provides spray cooling for long-term core cooling after a LOCA. In addition, the HPCS System serves as a backup to the RCIC System to provide makeup water in the event of a loss of feedwater flow transient.

[[

]]

4.2.3 Core Spray or Low Pressure Core Spray

The Core Spray or Low Pressure Core Spray (CS/LPCS) System is automatically initiated in the event of a LOCA. The primary purpose of the CS/LPCS System is to provide reactor coolant makeup for a large break LOCA and for any small break LOCA after the reactor vessel has depressurized. It also provides spray cooling for long-term core cooling in the event of a LOCA.

[[

]]

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.

[[

]]

4.2.5 Automatic Depressurization System

The ADS uses relief or 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/LPCS and LPCI to inject coolant into the reactor vessel. [[

]]

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, and Appendix R event. [[

]]

4.3 EMERGENCY CORE COOLING SYSTEM PERFORMANCE

The Emergency Core Cooling System (ECCS) is designed to provide protection against postulated LOCAs caused by ruptures in the primary system piping. ECCS analyses have been performed for a typical BWR/3, BWR/4, and BWR/6 plants to demonstrate that the 10CFR50.46 requirements are met when LOCAs are initiated from MELLLA+ power and flow conditions. The ECCS performance characteristics do not change for the MELLLA+ operating range expansion. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Large Break Peak Clad Temperature	Small Effect	[[
Small Break Peak Clad Temperature	Negligible Effect	
Local Cladding Oxidation	Negligible Effect	
Core Wide Metal Water Reaction	Negligible Effect	
Coolable Geometry	None	
Long-Term Cooling	None	
Flow Mismatch Limits	None	]]

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. [[

]]

Large Break Peak Clad Temperature - The effect of MELLLA+ on the LOCA performance is similar to that observed with the approved ELLLA and MELLLA low core flow regions. The peak cladding temperature response following a large recirculation line break has two peaks. The first peak is determined by 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. [[

]]

Generic LOCA analyses were performed for typical BWR/3, BWR/4, and BWR/6 plants over the MELLLA+ operating domain shown in Figure 1-1. [[

]]

The results of the generic LOCA analyses are shown in Table 4-1. The results for power/flow points at rated core flow and in the current MELLLA region are included to illustrate the trends due to changes in power and core flow. Table 4-2 shows the MELLLA+ LOCA results for several plants, along with the EPU and MELLLA results for those plants. [[

]]

Small Break Peak Clad Temperature - [[

]]

Single Failure Evaluation - [[

]]

10CFR50.46 Acceptance Criteria – The PCT change due to MELLLA+ will be calculated on a plant-specific basis for the limiting large break LOCA to demonstrate compliance with the 2200°F acceptance criterion of 10CFR50.46. [[

]]

Recirculation Drive Flow Mismatch Limits - Limits have been placed on recirculation drive flow mismatch over a range of core flow. For most plants, the limits on flow mismatch are more relaxed at lower core flow rates. The drive flow mismatch affects the core flow coastdown following the break. The effect of the drive flow mismatch on the LOCA evaluation is similar to a small change in the initial core flow. [[

]]

Plant-Specific MELLLA+ Submittal - The plant-specific MELLLA+ LOCA analyses build on the previous LOCA analyses for the plant (new fuel introduction, power uprate, MELLLA, etc.). The limiting case that defines the plant Licensing Basis PCT (break size, fuel type, and single active failure combination) will be analyzed on a plant specific basis for MELLLA+ conditions using both nominal and Appendix K assumptions in order to determine the changes due to MELLLA+. These changes in PCT will be used to demonstrate continued compliance with the 2200°F acceptance criterion of 10CFR50.46 and the requirements of the NRC SERs approving the SAFER/GESTR-LOCA application methodology. [[

]]

4.4 MAIN CONTROL ROOM ATMOSPHERE CONTROL SYSTEM

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Iodine intake	None	[[ ]]

The MELLLA+ operating range expansion does not result in a change in the source terms or the release rates (Section 8.0). [[

]]

4.5 STANDBY GAS TREATMENT SYSTEM

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Flow capacity	None	[[
Iodine removal capability	None	]]

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.

[[

]]

4.6 Main Steam Isolation Valve Leakage Control System

Most BWR plants do not have a MSIV Leakage Control system. Therefore, there is no need to evaluate the MSIV Leakage Control System. A plant specific evaluation will be provided for those plants that have this system.

4.7 Post-LOCA Combustible Gas Control System

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
System initiation time	None	[[
Recombiner operating temperature	None	
Nitrogen makeup	None	]]

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. [[

]]

Table 4-1 Typical LOCA Analysis Results for MELLLA+

Power/Flow Point[1]		100P/100F (Rated)	100P/80F (MELLLA)	120P/100F (EPU)	120P/80F (MELLLA+)	100P/55F (MELLLA+)
		Peak Cladding Temperature[2]				
Plant Type		1st / 2nd Peak, °F	1st / 2nd Peak, °F	1st / 2nd Peak, °F	1st / 2nd Peak, °F	1st / 2nd Peak, °F
BWR/3	Nominal Appendix K	[[				
BWR/4	Nominal Appendix K					
BWR/6	Nominal Appendix K					]]

(1) Power level shown is percent of original licensed thermal power

[[

]]

Table 4-2 Plant-Specific LOCA Analysis Results for MELLLA+

Power/Flow Point[1]		Rated	MELLLA	EPU	MELLLA+	MELLLA+
		Peak Cladding Temperature[2]				
Plant		1st / 2nd Peak, °F	1st / 2nd Peak, °F	1st / 2nd Peak, °F	1st / 2nd Peak, °F	1st / 2nd Peak, °F
218 BWR/4	Power/Flow Nominal Appendix K	[[				
251 BWR/4	Power/Flow Nominal Appendix K					
218 BWR/6	Power/Flow Nominal Appendix K					]]

(1) Power level shown is percent of original licensed thermal power

[[

]]

5.0 INSTRUMENTATION AND CONTROL

This section addresses the evaluations in Regulatory Guide 1.70, Chapter 7, which are documented in the CLTR. The principal instrumentation and control evaluations and summary disposition of these evaluations are as follows:

Section	Title	Generic	Plant Specific
5.1	NSSS Monitoring and Control	[[	
5.2	BOP Monitoring and Control		
5.3	Technical Specification Instrument Setpoints		]]

The detailed assessment dispositions as outlined in Section 1.1 are provided in the applicable sections. The plant specific evaluations will be reported in the plant specific submittal consistent with the format and level of detail indicated below. The applicability of the generic assessments for a specific plant application will be evaluated. The plant specific submittal will document the confirmation of the generic assessment or provide a plant specific evaluation.

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 of the MELLLA+ operating range expansion on Technical Specifications is addressed in Section 11.1 and effect on the setpoints is addressed in Section 5.3. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Average Power Range, Intermediate Range, and Source Range Monitors	None	[[
Local Power Range Monitors	None	
Rod Block Monitor	None	
Rod Worth Minimizer / Rod Control and Information System	None	]]

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 limited. The following evaluations of the NMS are applicable to GE or Reuter Stokes supplied monitoring equipment, or other equipment that meets GE specifications.

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. [[

]] Using normal plant surveillance procedures, the IRMs may be adjusted to ensure adequate overlap with the SRMs and APRMs.

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. [[

]]

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. [[

]]

5.1.2 Rod Worth Minimizer and Rod Control and Information System

The Rod Worth Minimizer (RWM) and Rod Control and Information System (RCIS) are normal operating systems that do not perform a safety related function. The function of the RWM and RCIS Rod Pattern Controller is to support the operator by enforcing rod patterns until reactor power has reached appropriate levels. The RCIS also provides rod position information to the operator. The RCIS Rod Withdrawal Limiter prevents excessive control rod withdrawal after reactor power has reached an appropriate level. [[

]]

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:

Topic	MELLLA+ Effect	Disposition
Pressure Control System	None	[[
Turbine Steam Bypass System (Normal Operation)	None	
Turbine Steam Bypass System (Safety Analysis)	None	

Topic	MELLLA+ Effect	Disposition
Feedwater Control System (Normal Operation)	None	
Feedwater Control System (Safety Analysis)	None	
Leak Detection System	None	]]

[[

]]

5.3 TECHNICAL SPECIFICATION INSTRUMENT SETPOINTS

Technical Specifications instrument allowable values and setpoints are those sensed variables, which initiate protective actions and are generally associated with the safety analysis. The determination of allowable values (AV) and setpoints includes consideration of measurement uncertainties and is derived from the analytical limits (AL) used in specific licensing or safety evaluations. The settings are selected with sufficient margin to minimize inadvertent initiation of the protective action, while assuring that adequate operating margin is maintained between the system settings and the actual limits. There is typically substantial margin in the safety analysis process that should be considered in establishing the setpoint process used to establish the Technical Specification allowable values and setpoints.

The MELLLA+ operating range expansion results in changes to some setpoints. [[

]]

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
APRM Flow-Biased Scram	Changed consistent with MELLLA+ operating boundary	[[
Rod Block Monitor	No change in ALs or trip settings due to MELLLA+. (Section 5.3.2).	]]

5.3.1 APRM Flow-Biased Scram

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

]] MELLLA+ does not apply to single loop operation (SLO), so the SLO setpoints are unchanged.

5.3.2 Rod Block Monitor

The RBM setpoints are established to mitigate Rod Withdrawal Error (RWE) during power operation.

For plants with flow-biased RBM systems, [[

]]

For plants with ARTS RBM systems, [[

]]

6.0 ELECTRICAL POWER AND AUXILIARY SYSTEMS

This section addresses the evaluations in Regulatory Guide 1.70, Chapters 8 and 9, that are documented in the CLTR. [[

]] The principal electrical power and auxiliary systems evaluations and summary disposition of these evaluations are as follows:

Section	Title	Generic	Plant Specific
6.1	AC Power	[[	
6.2	DC Power		
6.3	Fuel Pool		
6.4	Water Systems		
6.5	Standby Liquid Control		
6.6	Power Dependent HVAC		
6.7	Fire Protection		
6.8	Other Systems Affected		]]

The detailed assessment dispositions as outlined in Section 1.1 are provided in the applicable sections. The plant specific evaluations will be reported in the plant specific submittal consistent with the format and level of detail indicated below. The applicability of the generic assessments for a specific plant application will be evaluated. The plant specific submittal will document the confirmation of the generic assessment or provide a plant specific evaluation.

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:

Topic	MELLLA+ Effect	Disposition
AC Power (normal or degraded voltage)	None	[[ ]]

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. [[

]]

6.2 DC POWER

The direct current (DC) power distribution system provides control and motive power for various systems/components within the plant. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
DC Power	None	[[ ]]

The MELLLA+ operating range expansion does not change system requirements for control or motive power loads. [[ ]]

6.3 FUEL POOL

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Fuel Pool Cooling	None	[[
Crud Activity and Corrosion Products	None	
Radiation Levels	None	
Fuel Racks	None	]]

Fuel Pool Cooling: The MELLLA+ operating range expansion does not increase the core power level. [[
]]

Crud Activity and Corrosion Products: [[
]]

Radiation Levels: [[
]]

Fuel Racks: [[
]]

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:

Topic	MELLLA+ Effect	Disposition
Water Systems	None	[[ ]]

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. [[

]]

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 SLCS is typically a manually operated system, but a few BWRs have automatic actuation. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Shutdown margin	Addressed in Section 2.3, Reactivity Characteristics Potential increase in boron requirements	[[
System hardware	Potential increase in reactor pressure for system operation	
ATWS requirements	Potential increase in the boron injection rate requirements	]]

[[

]] An increase in the reactor boron concentration may be achieved by increasing, either individually or collectively, (1) the minimum solution volume, (2) the minimum specified solution concentration, or (3) the isotopic enrichment of the B^{10} in the stored neutron absorber solution.

The SLCS is typically designed for injection at a maximum reactor pressure equal to the upper analytical setpoint for the lowest group of SRVs operating in the relief mode. [[

]]

The ATWS analysis for MELLLA+ operating range conditions (Section 9.3.1) may impose new boron injection rate requirements. An increase in the reactor boron injection rate may be achieved by increasing, either individually or collectively, (1) the pump capacity, (2) the minimum specified solution concentration, or (3) the isotopic enrichment of the B^{10} in the stored neutron absorber solution. [[

]]

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:

Topic	MELLLA+ Effect	Disposition
Heating, Ventilation And Air Conditioning	None	[[ ]]

The process temperatures and heat load from motors and cables do not change due to MELLLA+. [[

]]

6.7 FIRE PROTECTION

This section addresses the effect of MELLLA+ on the fire protection program, fire suppression and detection systems, safe shutdown system responses to postulated 10 CFR 50 Appendix R fire events. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Fire Protection	None	[[ ]]

Because the decay heat does not change for the MELLLA+ operating range expansion, there are no changes in vessel water level response, operator response time, peak cladding temperature, and peak suppression pool temperature and containment pressure. [[

]]

6.8 OTHER SYSTEMS AFFECTED

The systems typically found in a BWR power plant have been evaluated to establish those systems that are affected by the MELLLA+ operating range expansion. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Other systems	None or not significant	[[ ]]

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 documented in the CLTR. The MELLLA+ core operating range expansion does not affect the power conversion systems. The pressure, steam and feedwater flow rate, and fluid temperature ranges do not change. The following table illustrates the MELLLA+ effect on each power conversion system topic.

Section	Title	Generic	Plant Specific
7.1	Turbine-Generator	[[	
7.2	Condenser and Steam Jet Air Ejectors		
7.3	Turbine Steam Bypass		
7.4	Feedwater and Condensate		]]

The detailed assessment dispositions as outlined in Section 1.1 are provided in the applicable sections. The plant specific evaluations will be reported in the plant specific submittal consistent with the format and level of detail indicated below. The applicability of the generic assessments for a specific plant application will be evaluated. The plant specific submittal will document the confirmation of the generic assessment or provide a plant specific evaluation.

7.1 TURBINE-GENERATOR

The turbine-generator converts the thermal energy in the steam into electrical energy. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Turbine-Generator	None	[[ ]]

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 the 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:

Topic	MELLLA+ Effect	Disposition
Condenser And Steam Jet Air Ejectors	None	[[ ]]

The MELLLA+ operating range expansion does not change the steam flow rate or power level. [[

]]

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 Turbine Steam Bypass System is required for normal plant maneuvering and transients, and is not safety related. The turbine bypass system capacity is used as an input to the cycle specific reload analysis. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Turbine Steam Bypass	None	[[ ]]

There is no change in the power level, pressure or steam flow for the MELLLA+ operating range expansion.

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 Feedwater and Condensate Systems are not safety related. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Feedwater And Condensate Systems	None	[[ ]]

There is no change in the feedwater pressure, temperature, or flow for the MELLLA+ operating range expansion. 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, which are documented in the CLTR. The radwaste and radiation source evaluations include:

Section	Title	Generic	Plant Specific
8.1	Liquid And Solid Waste Management	[[	
8.2	Gaseous Waste Management		
8.3	Radiation Sources in the Reactor Core		
8.4	Radiation Sources in the Reactor Coolant		
8.5	Radiation Levels		
8.6	Normal Operation Off-Site Doses		]]

The detailed assessment dispositions as outlined in Section 1.1 are provided in the applicable sections. The plant specific evaluations will be reported in the plant specific submittal consistent with the format and level of detail indicated below. The applicability of the generic assessments for a specific plant application will be evaluated. The plant specific submittal will document the confirmation of the generic assessment or provide a plant specific evaluation.

8.1 LIQUID AND SOLID WASTE MANAGEMENT

The Liquid Radwaste System collects, monitors, processes, stores and returns processed radioactive waste to the plant for reuse or discharge. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Coolant fission and corrosion product levels	Potential for increased moisture carryover in steam separator/dryer resulting in larger carryover of water to condensate system.	[[
Waste Volumes	None	]]

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 largest source of liquid and wet solid waste is from the backwash of condensate demineralizers. MELLLA+ will not cause the condensate demineralizer or the reactor water cleanup filter demineralizer backwash frequency to be changed. [[

]]

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:

Topic	MELLLA+ Effect	Disposition
Offsite release rate	None	[[
Recombiner performance	None	]]

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. [[

]]

8.3 RADIATION SOURCES IN THE REACTOR CORE

During power operation, the radiation sources in the core are directly related to the fission rate. These sources include radiation from the fission process, accumulated fission products, and neutron activation reactions. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Post operational radiation sources for radiological and shielding analysis	None	[[ ]]

The post-operation radiation sources in the core are primarily the result of accumulated fission products. [[

]]

8.4 RADIATION SOURCES IN REACTOR COOLANT

Radiation sources in the reactor coolant include activation products, activation corrosion products, and fission products. An assessment is provided for each of these sources. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Coolant Activation Products	None	[[
Fission and Activated Corrosion Products	Potential increase in moisture carryover result in lower levels in reactor water and higher levels in steam	]]

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. [[

]]

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 carryover activity from the reactor water. 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[[

]]

8.5 Radiation Levels

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

Topic	MELLLA+ Effect	Disposition
Normal operational radiation levels	Vary directly with reactor coolant radiation levels (Section 8.4)	[[
Post-shutdown radiation levels	Vary directly with reactor coolant radiation levels (Section 8.4)	
Post-accident radiation levels	No significant effect except plant specific analyses may be required by Section 9.2	]]

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. [[

]]

The post-accident radiation levels depend primarily upon the core inventory of fission products and technical specification levels of radionuclides in the coolant. [[

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

8.6 NORMAL OPERATION OFF-SITE DOSES

The primary source of normal operation 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:

Topic	MELLLA+ Effect	Disposition
Plant gaseous emissions	None	[[
Gamma shine from the turbine	None	]]

For the MELLLA+ operating range expansion, there is no change in the core power and the steam flow rate. [[

]]

9.0 REACTOR SAFETY PERFORMANCE EVALUATIONS

This section addresses the evaluations in Regulatory Guide 1.70, Chapter 15, which are documented in the CLTR. These reactor safety performance evaluations include:

Section	Title	Generic	Plant Specific
9.1	Anticipated Operational Occurrences	[[	
9.2	Design Basis Accidents		
9.3	Special Events		]]

The detailed assessment dispositions as outlined in Section 1.1 are provided in the applicable sections. The plant specific evaluations will be reported in the plant specific submittal consistent with the format and level of detail indicated below. The applicability of the generic assessments for a specific plant application will be evaluated. The plant specific submittal will document the confirmation of the generic assessment or provide a plant specific evaluation.

9.1 ANTICIPATED OPERATIONAL OCCURRENCES

The UFSAR for each plant defines the licensing basis AOOs. Table 9-1 provides an assessment of the effect of the MELLLA+ operating range expansion for each of the Reference 4 limiting UFSAR AOO and key non-limiting events that could be affected by MELLLA+. Table 9-1 includes fuel thermal margin, overpressure, and loss of water level events. The overpressure protection analysis events are addressed in Section 3.1.

The fuel thermal margin events are used to determine the fuel operating limit MCPR (OLMCPR). The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Fuel Thermal Margins Events	Small effect of increased void fraction and flatter power distribution	[[
Power and Flow Dependent Limits	Small effect of increased void fraction and flatter power distribution	
Non-Limiting Events	See Table 9-1	]]

9.1.1 Fuel Thermal Margin Events

[[

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

1. Generator Load Rejection Without Bypass Or Turbine Trip Without Bypass,
2. Loss Of Feedwater Heating Or Inadvertent HPCI Startup,

3. Control Rod Withdrawal Error,
4. Feedwater Controller Failure (Maximum Demand), and
5. Pressure Regulator Downscale Failure (BWR/6 Only).

In addition, the fuel loading error events are also analyzed as AOOs. [[
]]

[[
]]

[[
]]

[[

]]

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. [[

]]

Similarly, the thermal limits are modified by a power factor ($MCPR_p$) when the plant is operating at less than 100% power. This factor was generically developed for all plants and is referenced to the power level used in the reload transient analysis. [[

]]

9.1.3 Non-Limiting Events

Table 9-1 provides an assessment of the effect of the MELLLA+ operating range expansion for each of the Reference 4 limiting AOO events and key non-limiting events.

9.2 DESIGN BASIS ACCIDENTS

This section addresses the radiological consequences of a Design Basis Accident (DBA). The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Control Rod Drop Accident (CRDA)	None	[[
Instrument Line Break Accident (ILBA)	None	
Main Steam Line Break Accident (MSLBA) (Outside Containment)	None	
Loss of Coolant Accident (LOCA) (Inside Containment)	None	
Large Line Break (Feedwater or Reactor Water Cleanup)	None	

Liquid Radwaste Tank Failure	Possible increase in moisture content may cause the radionuclide carryover of the steam to the condensate demineralizer to increase	
Fuel Handling Accident (FHA)	None	
Offgas System Failure	None	
Cask Drop	None	]]

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, [[

]]

Table 9-4 provides a detailed evaluation of each of the above events. [[

]]

Other plant specific analyses that are incorporated into the UFSAR will be reviewed on a plant specific basis. The plant specific evaluations will be provided in the M+SAR.

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:

Topic	MELLLA+ Effect	Disposition
Anticipated Transient Without Scram (Overpressure)	Less effective power reduction from RPT	[[
Anticipated Transient Without Scram (Suppression Pool Temperature)	Less effective power reduction from RPT Significance depends on pool size	
Anticipated Transient Without Scram (Peak Cladding Temperature)	Insignificant change because same initial thermal margin (ICPR) and maximum linear heat generation rate are used for all power/flow conditions	
Station Blackout	None	
ATWS with Core Instability	The time of initiation of divergent oscillations and the magnitude of oscillations change slightly.	]]

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. [[

]] will be performed using the methodology documented in Section 5.3.4 of ELTR1 and will meet the following criteria:

- 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).
- Maintain coolable core geometry.

[[

]]

[[

]] The PCT for ATWS events is calculated using the methodology described in Section 3.7 of ELTR2.

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. [[

]]

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 14). The companion report, NEDO-32164, "Mitigation of BWR Core Thermal-Hydraulic Instabilities in ATWS," (Reference 15) 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 despite the severity of the event, the ATWS criteria are met. The ATWS criteria are established as:

1. Radiological consequences must be maintained within 10CFR100 guidelines;
2. Primary system integrity to be maintained;
3. Fuel damage limited so as not to significantly distort the core, impede core cooling, or prevent safe shutdown;
4. Containment integrity to be maintained; and
5. Long-term shutdown and cooling capability to be maintained.

Furthermore, the review concluded that the specified operator actions are sufficient to mitigate the consequences of an ATWS event with large core power oscillations. [[

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Table 9-1 Assessment of AOOs for MELLLA+ Operating Range

Event	Discussion
Fuel Thermal Margin Events	
Generator Load Rejection with Bypass Failure (Reference 4 limiting AOO)	[[
Turbine Trip with Bypass Failure (Reference 4 limiting AOO)	
Feedwater Controller Failure-Max. Demand (Reference 4 limiting AOO)	
Pressure Regulator Downscale Failure (Reference 4 limiting AOO)	
Loss of Feedwater Heater (Reference 4 limiting AOO)	
Inadvertent HPCI Start (If not bounded by Loss of FW Heater) (Reference 4 limiting AOO)	
Rod Withdrawal Error (Reference 4 limiting AOO)	
Slow Recirculation Increase (K_f, $MCPR_f$) (Reference 4 event – bounds recirculation event AOOs)	
Fast Recirculation Increase	
Generator Load Rejection	]]

Assessment of AOOs for MELLLA+ Operating Range (Continued)

Event	Discussion
Main Steam Isolation Valve Closure, All Valves	[[
Main Steam Isolation Valve Closure, One Valve	]]
Limiting Transient Overpressure Events	
Main Steam Isolation Valve Closure with Scram on High Flux (Failure of Direct Scram) (Reference 4 limiting overpressure event)	[[
Turbine Trip, Bypass Failure, with Scram on High Flux (Failure of Direct Scram)	]]
Limiting Loss of Water Level Transient Events	
Loss of Feedwater Flow	[[ ]]

Table 9-2 Typical AOO Event Results Summary

Event	Parameter	Unit	120% OLTP ICF Core Flow	120% OLTP 85% Core Flow
[[				
				]]

Table 9-3 Summary of TRACG AOO ΔCPR/ICPR Results from NEDC-32906P

Event	105% OLTP 110% Core Flow	105% OLTP 100% Core Flow	105% OLTP 75% Core Flow
[[			
			]]

Acronym Notes:

[[

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Table 9-4 Discussion of MELLLA+ Effect on Design Basis Accidents

Accident	MELLLA+ Effect
Control Rod Drop Accident	[[
Instrument Line Break Accident	
Main Steam Line Break Accident (Outside Containment)	
Loss of Coolant Accident (Inside Containment)	
Large Line Break	
Liquid Radwaste Tank Failure	
Fuel Handling Accident	
Offgas System Failure	
Cask Drop	]]

Table 9-5 Non-Mitigated ATWS Instability Limiting Fuel Conditions

Fuel Type	Initial Operating Statepoint (%OLTP, % Rated Core Flow)	Initial Core Power to Flow Ratio (MW/Mlb/hr)	Oscillation Mode	PCT (°K/°F)	Maximum Power Spike Energy Deposition (cal/g)
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Figure 9-1 [[ ]]

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Figure 9-2 [[ ]]

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Figure 9-3 [[ ]]

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Figure 9-4 [[ ]]

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Figure 9-5 [[

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Figure 9-6 [[

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Figure 9-7 [[

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Figure 9-8 [[
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Figure 9-9 [[

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Figure 9-10 [[

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Figure 9-11 [[

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10.0 OTHER EVALUATIONS

This section addresses the evaluations in Section 10 and certain items from Section 11 of the CLTR. The major evaluations and their disposition are summarized as follows:

Section	Title	Generic	Plant Specific
10.1	High Energy Line Break	[[	
10.2	Moderate Energy Line Break		
10.3	Environmental Qualification		
10.4	Testing		
10.5	Individual Plant Evaluation		
10.6	Operator Training and Human Factors		
10.7	Plant Life		
10.8	NRC and Industry Communications		
10.9	Emergency Operating Procedures		]]

The detailed assessment dispositions as outlined in Section 1.1 are provided in the applicable sections. The plant specific evaluations will be reported in the plant specific submittal consistent with the format and level of detail indicated below. The applicability of the generic assessments for a specific plant application will be evaluated. The plant specific submittal will document the confirmation of the generic assessment or provide a plant specific evaluation.

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:

Topic	MELLLA+ Effect	Disposition
Steam Lines	None	[[
Balance of Plant Liquid Lines	None	
Other Liquid Lines	None	]]

MELLLA+ has no effect on the steam pressure or enthalpy at the postulated steam or feedwater line break locations. [[

]] The scope of these evaluations includes MELLLA+ effects on subcompartment pressures and temperatures, pipe whip and jet impingement and flooding, consistent with the plant licensing basis.

10.2 MODERATE ENERGY LINE BREAK

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

Topic	MELLLA+ Effect	Disposition
Flooding	None	[[
Environmental Qualification	None	]]

[[

]]

10.3 ENVIRONMENTAL QUALIFICATION

Safety related components are required to be qualified for the environment in which they are required to operate. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Electrical Equipment	None	[[
Mechanical Equipment with Non-Metallic Components	None	
Mechanical Component Design Qualification	None	]]

10.3.1 Electrical Equipment

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. [[

]]

10.3.2 Mechanical Equipment With Non-Metallic Components

Operation in the MELLLA+ operating range does not increase any of the normal process temperatures. [[

]]

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. [[

]]

The change in fluid induced loads on safety-related components is discussed in Section 3.2.2, 3.5, and 4.1.2. [[

]]

10.4 TESTING

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

Topic	MELLLA+ Effect	Disposition
Steam Separator-Dryer Performance	Possible increase in moisture carryover	[[
APRM Calibration	None	
Core Performance	None	
Pressure Regulator	None	
Water Level Setpoint Changes	None	
Neutron Flux Noise Surveillance	None	]]

The above list bounds the testing needs for the MELLLA+ operating range expansion. While some of the tests may be performed for every plant, not all of the tests may be required for a particular plant. The needs and type of testing can be expected to change as operating experience with the affects of MELLLA+ is accumulated. Unless they have been replaced by updated criteria, the same performance criteria will be used as in the original power ascension tests.

Steam Separator-Dryer Performance: The performance of the steam separator-dryer (i.e., moisture carryover) is determined by a test similar to that performed in the original startup test program. 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

This section provides an assessment of the risk increase, including Core Damage Frequency (CDF) and Large Early Release Frequency (LERF), associated with operation in the MELLLA+ range. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Initiating Event Categories and Frequency	None	[[
Component Reliability	None	
Operator Response	None	
Success Criteria	None	
External Events	None	
Shutdown Risk	None	
PRA Quality	None	]]

As noted in the preceding table, there are no significant effects of MELLLA+ on the risk topics. Analysis for plants that have uprated to power levels up to 120% of OLTP indicates that the incremental risk increase due to MELLLA+ operating range expansion will be negligible relative to the risk increase associated with EPU. The key inputs to the plant specific risk that support the Generic disposition will be confirmed in the M+SAR. Factors to be considered in such an assessment are discussed below.

10.5.1 Initiating Event Categories and Frequency

The MELLLA+ core operating range expansion involves changes to the operating power/core 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. 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.

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]] As noted in Section 2.4, the Backup Stability Protection (BSP), which is considered a part of the DSS-CD stability solution, may be used when the OPRM system is temporarily inoperable. [[
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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+ core operating range expansion does not require major plant hardware modifications. [[

]] The Technical Specifications (TS) ensure that plant and system performance parameters are maintained within the values assumed in the safety analyses. The improved Standard Technical Specifications that could be affected by the MELLLA+

operating range expansion are listed in Table 11-1. 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. [[
]]

10.5.3 Operator Response

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

]]

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

[[

]] The minimum operator action time to initiate SLC is 2 minutes and the minimum operator action time to inhibit ADS and start water level reduction (if necessary, i.e., motor-driven feedwater pump plants) is 90 seconds in ATWS analyses (Section 9.3.1).

[[
]]

10.5.4 Success Criteria

Systems success criteria credited in a PRA to perform the critical safety functions were analyzed based on MELLLA+. The critical safety functions are as follows:

1) Reactivity Control
2) Overpressure Control
3) Vessel Depressurization
4) Reactor Coolant Makeup
5) Containment Heat Removal

The operating range expansion involves changes to the operating power/core 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 any of the safety, balance-of-plant, electrical, or auxiliary systems. Adequate SRV capacity is provided to ensure that the ATWS overpressure requirement for MELLLA+ is satisfied. [[
]]

10.5.5 External Events

The operating range expansion is not expected to affect the elements of an internal event PRA, as discussed in Sections 10.5.1 to 10.5.4. Therefore, there is no effect on the external events PRA.

10.5.6 Shutdown Risks

The operating range expansion does not change the shutdown conditions; therefore, it has no affect on the plant PRA shutdown risks.

10.5.7 PRA Quality

MELLLA+ is not expected to have a significant effect on any PRA elements. Therefore, the most likely response to this topic will be the confirmation of the acceptability of the PRA for MELLLA+ application. However, if a plant specific PRA submittal becomes necessary, the PRA should be of adequate quality to evaluate the impact of MELLLA+. The plant specific submittal, if required, will address the adequacy of the plant's PRA models to reflect the as-designed, as-operated plant. The plant specific submittal will also state how any weaknesses in the PRA quality identified in the staff SERs on the IPE and IPEEE submittals and any independent/peer/certification reviews, are addressed for MELLLA+.

10.6 Operator Training and Human Factors

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

Topic	MELLLA+ Effect	Disposition
Operator training and human factors	Changes in procedures, alarms, etc	[[ ]]

The operator training program and plant simulator will be evaluated to determine the specific changes required. The selection of training topics, operator training, and simulator modifications are within the scope of the Licensee. Required changes are part of the MELLLA+ implementation plan and will be made consistent with 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.

[[

]]

Training required to operate the plant following the MELLLA+ operating range expansion will be conducted prior to operation of the unit 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 operational sequences that are unique to MELLLA+. Because the plant dynamics will not change substantially for operation in the MELLLA+ region, simulator training on transients is not anticipated.

Simulator changes and fidelity validation will be performed in accordance with applicable ANSI 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. The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Irradiated Assisted Stress Corrosion Cracking (IASCC)	Slight Increase in peak fluence	[[
Flow Accelerated Corrosion (FAC)	None	]]

The longevity of most equipment is not affected by the MELLLA+ operating range expansion. The peak fluence experienced by the reactor internals may increase representing a minor increase in the potential for IASCC. Therefore, the current inspection strategy for the reactor internal components is adequate to manage any potential effects of MELLLA+. A summary of the plant specific IASCC assessments for MELLLA+ will be reported in the M+SAR.

For MELLLA+, there is no change in the main steam flow rate or temperature, and the feedwater flow rate and temperature. The moisture carryover may increase (Section 3.3.3) in the MS lines. If this occurs, it may slightly increase the FAC rates for a small period of time during the cycle when the plant is operating at or near the MELLLA+ minimum core flow. [[

]] The Maintenance Rule also provides oversight for the other mechanical and electrical components, important to plant safety, to guard against age-related degradation.

10.8 NRC AND INDUSTRY COMMUNICATIONS

The topics addressed in this evaluation are:

Topic	MELLLA+ Effect	Disposition
Plant disposition of NRC and Industry communications	Nothing required	[[ ]]

NRC and industry communications could affect the plant design and safety analyses. As discussed in Section 1.0, the MELLLA+ operating range expansion has a limited effect on the safety evaluations and system assessments. Because the maximum thermal power and core flow rate do not change for MELLLA+, the effect of the changes is limited to the NSSS and primarily within the core. Many systems and evaluations that are part of a power uprate may be dismissed as unaffected by the MELLLA+ changes. The evaluations and calculations included in this report, and those that will be provided in the M+SAR, demonstrate that the MELLLA+ operating range expansion can be accomplished within the applicable design criteria.

The evaluation of plant design and safety analyses affected by NRC and industry communications are inherently included in these assessments. Therefore, it is not necessary to review prior communications and no additional information is required in this area.

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:

Topic	MELLLA+ Effect	Disposition
Emergency Operating Procedures	Values for variables and limits	[[
Abnormal Operating Procedures	Operator actions	]]

EOPs include variables and limit curves, which define conditions where operator actions are indicated. The plant EOPs will be reviewed for any effects of MELLLA+, and the EOPs updated, as necessary. Utility support documentation and the safety parameter display system will be updated accordingly.

AOPs include event based operator actions. No new operator actions are expected and it is unlikely that changes will be necessary because of the MELLLA+ operating range expansion. However, The plant AOPs will be reviewed for any effects of the MELLLA+ operating range expansion and will be updated as necessary.

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

A generic list of Technical Specifications (TS) that could be 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. Each TS item in this list is based upon the content of the improved Standard Technical Specifications (References 17 and 18) and identifies: (1) the potential for requiring any change, (2) a description of each item, and (3) the disposition of the change, including a reference to sections in the report that support the change. This list will be used as guidance for the development of the plant unique TS changes to be requested by a utility. However, additional TS changes may be identified based on a review of the plant specific TS and related changes requested on a plant unique basis.

11.2 ENVIRONMENTAL ASSESSMENT

Each license amendment request will have its own environmental assessment. The following is generic input to this assessment for MELLLA+. Plant specific assessments, which will accompany the plant specific submittal, may reference all or a part of the following.

The environmental effects of MELLLA+ will be controlled at the same limits as for the current analyses. Normally, 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 Final Environmental Statement. Existing Federal, State and local regulatory permits presently in effect will usually accommodate MELLLA+ without modification. The makeup water sources requirements are not increased beyond the present Environmental Protection Plan. Effects to air, water, and land resources are nonexistent.

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. This will be confirmed in the plant specific submittal. The quantity of spent fuel will not be affected by MELLLA+. The short-term radioactivity level will not change. The normal effluents and doses will remain well within 10CFR20 and 10CFR50, Appendix I limits.

The MELLLA+ operating range expansion does not require a change to the Environmental Protection Plan or 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

Each license amendment request will have its own significant hazards consideration assessment. The following is generic input to this significant hazards assessment for MELLLA+. Plant specific assessments, which will accompany the plant specific submittal, may reference all or a part of the following.

Increasing the operating range that is available to a nuclear power plant at CLTP 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 will provide the safety analyses and evaluations to justify expanding the core flow rate operating range.

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 effects on the plant, outside of the core. 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.

11.3.2 Discussions of Issues Being Evaluated

Plant performance and responses to hypothetical accidents and transients have been analyzed for a MELLLA+ operating range expansion license amendment. This section summarizes the plant reactions to events analyzed 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 (e.g., ATWS and SBO events).

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 4 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 maintain core integrity 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/LPCS) pumps
- High pressure emergency core cooling system (HPCI or HPCS) 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 10CFR100.

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). MELLLA+ will have a minor effect on the PCT consequences of a LOCA. The ECCS performance evaluation demonstrates conformance to criteria of 10CFR50.46. The licensing safety margin is not affected by MELLLA+. The PCT changes for MELLLA+ are insignificant compared to the amount by which the results are below the regulatory criteria. 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 meet regulatory requirements and, confirm the suitability of the plant for operation in the MELLLA+ region. The containment dynamic loads for events initiated in the MELLLA+ region also meet regulatory requirements. When the structural loads change in the MELLLA+ region, the structure is evaluated to ensure that the safety criteria are met. 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 are not expected to 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 performed in accordance with Regulatory Guide 1.3 and SRP-15.6.5 calculates more severe radiological consequences than the combined effects of bounding DBAs that produce the greatest challenge to the fuel and containment. In contrast, the DBA that produces the highest PCT does not result in damage to the fuel equivalent to the assumptions used in the off-site dose evaluation, and the DBA that produces the maximum containment pressure, does not result in leak rates to the atmosphere equivalent to the assumptions used in the off-site dose evaluation. Thus, the off-site doses calculated in conformance with Regulatory Guide 1.3 and SRP-15.6.5 are conservative compared to the combined effect of the bounding DBA evaluations.

11.3.2.10 Non-LOCA Radiological Release Accidents

All of the other radiological releases discussed in Regulatory Guide 1.70 and UFSAR Chapters 11 and 15 are either unchanged or continue to demonstrate significant margin to the applicable criteria.

11.3.2.11 Equipment Qualification

Plant equipment and instrumentation have been evaluated against the applicable criteria. In most cases, the qualification envelope does not change due to the MELLLA+ operating range expansion or is bounded by the maximum core flow rate statepoint. When the qualification envelope changes, the equipment will be evaluated to assure acceptability for the new environment.

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+. A management procedure will be in place for all environmental limits with which the plant is presently required to comply and the environmental release margins are maintained.

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. The improved Standard Technical Specifications that could be affected by the MELLLA+ operating range expansion are listed in Table 11-1. Plant specific TS changes are provided with the plant specific M+SAR submittal. Proper account is taken for inaccuracies introduced by instrument drift, instrument accuracy, and calibration accuracy. This ensures that the actual plant responses at uprated condition 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.

11.3.3 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 (plant specific)% of rated with (plant specific)% 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 are shown to 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 4. Challenges to fuel (ECCS performance) are evaluated, and shown to still meet the criteria of 10CFR50.46 and Appendix K, and Regulatory Guide 1.70 SAR 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 meet the guidelines of 10CFR100 Regulatory Guide 1.70 SAR Chapter 15 or plant specific acceptance limits.

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 Regulatory Guide 1.70, 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.

Conclusions

A MELLLA+ operating range expansion to a minimum core flow rate of (plant specific)% of rated with (plant specific)% of original licensed thermal power has been investigated. The plant licensing challenges 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 (plant specific)% of rated with (plant specific)% of original licensed thermal power does not involve a Significant Hazards Consideration.

Table 11-1 Potential Technical Specification Changes

Potentially Affected ITS Section (Ref. 17 &18)	Description	Disposition
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12.0 REFERENCES

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

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3. GE Nuclear Energy, "Constant Pressure Power Uprate Licensing Topical Report," NEDC-33004P, Revision 1, July 2001, (Including Errata-Addenda Sheet #1, 12-21-01).

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

5. GE Nuclear Energy, "Detect And Suppress Solution–Confirmation Density Licensing Topical Report," NEDC-33075P, Revision 1, August 2002.

6. GE Nuclear Energy, "BWR Owners Group Long-Term Stability Solutions Licensing Methodology," NEDO-31960-A, November 1995.

7. "Radiation Embrittlement of Reactor Vessel Materials", USNRC Regulatory Guide 1.99, Revision 2, May 1988.

8. "Fracture Toughness Requirements", Appendix G to Part 50 of Title 10 of the Code of Federal Regulations, December 1995.

9. H. S. Mehta, T. A. Caine, and S. E. Plaxton, "10CFR50 Appendix G Equivalent Margin Analysis for Low Upper Shelf Energy in BWR/2 through BWR/6 Vessels", GE-NE, San Jose, CA, February 1994 (NEDO-32205-A, Rev. 1).

10. Letter from J. T. Wiggins (NRC) to L.A. England (Gulf States Utilities Co.), "Acceptance for Referencing of Topical Report NEDO-32205, Revision 1, '10CFR50 Appendix G Equivalent Margin Analysis for Low Upper Shelf Energy in BWR/2 Through BWR/6 Vessels'", December 8, 1993.

11. "Fracture Toughness Criteria for Protection Against Failure", Appendix G to Section III or XI of the ASME Boiler & Pressure Vessel Code, 1995 Edition with addenda through 1996 Addenda.

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14. GE Nuclear Energy, "ATWS Rule Issues Relative to BWR Core Thermal-Hydraulic Stability," NEDO-32047-A, June 1995, (SER includes approval for: "Mitigation of BWR Core Thermal-Hydraulic Instabilities in ATWS," NEDO-32164, December 1992.).

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

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

17. U.S.N.R.C., "Standard Technical Specifications General Electric Plants, BWR/4", NUREG-1433, Rev. 1.

18. U.S.N.R.C., "Standard Technical Specifications General Electric Plants, BWR/6", NUREG-1434, Rev. 1.