ATTACHMENT 7

GE Report NEDO-33057,
"Safety Analysis Report for Clinton Power Station
Maximum Extended Load Line Limit Analysis Plus,"
April 2003 (Nonproprietary)

GE Nuclear Energy

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SAFETY ANALYSIS REPORT FOR CLINTON POWER STATION MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS

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INFORMATION NOTICE

This is a non-proprietary version of the document NEDC-33057P, which has the proprietary information removed. Portions of the document that have been removed are indicated by an open and closed bracket as shown here [ ].

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

IMPORTANT NOTICE REGARDING CONTENTS OF THIS REPORT

PLEASE READ CAREFULLY

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EXECUTIVE SUMMARY

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

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

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

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

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

- All safety aspects of the plant that are affected by MELLLA+ were evaluated.
- There is no change in the existing design basis and licensing basis acceptance criteria of the plant as defined in 10 CFR 50.2.

- Evaluations are performed using NRC-approved or industry-accepted analytical methods.
- Where applicable, more recent industry codes and standards are used.
- USAR updates for MELLLA+ related changes are implemented in accordance with the requirements of 10 CFR 50.71(e).
- No major hardware modifications to safety-related equipment are required to support MELLLA+. Modifications associated with MELLLA+ are reviewed in accordance with plant procedures to ensure compliance with 10 CFR 50.59.
- Systems and components affected by MELLLA+ are reviewed to ensure that there is no significant challenge to any safety system.
- Compliance with existing plant environmental regulations is maintained.
- Potentially affected commitments to the NRC are reviewed.
- Changes not yet implemented have also been reviewed for the effects of MELLLA+.

This report summarizes the results of the safety evaluations needed to justify a licensing amendment to allow the MELLLA+ core flow rate operating range expansion to a minimum core flow rate of 85% of rated with 100% of CLTP. It has been demonstrated that this MELLLA+ operating range expansion can be accommodated:

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

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

The environmental evaluation demonstrates that MELLLA+ does not involve environmental effects that differ significantly from those previously evaluated for the presently authorized CLTP level. Where environmental effects differ from those previously evaluated, these effects are small and within regulatory environmental acceptance criteria.

REVISIONS

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

ACRONYMS

Term	Definition
AC	Alternating Current
ADS	Automatic Depressurization System
ANSI	American National Standards Institute
AOO	Anticipated Operational Occurrence
AOP	Abnormal Operating Procedure
AP	Annulus Pressurization
APRM	Average Power Range Monitor
ASME	American Society Of Mechanical Engineers
ATWS	Anticipated Transient Without Scram
AV	Allowable Value
BOP	Balance Of Plant
BWR	Boiling Water Reactor
CDF	Core Damage Frequency
CFR	Code Of Federal Regulations
CLTP	Current Licensed Thermal Power
CO	Condensation Oscillation
COLR	Core Operating Limits Report
CPR	Critical Power Ratio
ΔCPR	Change in Critical Power Ratio
CRD	Control Rod Drive
CRDA	Control Rod Drop Accident
CRGT	Control Rod Guide Tube
CS	Core Spray
CSC	Containment Spray Cooling
CPS	Clinton Power Station
DBA	Design Basis Accident
DC	Direct Current
DSS-CD	Detect and Suppress Solution–Confirmation Density
ECCS	Emergency Core Cooling System
EOP	Emergency Operating Procedure
EPU	Extended Power Uprate
FAC	Flow Accelerated Corrosion
FCV	Flow Control Valve
FFWTR	Final Feedwater Temperature Reduction
FHA	Fuel Handling Accident
FIV	Flow-Induced Vibration

Term	Definition
FW	Feedwater
FWHOOS	Feedwater Heater(s) Out-Of-Service
FWT	Feedwater Temperature
GE	General Electric Company
HELB	High Energy Line Break
HPCS	High Pressure Core Spray
HVAC	Heating, Ventilation And Air Conditioning
IASCC	Irradiation Assisted Stress Corrosion Cracking
ICF	Increased Core Flow
IEEE	Institute Of Electrical And Electronics Engineers
ILBA	Instrument Line Break Accident
IRM	Intermediate Range Monitor
ITS	Improved Technical Specification
LERF	Large Early Release Frequency
LHGR	Linear Heat Generation Rate
LOCA	Loss Of Coolant Accident
LOOP	Loss Of Offsite Power
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
MCR	Main Control Room
MELB	Moderate Energy Line Break
MELLLA	Maximum Extended Load Line Limit Analysis
MELLLA+	Maximum Extended Load Line Limit Analysis Plus
M+LTR	Maximum Extended Load Line Limit Analysis Plus Licensing Topical Report NEDC-33006P (Reference 1)
M+SAR	MELLLA+ Safety Analysis Report (Plant Specific Safety Analysis Report)
Mlb	Millions Of Pounds
MOV	Motor Operated Valve
MS	Main Steam
MSIV	Main Steam Isolation Valve
MSIVC	Main Steam Isolation Valve Closure
MSLBA	Main Steam Line Break Accident
MWt	Megawatt-Thermal

Term	Definition
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
RCIC	Reactor Core Isolation Cooling
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
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
SRO	Strong Rod Out

Term	Definition
SRP	Standard Review Plan
SRV	Safety Relief Valve
SRVDL	Safety Relief Valve Discharge Line
TAF	Top Of Active Fuel
TIP	Traversing In-Core Probe
TS	Technical Specification
TSV	Turbine Stop Valve
UHS	Ultimate Heat Sink
USAR	Updated Safety Analysis Report

1.0 INTRODUCTION

This report summarizes the results of all significant safety evaluations performed that justify the expansion of the operating boundary that would permit CPS operation at CLTP (3473 MWt) with core flow as low as 85% of rated. The changes expand the operating range in the region of operation with less than rated core flow, but do not increase the licensed power level or the maximum core flow. The expanded operating range is identified as Maximum Extended Load Line Limit Analysis Plus (MELLLA+).

The scope of evaluations required to support the expansion of the core flow operating range to the MELLLA+ boundary is contained in the Licensing Topical Report (LTR) NEDC-33006P, "Maximum Extended Load Line Limit Analysis Plus", referred to as the M+LTR (Reference 1). This report provides a systematic disposition of the M+LTR subjects applied to CPS, including performance of plant specific assessments and confirmation of the applicability of generic assessments to support a MELLLA+ core flow operating range expansion. With respect to the power-flow map, there are no changes other than the increase in core flow range.

The MELLLA+ core operating range expansion does not require major plant hardware modifications. CPS will implement the Detect and Suppress Solution–Confirmation Density (DSS-CD) solution (Reference 6) consistent with the M+LTR. The DSS-CD requires a revision to the existing stability solution software. The operating range expansion involves changes to the operating power/core flow map and a small number of setpoints and alarms. Because there are no changes in the operating pressure, power, steam flow rate, and feedwater flow rate, there are no significant effects on the plant hardware outside of the Nuclear Steam Supply System (NSSS). There is a potential increase in the steam moisture content at certain times while operating in the MELLLA+ operating domain. The effects of the potential increase in moisture content on plant hardware have been evaluated and determined to be minor. The MELLLA+ operating range expansion does not cause additional requirements to be imposed on any of the safety, balance-of-plant, electrical, or auxiliary systems. No changes to the power generation and electrical distribution systems are required due to the introduction of MELLLA+.

1.1 REPORT APPROACH

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

The CPS MELLLA+ safety analysis report (M+SAR) follows the same structure and content as the M+LTR (Reference 1). Two dispositions of the evaluation topics are used to characterize the MELLLA+ evaluation scope:

- Generic, and
- Plant Specific.

1.1.1 Generic Assessments

Generic assessments are those safety evaluations that can be dispositioned by:

- Providing or referencing a bounding analysis for the limiting conditions,
- Demonstrating that there is a negligible effect due to MELLLA+,
- Identifying the portions of the plant that are unaffected by the MELLLA+ power-flow map operating range expansion, or
- Demonstrating that the sensitivity to MELLLA+ is small enough that the required plant cycle specific reload analysis process is sufficient and appropriate for establishing the MELLLA+ licensing basis (as defined in GESTAR, Reference 5).

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

1.1.2 Plant Specific Evaluation

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

1.1.3 Computer Codes and Methods

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

1.1.4 Scope of Evaluations

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

Section 2.0 Reactor Core and Fuel Performance: Core and fuel performance parameters are confirmed for each fuel cycle, and will be evaluated and documented in the Supplemental Reload Licensing Report (SRLR) and Core Operating Limit Report (COLR) for each fuel cycle that implements MELLLA+.

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

Section 4.0 Engineered Safety Features: The effects of MELLLA+ on the containment, ECCS, Standby Gas Treatment, and other Engineered Safety Features (ESF) are evaluated. The operating pressure for ESF equipment is not increased because operating pressure and safety/relief valve setpoints are unchanged by MELLLA+.

Section 5.0 Instrumentation and Control: The instrumentation and control systems and analytical limits for setpoints are evaluated to establish the effects of MELLLA+ changes in process parameters.

Section 6.0 Electrical Power and Auxiliary Systems: Because the power level is not changed by MELLLA+, the electrical power and distribution systems are not affected. The CPS Standby Liquid Control System (SLCS) is not 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.

Section 10.0 Other Evaluations: High energy line break and environmental qualification evaluations for the MELLLA+ range are confirmed to demonstrate the operability of plant equipment. The effects on the Individual Plant Evaluation (IPE) are evaluated to demonstrate there is no change on the CPS vulnerability to severe accidents.

Section 11.0 Licensing Evaluations: This section includes: the effect on Technical Specifications, the Environmental Assessment, and the Significant Hazards Consideration Assessment.

1.1.5 Product Line Applicability

The processes, evaluations, and dispositions in the M+LTR are applicable to the CPS BWR/6.

1.2 OPERATING CONDITIONS AND CONSTRAINTS

1.2.1 Power / Flow Map

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

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

The MELLLA+ region extends down to 55% core flow. Normal core performance characteristics for plant power/flow maneuvers at near full power can be accomplished above

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

1.2.2 Reactor Heat Balance

The changes in the reactor heat balance resulting from the MELLLA+ operating range expansion are only those that are a result of the decrease in recirculation pump heat and the decrease in core inlet enthalpy as result of the lower operating core flow.

1.2.3 Core and Reactor Conditions

Table 1-2 compares MELLLA and MELLLA+ thermal-hydraulic operating conditions for CPS. There are no temperature changes in the steam and feedwater piping. The small temperature decrease in the recirculation loops (relative to the rated core flow condition) is within current MELLLA ranges. The core void fractions are increased 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 enthalpy is lower than the MELLLA+ value at CLTP and normal feedwater temperature.

1.2.4 Operational Enhancements

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

Operational Enhancements	MELLLA+
Increased Core Flow (ICF)	Allowed
Feedwater Heater out-of-service (FWHOOS)	Not Allowed
Single-Loop Operation (SLO)	Not Allowed
Final Feedwater Temperature Reduction (FFWTR)	Not Included
2 SRVs out-of-service	Allowed
1 ADS valve out-of-service	Allowed
3% SRV setpoint tolerance	Allowed

1.3 Summary and Conclusions

The M+SAR demonstrates that the MELLLA+ range expansion can be accommodated without a significant increase in the probability or consequences of an accident previously evaluated, without creating the possibility of a new or different kind of accident from any accident previously evaluated, and without exceeding any existing regulatory limits or design allowable limits applicable to the plant which might cause a reduction in a margin of safety.

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

Task	Computer Code	Version or Revision	NRC Approved	Comments
Reactor Heat Balance	ISCOR	09	Y (1)	NEDE-24011-P Rev. 0 SER
Reactor Core and Fuel Performance	TGBLA PANAC ISCOR	04 10 09	Y Y Y (1)	NEDE-30130-P-A NEDE-30130-P-A NEDE-24011-P Rev. 0 SER
Reactor Internal Pressure Differences	LAMB TRACG ISCOR	07 02 09	(2) (3) Y (1)	NEDE-20566P-A NEDE-32176P, Rev 2, Dec 1999 NEDC-32177P, Rev 2, Jan 2000 NRC TAC No M90270, Sep 1994 NEDE-24011-P Rev. 0 SER
Transient Analysis	PANAC ODYN ISCOR	10 09 (5) 09	Y Y Y (1)	NEDE-30130-P-A (4) NEDE-24154P-A NEDC-24154P-A, Vol 4, Sup 1 NEDE-24011-P Rev. 0 SER
Anticipated Transient Without Scram	PANAC ODYN STEMP	10 09 (5) 04	Y Y (6)	NEDE-30130-P-A (4) NEDC-24154P-A, Vol 4, Sup 1 NEDO-32047-A
Containment System Response	M3CPT LAMB	05 08	Y (2)	NUREG-0978 NEDE-20566P-A
Reactor Recirculation System	BILBO	04V	(7)	NEDE-23504, Feb. 1977
ECCS-LOCA	LAMB GESTR SAFER ISCOR TASC	08 08 04 09 03	Y Y Y Y (1) Y	NEDE-20566P-A NEDE-23785-1P-A, Rev. 1 (8)(9)(10) NEDE-24011-P Rev. 0 SER NEDC-32084P-A

Notes For Table 1-1:

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

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

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

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

(5) Version 09 of ODYN is applicable to plants that use Flow Control Valves (FCV) for recirculation flow control.

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

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

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

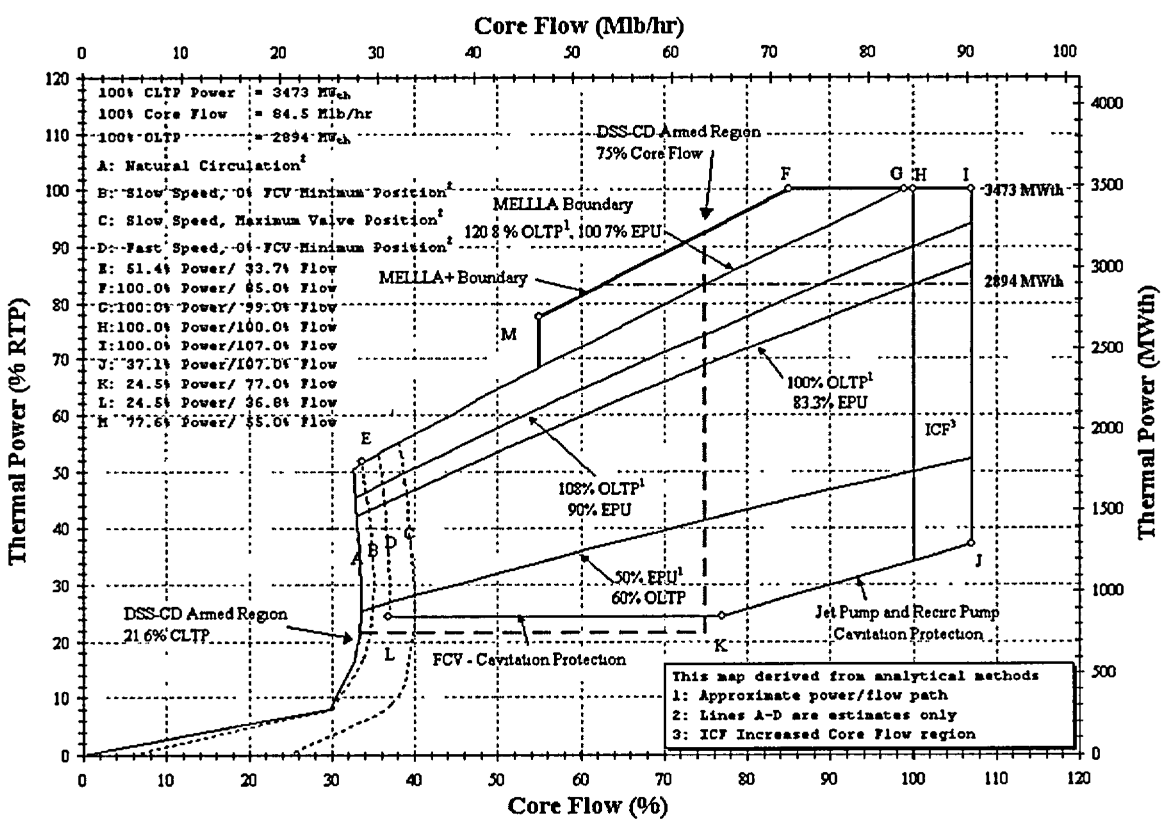
(9) "Compilation of Improvements to GENE's SAFER ECCS-LOCA Evaluation Model," NEDC-32950P, January 2000.

(10) Letter, S.A Richards (NRC) to J F. Klapproth (GE), "General Electric Nuclear Energy Topical Reports NEDC-32950P and NEDC-32084P Acceptability Review," May 24, 2000.

Table 1-2 Comparison of Thermal-Hydraulic Parameters

Parameter	MELLLA 100% CLTP, 99% Core Flow Normal FWT	MELLLA 100% CLTP, 99% Core Flow Reduced FWT	MELLLA+ 100% CLTP, 85% Core Flow Normal FWT
Thermal Power (MWt)	3473	3473	3473
Steam Flow Rate (Mlb/Hr)	15.15	14.18	15.15
Dome Pressure (psia)	1040	1040	1040
Feedwater Temperature (°F)	430	380	430
Core Flow (Mlb/Hr)	83.7	83.7	67.6
Core Inlet Enthalpy (Btu/Lb)	525.2	517.8	519.0
Core Pressure Drop (psi)	26.1	25.4	19.3
Core Average Void Fraction	0.52	0.49	0.55
Average Core Exit Void Fraction	0.73	0.71	0.77

Figure 1-1 CPS MELLLA+ Operating Range Power-Flow Map



2.0 REACTOR CORE AND FUEL PERFORMANCE

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

2.1 FUEL DESIGN AND OPERATION

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

Topic	M+LTR Disposition	CPS Result
Fuel product line design	[	
Core design		
Fuel thermal margin monitoring threshold		]

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

The range of void fraction, axial and radial power shape, and rod positions may change slightly in the MELLLA+ range. The average bundle power and maximum allowable peak bundle power are not changed. The change in power distribution in the core is achieved, while limiting the MCPR, LHGR, and MAPLHGR in any individual fuel bundle to be within its allowable value as defined in the Core Operating Limits Report (COLR).

Because there is no change to the average power density, there is no change to the fuel thermal margin monitoring threshold.

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2.2 THERMAL LIMITS ASSESSMENT

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

Topic	M+LTR Disposition	CPS Result
Safety Limit MCPR	[	
Operating Limit MCPR		
MAPLHGR Limit		
LHGR Limit		]

2.2.1 Safety Limit Minimum Critical Power Ratio

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

[

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2.2.2 Operating Limit Minimum Critical Power Ratio

The Operating Limit Minimum Critical Power Ratio (OLMCPR) is calculated by adding the change in MCPR due to the limiting Anticipated Operational Occurrence (AOO) event to the SLMCPR. The OLMCPR is determined on a cycle-specific basis from the results of the reload transient analysis, as described in Reference 5. The cycle specific analysis results are documented in the Supplemental Reload Licensing Report (SRLR) and included in the COLR. The MELLLA+ operating conditions do not change the methods used to determine this limit.

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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 to demonstrate that the plant meets the regulatory limits in the MELLLA+ operating domain. The reload analysis determines the MAPLHGR operating limit for each reload fuel bundle design and the limits are documented in the cycle specific COLR.

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

[

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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	M+LTR Disposition	CPS Result
Hot Excess Reactivity	[.	
SRO Shutdown Margin		
SLCS Shutdown Margin		]

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

Higher core average void fraction, higher plutonium production, increased hot reactivity later in the operational cycle, decreased hot-to-cold reactivity differences, and smaller cold shutdown margins may result from cores designed for operation with the MELLLA+ operating range expansion. However, this potential loss in margin can be accommodated through core design within current design and TS cold shutdown margin requirements. All minimum SRO shutdown margin requirements apply to cold most reactive conditions, and are maintained without change. In order to account for reactivity uncertainties, including the effects of temperature and analysis methods, margin well in excess of the TS limits are included in the design requirements.

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

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

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2.4 STABILITY

For MELLLA+, CPS will change the long-term stability solution from Option III to the Detect and Suppress Solution–Confirmation Density (DSS-CD) solution (NEDC-33075P, Reference 6) consistent with the M+LTR. The DSS-CD introduces an enhanced detection algorithm that detects the inception of power oscillations and generates an earlier power suppression trip signal exclusively based on successive period confirmation recognition. The DSS-CD algorithm, licensing basis, and application procedures are generically described in NEDC-33075P, and are applicable to CPS.

The revised algorithm needed to implement DSS-CD will be installed in the existing CE/ABB OPRM system. The CE/ABB hardware design is unchanged from the Option III solution described in Reference 7. The Option III algorithm contained in an OPRM Erasable Programmable Memory will be updated to include the DSS-CD solution algorithm. The DSS-

CD system does not interact with equipment whose failure could cause an accident. The reliability of the DSS-CD will be the same or better than that of the existing system.

The DSS-CD solution is designed to identify the power oscillations upon inception and initiate control rod insertion to terminate the oscillations prior to any significant amplitude growth. Compliance with General Design Criteria (GDC) 10 and 12 of 10CFR50, Appendix A is accomplished via automatic action. The DSS-CD solution algorithm and associated setpoints maintain or increase the margin to the SLMCPR for anticipated instability events. As a result, there is no impact on the MCPR Safety Limit identified for an instability event. The safety analyses in NEDC-33075P demonstrate the margin to the SLMCPR for postulated bounding stability events.

In addition, the DSS-CD retains the existing Option III algorithms (with generic setpoints) to provide defense-in-depth protection for unanticipated reactor instability events. The DSS-CD solution defense-in-depth features incorporate all the backup scram algorithms plus the licensed scram feature of the existing Option III system.

The following subjects, as defined in the M+LTR, characterize the applicability of the DSS-CD solution to CPS.

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

In NEDC-33075P, the DSS-CD is demonstrated to provide an early trip signal upon instability inception prior to any significant oscillation amplitude growth and MCPR degradation for both core wide and regional mode oscillations. The confirmation analyses presented in Reference 6 provide confidence in the adequacy of the generic setpoints for the DSS-CD algorithm. The applicability checklist provided in the DSS-CD LTR is used to confirm that the generic basis is applicable to a plant-specific reload design. The checklist is incorporated into the reload evaluation process and is documented in the SRLR.

For CPS, the Armed Region boundaries are defined conservatively larger than those established for Option III per the DSS-CD LTR. (See Figure 1-1) The DSS-CD LTR generically specifies the Armed Region for MELLLA+ operation below 75% rated core flow and above 25% OLTP. For CPS, which has been uprated to 120% OLTP, the setpoint in %CLTP is scaled to 21.6% consistent with the current thermal limit monitoring threshold used in CPS Technical Specifications.

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

the DSS-CD LTR. The alternate stability protection approach is confirmed on a cycle-specific basis to demonstrate adequacy to the reload cycle design.

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

2.5 Reactivity Control

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

Topic	M+LTR Disposition	CPS Result
Scram Time Response	[	
CRD Positioning and Cooling		
CRD Integrity		]

2.5.1 Control Rod Scram

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, there is no change in the TS scram requirements. The scram times for ASME overpressure protection and AOO analyses are based on generic reactor pressure versus time envelopes. The evaluations in Section 3.1 and 9.1 confirm that the CLTP, Maximum Core Flow conditions are limiting. Therefore, the MELLLA+ operating range change does not affect the transient scram response times.

[

]

2.5.2 Control Rod Drive Positioning and Cooling

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

[

]

2.5.3 Control Rod Drive Integrity Assessment

The postulated abnormal operating conditions for the CRD design assume a failure of the CRD system pressure-regulating valve that applies the maximum pump discharge pressure to the CRD mechanism internal components. This postulated abnormal pressure bounds the ASME reactor overpressure limit. The reactor operating conditions for MELLLA+ do not affect the CRD pump discharge pressure, and the stresses for the limiting CRD component do not change for MELLLA+. There is no change in other mechanical loads.

[

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3.0 REACTOR COOLANT AND CONNECTED SYSTEMS

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

3.1 NUCLEAR SYSTEM PRESSURE RELIEF AND OVERPRESSURE PROTECTION

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Flow-Induced Vibration	[	
Overpressure Relief Capacity		]

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

[

]

The pressure relief system prevents overpressurization of the nuclear system during AOOs, the plant ASME Upset overpressure protection event, and postulated ATWS events. The plant safety relief valves (SRVs) along with other functions provide this protection. For CPS, the limiting overpressure event is the Main Steam Isolation Valve Closure with Scram on High Flux (MSIVF). The M+LTR establishes that the MSIVF is limiting at the 1.02*100% CLTP, maximum core flow statepoint. The SRV setpoint tolerance is independent of the MELLLA+ operating range expansion. The SRV setpoint tolerances are monitored at CPS for compliance to the TS requirements. Therefore, no changes in the CPS pressure relief system or SRV setpoints are required for MELLLA+. The ATWS analysis is discussed in Section 9.3.1.

[

]

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	M+LTR Disposition	CPS Result
Fracture Toughness	[	
Reactor Vessel Structural Evaluation		]

3.2.1 Fracture Toughness

The MELLLA+ operating range expansion results in a slightly higher operating neutron flux in the upper portion of the core due to the decreased water density. The MELLLA+ fluence is estimated from the EPU fluence calculated using the approved methodology of NEDC-32983P-A (Reference 8). The maximum increase in fluence in the upper portion of the core is [ ]. At the reactor vessel, the change in peak fluence is [ ] The CPS vessel fluence evaluation for OLTP was a conservative upper bound estimate. The use of improved methods (Reference 8) have resulted in fluence predictions at 100% CLTP 38 EFPY that are bounded by the OLTP 32 EFPY fluence. The following table provides a comparison of the original fluence estimate and the current predictions at CLTP (120% OLTP) for MELLLA and MELLLA+. The MELLLA+ fluence is [ ] for the remaining lifetime to 38 EFPY.

Parameter	OLTP 32 EFPY (n/cm^2)	CLTP - MELLLA 38 EFPY (n/cm^2)	CLTP - MELLLA+ 38 EFPY (n/cm^2)
Peak Surface Fluence	8.7×10^{18}	[	
1/4T Fluence	6.2×10^{18}		]

The table shows that substantial margin to the original estimate remains. Therefore, no changes to the CPS reactor vessel pressure/temperature curves are required.

3.2.2 Reactor Vessel Structural Evaluation

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

[ ]

3.3 Reactor Internals

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Reactor Internals Pressure Differences for Normal, Upset, and Emergency Conditions	[	
Reactor Internals Pressure Differences for Faulted Conditions		
Reactor Internals Structural Evaluation for Normal, Upset, and Emergency Conditions		
Reactor Internals Structural Evaluation for Faulted Conditions		
Steam Dryer Separator Performance		]

3.3.1 Reactor Internal Pressure Differences

The core exit steam flow, operating pressure, and feedwater and steam flow at the CLTP, 85% core flow MELLLA+ statepoint are the same as at the CLTP, 107% core flow statepoint. Because the core flow is less at the MELLLA+ statepoint, the normal, upset, emergency, and faulted RIPDs and fuel bundle and Control Rod Guide Tube (CRGT) lift forces are less than the values at the CPS licensed 107% core flow rate.

[ ]

The faulted acoustic and flow induced loads in the RPV annulus resulting from the recirculation line break LOCA have been considered in the CPS evaluation. [ ] The CPS faulted acoustic and flow induced loads in the MELLLA+ region [ ] are bounded by the loads in the MELLLA operating domain [ ].

3.3.2 Reactor Internals Structural Evaluation

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

Load Category	MELLLA+ Results
Dead Weight	Dead weight loads are unchanged by MELLLA+
RIPDs	Section 3.3.1 concludes that the RIPDs for the MELLLA+ operating domain are bounded by the MELLLA (or ICF) conditions
Seismic	The seismic response is unaffected by MELLLA+.
Hydrodynamic Containment Dynamic Loads - (LOCA and SRV)	The hydrodynamic containment dynamic loads in the MELLLA+ operating domain are bounded by the loads in the MELLLA domain. (Section 4.1 and 4.1.2)
Annulus Pressurization (AP)	The AP loads in the MELLLA+ operating domain are bounded by the loads in the MELLLA domain. (Section 4.1 and 4.1.2)
Jet Reaction	The jet reaction loads in the MELLLA+ operating domain are bounded by the MELLLA domain. (Section 4.1 and 4.1.2)
Thermal Effects	The temperature ranges for the MELLLA+ operating domain are bounded by the MELLLA domain with reduced feedwater temperature. (Table 1-2)
Flow	The maximum flow loads in the MELLLA+ operating domain are bounded by the loads in the ICF domain. (Table 1-2)
Acoustic and Flow-Induced Loads Due To Recirculation Line Break	Section 3.3.1 concludes that the acoustic and flow-induced loads in the MELLLA+ domain are bounded by the MELLLA domain with reduced feedwater temperature.
Fuel Assembly and CRGT Lift	Section 3.3.1 concludes that the RIPDs for the MELLLA+ operating domain are bounded by the ICF conditions. Therefore, the Lift margin will be larger for MELLLA+.

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

[

]The faulted condition loads for the CPS reactor internal components resulting from the MELLLA+ operating domain conditions are bounded by the loads in the MELLLA or ICF domain.

3.3.3 Steam Separator and Dryer Performance

The performance of the CPS steam separators and dryer has been evaluated to determine the moisture content of the steam leaving the reactor pressure vessel. Compared to the CLTP, 100% (or ICF) core flow statepoint, the average separator inlet flow decreases and the average separator inlet quality increases at MELLLA+ conditions. These factors, in addition to the core radial power distribution, affect the steam separator-dryer performance. Steam separator-dryer performance was evaluated at equilibrium cycle limiting conditions of high radial power peaking and 85% rated core flow. The predicted steam moisture content was found acceptable based on the revised moisture content limit of 0.35 wt%.

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

3.4.1 FIV Influence on Piping

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

[

]

3.4.2 FIV Influence on Reactor Internals

The flow range in the MELLLA+ operating domain at EPU power (85% to 107%) is bounded by the MELLLA flow range at OLTP (75% to 107%). The MELLLA+ operating domain does not

result in new flow rate conditions inside the reactor vessel. The following table presents the effect on the reactor internals components for the MELLLA+ operating domain.

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

[

]

3.5 PIPING EVALUATION

3.5.1 Reactor Coolant Pressure Boundary Piping

The Reactor Coolant Pressure Boundary (RCPB) piping systems evaluation consists of a number of safety related piping subsystems that move fluid through the reactor and other safety systems. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Main Steam and Feedwater (Inside Containment)	[	
Recirculation and Control Rod Drive		
Reactor Core Isolation Cooling (RCIC) High Pressure Core Spray (HPCS) 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		]

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). Therefore, the existing structural evaluation is bounding for compliance with ASME criteria and for the effects of thermal expansion displacements on the piping snubbers, hangers, struts, and pipe whip restraints. Piping interfaces with RPV nozzles, penetrations, flanges, pumps and valves also need not be evaluated. There is no change in the loads on the piping and supports caused by closing the MSIVs or turbine stop valves (TSV).

For MELLLA+, there is no change in the main steam flow rate or temperature, and no change in the feedwater flow rate and temperature. There is a small change in average moisture content (See Section 8.4). No changes are required in the existing programs discussed in Section 10.7. There is no change in the characteristics of erosion/corrosion in the MS, 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. Therefore, pipe stress, pipe support loads (snubbers, hangers, and struts), RPV nozzles, penetrations, pump and valve-to-pipe welds are not affected. This conclusion is also applicable for the Control Rod Drive System.

[

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

- RHR Low Pressure Coolant Injection lines
- High Pressure Core Spray line
- Low Pressure Core Spray
- Standby Liquid Control System Injection line

The safety related thermowells, RPV head vent line, and SRV discharge lines are similar to the above with the exception that they do not communicate outside containment. They are normally isolated lines within the containment and are unaffected by the MELLLA+ operating range expansion because the pressure, temperature and flows in these systems does not change with MELLLA+.

MELLLA+ does not change the operating pressure or flow rate of any of these systems and the inlet temperature to the RWCU system is within the same range as for MELLLA operation. The

RPV bottom head drain line is a normally open suction flow path for the RWCU, and like the RWCU, the fluid conditions do not change when operating in the MELLLA+ domain. Therefore, the susceptibility of these systems to erosion/corrosion does not change as a result of the MELLLA+ operating range expansion.

[

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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	M+LTR Disposition	CPS Result
Main Steam and Feedwater (Outside Containment)	[	
Reactor Core Isolation Cooling (RCIC) High Pressure Core Spray (HPCS) Low Pressure Core Spray (LPCS) Residual Heat Removal (RHR)		
Off Gas System Containment Air Monitoring Neutron Monitoring System		]

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

[

]

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

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

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

[

]

3.6 REACTOR RECIRCULATION SYSTEM

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
System evaluation	[	
NPSH		
Flow mismatch		
Single loop operation		]

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

An evaluation of the net positive suction head (NPSH) for the recirculation pumps, jet pumps, and flow control valves shows that MELLLA+ does not increase the NPSH required and increases the NPSH margin. The cavitation protection interlock for the recirculation pumps and jet pumps is expressed in terms of a temperature difference between the reactor vessel dome temperature (derived from the dome pressure) and the recirculation suction temperature in each recirculation loop. The cavitation protection interlock for the flow control valves is expressed in terms of feedwater flow, which does not change for MELLLA+. The interlocks are based on sub-cooling and thus are a function of flow rate and feedwater temperature and are not changed by MELLLA+. The cavitation protection interlock does not change for MELLLA+. The affect on the TS for Recirculation Flow Mismatch Requirements is included in Section 4.3.

[

]

3.7 MAIN STEAM LINE FLOW RESTRICTORS

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Structural integrity	[	]

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

[

]

3.8 Main Steam Isolation Valves

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Isolation performance	[	
Valve pressure drop		]

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

[

]

3.9 Reactor Core Isolation Cooling

The Reactor Core Isolation Cooling (RCIC) System provides inventory makeup to the reactor vessel when the vessel is isolated from the normal high pressure makeup systems. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
System hardware	[	
System initiation		
Net positive suction head		
Inventory makeup level margin to TAF	]	

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

]

The NPSH available for the RCIC pump [

] For Anticipated Transients without Scram (Section 9.3.1) and Fire Protection (Section 6.7), operation of the

RCIC System at suppression pool temperatures greater than the operational limit may be accomplished by using the RCIC storage tank volume as the source of water. Therefore, the specified operational temperature limit for the process water does not change with MELLLA+. The NPSH required by the RCIC pump [

]

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

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 operational requirement is intended to avoid unnecessary initiations of safety systems and continues to be met in the MELLLA+ domain. Any operator action to inhibit ADS actuation following transient events will remain the same for MELLLA+.

[

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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 topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Low Pressure Coolant Injection mode	[	
Suppression pool and containment spray cooling modes		
Shutdown Cooling mode		
Steam Condensing mode		
Fuel pool cooling assist		]

The primary design parameters for the RHR System are the decay heat in the core and the amount of reactor heat discharged into the containment during a LOCA. The RHR System operates in various modes, depending on plant operating modes as assumed in accident analyses.
[

]

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

The Suppression Pool Cooling (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 Containment Spray Cooling (CSC) mode reduces the containment pressure and suppression pool water temperature following an accident where steam bypass of the suppression pool occurs. These modes are unaffected by MELLLA+, because there is no change in the containment long-term response (Section 4.1).

The Shutdown Cooling (SDC) mode is designed to remove the sensible and decay heat from the reactor primary system during a normal reactor shutdown. This non-safety related mode allows the reactor to be cooled down within a certain time, so that the SDC mode of operation will not become a critical path during refueling operations. Because MELLLA+ does not change the reactor sensible and decay heat, there is no change in the SDC time for the reactor cool down.

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

The Fuel Pool Cooling Assist mode, using existing RHR heat removal capacity, provides supplemental fuel pool cooling in the event that the fuel pool heat load exceeds the capability of the Fuel Pool Cooling and Cleanup System. Because there is no change in the decay heat deposited in the fuel pool, there is no effect on the Fuel Pool Cooling Assist mode.

[

]

3.11 Reactor Water Cleanup System

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
System performance	[	
Containment isolation		]

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

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

[ ]

4.0 ENGINEERED SAFETY FEATURES

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

4.1 CONTAINMENT SYSTEM PERFORMANCE

The topics addressed in this evaluation are:

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

Because the sensible and decay heat do not change in the MELLLA+ operating domain, the long-term suppression pool temperature response does not change. Similarly, the safety-relief valve loads do not change because SRV setpoints, and sensible and decay heat do not change.

[

]

4.1.1 Short Term Temperature and Pressure Response

For Mark III containments the main steam line break is the limiting break. [

] Operation in the MELLLA+ range may change the break energy for the design basis accident (DBA) recirculation suction line break (RSLB). The CPS short-term temperature and pressure response for the RSLB at MELLLA+ conditions has been evaluated and is bounded by the MELLLA results at the ICF flow rate (107%).

4.1.2 Containment Dynamic Loads

Results from the MSLB short-term containment response evaluation were used to evaluate the impact of MELLLA+ on the LOCA containment dynamic loads. The key parameters are drywell and wetwell pressure, vent flow rates, and suppression pool temperature. The LOCA

dynamic loads include pool swell, condensation oscillation (CO) and chugging. The short-term containment response at MELLLA+ conditions is bounded by the results at the ICF flow rate (107%). Therefore, the LOCA containment dynamic loads are not affected by the MELLLA+ operating domain.

Because the maximum normal operating reactor pressure, steam flow, and feedwater flow do not increase, there is no change in annulus pressurization due to the feedwater and steam line breaks.

As discussed in Section 4.1.2.3 of NEDC-32989P (Reference 9), the OLTP mass and energy releases were calculated using conservative methods. The MELLLA+ mass and energy releases were calculated using the methods recommended in NEDO-24548 (Reference 10), which are the same methods used for EPU. The recirculation inlet line break continues to be the limiting break for annulus pressurization. Reduced feedwater temperature operational enhancement options are not allowed in the MELLLA+ operating domain. [

] The MELLLA+ mass and energy releases for the recirculation inlet line break are bounded [

] by the conservative OLTP releases used in the structural design.

The pressure loadings on the drywell head refueling bulkhead plate due to the postulated pipe breaks in the drywell heads and the drywell do not increase. Therefore, the drywell head refueling bulkhead plate design remains adequate.

[

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4.1.3 Containment Isolation

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

[

]

4.1.4 Generic Letter 89-10

Section 4.1.1 confirms that the containment pressure and temperature response at MELLLA+ conditions is bounded by the current design basis analysis. Other parameters with the potential to impact the capability of safety-related motor-operated valves, such as the ambient temperature profile in the auxiliary building, were also reviewed. For each of the assessed parameters, the values at MELLLA+ are bounded by those at previously evaluated operating conditions. Therefore, a Generic Letter (GL) 89-10 motor-operated-valve (MOV) program evaluation is not required.

[

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4.1.5 Generic Letter 89-16

Generic Letter 89–16 is not applicable to the CPS Mark III containment.

4.1.6 Generic Letter 95-07

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

[

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4.1.7 Generic Letter 96-06

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

[

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4.2 EMERGENCY CORE COOLING SYSTEMS

The emergency core cooling systems (ECCS) include the High Pressure Core Spray (HPCS), the 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	M+LTR Disposition	CPS Result
High Pressure Coolant Injection	[	
High Pressure Core Spray		
Low Pressure Core Spray		
Low Pressure Coolant Injection Mode of the RHR System		
Automatic Depressurization		
ECCS Net Positive Suction Head		]

4.2.1 High Pressure Coolant Injection

Not applicable to CPS.

4.2.2 High Pressure Core Spray

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

For the MELLLA+ operating range expansion, there is no change in the reactor operating pressure, decay heat, and the SRV setpoints. [ ] Because the HPCS is a part of the analysis models used in the LOCA, the adequacy of the HPCS System performance is confirmed by the analysis discussed in Section 4.3.

[ ]

4.2.3 Low Pressure Core Spray

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

The MELLLA+ operating range expansion does not change the reactor pressures at which LPCS operation is required. [ ] Because the LPCS is a part of the analysis models used in the LOCA analysis, the adequacy of the LPCS System performance is confirmed by the analysis in Section 4.3.

[ ]

4.2.4 Low Pressure Coolant Injection

The LPCI mode of the RHR System is automatically initiated in the event of a LOCA. The primary purpose of the LPCI mode is to provide reactor coolant makeup for a large break LOCA and for any small break LOCA after the reactor vessel has depressurized.

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

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

[

]

4.2.5 Automatic Depressurization System

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

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

[

]

4.2.6 ECCS Net Positive Suction Head

The MELLLA+ operating range expansion does not result in an increase in the heat addition to the suppression pool following a LOCA, Station Blackout, or Appendix R event. The long-term peak suppression pool water temperature and long-term peak containment pressure do not change. The most limiting case for ECCS NPSH occurs at the peak long-term suppression pool temperature during a LOCA, which is not affected by MELLLA+. There are no physical changes in the piping or system arrangement.

[

]

4.3 EMERGENCY CORE COOLING SYSTEM PERFORMANCE

The CPS Emergency Core Cooling System (ECCS) is designed to provide protection against postulated LOCAs caused by ruptures in the primary system piping. The ECCS performance characteristics do not change for the MELLLA+ operating range expansion. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Large Break Peak Clad Temperature	[	
Small Break Peak Clad Temperature		
Local Cladding Oxidation		

Core Wide Metal Water Reaction		
Coolable Geometry		
Long-Term Cooling		
Flow Mismatch Limits		]

Break Spectrum Response - [ ] The break spectrum response is determined by the ECCS network design and is common to all BWRs. SAFER evaluation experience shows that the basic break spectrum response is not affected by changes in core flow (Reference 11). [ ]

Large Break Peak Clad Temperature - The CPS MELLLA+ LOCA analysis is based on the generic MELLLA+ region (100% CLTP, 80% rated core flow). Since the major impact that MELLLA+ introduces is the reduced core flow, performing the analysis at the lower generic core flows bounds the CPS-specific MELLLA+ region. [ ] The peak cladding temperature response following a large recirculation line break has two peaks. The first peak is determined by the boiling transition during core flow coastdown early in the event. The second peak is determined by the core uncovery and reflooding. MELLLA+ has two effects on the boiling transition and first peak PCT. First, the reduced core flow causes the boiling transition to occur earlier and 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 both CLTP and OLTP power levels, the early boiling transition times (boiling transitions that occur before jet pump uncovery) for CPS occur earlier in the event and penetrate lower in the fuel bundle as the core flow is reduced, but the impact of the earlier boiling transition on the LOCA PCT depends on the particular conditions. [ ] The CPS MELLLA+ results show that the first peak PCT has little impact on the second peak PCT, even for the low flow cases that show a significant increase in the first peak PCT. At the CLTP, 80% flow point, the second peak PCT is not significantly affected because the cladding of the hot node rewets after the first peak. At the OLTP, 55% flow point, the peak PCT is not significantly affected although the cladding of the hot node does not rewet. At this power/flow point, the reduced hot bundle power mitigates the heatup after uncovery.

The PCT for the limiting large break LOCA is determined primarily by the hot bundle and peak fuel node powers. [ ] The local fuel conditions do not significantly change with MELLLA+ because the hot bundle power is constrained by the same thermal limits for the purposes of the CPS analysis. [ ]

[

] The Licensing Basis PCT (Reference 9) is based on the Appendix K PCT. [

] The PCT results summarized below show that there are no unusual trends in PCT in the MELLLA+ region and that there is significant margin to the 2200°F PCT limit. The CPS MELLLA+ LOCA analysis also meets the Upper Bound PCT criteria of not exceeding 1600°F and being bounded by the Licensing Basis PCT.

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

(1) PCT results shown are for GE14 fuel.

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

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

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

10CFR50.46 Acceptance Criteria - The PCT discussion above shows that CPS at MELLLA+ conditions have significant margins to the 2200°F acceptance criterion of 10CFR50.46. Jet pump BWRs have significant margin to the local cladding oxidation and core-wide metal-water reaction acceptance criteria, even for peak cladding temperatures at the 2200°F limit. Since the cladding oxidation is determined by the PCT, MELLLA+ will affect the amount of cladding oxidation; however, compliance with the 2200°F limit ensures compliance with the local cladding oxidation and core-wide metal-water reaction acceptance criteria. Compliance with the coolable geometry and long-term cooling acceptance criteria were demonstrated generically for GE BWRs (Reference 11). These generic dispositions are applicable to CPS for operation in the

MELLLA+ operating range and there is a negligible effect on compliance with the other acceptance criteria of 10CFR50.46.

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

[
]

4.4 MAIN CONTROL ROOM ATMOSPHERE CONTROL SYSTEM

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Iodine intake	[	]

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

[
]

4.5 STANDBY GAS TREATMENT SYSTEM

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Flow capacity	[	
Iodine removal capability		]

The Standby Gas Treatment System (SGTS) is designed to maintain secondary containment at a negative pressure and to filter the exhaust air for removal of fission products potentially present during abnormal conditions. By limiting the release of airborne particulates and halogens, the SGTS limits off-site dose following a postulated design basis accident.

The design flow capacity of the CPS SGTS was selected to maintain the secondary containment at the required negative pressure to minimize the potential for exfiltration of air from the reactor building. [
] the system design flow requirement is unaffected. [

] there is no effect on the SGTS.

[

]

4.6 MAIN STEAM ISOLATION VALVE LEAKAGE CONTROL SYSTEM

The Main Steam Line Isolation Valve Leakage Control System controls the release of fission products that leak through the MSIVs following a LOCA. The leakage is directed to bleed lines aided by blowers, which maintain the pressure between the inboard and outboard isolation valves and between the outboard isolation valves and the downstream shutoff valves slightly negative with respect to atmosphere. The bleed lines pass the leakage into the SGTS.

The conditions in the steam lines and in the containment following a LOCA are not changed by MELLLA+. Therefore the leakage control system capability is unaffected by MELLLA+.

4.7 POST-LOCA COMBUSTIBLE GAS CONTROL SYSTEM

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
System initiation time	[	
Recombiner operating temperature		
Nitrogen makeup		]

The Combustible Gas Control System is designed to maintain the post-LOCA concentration or hydrogen in the containment atmosphere below the lower flammability limit. [

] there is no change in the production of hydrogen.

[

]

5.0 INSTRUMENTATION AND CONTROL

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

5.1 NSSS MONITORING AND CONTROL

Changes in process parameters resulting from the MELLLA+ operating range expansion and their effects on instrument performance are evaluated in the following sections. The effect of the MELLLA+ operating range expansion on the Technical Specifications is addressed in Section 11.1 and on the setpoints is addressed in Section 5.3. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Average Power Range, Intermediate Range, and Source Range Monitors	[	
Local Power Range Monitors		
Rod Block Monitor		
Rod Control and Information System		]

5.1.1 Neutron Monitoring System

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

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

The Average Power Range Monitor (APRM) output signals are calibrated to read 100% at the CLTP. Because there is no change in the maximum core power for the MELLLA+ operating range expansion, the APRM hardware is unaffected. The effect on APRM setpoints is discussed in Section 5.3. The MELLLA+ operating range expansion has no effect on the Intermediate Range Monitors (IRMs) overlap with the Source Range Monitors (SRMs) and APRMs, because overlap occurs at a lower power level than the MELLLA+ region. Using normal plant surveillance procedures, the IRMs may be adjusted to ensure adequate overlap with the SRMs and APRMs.

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

]

5.1.1.2 Local Power Range Monitors

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

The LPRMs and TIPs are installed at CPS in accordance with the requirements established by the GE design specifications. [
]

5.1.1.3 Rod Block Monitor

Not Applicable to CPS.

5.1.2 Rod Control and Information System

The Rod Control and Information System (RCIS) is a normal operating system that supports the operator in making control rod movements. The RCIS provides rod position information to the operator and limits rod movements to ensure that fuel design limits are not exceeded. The Rod Pattern Controller (RPC) and Rod Withdrawal Limiter (RWL) are functions of the RCIS.

The RPC ensures that control rod patterns during startup are such that only specified control rod sequences and relative positions are allowed over the operating range from all control rods inserted to the LPSP lower bounding analytical limit in %CLTP. The sequences effectively limit the amount and rate of reactivity increases during a Control Rod Drop Accident. The Low Power Setpoint (LPSP) is the point at which rod control makes the transition between RPC and RWL control. The LPSP has upper and lower bounding analytical limits.

The LPSP upper bounding analytical limit is based on the RWL function. The RWL prevents violation of the Minimum Critical Power Ratio Safety Limit and the cladding 1% plastic strain fuel design limit that may result from a single control rod withdrawal error. The High Power Setpoint (HPSP) is the point where the RWL changes allowable control rod withdrawal distances.

No changes in the LPSP upper and lower analytical limits or the HPSP are required for the MELLLA+ operating range expansion.

[
]

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	M+LTR Disposition	CPS Result
Pressure Control System	[	
Turbine Steam Bypass System (Normal Operation)		
Turbine Steam Bypass System (Safety Analysis)		
Feedwater Control System (Normal Operation)		
Feedwater Control System (Safety Analysis)		
Leak Detection System		]

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

[

]

5.3 TECHNICAL SPECIFICATION INSTRUMENT SETPOINTS

Technical Specifications (TS) instrument allowable values (AV) and nominal trip setpoints (NTSP) are those sensed variables, which initiate protective actions and are generally associated with the safety analysis. The determination of the AV and NTSP includes consideration of measurement uncertainty and is derived from the analytical limit (AL). Standard GE setpoint methodologies (References 4 and 16) are used to generate the AV and NTSPs from the related ALs. The MELLLA+ operating range expansion results in the development of two ALs.

The topics addressed in this evaluation are:

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

5.3.1 APRM Flow-Biased Scram

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

] The MELLLA+ APRM Flow Biased AV expressions are:

$AV_{M+SCRAM\ Clamp}$	$= 113\%$,	for the Scram Clamp, and
$AV_{M+SCRAM}$	$= 0.61\ W_d + 61.4\ \%$,	for the Scram.

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

5.3.2 Rod Block Monitor

The Rod Block Monitor is not applicable to CPS.

6.0 ELECTRICAL POWER AND AUXILIARY SYSTEMS

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

6.1 AC POWER

The alternating current (AC) power supply includes both off-site and on-site power. The on-site power distribution system consists of transformers, buses, and switchgear. AC power to the distribution system is provided from the transmission system or from onsite Diesel Generators. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
AC Power (normal or degraded voltage)	[	]

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

[

]

6.2 DC POWER

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

Topic	M+LTR Disposition	CPS Result
DC Power	[	]

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

[

]

6.3 FUEL POOL

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Fuel Pool Cooling	[	
Crud Activity and Corrosion Products		
Radiation Levels		
Fuel Racks		]

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

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

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

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

[

]

6.4 WATER SYSTEMS

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

Topic	M+LTR Disposition	CPS Result
Water Systems	Generic	Confirmed

The performance of the safety related Service Water System during and following the most limiting design basis event, the LOCA, is not affected by the MELLLA+ operating range expansion. MELLLA+ does not change the cooling requirements on the RHR System or the heat load discharged to the environment. Therefore, no changes to the Service Water System are required and the ultimate heat sink (UHS) temperature is not affected by MELLLA+.

[

]

6.5 STANDBY LIQUID CONTROL SYSTEM

The Standby Liquid Control System (SLCS) is a manually operated system that pumps a sodium pentaborate solution into the vessel to provide neutron absorption and achieve a subcritical reactor condition in the situation where none of the control rods can be inserted. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Shutdown margin	[	
System hardware		
ATWS requirements		]

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

[

]

The SLCS is designed for injection at a maximum reactor pressure equal to the upper analytical limit for the second lowest SRV operating in the safety relief mode, which is 1143 psig. Since the reactor dome pressure and SRV setpoints are unchanged for MELLLA+, the current SLCS process parameters do not change. Therefore, the capability of the SLCS to perform its backup shutdown function is not affected by MELLLA+.

The SLCS ATWS performance is evaluated in Section 9.3.1 [

] The MELLLA+ evaluation shows that the SLCS maintains the capability to mitigate an ATWS and that the current boron injection rate is sufficient relative to the peak suppression pool temperature. The ATWS analysis in Section 9.3.1 also demonstrates that there is no increase in the peak vessel dome pressure during the time the SLCS is in operation. Consequently, there is no increase in the pump discharge pressure and no decrease in the pressure margin to the SLCS pump discharge relief valve setpoint. Therefore, SLCS operation during an ATWS is not affected by the MELLLA+ operating range expansion.

6.6 HEATING, VENTILATION AND AIR CONDITIONING

The Heating Ventilation and Air Conditioning (HVAC) System consists mainly of heating, cooling supply, exhaust and recirculation units in the turbine building, containment building and the drywell, auxiliary building, fuel handling building, control building, and the radwaste building. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Heating, Ventilation And Air Conditioning	[	]

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

[

]

6.7 FIRE PROTECTION

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

Topic	M+LTR Disposition	CPS Result
Fire Protection	[	]

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

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

[

]

6.8 OTHER SYSTEMS AFFECTED

The topics addressed in this evaluation are other systems that may be affected by the MELLLA+ operating range expansion:

Topic	M+LTR Disposition	CPS Result
Other systems	[	]

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

[

]

7.0 POWER CONVERSION SYSTEMS

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

7.1 TURBINE-GENERATOR

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

Topic	M+LTR Disposition	CPS Result
Turbine-Generator	[	]

The MELLLA+ operating range expansion does not change the pressure, thermal energy, and steam flow from the reactor. Likewise, there is no change in the electrical output of the generator. There is no change in the previous missile avoidance and protection analysis.

[

]

7.2 CONDENSER AND STEAM JET AIR EJECTORS

The condenser removes heat from the steam discharged from the turbine and provides liquid for the condensate and feedwater systems. The steam jet air ejectors remove non-condensable gases from the condenser to improve thermal performance. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Condenser And Steam Jet Air Ejectors	[	]

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

[

]

7.3 TURBINE STEAM BYPASS

The Turbine Steam Bypass System provides a means of accommodating excess steam generated during normal plant maneuvers and transients. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Turbine Steam Bypass	[	]

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

[

]

7.4 FEEDWATER AND CONDENSATE SYSTEMS

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

Topic	M+LTR Disposition	CPS Result
Feedwater And Condensate Systems	[	]

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

[

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8.0 RADWASTE SYSTEMS AND RADIATION SOURCES

This section addresses the evaluations in Regulatory Guide 1.70, Chapter 11 that are applicable to MELLLA+.

8.1 LIQUID AND SOLID WASTE MANAGEMENT

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

Topic	M+LTR Disposition	CPS Result
Coolant fission and corrosion product levels	See Section 8.4	
Waste Volumes	[	]

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. Although the volume of waste generated is not expected to increase, potentially higher moisture content in the reactor steam could result in slightly higher loading on the condensate demineralizers. Because the conditions of higher moisture content occur infrequently (See Section 8.4), MELLLA+ will not cause the condensate demineralizer or the reactor water cleanup filter demineralizer backwash frequency to change significantly.

[

]

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	M+LTR Disposition	CPS Result
Offsite release rate	[	
Recombiner performance		]

The radiological release rate is administratively controlled to remain within existing limits, and is a function of fuel cladding performance, main condenser air inleakage, charcoal adsorber inlet dew point, and charcoal adsorber temperature. None of these parameters is affected by the MELLLA+ operating range expansion. Because the MELLLA+ operating range expansion does not change the flow rate of radiolytic hydrogen and oxygen to the Offgas System, the catalytic

recombiner temperature and offgas condenser heat load, as well as components downstream of the offgas condenser, are unaffected.

[

]

8.3 RADIATION SOURCES IN THE REACTOR CORE

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

Topic	M+LTR Disposition	CPS Result
Post operational radiation sources for radiological and shielding analysis	[	]

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

[

]

8.4 RADIATION SOURCES IN REACTOR COOLANT

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

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

Coolant Activation Products: During reactor operation, the coolant passing through the core region becomes radioactive as a result of nuclear reactions. The coolant activation process is the dominant source resulting in the production of short-lived radionuclides of N-16 and other activation products, which result in the primary source of radiation in the turbines during operation. The production of activation products is proportional to neutron flux and steam flow, which remain unchanged for the MELLLA+ operating range expansion. Therefore, there is no change in the coolant activation products in the MELLLA+ operating domain.

[

]

Fission and Activated Corrosion Products: The fission products in the reactor coolant are the result of minute releases from the fuel rods, while the activated corrosion products are the result

of metallic materials entering the water and being activated in the reactor region. Production of fission and activated corrosion products are approximately proportional to reactor power. Because the core power level and fuel thermal limits are not changed for the MELLLA+ operating range expansion, the releases from the fuel do not change. For the MELLLA+ operating range expansion there is no change in the feedwater flow, steam flow, or power. Therefore, the MELLLA+ operating range expansion does not effect the total activity concentration in the reactor coolant.

As discussed in Section 3.3.3, the limit for the moisture content of the main steam leaving the vessel has been increased from 0.1 wt% to 0.35 wt%. The moisture content of the main steam leaving the vessel may approach the limit at times while operating near the minimum core flow in the MELLLA+ domain. The distribution of the fission and activated corrosion product activity between the reactor water and steam will be affected by the increased moisture content. With increased moisture carryover, additional activity will be carried over from the reactor water with the steam. While the moisture content limit has been increased from 0.1 wt% to 0.35 wt%, [

] the fission and activated corrosion product levels in the BOP are not significantly affected for operation in the MELLLA+ operating domain.

8.5 RADIATION LEVELS

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

Topic	M+LTR Disposition	CPS Result
Normal operational radiation levels	[	
Post-shutdown radiation levels		
Post-accident radiation levels		]

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. As noted in Section 8.4, the primary source of radiation in the turbines during operation is the power dependent coolant activation process. Since there is no change in power or steam flow rate under MELLLA+, the radiation levels from the coolant activation products do not change. The shutdown radiation levels are dominated by the accumulated contamination of some fission and activated corrosion products. These radionuclide concentrations in the coolant do not vary significantly unless the moisture carryover from the vessel increases, which affects the equilibrium concentrations in the coolant. As discussed in Section 8.4, the moisture content of the main steam leaving the vessel may increase at certain times while operating in the MELLLA+ operating domain. However, the cycle average affect is estimated to be approximately 0.11 wt%. The overall radiological affect of the increased moisture content is a function of the plant water radiochemistry and the levels of

activated corrosion products maintained. Appropriate health physics and ALARA controls are maintained to address any increase in the normal operation and shutdown radiation levels.

The post-accident radiation levels depend primarily upon the core inventory of fission products and technical specification levels of radionuclides in the coolant. As such, they are not significantly affected by MELLLA+.

Section 9.2 shows one accident, Liquid Radwaste Tank Failure that requires a plant specific evaluation. The moisture content of the main steam increases in a small area of the MELLLA+ region near the minimum core flow and 100% RTP (See Section 3.3.3 and 8.4). As a result, the inventory of many radionuclides in radwaste system components also increases. However, the CPS radwaste tank accident analysis described in USAR Section 15.7.3 was based on a conservative radionuclide inventory in the storage tanks. The inventory of radionuclides in the tanks was based on estimated equilibrium concentrations of isotopes in the reactor coolant from early 1970's plant data. The radwaste tank inventory has been recalculated using the ANS 18.1-1984 reactor coolant concentrations. The radionuclide concentrations in the reactor steam are adjusted for the 0.35 wt% moisture carryover limit. The 1984 version of ANS 18.1 was used because the recommended maximum radionuclide concentrations in the reactor water are higher than in the 1999 version of the standard. This produces a more conservative result. Using the 0.35 wt% carryover limit to determine the maximum concentration in the radwaste tanks is conservative because, as described in Section 8.4, the [

] Using the higher carryover produces a higher radionuclide concentration in the radwaste storage tanks. The USAR inventory in the radwaste tanks bounds the inventory calculated using the 1984 ANS standard. 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	M+LTR Disposition	CPS Result
Plant gaseous emissions	[	
Gamma shine from the turbine		]

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

[

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9.0 REACTOR SAFETY PERFORMANCE EVALUATIONS

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

9.1 ANTICIPATED OPERATIONAL OCCURRENCES

The CPS USAR defines the licensing basis Anticipated Operational Occurrences (AOOs). Table 9-1 of the M+LTR provides an assessment of the effect of the MELLLA+ operating range expansion on each of the Reference 5 limiting AOO events and key non-limiting events. Table 9-1 of the M+LTR includes fuel thermal margin, overpressure, and loss of water level events. The overpressure protection analysis events are addressed in Section 3.1. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Fuel Thermal Margins Events	[	
Power and Flow Dependent Limits		
Non-Limiting Events		]

9.1.1 Fuel Thermal Margin Events

[

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

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

The fuel loading error events are also analyzed as AOOs. [
]

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

- Turbine Trip Without Bypass,
- Feedwater Controller Failure (Maximum Demand), and

- Loss of Feedwater Heater.

[

]

[

] The limiting thermal margin events are analyzed for each reload core and documented in the Supplemental Reload Licensing Report (SRLR).

9.1.2 Power and Flow Dependent Limits

The operating MCPR, LHGR, and/or MAPLHGR thermal limits are modified by a flow factor when the plant is operating at less than 100% core flow. The MCPR flow factor ($MCPR_f$) is primarily based upon an evaluation of the slow recirculation increase event. The slow recirculation increase has been analyzed from the maximum MELLLA+ core power at the MELLLA+ minimum core flow of 55%. [

]

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

]

[

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

9.1.3 Non-Limiting Events

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

[

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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	M+LTR Disposition	CPS Result
Control Rod Drop Accident (CRDA)	[	]
Instrument Line Break Accident (ILBA)	Not a submitted and reviewed accident. CPS-USAR states that it is bounded by the Main Steam Line Break analysis	
Main Steam Line Break Accident (MSLBA) (Outside Containment)	[	
Loss of Coolant Accident (LOCA) (Inside Containment)		
Large Line Break (Feedwater or Reactor Water Cleanup)		
Liquid Radwaste Tank Failure		
Fuel Handling Accident (FHA)		
Offgas System Failure		
Cask Drop		]

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

[

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As discussed in Section 3.3.3, the moisture content of the main steam leaving the vessel will increase in a portion of the MELLLA+ operating domain. Section 8.5 discusses the analysis of the radioactive nuclide inventory in the radwaste tank. The radionuclide inventory in the radwaste tanks calculated based on ANS 18.1-1984 and adjusted for higher carryover is bounded by the inventory used in the Liquid Radwaste Tank Failure analysis described in the USAR. Therefore, the dose calculation described in the USAR for the Liquid Radwaste Tank Failure remains bounding and operation in the MELLLA+ operating domain will not affect the current Liquid Radwaste Tank Failure analysis.

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	M+LTR Disposition	CPS Result
ATWS (Overpressure)	[	
ATWS (Suppression Pool Temperature)		
ATWS (Peak Cladding Temperature)		
Station Blackout		
ATWS with Core Instability		]

9.3.1 Anticipated Transients without Scram

There is no change in core power, decay heat, pressure, or steam flow as a result of the MELLLA+ operating range expansion. However, operation at the higher MELLLA+ power-flow boundary results in a less effective power reduction from the RPT. The ATWS evaluation criteria are to:

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

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

The ATWS analysis results in the following table demonstrate that the MELLLA+ operating range expansion has a minimal effect and there remains substantial margin to the limits.

ATWS Acceptance Criteria	CLTP Result	MELLLA+ Result	Limit
Peak vessel bottom pressure (psig)	1336	1359	1500
Peak suppression pool temperature (°F)	165	171	185
Peak containment pressure (psig)	6.3	7.2	15

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

]

9.3.2 Station Blackout

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

[

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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 13). The companion report, NEDO-32164, "Mitigation of BWR Core Thermal-Hydraulic Instabilities in ATWS," (Reference 14) was approved by the same SER. The NRC review concluded that the GE TRACG code is an adequate tool to estimate the behavior of operating reactors during transients that may result in large power oscillations. The review also concluded that the severity of the event indicates that core coolable geometry and containment integrity can be maintained, and specified operator actions are sufficient to mitigate the consequences of an ATWS event with large core power oscillations.

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

] The analysis conditions and assumptions used in the analysis bound the CPS conditions. [

]

[

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10.0 OTHER EVALUATIONS

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

10.1 HIGH ENERGY LINE BREAK

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

Topic	M+LTR Disposition	CPS Result
Steam Lines	[	
Balance of Plant Liquid Lines		
Other Liquid Lines		]

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

[

]

[

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

[

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10.2 MODERATE ENERGY LINE BREAK

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

Topic	M+LTR Disposition	CPS Result
Flooding	[	
Environmental Qualification		]

Operation in the MELLLA+ core flow range does not affect the auxiliary system flow rates or system inventories. No system operational modes evaluated for MELB are affected by

MELLLA+. The plant internal flooding analysis and safe shutdown analysis are not affected by MELLLA+ and the MELB analysis for CPS is unaffected.

[

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10.3 Environmental Qualification

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

Topic	M+LTR Disposition	CPS Result
Electrical Equipment	[	
Mechanical Equipment with Non-Metallic Components		
Mechanical Component Design Qualification		]

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. The safety-related electrical equipment was reviewed to assure the existing qualification for the normal and accident conditions expected in the area where the equipment is located remain adequate. Section 4.1 confirms that the containment pressure and temperature for MELLLA+ is bounded by the current MELLLA analysis. Similarly, Section 10.1 confirms that the response for pipe breaks outside containment is bounded by current MELLLA evaluations. Section 9.2 concludes that MELLLA+ does not effect the radiological consequences of the limiting events at CPS.

[

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10.3.2 Mechanical Equipment With Non-Metallic Components

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

[

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10.3.3 Mechanical Component Design Qualification

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

The change in fluid induced loads on safety-related components is discussed in Section 3.2.2, 3.5, and 4.1.2. The nozzle loads and component support loads do not change due to operation in the MELLLA+ range. Therefore, the mechanical components and component supports are adequately designed for the MELLLA+ operating range.

[

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10.4 TESTING

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

Topic	M+LTR Disposition	CPS Result
Steam Separator-Dryer Performance	[	
APRM Calibration		
Core Performance		
Pressure Regulator		
Water Level Setpoint Changes		
Neutron Flux Noise Surveillance		]

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.

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 / Probabilistic Risk Assessment

An assessment of the risk increase has been performed, including Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) associated with operation in the MELLLA+ range. The assessment includes the effect of arming the OPRM and modifying the OPRM software to support the DSS-CD as described in Section 2.4. The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Initiating Event Categories and Frequency	[	
Component Reliability		
Operator Response		
Success Criteria		
External Events		
Shutdown Risk		
PRA Quality		]

The CPS analysis indicates that the incremental risk increase due to MELLLA+ operating range expansion is very small. The key inputs to the CPS Probabilistic Risk Assessment are confirmed in the sections below.

10.5.1 Initiating Event Categories and Frequency

The MELLLA+ core operating range expansion involves changes to the operating power-flow map and a few setpoints and alarms. There is no change in the operating pressure, power, steam flow rate, and feedwater flow rate. MELLLA+ implementation does not include changes to plant hardware or operating procedures that would create additional event categories or have a significant effect on initiating event frequencies.

Internal initiating event categories for CPS were assessed by reviewing the contributors to their occurrence that could be impacted by MELLLA+ to determine to what extent they are impacted. As demonstrated below, no new CPS initiating event categories or significant impacts on initiating event frequencies were identified.

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

The MELLLA+ operating range expansion does not significantly change the probability of an instability event at CPS. The probability of a two-recirculation-pump trip or a recirculation flow runback are unchanged. As noted in Section 2.4, the DSS-CD solution will be implemented at the same time as MELLLA+. The Back-up Stability Protection regions (BSPs), which replace the Interim Corrective Actions (ICAs), are determined in accordance with Reference 6 (NEDC-33075P) to maintain stability characteristics similar to the ICAs. The arming of the OPRM is not anticipated to produce an increase in the scram frequency. Therefore, the effect of the stability region modifications on the initiating event frequency in the PRA is negligible.

The MELLLA+ operating range expansion at CPS will not change the probability of an ATWS event. MELLLA+ implementation does not involve any changes to the reliability of reactivity control systems and does not increase the scram demand frequency significantly.

The initiating event categories and frequency were evaluated on a CPS specific basis and determined not to require additional adjustment for implementation of MELLLA+.

10.5.2 Component and System Reliability

There is no change in the operating pressure, power, steam flow rate, and feedwater flow rate. The MELLLA+ operating range expansion does not require significant plant hardware modifications. No additional requirements are imposed on any of the safety, balance-of-plant, electrical, or auxiliary systems. The environmental qualification envelope is not changed. 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, and operating limits are selected such that the equipment parameter values are equal to or more conservative than the values used in the safety analyses. In addition, the surveillance test intervals for plant equipment remain unchanged. Therefore, the operating range expansion does not affect the system or component reliability.

[

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10.5.3 Operator Response

The operator responses to anticipated occurrences, accidents and special events within the MELLLA+ operating domain are the same as from within the MELLLA operating domain. MELLLA+ does not cause changes in automatic safety actions. Arming the OPRM causes an additional automatic scram where there used to be a manual scram required, however the operator response to this scram is not different from other scrams. After automatic responses have initiated, the post-event operator actions for plant safety (e.g., maintaining safe shutdown, core cooling, containment cooling) remain the same for MELLLA+. Because decay heat is unchanged, the time for boil-off is unchanged. Therefore, operator actions for long term core cooling are not affected by the MELLLA+ operating range expansion.

The MELLLA+ operating range expansion does not significantly affect the requirements for operator actions in response to ATWS events. The CPS MELLLA+ ATWS evaluations provided in Section 9.3.1 and 9.3.3 do not result in changes to the boron injection requirements. There are no changes to the operator ATWS response requirements (SLCS initiation, ADS inhibit, and level reduction). The CPS PRA uses realistic rather than design values for the minimum operator action time to initiate SLC. Because the realistically available time to initiate SLC is shorter after implementation of MELLLA+, the Human Reliability Analysis values for probability of failure are larger after MELLLA+. The change in time available to inhibit ADS is not realistically expected to impact the likelihood of operator success since this is an immediate action under the ATWS EOP. The CPS PRA results are not sensitive to the failure rate for ATWS level/power control because the timing for actions such as SLC were determined given little credit for level/power control.

There are no new operator actions for MELLLA+. The time available to initiate SLC was used to calculate new operator failure rates for SLC initiation. The corresponding decrease in probability of success has been used to evaluate the risk associated with the MELLLA+ condition through the CPS PRA model.

The changes to the operator response requirements at CPS due to MELLLA+ have been evaluated. The resultant impact to the Core Damage Frequency and Large Early Release Frequency is very small in accordance with the classification guidance of Regulatory Guide 1.174 (Reference 17).

10.5.4 Success Criteria

Systems success criteria credited to perform the critical safety functions in the CPS PRA were evaluated based on the MELLLA+ operating domain. 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 power-flow map and a small number of setpoints and alarms. There is no change in the operating pressure, power, steam flow rate, and feedwater flow rate. The MELLLA+ operating range expansion does not impose any additional requirements on the safety, balance-of-plant, electrical, or auxiliary systems. As demonstrated in Section 9.3.1, adequate SRV capacity is provided to ensure that the ATWS overpressure requirement for MELLLA+ is satisfied. Section 6.5 demonstrates that the SLC capability to shut down the reactor is maintained after implementation of MELLLA+. Therefore, MELLLA+ operating range expansion will not affect the PRA success criteria.

[

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10.5.5 External Events

The evaluation of the CPS MELLLA+ operating range expansion demonstrates that the elements of the internal event IPE, discussed in Sections 10.5.1 to 10.5.4, are not significantly affected. The external events have a much smaller initiating event frequency than the internal events and do not impact the plant in any way that make operating at MELLLA+ conditions more significant. Therefore, there is no perceptible effect on the external events IPE.

[

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10.5.6 Shutdown Risks

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

[

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10.5.7 PRA Quality

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

- Sufficient scope and level of detail in the PRA
- Comprehensive critical reviews

The CPS MELLLA+ does not have a significant effect on any elements of the PRA such that the structure of the model would need to be changed, therefore it does not affect the PRA quality.

[

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10.6 Operator Training and Human Factors

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

Topic	M+LTR Disposition	CPS Result
Operator training and human factors	[	]

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

[

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The primary impacts of MELLLA+ on Main Control Room (MCR) operation involve changes to the power-to-flow map. Other than the changes to the computer display for the power to flow map, there are no major physical changes to the MCR controls, displays or alarms as a result of MELLLA+. Some changes are required to MCR panel board alarm settings and automatic actuation setpoints to accommodate changes due to MELLLA+. There is no anticipated impact to the existing zone banding (i.e., green, yellow, and red) on MCR panel board indications due to MELLLA+.

The Average Power Range Monitor Flow-Biased Scram and Rod Block Setpoints are also being changed as a result of MELLLA+. These setpoint changes are described in Section 5.3.1. Changes to the automatic actuation setpoints are implemented as design changes in accordance with approved change control procedures. The change control process includes an impact review by operations and training personnel. Training and implementation requirements are identified and tracked, including simulator impact. Verification of training is required as part of the design change closure process.

There are no planned upgrades of controls, displays or alarms from analog to digital instruments as part of MELLLA+. There are no changes to the analog and digital inputs for the Safety Parameter Display System (SPDS) for MELLLA+.

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

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

Topic	M+LTR Disposition	CPS Result
Irradiated Assisted Stress Corrosion Cracking (IASCC)	[	
Flow Accelerated Corrosion		]

Section 3.2.1 provides an evaluation of the change in fluence experienced by the reactor internals. The change in fluence is minor resulting in an insignificant change in the potential for IASCC. Therefore, the current inspection strategy based on the Boiling Water Reactor Vessel Internals Project (BWRVIP) (Reference 18) is sufficient to address the small increase in fluence.

Because there is no increase in the steam flow rate, feedwater flow rate, and a small change in average moisture content (See Section 8.4), there is no change in the potential for flow accelerated corrosion (FAC). The evaluation of and inspection for flow-induced

erosion/corrosion in piping systems that are affected by FAC is addressed by compliance with NRC Generic Letter 89-08, "Erosion/Corrosion in Piping". The requirements of Generic Letter (GL) 89-08 are implemented at CPS by utilization of the Electric Power Research Institute generic program, "CHECWORKS." CPS specific parameters are entered into this program to develop requirements for monitoring and maintenance of specific system components. No changes are anticipated to the CPS specific parameters that are entered into the CHECWORKS program. The FAC monitoring programs are adequate to manage potential effects of MELLLA+.

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The Maintenance Rule also provides oversight for the other mechanical and electrical components, important to plant safety, to guard against age-related degradation. The longevity of CPS equipment is not affected by the MELLLA+ operating range expansion.

10.8 NRC AND INDUSTRY COMMUNICATIONS

The topics addressed in this evaluation are:

Topic	M+LTR Disposition	CPS Result
Plant disposition of NRC and Industry communications	[	]

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

10.9 EMERGENCY AND ABNORMAL OPERATING PROCEDURES

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

Topic	M+LTR Disposition	CPS Result
Emergency Operating Procedures	[	
Abnormal Operating Procedures		]

EOPs include variables and limit curves, which define conditions where operator actions are indicated. The Emergency Operating Procedures (EOPs) remain symptom-based and thus the operator actions remain unchanged. MELLLA+ is not expected to impact the CPS EOPs, however, the EOPs will be reviewed for impacts prior to implementation of MELLLA+. AOPs include event based operator actions. No significant Abnormal Operating Procedure (AOP) revisions are expected as a result of MELLLA+. However, all AOPs will be reviewed for MELLLA+ conditions and necessary revisions will be completed prior to MELLLA+ implementation.

Any changes identified to the EOPs and AOPs will be included in the operator training to be conducted prior to implementation of MELLLA+.

11.0 LICENSING EVALUATIONS

The licensing evaluations addressed in this section include:

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

11.1 EFFECT ON TECHNICAL SPECIFICATIONS

The Technical Specifications (TS) that are affected by a MELLLA+ operating range expansion is provided in Table 11-1. In contrast to a power uprate, the CLTP, both in relative (%) terms and absolute terms (MWt), does not change. Therefore, the implementation of MELLLA+ requires revision of a limited number of the TS. In addition, changes required for the DSS-CD stability solution option are included. Note that the TS changes included in Table 11-1 are those related to the change from the Option III solution to the Confirmation Density solution. There are other TS changes required for the Option III implementation and arming of the Oscillation Range Power Monitor (OPRM) Instrumentation.

11.2 ENVIRONMENTAL ASSESSMENT

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

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

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

- A significant increase in any adverse environmental effect previously evaluated in the final statement, environmental effect appraisals, or in any decisions of the Atomic Safety and Licensing Board; or
- A significant change in effluents; or

- A matter not previously reviewed and evaluated in the documents specified above which may have a significant adverse environmental effect.

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

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

11.3 SIGNIFICANT HAZARDS CONSIDERATION ASSESSMENT

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

The DSS-CD introduces an enhanced detection algorithm, the Confirmation Density Algorithm (CDA), which reliably detects the inception of power oscillations and generates an early power suppression trip signal prior to any significant oscillation amplitude growth and Minimum Critical Power Ratio (MCPR) degradation.

11.3.1 Modification Summary

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

The stability solution is being changed from Option III to the DSS-CD solution. The DSS-CD solution algorithm, licensing basis, and application procedures are generically described in NEDC-33075P (Reference 6), and are applicable to CPS. The DSS-CD solution uses the same hardware as the current Option III solution. The Option III algorithm contained in an OPRM Erasable Programmable Memory will be updated to include the enhanced DSS-CD solution algorithm.

11.3.2 Discussion of MELLLA+ Issues

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

11.3.2.1 MELLLA+ Analysis Basis

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

11.3.2.2 Fuel Thermal Limits

No change is required in the mechanical fuel design to meet the plant licensing limits while operating in the MELLLA+ region. No increase in allowable peak bundle power is needed and fuel thermal design limits will be met in the MELLLA+ region. The analyses for each fuel reload are required to meet the criteria accepted by the NRC as specified in Reference 5 or otherwise approved in the Technical Specification amendment request. In addition, future fuel designs will meet acceptance criteria approved by the NRC.

11.3.2.3 Makeup Water Sources

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

- Feedwater and condensate system pumps
- Low pressure emergency core cooling system (LPCI & CS) pumps
- High pressure emergency core cooling system (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 USAR. The PCT calculated for a LOCA from the MELLLA+ region may be higher than the license basis PCT that was calculated based on rated flow. However, the ECCS performance evaluation (Section 4.3) demonstrates significant margin to criteria of 10CFR50.46 at the reduced flow of MELLLA+. Therefore, the ECCS safety margin is not significantly affected by MELLLA+.

11.3.2.6 Challenges to the Containment

The peak values for containment pressure and temperature for events initiated in the MELLLA+ region meet design requirements and confirm the suitability of the plant for operation in the MELLLA+ region. The containment dynamic and structural loads for events initiated in the MELLLA+ region do not increase and continue to meet design requirements. The change in short-term containment response is negligible and, because there is no change in decay heat, there is no change in the long-term response. The containment pressure and temperature remains below the design limits following any DBA. Therefore, the containment and its cooling systems are satisfactory for operation in the MELLLA+ region.

11.3.2.7 Design Basis Accident Radiological Consequences

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

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

11.3.2.8 Anticipated Operational Occurrence Analyses

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

11.3.2.9 Combined Effects

DBAs are postulated using deterministic regulatory criteria to evaluate challenges to the fuel, containment, and off-site radiation dose limits. The off-site dose evaluation specified by Regulatory Guide (RG) 1.3 and SRP-15.6.5 provides a more severe DBA radiological consequences scenario than the combined effects of the hypothetical LOCA, which produces the greatest challenge to the fuel and/or containment. That is, the DBA, which produces the highest PCT and/or containment pressure, does not damage large amounts of fuel, and thus, the source terms and doses are much smaller than those postulated in RG 1.3 evaluations. The conservatism associated with combined effects is not reduced by operation in the MELLLA+ region.

11.3.2.10 Non-LOCA Radiological Release Accidents

All of the limiting non-LOCA events discussed in Regulatory Guide 1.70 and USAR Chapter 15 were reviewed for the effect of MELLLA+. The dose consequences for all of the non-LOCA radiological release accident events are shown in Section 9.0 to remain below regulatory limits.

11.3.2.11 Equipment Qualification

Plant equipment and instrumentation have been evaluated against the applicable criteria. The qualification envelope does not change due to the MELLLA+ operating range expansion or is bounded by the maximum core flow rate statepoint.

11.3.2.12 Balance-of-Plant

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

11.3.2.13 Environmental Consequences

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

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

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

11.3.2.14 Technical Specifications Changes

The Technical Specifications (TS) ensure that plant and system performance parameters are maintained within the values assumed in the safety analyses. The TS setpoints, allowable values, operating limits, and the like are selected such that the equipment parameter values are equal to or more conservative than the values used in the safety analyses. CPS TS changes are provided in Table 11-1. Instrument uncertainties were properly considered for the setpoint changes associated with MELLLA+. This ensures that the actual plant response is less severe than that represented by the safety analysis.

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

11.3.2.15 Assessment of 10CFR50.92 Criteria

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

11.3.3 Discussion of DSS-CD Stability Solution Issues

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

The DSS-CD solution is designed to identify the power oscillation upon inception and initiate control rod insertion to terminate the oscillations prior to any significant amplitude growth. The DSS-CD provides protection against violation of the Safety Limit Minimum Critical Power Ratio (SLMCPR) for anticipated oscillations. Compliance with General Design Criteria (GDC) 10 and 12 of 10CFR50, Appendix A is accomplished via an automatic action. The DSS-CD is based on the same hardware design as Option III. However, it introduces an enhanced detection algorithm that detects the inception of power oscillations and generates an earlier power suppression trip signal exclusively based on successive period confirmation recognition. The existing Option III algorithms are retained (with generic setpoints) to provide defense-in-depth protection for unanticipated reactor instability events.

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

Table 11-1 MELLLA+ Technical Specification Changes for CPS

Specification	Existing Requirement	Proposed Requirement
TS 3.3.1.1, "Reactor Protection System (RPS) Instrumentation" Table 3.3 1.1-1, Function 2.b (Average Power Range Monitors, Flow Biased Simulated Thermal Power - High) Allowable Value	< 0.55W + 62.% RTP and < 113% RTP	< 0.61W + 61.4% RTP and < 113% RTP (Section 5.3.1)
TS 3.3.1.3, "Oscillation Range Power Monitor (OPRM) Instrumentation" (See Note) LCO 3.3.1.3, Applicability	Thermal Power ≥ 25% RTP	Thermal Power ≥ 21.6% RTP (Section 2.4)
TS 3.3.1.3, "Oscillation Range Power Monitor (OPRM) Instrumentation" (See Note) LCO 3.3.1.3, Actions, Required Action C.1	Reduce Thermal Power < 25% RTP	Reduce Thermal Power < 21.6% RTP (Section 2.4)
TS 3.3.1.3, "Oscillation Range Power Monitor (OPRM) Instrumentation" Surveillance Requirements SR 3 3.1.3.5	Verify OPRM is not bypassed when THERMAL POWER is ≥ 30% RTP and recirculation drive flow is ≤ the value corresponding to 60% of rated core flow.	Delete the Surveillance. Deleted to eliminate redundant actions.
TS 3.4.1 Recirculation Loops Operating LCO 3.4.1	Two recirculation loops shall be in operation with matched flows, OR One recirculation loop may be in operation with:	Two recirculation loops shall be in operation with matched flows, OR One recirculation loop may be in operation provided the plant is not operating in the MELLLA+ region defined in the COLR and with:
TS 5.6.5 Core Operating Limits Report (COLR) a Core operating limits shall be established prior to each reload cycle, or prior to any remaining portion of a reload cycle, and shall be documented in the COLR for the following: b.	5. LCO 3.3.1.3 Oscillation Range Power Monitor (OPRM) Instrumentation The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC in (1) General Electric Standard Application for Reactor Fuel (GESTAR), NEDE-24011-P-A or (2) NEDO-32465, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications."	Delete the requirement. and replace with 5 The Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operating region. NEDO-32465 is no longer applicable The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC in General Electric Standard Application for Reactor Fuel (GESTAR), NEDE-24011-P-A.

Note: The above changes relating to TS 3 3.1.3, "Oscillation Range Power Monitor (OPRM) Instrumentation" are those related to the change from the Option III solution to the Confirmation Density solution. There are other TS changes that are required for the OPRM implementation.

12.0 REFERENCES

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4. GE Nuclear Energy, "Licensing Topical Report, Constant Pressure Power Uprate," NEDC-33004P, Revision 3, February 2003.

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

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

7. CENPD-400-P-A, Rev. 01, "Generic Topical Report for the ABB Option III Oscillation Power Range Monitor (OPRM)," May 1995.

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9. GE Nuclear Energy, "Safety Analysis Report For Clinton Power Station Extended Power Uprate," NEDC-32989P, June 2001.

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

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

13. 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.).

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17. U.S. Nuclear Regulatory Commission, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis", Regulatory Guide 1.174, Revision 1, November 2002.

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