ATTACHMENT 8
GEH Nuclear Energy Safety Analysis Report for LaSalle County Station, Units 1 and 2 Thermal Power Optimization, NEDO-33485 (Non-Proprietary Version)

GE Hitachi Nuclear Energy

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Non-Proprietary Information

SAFETY ANALYSIS REPORT
FOR
LASALLE COUNTY STATION UNITS 1 AND 2
THERMAL POWER OPTIMIZATION

INFORMATION NOTICE

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The design, engineering, and other information contained in this document is furnished for the purposes of supporting: a License Amendment Request by Exelon Generating Company, LLC (Exelon), for a thermal power uprate at LaSalle County Station Units 1 and 2 to 3546 MWt in proceedings before the U.S. Nuclear Regulatory Commission. The only undertakings of GE Hitachi Nuclear Energy (GEH) with respect to information in this document are contained in the contract between GEH and Exelon, Contract Agreement No. 00443308, Release No. 00001, effective February 13, 2009, and nothing contained in this document will be construed as changing that contract. The use of this information by anyone for any purpose other than that for which it is intended is not authorized; and with respect to any unauthorized use, GEH makes no representation or warranty, and assumes no liability as to the completeness, accuracy, or usefulness of the information contained in this document.

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ACRONYMS AND ABBREVIATIONS

Term	Definition
AC	Alternating Current
ADS	Automatic Depressurization System
AHC	Access Hole Cover
AL	Analytical Limit
ALARA	As Low As Reasonably Achievable
AOO	Anticipated Operational Occurrence
AP	Annulus Pressurization
APRM	Average Power Range Monitor
ARI	Alternate Rod Insertion
ART	Adjusted Reference Temperature
ARTS	Average Power Range Monitor, Rod Block Monitor, Technical Specifications Improvement Program
ASME	American Society of Mechanical Engineers
ATWS	Anticipated Transient Without Scram
AV	Allowable Value
B&PV	Boiler and Pressure Vessel
BHP	Brake Horsepower
BIIT	Boron Injection Initiation Temperature
BOC	Beginning Of Cycle
BOP	Balance of Plant
BWR	Boiling Water Reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Project
CF	Chemistry Factor
CF/D	Condensate Filter/Demineralizer
CFR	Code of Federal Regulations
CGCS	Combustible Gas Control System
CLTP	Current Licensed Thermal Power
CPR	Critical Power Ratio
CRD	Control Rod Drive
CRDH	Control Rod Drive Housing
CRGT	Control Rod Guide Tube
CMTR	Certified Material Test Report
CSC	Containment Spray Cooling
CSCS/ECW	Core Standby Cooling System/Equipment Cooling Water
CSL&S	Core Spray Lines and Spargers
CSS	Core Support Structure

Term	Definition
CUF	Cumulative Usage Factor
DBA	Design Basis Accident
DC	Direct Current
DP	Differential Pressure
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generators
EFPY	Effective Full Power Years
EHC	Electro-hydraulic Control
ELTR1	NEDC-32424P-A, Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate
ELTR2	NEDC-32523P-A, Generic Evaluations of General Electric Boiling Water Reactor Extended Power Uprate
EOC	End of Cycle
EOOS	Equipment Out-of-Service
EOP	Emergency Operating Procedure
EPGs	Emergency Procedure Guidelines
EPU	Extended Power Uprate
EQ	Environmental Qualification
FAC	Flow Accelerated Corrosion
FFWTR	Final Feedwater Temperature Reduction
FIV	Flow-Induced Vibration
FPCC	Fuel Pool Cooling and Cleanup System
FW	Feedwater
FWCF	Feedwater Controller Failure
FWHOOS	Feedwater Heater(s) Out-of-Service
GDC	General Design Criteria
GE	General Electric Company
GEES	General Electric Energy Services
GEH	GE-Hitachi Nuclear Energy
GL	Generic Letter
HELB	High Energy Line Break
HEPA	High Efficiency Particulate Air
HP	High Pressure
HPCI	High Pressure Coolant Injection
HPCS	High Pressure Core Spray
HSR	Hydraulic Steam Return
HVAC	Heating, Ventilation and Air Conditioning
IASCC	Irradiation Assisted Stress Corrosion Cracking
ICF	Increased Core Flow

Term	Definition
ICHGT	In Core Housing and Guide Tube
ICLTM	Isolation Condenser Leakage Treatment Method
IORV	Inadvertent Opening of a Relief Valve
IPE	Individual Plant Examination
IRM	Intermediate Range Monitor
ISP	Integrated Surveillance Program
JR	Jet Reaction
ksi	Kips Per Square Inch
kV	Kilovolt
kW	Kilowatt
LaSalle	LaSalle County Station Units 1 and 2
LCO	Limiting Conditions For Operation
LCL	Liquid Control Line
LFWH	Loss of Feedwater Heater
LHGR	Linear Heat Generation Rate
LOCA	Loss-Of-Coolant-Accident
LOOP	Loss-of-Offsite Power
LP	Low Pressure
LPCI	Low Pressure Core Injection
LPCS	Low Pressure Core Spray
LPRM	Local Power Range Monitor
LPSP	Low Power Setpoint
LRNB	Generator Load Rejection No Bypass
LTA	Lead Test Assemblies
MAPLHGR	Maximum Average Planar Linear Heat Generation Rate
MCC	Motor Control Circuit/Center
MCPR	Minimum Critical Power Ratio
MELB	Moderate Energy Line Break
MELLLA	Maximum Extended Load Line Limit Analysis
MeV	Million Electron Volts
Mlb	Millions of Pounds
MOV	Motor Operated Valve
MPT	Main Power Transformer
MS	Main Steam
MSIV	Main Steam Isolation Valve
MSIVC	Main Steam Isolation Valve Closure
MSIV-LCS	Main Steam Isolation Valve-Leakage Control System
MSL	Main Steam Line

Term	Definition
MSLB	Main Steam Line Break
MVA	Million Volt Amps
MVAR	Million Volt Amps Reactive
MWe	Megawatt-Electric
MWt	Megawatt-Thermal
NPDES	National Pollutant Discharge Elimination System
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NTSP	Nominal Trip Setpoint
NUMARC	Nuclear Utilities Management and Resources Council
NUREG	Nuclear Regulations (NRC Document)
OFS	Orificed Fuel Support
OLMCPR	Operating Limit Minimum Critical Power Ratio
OLTP	Original Licensed Thermal Power
OOS	Out-of-Service
OPRM	Oscillation Power Range Monitor
P/F	Power/Flow
P-T	Pressure-Temperature
PCS	Pressure Control System
PCT	Peak Clad Temperature
PF	Power Factor
PLU	Pressure Load Unbalance
PR	Pressure Regulator
PRA	Probabilistic Risk Assessment
PRFO	Pressure Regulator Failure Open – Maximum Steam Demand
psi	Pounds Per Square Inch
psia	Pounds Per Square Inch - Absolute
psid	Pounds Per Square Inch - Differential
psig	Pounds Per Square Inch - Gauge
RBCCW	Reactor Building Closed Cooling Water
RBM	Rod Block Monitor
RCIC	Reactor Core Isolation Cooling
RCPB	Reactor Coolant Pressure Boundary
RFP	Reactor Feed Pump
RG	Regulatory Guide
RHR	Residual Heat Removal
RIPD	Reactor Internal Pressure Difference

Term	Definition
RIS	Regulatory Issue Summary
RPT	Recirculation Pump Trip
RPV	Reactor Pressure Vessel
RTNDT	Reference Temperature Of Nil-Ductility Transition
RTP	Rated Thermal Power
RWCU	Reactor Water Cleanup
RWE	Rod Withdrawal Error
RWM	Rod Worth Minimizer
SAG	Severe Accident Guideline
SBLC	Standby Liquid Control System
SBO	Station Blackout
SDC	Shutdown Cooling
SER	Safety Evaluation Report
SFP	Spent Fuel Pool
SGTS	Standby Gas Treatment System
SJAE	Steam Jet Air Ejector
SL	Safety Limit
SLMCPR	Safety Limit Minimum Critical Power Ratio
SLO	Single (reactor recirculation) Loop Operation
SPC	Suppression Pool Cooling
SR	Surveillance Requirement
SRM	Source Range Monitor
SRP	Standard Review Plan
SRV	Safety Relief Valve
SRVDL	Safety Relief Valve Discharge Line
TBCCW	Turbine Building Closed Cooling Water System
TBCS	Turbine Bypass Control System
TBV	Turbine Bypass Valve
TCV	Turbine Control Valve
T/G	Turbine-Generator
TIP	Traversing In-Core Probe
TLO	Two (Recirculation) Loop Operation
TLTR	NEDC-32938P-A, Thermal Power Optimization Licensing Topical Report
TPO	Thermal Power Optimization
TPU	Target Power Uprate
TS	Technical Specification
TSAR	Thermal Power Optimization Safety Analysis Report
TSV	Turbine Stop Valve

Term	Definition
TTNB	Turbine Trip No Bypass
UFSAR	Updated Final Safety Analysis Report
UHS	Ultimate Heat Sink
USE	Upper Shelf Energy
VHCSN	Vessel Head Cooling Spray Nozzle
VWO	Valves Wide Open

EXECUTIVE SUMMARY

This report summarizes the results of all significant safety evaluations performed that justify increasing the licensed thermal power at LaSalle County Station Units 1 and 2 (LaSalle) to 3546 MWt. The requested license power level is 1.65% above the current licensed thermal power (CLTP) level of 3489 MWt.

This report follows the Nuclear Regulatory Commission (NRC) approved format and content for Boiling Water Reactor (BWR) Thermal Power Optimization (TPO) licensing reports documented in NEDC-32938P-A, "Generic Guidelines and Evaluations for General Electric Boiling Water Reactor Thermal Power Optimization," called "TLTR." Per the outline of the TPO Safety Analysis Report (TSAR) in the TLTR Appendix A, every safety issue that should be addressed in a plant-specific TPO licensing report is addressed in this report. For issues that have been evaluated generically, this report references the appropriate evaluation and establishes that the evaluation is applicable to the plant.

Only previously NRC approved or industry-accepted methods were used for the analysis of accidents, transients, and special events. Therefore, because the safety analysis methods have been previously addressed, they are not addressed in this report. Also, event and analysis descriptions that are provided in other licensing documents or the Updated Final Safety Analysis Report (UFSAR) are not repeated. This report summarizes the results of the safety evaluations needed to justify a license amendment to allow for TPO operation.

The TLTR addresses power increases of up to 1.5% of CLTP, which will produce up to an approximately 2% increase in steam flow to the turbine-generator. The amount of power uprate (≤ 1.5%) contained in the TLTR was based on the expected reduction in power level uncertainty with the instrumentation technology available in 1999. The present instrumentation technology has evolved to where a power level uncertainty is reduced to as low as 0.3%, thereby supporting the evaluation of a power level increase up to 1.7%. The requested power uprate for LaSalle is 1.65%. Even though LaSalle is requesting a 1.65% uprate, unless otherwise specified in this report, evaluations for LaSalle were performed for a 1.7% uprate (i.e., 3548 MWt), which bounds the requested 1.65% uprate (i.e., 3546 MWt). A higher steam flow is achieved by increasing the reactor power along the current rod and core flow control lines. A limited number of operating parameters are changed, some setpoints are adjusted and instruments are recalibrated. Plant procedures are revised, and tests similar to some of the original startup tests are performed.

Evaluations of the reactor, engineered safety features, power conversion, emergency power, support systems, environmental issues, design basis accidents, and previous licensing evaluations were performed. This report demonstrates that LaSalle can safely operate at a power level of 3546 MWt.

The following evaluations were conducted in accordance with the criteria of TLTR Appendix B:

All safety aspects of the plant that are affected by a 1.65% increase in the thermal power level were evaluated, including the Nuclear Steam Supply System (NSSS) and Balance-of-Plant (BOP) systems.

Evaluations and reviews were based on licensing criteria, codes, and standards applicable to the plant at the time of the TSAR submittal. Plant specific analyses were performed in support of the LaSalle TPO and are detailed in this report.

Evaluations and/or analyses were performed using NRC-approved or industry-accepted analysis methods for the UFSAR accidents, transients, and special events affected by TPO.

Evaluations and reviews of the NSSS systems and components, containment structures, and BOP systems and components show continued compliance to the codes and standards applicable to the current plant licensing basis (i.e., no change to comply with more recent codes and standards is proposed due to TPO).

NSSS components and systems were reviewed to confirm that they continue to comply with the functional and regulatory requirements specified in the UFSAR and/or applicable reload license.

Any modification to safety-related or non-safety-related equipment will be implemented in accordance with 10 CFR 50.59.

All plant systems and components affected by an increased thermal power level were reviewed to ensure that there is no significant increase in challenges to the safety systems.

A review was performed to assure that the increased thermal power level continues to comply with the existing plant environmental regulations.

An assessment, as defined in 10 CFR 50.92(C), was performed to establish that no significant hazards consideration exists as a result of operation at the increased power level.

A review of the latest UFSAR and of design changes / 10 CFR 50.59 evaluations implemented, but not yet shown in the UFSAR, ensures adequate evaluation of the licensing basis for the effect of TPO through the date of that evaluation. Additionally, 10 CFR 50.59 evaluations for changes not yet implemented were reviewed for the effects of increased power.

The plant licensing requirements have been reviewed, and it is concluded that this TPO can be accommodated (1) without a significant increase in the probability or consequences of an accident previously evaluated, (2) without creating the possibility of a new or different kind of accident from any accident previously evaluated, and (3) without exceeding any existing regulatory limits applicable to the plant, which might cause a significant reduction in a margin of safety. Therefore, the requested TPO uprate does not involve a significant hazards consideration, as defined in 10 CFR 50.92 (C).

1 INTRODUCTION

1.1 OVERVIEW

This document addresses a Thermal Power Optimization (TPO) power uprate of 1.65% of the current licensed thermal power (CLTP), consistent with the magnitude of the thermal power uncertainty reduction for the LaSalle Units 1 and 2 (LaSalle) plant. This will result in an increase in licensed thermal power from 3489 MWt to 3546 MWt and an increase in electrical power from 1190 MWe to 1223 MWe.

This report follows the Nuclear Regulatory Commission (NRC)-approved format and content for Boiling Water Reactor (BWR) Thermal Power Optimization (TPO) licensing reports documented in NEDC-32938P-A, "Generic Guidelines and Evaluations for General Electric Boiling Water Reactor Thermal Power Optimization," (TLTR) (Reference 1). Power uprates in General Electric (GE) BWRs of up to 120% of original licensed thermal power (OLTP) are based on the generic guidelines and approach defined in the Safety Evaluation Reports provided in NEDC-32424P-A, "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate," (ELTR1) (Reference 2) and NEDC-32523P-A, "Generic Evaluations of General Electric Boiling Water Reactor Extended Power Uprate," (ELTR2) (Reference 3). Since their NRC approval, numerous extended power uprate (EPU) submittals have been based on these reports. The outline for the TPO Safety Analysis Report (TSAR) in TLTR Appendix A follows the same pattern as that used for the EPUs. All of the issues that should be addressed in a plant-specific TPO licensing report are included in this TSAR. For issues that have been evaluated generically, this report references the appropriate evaluation and establishes that it is applicable to LaSalle.

BWR plants, as currently licensed, have safety systems and component capability for operation at least 1.5% above the CLTP level. The amount of power uprate (≤ 1.5%) contained in the TLTR was based on the expected reduction in power level uncertainty with the instrumentation technology available in 1999. The present instrumentation technology has evolved to where a power level uncertainty is reduced to as low as 0.3%, thereby supporting the evaluation of a power level increase of up to 1.7%. Several Pressurized Water Reactor and BWR plants have already been authorized to increase their thermal power above the OLTP based on a reduction in the uncertainty in the determination of the power through improved feedwater (FW) flow rate measurements. When a previous uprate (other than a TPO) has been accomplished, the ≥ 102% safety analysis basis is reestablished above the uprated power level. Therefore, all GEH BWR plant designs have the capability to implement a TPO uprate, whether or not the plant has previously been uprated.

1.2 PURPOSE AND APPROACH

1.2.1 TPO Analysis Basis

LaSalle was originally licensed at 3323 MWt. In amendments 140 and 135 for Units 1 and 2, the NRC approved a five percent power uprate to 3489 MWt, which is the CLTP. The current safety analysis basis assumes, where required, that the reactor had been operating continuously at a power level at least 1.02 times the licensed power level. The analyses performed at 102% of CLTP remain applicable at the TPO rated thermal power (RTP), because the 2% factor from Regulatory Guide (RG) 1.49, "Power Levels of Nuclear Power Plants," is effectively reduced by the improvement in the FW flow measurements. Some analyses may be performed at TPO RTP, because the uncertainty factor is accounted for in the methods, or the additional 2% margin is not required (e.g., Anticipated Transient Without Scram (ATWS)). Detailed descriptions of the basis for the TPO analyses are provided in the subsequent sections of this report.

The TPO uprate is based on the evaluation of the improved FW flow rate measurement provided in Section 1.4. Figure 1-1 illustrates the TPO power/flow (P/F) operating map for the analysis at 101.65% of CLTP for LaSalle. The changes to the P/F operating map are consistent with the generic descriptions given in TLTR Section 5.2. The approach to achieve a higher thermal power level is to increase core flow along the established Maximum Extended Load Line Limit Analysis (MELLLA) rod lines. This strategy allows LaSalle to maintain most of the existing available core flow operational flexibility while assuring that low power related issues (e.g., stability and ATWS instability) do not change because of the TPO uprate.

No increase in the previously licensed maximum core flow limit is associated with the TPO uprate. When end of full power reactivity condition (all rods out) is reached, end-of-cycle coast down may be used to extend the power generation period. Previously licensed performance improvement features are presented in Section 1.3.2.

With respect to absolute thermal power and flow, there is no change in the extent of the Single-Loop Operating (SLO) domain as a result of the TPO uprate. Therefore, the SLO domain is not provided. For LaSalle the maximum reactor core thermal power for SLO operation remains at 2640 MWt.

The TPO uprate is accomplished with no increase in the nominal vessel dome pressure. This minimizes the effect of uprating on reactor thermal duty, evaluations of environmental conditions, and minimizes changes to instrument setpoints related to system pressure, etc. Satisfactory reactor pressure control capability is maintained by evaluating the steam flow margin available at the turbine inlet. This operational aspect of the TPO uprate will be demonstrated by performing controller testing as described in Section 10.4. The TPO uprate does not affect the pressure control function of the turbine bypass valves.

1.2.2 Margins

The TPO analysis basis ensures that the power-dependent instrument error margin identified in RG 1.49 is maintained. NRC-approved or industry-accepted computer codes and calculation techniques are used in the safety analyses for the TPO uprate. A list of the NSSS computer codes used in the evaluations is provided in Table 1-1. Computer codes used in previous analyses (i.e., analyses at 102% of CLTP) are not listed. Similarly, factors and margins specified by the application of design code rules are maintained, as are other margin-assuring acceptance criteria used to judge the acceptability of the plant.

1.2.3 Scope of Evaluations

The scope of evaluations is discussed in TLTR Appendix B. Tables B-1 through B-3 illustrate those analyses that are bounded by current analyses, those that are not significantly affected, and those that require updating. The disposition of the evaluations as defined by Tables B-1 through B-3 is applicable to LaSalle. This TSAR includes all of the evaluations for the plant-specific application. Many of the evaluations are supported by generic reference, some supported by rational considerations of the process differences, and some plant-specific analyses are provided.

The scopes of the evaluations are summarized in the following sections:

2 Reactor Core and Fuel Performance

Overall heat balance and power-flow operating map information is provided. Key core performance parameters are confirmed for each fuel cycle, and will continue to be evaluated and documented for each fuel cycle.

3 Reactor Coolant and Connected Systems

Evaluations of the NSSS components and systems are performed at the TPO conditions. These evaluations confirm the acceptability of the TPO changes in process variables in the NSSS.

4 Engineered Safety Features

The effects of TPO changes on the containment, Emergency Core Cooling Systems (ECCS), Standby Gas Treatment, and other Engineered Safety Features are evaluated for key events. The evaluations include the containment responses during limiting abnormal events, Loss-of-Coolant Accident (LOCA), and safety relief valve containment dynamic loads.

5 Instrumentation and Control

The instrumentation and control signal ranges and analytical limits for setpoints are evaluated to establish the effects of TPO changes in process parameters. If required, analyses are performed to determine the need for setpoint changes for various functions. In general, setpoints are changed only to maintain adequate operating margins between plant operating parameters and trip values.

6 Electrical Power and Auxiliary Systems

Evaluations are performed to establish the operational capability of the plant electrical power and distribution systems and auxiliary systems to ensure that they are capable of supporting safe plant operation at the TPO RTP level.

7 Power Conversion Systems

Evaluations are performed to establish the operational capability of various (non-safety) balance-of-plant (BOP) systems and components to ensure that they are capable of delivering the increased TPO power output.

8 Radwaste and Radiation Sources

The liquid and gaseous waste management systems are evaluated at TPO conditions to show that applicable release limits continue to be met during operation at the TPO RTP level. The radiological consequences are evaluated to show that applicable regulations are met for TPO including the effect on source terms, on-site doses, and off-site doses during normal operation.

9 Reactor Safety Performance Evaluations

[[

]] The standard reload analyses consider the plant conditions for the cycle of interest.

10 Other Evaluations

High energy line break and environmental qualification evaluations are performed at bounding conditions for the TPO range to show the continued operability of plant equipment under TPO conditions. The Individual Plant Examination (IPE) Probabilistic Risk Assessment (PRA) will not be updated, because the change in plant risk from the subject power uprate is insignificant. This conclusion is supported by NRC Regulatory Issue Summary (RIS) 2002-03 (Reference 4). In response to feedback received during the public workshop held on August 23, 2001, the Staff wrote, "The NRC has generically determined that measurement uncertainty recapture power uprates have an insignificant effect on plant risk. Therefore, no risk information is requested to support such applications."

1.2.4 Exceptions to the TLTR

One exception to the TLTR, regarding the Turbine Stop Valve (TSV) closure scram, Turbine Control Valve (TCV) fast closure scram, and End-of-Cycle (EOC)-Recirculation Pump Trip (RPT) bypasses is discussed in Section 5.3.16.

1.2.5 Concurrent Changes Unrelated to TPO

No concurrent changes unrelated to TPO are included in this evaluation.

1.3 TPO PLANT OPERATING CONDITIONS

1.3.1 Reactor Heat Balance

The following typical heat balance diagram at the TPO conditions is presented:

Figure 1-2 Reactor Heat Balance – 3546 MWt (101.65% of CLTP), 100% Core Flow.

The small changes in thermal-hydraulic parameters for the TPO are illustrated in Table 1-2. These parameters are generated for TPO by performing coordinated reactor and turbine-generator heat balances that relate the reactor thermal-hydraulic parameters to the increased plant FW and steam flow conditions. Input from LaSalle operation is considered (e.g., steam line pressure drop) to match expected TPO uprate conditions.

1.3.2 Reactor Performance Improvement Features

The following performance improvement and equipment out-of-service (OOS) features currently licensed at LaSalle are acceptable at the TPO RTP level:

Performance Improvement Feature
Single Loop Operation (SLO)
Increased Core Flow (ICF) (105.0% of rated)
Average Power Range Monitor, Rod Block Monitor, Technical Specifications Improvement Program (ARTS) / MELLLA (82.8% of Rated Core Flow at TPO RTP)
Final Feedwater Temperature Reduction (FFWTR), -100ºF
Feedwater Heater(s) OOS, -100ºF
Safety Relief Valve (SRV)/Automatic Depressurization System (ADS) OOS, one valve
TCV Slow Closure
RPT OOS
Turbine Bypass Valve (TBV) OOS
24 Month Cycle
Main Steam Isolation Valve (MSIV) OOS
TCV Stuck Closed

Performance Improvement Feature
TSV Stuck Closed
Power Load Unbalance (PLU) OOS
Pressure Regulator (PR) OOS

1.4 BASIS FOR TPO UPRATE

The safety analyses in this report are based on a total thermal power measurement uncertainty of 0.3%. This will bound the actual power level requested. The detailed basis value is provided in separate documentation, which addresses the improved FW flow measurement accuracy using the Caldon Leading Edge Flow Meter Check-Plus system.

1.5 SUMMARY AND CONCLUSIONS

This evaluation has investigated a TPO uprate to 101.65% of CLTP. The strategy for achieving higher power is increase core flow along the established MELLLA rod lines. The plant licensing challenges have been reviewed (Table 1-3) to demonstrate how the TPO uprate 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. The TPO uprate described herein involves no significant hazards consideration.

Table 1-1
Computer Codes For TPO Analyses*

Task	Computer Code	Version or Revision	NRC Approved	Comments
Anticipated Transient Without Scram	ODYN STEMP PANACEA ISCOR	09 04 11 09	Y (3) Y (2) Y (1)	NEDE-24154P-A Supp. 1, Vol. 4 NEDE-30130-P-A NEDE-24011-P Rev. 0 Safety Evaluation Report (SER)
Reactor heat balance	ISCOR HTBAL	09	Y (1) (4)	NEDE-24011-P Rev. 0 SER
Reactor core and fuel performance	CASMO-4 MICROBURN-B2		Y Y	EMF-2158(P)(A) Rev. 0 (Reference 5) EMF-2158(P)(A) Rev. 0 (Reference 5)
Safety limit Minimum Critical Power Ratio (MCPR)	SAFLIM2		Y	ANF-524(P)(A) Rev. 2 (Reference 6)
Transient analysis	MICROBURN-B2 XCOBRA COTRANSA2 XCOBRA-T RODEX2		Y Y (5) Y (6) Y (6) Y	EMF-2158(P)(A) Rev. 0 (Reference 5) XN-NF-80-19(P)(A) Vol. 3 Rev. 2 (Reference 7) ANF-913(P)(A) Vol. 1 Rev. 1 (Reference 8) XN-NF-84-105(P)(A) Vol. 1 (Reference 9) XN-NF-81-58(P)(A) Rev. 2 (Reference 10)
Overpressurization Analyses	COTRANSA2		Y (6)	ANF-913(P)(A) Vol. 1 Rev. 1 (Reference 8)
LOCA-ECCS	HUXY RODEX2		Y Y	XN-CC-33(P)(A) Rev. 1 (Reference 11) XN-NF-81-58(P)(A) Rev. 2 (Reference 10)
Reactor core stability Option III Backup Stability	MICROBURN-B2 RAMONA5-FA STAIF		Y Y Y	EMF-2158(P)(A) Rev.0 (Reference 5) BAW-10255PA Rev 2 (Reference 12) EMF-CC-074(P)(A) Rev. 0 (Reference 13)
Fuel Channel Structural Evaluation	ANSYS		Y (7)	EMF-93-177(P)(A) Rev. 1 (Reference 14)

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

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

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

(3) 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.

(4) HTBAL is not explicitly approved by the NRC but it is a stand-alone version of the heat balance routine included in the NRC-approved MICROBURN-B2 code documented in Reference 5.

(5) The approval of XCOBRA is included in the approval of the THERMEX methodology in Reference 7.

(6) The list of events for which COTRANSA2 and XCOBRA-T can be used was expanded in the clarification acceptance in References 8 and 9.

(7) The fuel channel methodology document approves the use of ANSYS for fuel channel calculations.

Table 1-2
Thermal-Hydraulic Parameters at TPO Uprate Conditions

Parameter	CLTP	TPO RTP (101.65% of CLTP)
Thermal Power (MWt) (Percent of Current Licensed Power)	3489 100.0	3546 101.65
Steam Flow (Mlb/hr) (Percent of Current Rated)	15.145 100.0	15.435 101.9
FW Flow (Mlb/hr) (Percent of Current Rated)	15.113 100.0	15.403 101.9
Dome Pressure (psia)	1020	1020
Dome Temperature (°F)	547.0	547.0
FW Temperature (°F)	426.5	428.5
Full Power Core Flow Range (Mlb/hr) (Percent of Current Rated)	87.9 to 113.9 81.0 to 105.0	89.8 to 113.9 82.8 to 105.0

Table 1-3
Summary of Effect of TPO Uprate on Licensing Criteria

Key Licensing Criteria	Effect of 1.7% Thermal Power Increase	Explanation of Effect
LOCA challenges to fuel (10 CFR 50, Appendix K)	No increase in peak clad temperature (PCT), no change of maximum Linear Heat Generation Rate (LHGR) required.	Previous analysis accounted for ≥ 102% of licensed power, bounding TPO operation. No vessel pressure increase.
Change of Operating Limit MCPR	< 0.01 increase.	Minor increase (< 0.01) due to slightly higher power density and increased MCPR safety limit (slightly flatter radial power distribution).
Challenges to reactor pressure vessel (RPV) overpressure	No increase in peak pressure.	No increase because previous analysis accounted for ≥ 102% overpower, bounding TPO operation.
Primary containment pressure during a LOCA	No increase in peak containment pressure.	Previous analysis accounted for ≥ 102% overpower, bounding TPO operation. No vessel pressure increase. No increase in energy to the pool.
Pool temperature during a LOCA	No increase in peak pool temperature.	Previous analysis accounted for ≥ 102% overpower, bounding TPO operation. No vessel pressure increase. No increase in energy to the pool.
Offsite Radiation Release, design basis accidents	No increase (remains within 10 CFR 100).	Previous analysis bounds TPO operation. No vessel pressure increase.
Onsite Radiation Dose, normal operation	Approximately 1.7% increase, must remain within 10 CFR 20.	Slightly higher inventory of radionuclides in steam/FW flow paths.
Heat discharge to environment	< 1°F temperature increase.	Small % power increase.
Equipment Qualification	Remains within current pressure, radiation, and temperature envelopes.	No change in Harsh Environment terms (TPO operating conditions bounded by previous analyses); minimal change in normal operating conditions.
Fracture Toughness, 10 CFR 50, Appendix G	< 2°F increase in Reference Temperature of the Nil-Ductility Transition (RTNDT).	Small increase in neutron fluence.
Stability	No direct effect of TPO uprate because applicable stability regions and lines are extended beyond the absolute values associated with the current boundaries to preserve MWt-core flow boundaries as applicable for each stability option.	No increase in maximum rod line boundary. Characteristics of each reload core continue to be evaluated as required for each stability option.
ATWS peak vessel pressure	Slight increase (17 psig), must stay within existing American Society of Mechanical Engineers (ASME) Code "Emergency" category stress limit.	Slightly increased power relative to SRV capacity.
Vessel and NSSS equipment design pressure	No change.	Comply with existing ASME Code stress limits of all categories.

Figure 1-1
Power/Flow Map for TPO (101.65% of CLTP)

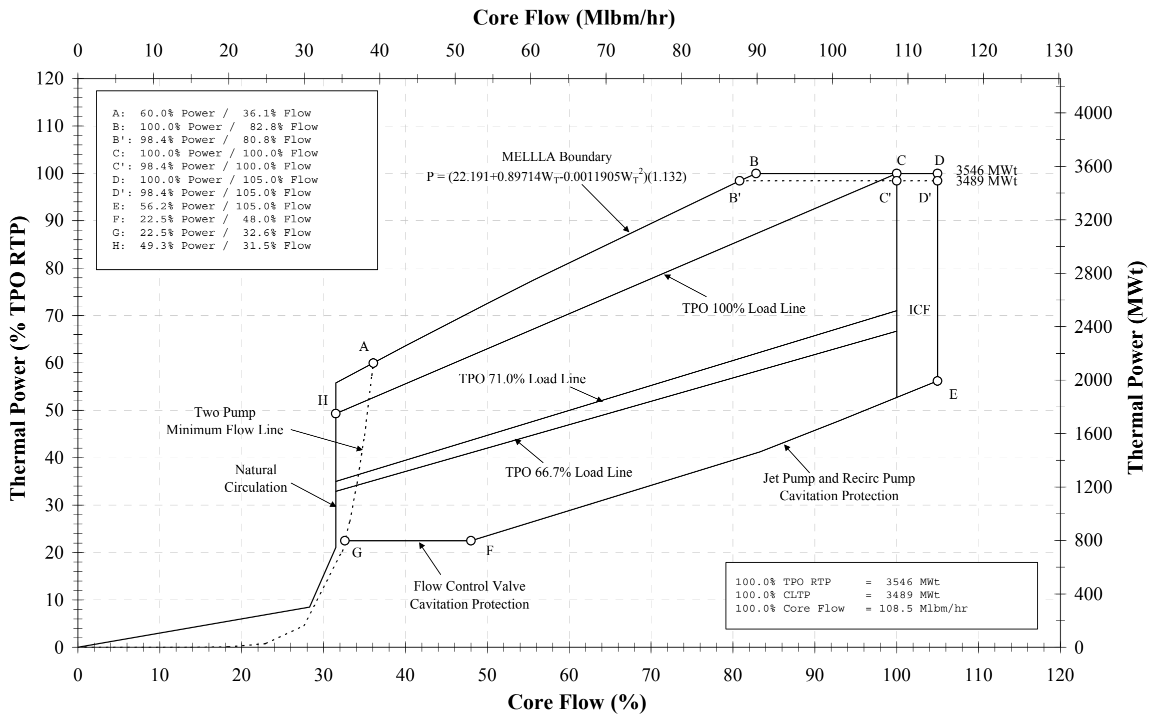
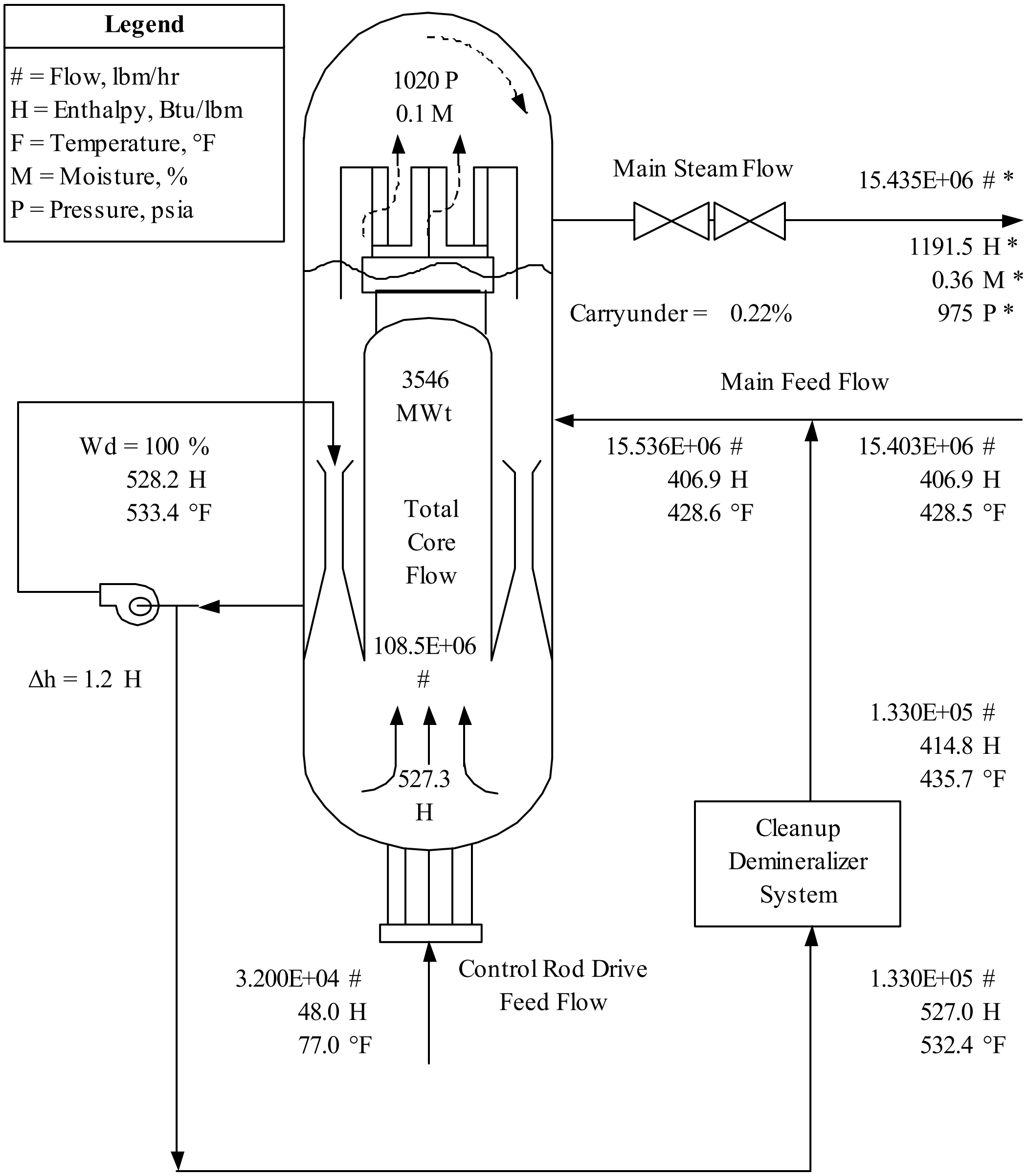


Figure 1-2
Reactor Heat Balance – TPO Power (101.65% of CLTP, 100% Core Flow)



*Conditions at upstream side of TSV

Core Thermal Power	3546.0
Pump Heating	12.4
Cleanup Losses	-4.4
Other System Losses	-1.1
Turbine Cycle Use	3552.9 MWt

2 REACTOR CORE AND FUEL PERFORMANCE

2.1 FUEL DESIGN AND OPERATION

At the TPO RTP conditions, all fuel and core design limits are met by the deployment of fuel enrichment and burnable poison, control rod pattern management, and core flow adjustments. New fuel designs are not needed for the TPO to ensure safety. However, revised loading patterns, slightly larger batch sizes, and potentially new fuel designs may be used to provide additional operating flexibility and maintain fuel cycle length. NRC-approved limits for burnup on the fuel are not exceeded. Therefore, the reactor core and fuel design is adequate for TPO operation.

The initial TPO cycles at LaSalle Unit 1 and Unit 2 will be loaded with fresh and previously irradiated ATRIUM-10 fuel assemblies. LaSalle Unit 2 will also have eight previously irradiated ATRIUM-10XM lead test assemblies (LTAs). The mechanical design criteria for AREVA fuel is presented in Reference 15. The transients and accidents are discussed in Sections 4.0 and 9.0 of this report.

2.2 THERMAL LIMITS ASSESSMENT

Operating thermal limits ensure that regulatory and/or safety limits are not exceeded for a range of postulated events (e.g., transients, Loss of Coolant Accident (LOCA)). This section addresses the effects of TPO on thermal limits. Cycle-specific core configurations, which are evaluated for each reload, are used to confirm TPO RTP capability and establish or confirm cycle-specific limits.

The historical 25% of RTP value for the Technical Specification Safety Limit, some thermal limits monitoring Limiting Conditions for Operation (LCOs) thresholds, and some Surveillance Requirements (SRs) thresholds has a conservative basis, as described in the plant Technical Specifications. This value is maintained for TPO.

2.2.1 Safety Limit MCPR

The Safety Limit Minimum Critical Power Ratio (SLMCPR) is dependent upon the nominal average power level and the uncertainty in its measurement. The slightly higher power associated with TPO results in a slightly flatter radial power distribution. The SLMCPR analysis reflects the actual core loading and is performed for each reload core.

2.2.2 MCPR Operating Limit

The Operating Limit Minimum Critical Power Ratios (OLMCPRs) are determined each cycle based on the results of the cycle-specific transient analyses for the actual core loading. The OLMCPRs are established to protect the sum of the change in MCPR (ΔCPR) for the limiting anticipated operational occurrence (AOO) event and the SLMCPR. Separate OLMCPRs may be established to support operation with the equipment OOS conditions. To support operation at off-rated conditions, power- and flow-dependent OLMCPRs ensure the acceptance criteria are met during AOOs. The power- and flow-dependent OLMCPRs are established or confirmed each cycle. Exposure dependent OLMCPRs may be established to provide operational flexibility.

2.2.3 MAPLHGR and Maximum LHGR Operating Limits

Loss of Coolant Accident – Emergency Core Cooling System (LOCA-ECCS) analyses are performed to demonstrate that the Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) limits provide the necessary protection. Analyses are performed each cycle to ensure that the established MAPLHGR limits are applicable to the reload fuel. The results in Section 4.3 show that the MAPLHGR limits for the ATRIUM-10 fuel and ATRIUM-10XM LTAs meet the regulatory requirements. The analyses that support CLTP remain applicable for operation with the TPO uprate.

The Linear Heat Generation Rate (LHGR) limits are fuel type dependent and apply regardless of power level and thus are not affected by the TPO uprate. To support operation at off-rated conditions, power-dependent and flow-dependent multipliers are applied to the LHGR limits to ensure that the fuel meets the thermal-mechanical limits during AOOs. While the LHGR limits for ATRIUM-10 fuel and ATRIUM-10XM LTAs are not cycle-specific, the power- and flow-dependent LHGR multipliers are established or confirmed each cycle. Exposure dependent LHGR multipliers may be established to provide operational flexibility.

2.3 REACTIVITY CHARACTERISTICS

All minimum shutdown margin requirements apply to cold shutdown (< 200°F) conditions and are maintained without change. Checks of cold shutdown margin based on Standby Liquid Control System (SBLC) boron injection capability and shutdown using control rods with the most reactive control rod stuck out are made for each reload. The TPO uprate has no significant effect on these conditions; the shutdown margin is confirmed for each reload core design.

Operation at the TPO RTP could result in a minor decrease in the hot excess reactivity during the cycle. This loss of reactivity does not affect safety and does not affect the ability to manage the power distribution through the cycle to achieve the target power level. However, the lower hot excess reactivity can result in achieving an earlier all-rods-out condition. Through fuel cycle redesign, sufficient excess reactivity can be obtained to match the desired cycle length.

2.4 THERMAL HYDRAULIC STABILITY

LaSalle is operating under the requirements of reactor stability Long-Term Solution Option III. The Option III solution monitors Oscillation Power Range Monitor (OPRM) signals to determine when a reactor scram is required. The OPRM signal is evaluated by the Option III stability algorithms to determine when the signal is becoming sufficiently periodic and large to warrant a reactor scram to disrupt the oscillation (Reference 16). The OPRM system may only cause a scram when plant operation is in the Option III Armed Region. For TPO operation, the Armed Region is modified to maintain the CLTP absolute power of 998 MWt (28.1% of the planned TPO uprated power of 3546 MWt) and flow (60% of rated recirculation drive flow). The stability based OLMCPR associated with the OPRM setpoint assures that the Critical Power Ratio (CPR) safety limit is not violated following an instability event. This is to be validated for every reload cycle.

2.5 REACTIVITY CONTROL

The generic discussion in TLTR Sections 5.6.3 and Appendix J.2.3.3 applies to the LaSalle plant. The Control Rod Drive (CRD) and CRD hydraulic systems and supporting equipment are not affected by the TPO uprate and no further evaluation of CRD performance is necessary.

3 REACTOR COOLANT AND CONNECTED SYSTEMS

3.1 NUCLEAR SYSTEM PRESSURE RELIEF / OVERPRESSURE PROTECTION

The pressure relief system prevents over-pressurization of the nuclear system during abnormal operational transients. The safety relief valves (SRVs) along with other functions provide this protection. Evaluations and analyses for the CLTP have been performed at 102% of CLTP to demonstrate that the reactor vessel conformed to ASME Boiler and Pressure Vessel (B&PV) Code and plant Technical Specification requirements. There is no increase in nominal operating pressure for the LaSalle TPO uprate. There are no changes in the SRV setpoints or valve OOS options. There is no change in the methodology or the limiting overpressure event. Therefore, the generic evaluation contained in the TLTR is applicable.

The analysis for each fuel reload, which is current practice, confirms the capability of the system to meet the ASME design criteria.

3.2 REACTOR VESSEL

The RPV structure and support components form a pressure boundary to contain reactor coolant and moderator, and form a boundary against leakage of radioactive materials into the drywell. The RPV also provides structural support for the reactor core and internals.

3.2.1 Fracture Toughness

The TLTR, Section 5.5.1.5 describes the RPV fracture toughness evaluation process. RPV embrittlement is caused by neutron exposure of the wall adjacent to the core including the regions above and below the core that experience fluence $\geq 1 \times 10^{17}$ n/cm^2; this region is defined as the "beltline" region. Operation at the TPO conditions results in a higher neutron flux, which increases the integrated fluence over the period of plant life.

The current Pressure-Temperature (P-T) curves are based upon the 20 Effective Full Power Years (EFPY) fluence from Reference 17. The CLTP (3489 MWt) fluences (Reference 15) for 32 EFPY are 1.02E+18 n/cm^2 and 1.09E+18 n/cm^2 for LaSalle Units 1 and 2, respectively. These values were conservatively scaled by [[ ]] to determine the 32 EFPY TPO peak surface fluences (1.04E+18 n/cm^2 for LaSalle Unit 1, and 1.112E+18 n/cm^2 for LaSalle Unit 2) to represent 3548 MWt. These fluences are used to evaluate the vessel against the requirements of 10 CFR 50, Appendix G as defined in Reference 18. The results of these evaluations indicate that:

(a) The upper shelf energy (USE) for the beltline region materials remains greater than 50 ft-lb for the design life of the vessel and maintains the margin requirements of 10 CFR 50 Appendix G as defined in Reference 18. These values are provided in Tables 3-1a, 3-1b, 3-2a and 3-2b for LaSalle Units 1 and 2 respectively.

(b) The change of beltline material reference temperature of the nil-ductility transition (RTNDT) is negligibly small (< 1°F) and RTNDT remains below the 200°F screening criteria as defined in Reference 18. These values are provided in Tables 3-3a, 3-3b, 3-4a and 3-4b for LaSalle Units 1 and 2 respectively.

(c) The CLTP P-T curves remain unchanged for TPO operation up to 20 and 32 EFPY; sufficient margin exists to account for the approximately 2°F increase in Adjusted Reference Temperature (ART). For LaSalle Units 1 and 2 the N12 (Water level Instrumentation) nozzle ART values are not the limiting materials, however, due to the stresses inherent in these components, an assessment was performed that demonstrated that the limiting curve remains unchanged.

(d) The reactor vessel material surveillance program consists of three capsules for each unit.

One capsule containing Charpy specimens was removed from each vessel and tested after 6.5 EFPY of operation (Unit 1 – 300°) and 6.98 EFPY of operation (Unit 2 - 300°). Two capsules remain installed in the reactor vessel for LaSalle Unit 1 and will be withdrawn according to Integrated Surveillance Program (ISP), one of which is currently scheduled for withdrawal in 2010. The 120° Unit 2 capsule was relocated to the spent fuel pool, where it will remain indefinitely. One capsule (30°) remains installed for LaSalle Unit 2, which is represented by other plant capsules in the ISP, and currently there is no plan for withdrawal.

TPO has no effect on the existing surveillance schedule; LaSalle will comply with the ISP requirements.

(e) The conditional failure probability for the LaSalle Units 1 and 2 RPVs for TPO operating conditions up to 32 EFPY is bounded by the NRC analysis results, and remains qualified for weld inspection relief. The values are compared in Table 3-5.

The maximum normal operating dome pressure for TPO is unchanged from that for CLTP power operation. Therefore, the hydrostatic and leakage test pressures and associated temperatures are acceptable for the TPO. Because the vessel is still in compliance with the regulatory requirements as demonstrated above, operation with TPO does not have an adverse effect (not exceeding regulatory requirements) on the reactor vessel fracture toughness.

3.2.2 Reactor Vessel Structural Evaluation

Unit 1

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High and low pressure seal leak detection nozzles were not considered to be pressure boundary components at the time that the OLTP evaluation was performed, and have not been evaluated for TPO.

The effect of TPO was evaluated to ensure that the reactor vessel components continue to comply with the existing structural requirements of the ASME Boiler and Pressure Vessel Code. For the components under consideration, the 1968 Edition with addenda to and including Winter 1969 (except that Figure N-462(e)(2) of the Summer 1970 Addenda was applied) was used as the governing code and is considered the code of construction. Exception for the following components:

- Top Head Cooling Spray Nozzle: This component was evaluated using the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Summer 1976 and 1980 Edition.

- Jet Pump Instrumentation Penetration Seal: This component was evaluated using the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition.
- CRD Housing: This component was evaluated using the ASME Boiler and Pressure Vessel Code, Section III, 1965 Edition with Addenda to and including Winter 1966 and 1968 Edition to and including Summer 1970 Addenda.
- In-Core Housing: This component was evaluated using the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Summer 1976.

However, if a component's design has been modified, the governing code for that component was the code used in the stress analysis of the modified component. The following components were modified since the original construction of LaSalle County Station Unit 1:

- Feedwater Nozzle: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Summer 1976.
- Core Spray Nozzle: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Winter 1975.
- LPCI Nozzle: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Winter 1975.
- Recirculation Inlet Nozzle: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Summer 1976.
- CRD Hydraulic System Return Nozzle: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Winter 1975.
- In-Core Housing: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1968 Edition with Addenda to and including Winter 1970.
- Universal Dry Tube: This component was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1971 Edition with Addenda to and including Summer 1973.
- IRM/SRM/Dry Tube: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1968 Edition with Addenda to and including Winter 1969 and 1977 Edition to and including Summer 1977 Addenda.
- Power Range Detector: This component was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1971 Edition with Addenda to and including Summer 1973.

- In-Core Detector Assembly: This component was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1971 Edition with Addenda to and including Summer 1973.

Typically, new stresses are determined by scaling the original stresses based on the TPO conditions (pressure, temperature, and flow). The bounding analyses were performed for the design, normal/upset, and emergency/faulted conditions. If there is an increase in annulus pressurization, jet reaction, pipe restraint or fuel lift loads, the changes are considered in the analysis of the components affected for normal, upset, emergency and faulted conditions.

Unit 2

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High and low pressure seal leak detection nozzles were not considered to be pressure boundary components at the time that the OLTP evaluation was performed, and have not been evaluated for TPO.

The effect of TPO was evaluated to ensure that the reactor vessel components continue to comply with the existing structural requirements of the ASME Boiler and Pressure Vessel Code. For the components under consideration, the 1968 Edition with addenda to and including Winter 1970 (except that Appendix I of the Winter 1970 Addenda was excluded; in addition, Paragraph NB-3338.2(d)(4) of the Winter 1971 Addenda superseded Paragraph I-613(d) of the 1968 Edition) was used as the governing code and is considered the code of construction. However, if a component's design has been modified, the governing code for that component was the code used in the stress analysis of the modified component. The following components were modified since the original construction of LaSalle County Station Unit 2:

- FW Nozzle: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Summer 1976.
- Recirculation Inlet Nozzle: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Summer 1976.
- CRD Hydraulic System Return Nozzle: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Winter 1975.
- In-core Housing Penetration Seal: This component was modified and the governing Code for the modification is the ASME Boiler and Pressure Vessel Code, Section III, 1968 Edition with Addenda to and including Winter 1970.
- In-core Instrumentation Dry Tube: This component was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1971 Edition with Addenda to and including Summer 1973.
- IRM/SRM Dry Tube: This component was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1968 Edition with Addenda to and including Winter 1969.
- Power Range Detector: This component was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1971 Edition with Addenda to and including Summer 1973.
- In-Core Detector Assembly: This component was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1971 Edition with Addenda to and including Summer 1973.

Typically, new stresses are determined by scaling the original stresses based on the TPO conditions (pressure, temperature, and flow). The bounding analyses were performed for the design, normal/upset, and emergency/faulted conditions. If there is an increase in annulus pressurization, jet reaction, pipe restraint or fuel lift loads, the changes are considered in the analysis of the components affected for normal, upset, emergency and faulted conditions.

3.2.2.1 Design Conditions

Because there are no changes in the design conditions due to TPO, the design stresses are unchanged and the Code requirements are met.

3.2.2.2 Normal and Upset Conditions

The evaluation type is mainly reconciliation of the stresses and usage factors to reflect TPO conditions. A primary plus secondary stress analysis was performed showing TPO stresses still meet the requirements of the ASME Code, Section III, Subsection NB for all components. Lastly, the fatigue usage was evaluated for the limiting location of components with a usage factor [[ ]] The reactor coolant temperature and flows at TPO conditions are unchanged from those at current rated conditions, because the 105% of OLTP power uprate evaluations were performed at conditions [[ ]] that bound the change in operating conditions from CLTP to TPO. The LaSalle County Station Unit 1 fatigue analysis results for the limiting components are provided in Table 3-6. The LaSalle County Station Unit 1 analysis results for TPO show that all components meet their ASME Code requirements and no further analysis is required.

3.2.2.3 Emergency and Faulted Conditions

The stresses due to Emergency/Faulted conditions are based on loads such as peak dome pressure, which are unchanged for TPO. Therefore, Code requirements are met for all RPV components under Emergency/Faulted conditions.

3.3 REACTOR INTERNALS

The reactor internals include core support structure (CSS) and non-core support structure (non-CSS) components.

3.3.1 Reactor Internal Pressure Difference

The reactor internal pressure differences (RIPDs) are affected more by the maximum licensed core flow rate than by the power level. The maximum flow rate is not changed for the TPO uprate. The effect due to the changes in loads for both Normal and Upset conditions is reported in Section 3.2.2.2. The Normal and Upset evaluations of RIPDs for the TPO uprate increase slightly or are bounded by the current analyses that assumed an initial power level of 102% of CLTP. The Emergency and Faulted evaluations of RIPDs for the TPO uprate are bounded by the current analyses that assumed an initial power level of 102% of CLTP.

Fuel Bundle Lift Margins and Control Rod Guide Tube (CRGT) lift forces are calculated for the Emergency and Faulted conditions for 102% of CLTP, to demonstrate that fuel bundles would not be lifted under the worst conditions. The Fuel Lift Margins at Normal and Upset conditions are bounded by Emergency and Faulted conditions.

Acoustic and flow-induced loads on jet pump, core shroud and shroud support due to recirculation line break are bounded by the current analyses that assumed an initial power level of 102% of CLTP.

Fuel Assembly liftoff evaluations for the ATRIUM-10 fuel and ATRIUM-10XM LTAs were performed at TPO RTP and 105% core flow. Lower flow rates are bound by the 105% core flow result. The liftoff analysis shows that the net lift force for both the ATRIUM-10 and ATRIUM-10XM fuel assemblies during normal and upset conditions remains in the downward direction. The evaluation also concludes that under Faulted conditions, the assemblies will remain engaged in the fuel support so the fuel lift criteria are met.

3.3.2 Reactor Internals Structural Evaluation

The RPV internals consist of the core support structure components and non-core support structure components. The RPV Internals are not ASME Code components, however, the requirements of the ASME Code are used as guidelines in their design/analysis. The evaluations/stress reconciliation in support of the TPO is performed consistent with the design basis analysis of the components. The reactor internal components evaluated are:

Core Support Structure Components

- Shroud Support
- Shroud
- Core Plate
- Top Guide
- Control Rod Drive Housing
- Control Rod Guide Tube
- Orificed Fuel Support

Non-Core Support Structure Components

- Feedwater Sparger
- Jet Pump
- Core Spray Line and Sparger
- Access Hole Cover
- Shroud Head & Steam Separator Assembly
- In-core Housing & Guide Tube
- Vessel Head Cooling Spray Nozzle
- Core Differential Pressure & Liquid Control Line
- LPCI Coupling
- Steam Dryer

The original configurations of the internal components are considered in the TPO evaluation unless a component has undergone permanent structural modifications, in which case, the modified configuration is used as the basis for the evaluation.

The effects of the thermal-hydraulic changes due to TPO on the reactor internals are evaluated. All applicable Normal (Service Level A), Upset (Service Level B), Emergency (Service Level C), and Faulted condition (Service Level D) loads are considered consistent with the existing design basis analysis. These loads include the RIPDs, deadweight, seismic loads, hydrodynamic loads such as SRV, LOCA, Annulus Pressurization (AP) and Jet Reaction (JR) loads, acoustic loads, fuel lift loads, flow loads and thermal loads.

TPO loads are compared to those used in the existing design basis analysis. If the TPO loads are bounded by the design basis loads for the RPV internals, then the existing design basis qualification is valid for TPO. In such cases, no further evaluations are required or performed. For RPV internals exhibiting increases in loads, the method of analysis is to linearly scale the critical/governing stresses based on increase in loads as applicable, and compare the resulting stresses against the allowable stress limits, consistent with the design basis.

Table 3-7 presents the governing stresses and fatigue values for the various reactor internal components as affected by TPO. All stresses and fatigue usage factors are within the design basis allowable limits, and the RPV internal components are demonstrated to be structurally qualified for operation in the TPO conditions.

The following RPV internals are evaluated for the effects of changes in loads due to TPO.

Shroud Support: Quantitative analysis is performed for the shroud support. The loads applicable to the shroud support evaluation are deadweight, seismic, RIPD, SRV, LOCA, AP/JR, acoustic and fuel lift loads. Deadweight and seismic loads remain unchanged for the TPO conditions. RIPDs contributing to the shroud support load increase in the normal and upset conditions. SRV, LOCA, AP/JR, acoustic and fuel lift loads remain bounded in the TPO conditions by the CLTP values. The existing design basis calculations are reconciled for the TPO loads to show that the stresses remain within the design basis allowable limits. Hence, the shroud support in its original configuration remains structurally qualified for the TPO conditions.

Shroud: Quantitative and qualitative analysis is performed for the shroud. The loads applicable to the shroud evaluation are deadweight, seismic, RIPD, SRV, LOCA, AP/JR, acoustic and fuel lift loads. Deadweight and seismic loads remain unchanged for the TPO conditions. RIPDs contributing to the shroud load increase in the normal and upset conditions. SRV, LOCA, AP/JR, acoustic and fuel lift loads remain bounded in the TPO conditions by the CLTP values. The existing design basis calculations are reconciled for the TPO loads to show that the stresses remain within the design basis allowable limits. Hence, the shroud in its original configuration remains structurally qualified for the TPO conditions.

Core Plate: Quantitative and qualitative analysis is performed for the core plate. The loads applicable to the core plate evaluation are deadweight, seismic, RIPD, SRV, LOCA, AP/JR and fuel lift loads. Deadweight and seismic loads remain unchanged for the TPO conditions. RIPDs contributing to the core plate load increase in the normal and upset conditions. SRV, LOCA, AP/JR and fuel lift loads remain bounded in the TPO conditions by the CLTP values. The existing design basis calculations are reconciled for the TPO loads to show that the stresses remain within the design basis allowable limits. Hence, the Core Plate in its original configuration remains structurally qualified for the TPO conditions.

Top Guide: Qualitative analysis is performed for the top guide. The loads applicable to the top guide evaluation are deadweight, seismic, RIPD, SRV, LOCA, AP/JR and fuel lift loads. All applicable loads to the top guide are unaffected by the TPO conditions. Hence, the top guide in its original configuration remains structurally qualified for the TPO conditions.

Control Rod Drive Housing (CRDH): Qualitative analysis is performed for the CRDH. The loads applicable to the CRDH evaluation are deadweight, seismic, SRV, LOCA, AP/JR, fuel lift and flow loads. All applicable loads to CRDH remain unchanged for the TPO conditions. Hence, the CRDH in its original configuration remains structurally qualified for the TPO conditions.

Control Rod Guide Tube (CRGT): Qualitative and quantitative analysis is performed for the CRGT. The loads applicable to the CRGT evaluation are deadweight, seismic, RIPD, SRV, LOCA, AP/JR, fuel lift and flow loads. Deadweight and seismic loads remain unchanged for the TPO conditions. RIPDs contributing to the CRGT load increase in the normal and upset conditions. SRV, LOCA, AP/JR, fuel lift and flow loads remain bounded in the TPO conditions by the CLTP values. The existing design basis calculations are reconciled for the TPO loads to show that the stresses remain within the design basis allowable limits. Hence, the CRGT in its original configuration remains structurally qualified for the TPO conditions.

Orificed Fuel Support (OFS): Qualitative analysis is performed for the OFS. The loads applicable to the OFS evaluation are deadweight, seismic, RIPD, SRV, LOCA, AP/JR and fuel lift loads. Deadweight and seismic loads remain unchanged for the TPO conditions. RIPDs contributing to the OFS load increase in the normal and upset conditions. SRV, LOCA, AP/JR and fuel lift loads remain bounded in the TPO conditions by the CLTP values. The design basis loads are reconciled for the TPO conditions to show that the TPO loads in the OFS are within the allowable limits. Hence, the OFS in its original configuration remains structurally qualified for the TPO conditions.

Feedwater (FW) Sparger: Qualitative analysis is performed for the FW sparger. The loads applicable to the FW sparger evaluation are deadweight, seismic, thermal loads, SRV, LOCA, AP/JR and flow loads. All applicable loads to the FW sparger remain bounded by the original design basis values. Hence, the FW sparger in its current condition remains structurally qualified for the TPO conditions.

Jet Pump Assembly: Quantitative and qualitative evaluations are performed for the jet pump components. The loads applicable to the jet pump assembly evaluation are deadweight, seismic, RIPDs, thermal, SRV, LOCA, AP/JR, acoustic and flow loads. All applicable loads to the jet pump are unaffected by the TPO. Based on the above, the jet pump assembly remains qualified in its original configuration for the TPO conditions.

Core Spray Lines and Spargers (CSL&S): Qualitative evaluation is performed for the CSL&S. The loads applicable to the CSL&S evaluation are deadweight, seismic, thermal, SRV, LOCA, AP/JR and flow loads. All applicable loads to the CSL&S are unaffected by the TPO conditions. Therefore, the CSL&S in its original configuration remains structurally qualified for the TPO conditions.

Access Hole Cover (AHC): Qualitative evaluation is performed for the AHC. The loads applicable to the AHC evaluation are deadweight, seismic, RIPDs, SRV, LOCA, AP/JR and acoustic loads. All applicable loads to the AHC are bounded by the original design basis for the TPO conditions. Therefore, the AHC in its original configuration is qualified for the TPO conditions.

Shroud Head and Steam Separator Assembly: Quantitative evaluation is performed for the shroud head and separators assembly. The loads applicable to the evaluation of this component are deadweight, seismic, RIPD, thermal, SRV, LOCA and AP/JR loads. Deadweight and seismic loads remain unchanged for the TPO conditions. RIPDs contributing to this component load increase in the normal and upset conditions. Thermal, SRV, LOCA and AP/JR loads remain bounded in the TPO conditions by the CLTP values. The existing design basis calculations are reconciled for the TPO loads to show that the bolt stresses remain within the design basis allowable limits. Based on the above, the shroud head and separator assembly are qualified in their original configuration for the TPO conditions.

In-Core Housing and Guide Tube (ICHGT): Qualitative evaluation is performed for the ICHGT. The loads applicable to the evaluation of this component are deadweight, seismic, SRV, LOCA, AP/JR and hydraulic loads. All the applicable loads are unaffected by the TPO conditions. Therefore, the ICHGT remains qualified in its original configuration for the TPO conditions.

Vessel Head Cooling Spray Nozzle (VHCSN): Qualitative evaluation is performed for the VHCSN. The loads applicable to the VHCSN evaluation are deadweight, seismic, thermal effects, SRV, LOCA and AP/JR loads. All the applicable loads are unaffected by the TPO conditions. Therefore, the VHCSN remains qualified in its original configuration for the TPO conditions.

Core Differential Pressure and Liquid Control Line (Core DP & LCL): Qualitative evaluation is performed for the core DP & LCL. The loads applicable to the evaluation are deadweight, seismic, SRV, LOCA, AP/JR and flow loads. All the applicable loads are unaffected by the TPO conditions. Therefore, the core DP & LCL remains qualified in its original configuration for the TPO conditions.

LPCI Coupling: Qualitative evaluation is performed for the LPCI coupling. The loads applicable to the evaluation are deadweight, seismic, RIPD, SRV, LOCA and AP/JR loads. RIPDs remain bounded by the design basis loads. Other applicable loads are unaffected by the TPO conditions. Therefore, the LPCI coupling remains qualified in its original configuration for the TPO.

Steam Dryer: Qualitative analysis was performed for the steam dryer Flow Induced Vibration (FIV) using 1/5th scale model testing and an analytical approach. The analysis results indicated acoustic loading is far from on-set velocity initiation. Other loads applicable to the Steam Dryer evaluation are deadweight, seismic, RIPD, SRV, LOCA, AP, JR and fuel lift loads. Deadweight and seismic loads remain unchanged for the TPO conditions. RIPDs contributing to the steam dryer load increased in the normal and upset conditions. SRV, LOCA, AP, JR, and fuel lift loads remain bounded in the TPO conditions by the CLTP values. All applicable loads to the steam dryer are bounded by the existing design basis for the TPO conditions. Hence, the steam dryer remains structurally qualified for plant operation in the TPO conditions.

3.3.3 Steam Separator and Dryer Performance

The TPO performance of the steam dryer/separator was evaluated based on a plant specific evaluation using a representative core design. The results of the evaluation demonstrated that the steam dryer/separator performance remains acceptable (e.g., moisture content ≤ 0.1 weight %) at TPO conditions. TPO results in an increase in the amount of saturated steam generated in the reactor core. For constant core flow, this results in an increase in the separator inlet quality, an increase in the steam dryer face velocity and a decrease in the water level inside the dryer skirt. These factors, in addition to the radial power distribution, affect the steam dryer/separator performance. The net effect of these changes does not result in exceeding the acceptable moisture content of 0.1 wt % leaving the steam dryer.

3.4 FLOW-INDUCED VIBRATION

The process for the reactor vessel internals vibration assessment is described in TLTR Section 5.5.1.3. An evaluation determined the effects of FIV on the reactor internals at TPO at 105% of rated core flow and RTP of 101.7%. The vibration levels for the TPO uprate conditions were estimated from vibration data recorded during startup testing of the NRC designated prototype plant (Tokai-2), at LaSalle 1, and from operating experience at similar plants. These expected vibration levels were compared with established vibration acceptance limits. The following components are evaluated for the TPO uprate:

Component(s)	Process Parameter(s)	TPO Evaluation
Shroud Shroud Head and Steam Separators	Steam flow at TPO RTP is 1.98% greater than CLTP.	Slight increase in FIV. Extrapolation of measured data shows stresses are within limits.
Liquid Control and Core dP Lines	Core flow at TPO RTP is unchanged from CLTP.	The maximum response is less than 17% of the allowable criteria.
Jet Pumps	Core flow at TPO RTP is unchanged from CLTP.	No change
Jet Pump Sensing Lines	Vane Passing Frequency of recirculation pumps is unchanged.	No change in possibility of resonance.

Component(s)	Process Parameter(s)	TPO Evaluation
FW Sparger	FW flow at TPO RTP is 1.98% greater than CLTP.	Slight increase in FIV. Extrapolation of measured data shows stresses are within limits.
Control Rod Guide Tube; In-Core Guide Tubes	Core flow at TPO RTP is unchanged from CLTP.	No change

The calculations for the TPO uprate conditions indicate that vibrations of all safety-related reactor internal components are within the GEH acceptance criteria.

Therefore, it is concluded that the flow-induced vibrations of the reactor vessel internals remain within acceptable limits.

The safety-related Main Steam (MS) and FW piping have minor increased flow rates and flow velocities resulting from the TPO uprate. The MS and FW piping experience increased vibration levels, approximately proportional to the increase in the square of the flow velocities and also in proportion to any increase in fluid density. The decrease in FW fluid density for TPO uprate conditions, as a result of the ~2°F increase in FW temperature, is insignificant. The MS and FW piping vibration is expected to increase only by about 4%. An MS and FW piping FIV test program, during initial plant startup, showed that vibration levels were within acceptance criteria and operating experience shows that there have been no vibration problems in MS and FW lines at CLTP operating conditions. Therefore, the MS and FW lines vibration will remain within acceptable limits during TPO. Analytical evaluation has shown that the safety-related thermowells in the MS, FW, and Recirculation piping systems are structurally adequate for the TPO operating conditions.

3.5 PIPING EVALUATION

3.5.1 Reactor Coolant Pressure Boundary Piping

The methods used for the piping and pipe support evaluations are described in Appendix K of the TLTR. These approaches are identical to those used in the evaluation of previous BWR power uprates of up to 20% power. The effect of the TPO uprate with no vessel dome nominal pressure increase is negligible for the Reactor Coolant Pressure Boundary (RCPB) portion of all piping except for portions of the FW lines, main steam lines, and piping connected to the FW and main steam lines. The following table summarizes the evaluation of the piping inside containment.

Component(s) / Concern	Process Parameter(s)	TPO Evaluation
Recirculation System Pipe Stresses Pipe Supports	Nominal dome pressure at TPO RTP is identical to CLTP Recirculation flow at TPO RTP is identical to CLTP Small increase in core pressure drop of < 1 psi Recirculation fluid temperature decreases < 1°F	Negligible change in pipe stress Negligible effect on pipe supports
MS and Attached Piping (Inside Containment) (e.g., SRV Discharge Line (SRVDL) piping up to first anchor, Reactor Core Isolation Cooling (RCIC), MS drain lines, RPV head vent line piping located Inside Containment) Pipe Stresses Pipe Supports Flow-accelerated erosion/corrosion (FAC)	Nominal dome pressure at TPO RTP is identical to CLTP Steam flow at TPO RTP is ~2% greater than CLTP No change in main steam line (MSL) pressure	Plant specific evaluation indicates piping systems listed are acceptable for TPO. Negligible change in pipe stress. Negligible effect on pipe supports Minor increase in the potential for Erosion /Corrosion (FAC concerns are covered by existing piping monitoring program)
FW and attached Piping (Inside Containment) Pipe Stresses Pipe Supports FAC	Nominal dome pressure at TPO RTP is identical to CLTP FW flow at TPO RTP is ~2% greater than CLTP Minor change in FW line pressure Fluid temperature remains the same	Current Licensing Basis envelops TPO conditions; therefore, piping system is acceptable for TPO. Negligible change in pipe stress Negligible effect on pipe supports Minor increase in the potential for FAC (FAC concerns are covered by existing piping monitoring program)
RPV bottom head drain line, RCIC piping, High Pressure Core Spray (HPCS) piping, LPCI piping, Low Pressure Core Spray (LPCS) piping, SBLC piping, and Reactor Water Cleanup (RWCU) piping Pipe Stresses Pipe Supports FAC	Nominal dome pressure at TPO RTP is identical to CLTP No change in pressure drop for RPV bottom head drain line, RCIC piping, SBLC piping, and RWCU piping; HPCS piping, LPCI piping, and LPCS piping have a pressure increase of <1 psi. Recirculation fluid temperature decreases < 1°F	Negligible change in pipe stress Negligible effect on pipe supports Minor increase in the potential for FAC (FAC concerns are covered by existing piping monitoring program

For the MS and FW lines, supports, and connected lines, the methodologies as described in TLTR Section 5.5.2 and Appendix K were used to determine the percent increases in applicable ASME Code stresses, displacements, cumulative usage factors (CUF), and pipe interface component loads (including supports) as a function of percentage increase in pressure (where applicable), temperature, and flow due to TPO conditions. The percentage increases were applied to the highest calculated stresses, displacements, and the CUF at applicable piping system node points to conservatively determine the maximum TPO calculated stresses, displacements and usage factors. This approach is conservative because the TPO does not affect weight and all building filtered loads (e.g., seismic loads are not affected by the TPO). The factors were also applied to nozzle load, support loads, penetration loads, valves, pumps, heat exchangers and anchors so that these components could be evaluated for acceptability, where required. No new computer codes were used or new assumptions introduced for this evaluation.

MS and Attached Piping System Evaluation

The MS piping system (Inside Containment and Class I piping outside Containment) was evaluated for compliance with the ASME code stress criteria, and for the effects of thermal displacements on the piping snubbers, hangers, and struts. Piping interfaces with RPV nozzles, penetrations, flanges and valves were also evaluated.

Pipe Stresses

The evaluation shows that the increase in flow associated with the TPO uprate does not result in load limits being exceeded for the MS piping system or for the RPV nozzles. The current licensing basis design analyses have sufficient design margin between calculated stresses and ASME Code allowable limits to justify operation at the TPO uprate conditions. The temperature of the MS piping (Inside Containment) is unchanged for the TPO.

The design adequacy evaluation results show that the requirements of ASME, Section III, Subsection NB/ND (as applicable) requirements are satisfied for the evaluated piping systems. Therefore, the TPO does not have an adverse effect on the MS piping design.

Pipe Supports

The current licensing basis MS piping was reviewed for the effects of transient loading on the piping snubbers, hangers, struts, and pipe whip restraints. A review of the increases in MS flow associated with the TPO uprate indicates that piping load changes do not result in any load limit being exceeded.

Erosion / Corrosion

The carbon steel MS piping can be affected by FAC. FAC is affected by changes in fluid velocity, temperature and moisture content. LaSalle has an established FAC monitoring program for monitoring pipe wall thinning in single and two-phase high-energy carbon steel piping. The variation in velocity, temperature, and moisture content resulting from the TPO uprate are minor changes to parameters affecting FAC. The FAC monitoring program includes the use of a predictive method to calculate wall thinning of components susceptible to FAC. For TPO, the evaluation of flow velocities in the MS and attached piping indicates minimal effect.

Table 3-8 shows piping line segments that are recommended for additional review under the station FAC program.

The continuing inspection program will take into consideration adjustments to predicted material loss rates used to project the need for maintenance/replacement prior to reaching minimum wall thickness requirements. This program provides assurance that the TPO uprate has no adverse effect on high-energy piping systems potentially susceptible to pipe wall thinning due to FAC.

FW Piping System Evaluation

The current licensing based FW piping system (Inside Containment and Class I piping outside Containment) was evaluated for compliance with the ASME Section III Code stress criteria, and for the effects of thermal expansion displacements on the piping snubbers, hangers, and struts. Piping interfaces with RPV nozzles, penetrations, and valves were also evaluated.

Pipe Stresses

A review of the change in temperature, pressure, and flow associated with the TPO uprate indicates that piping load changes do not result in load limits being exceeded for the FW piping system or for RPV nozzles. The current licensing basis design analyses have adequate design margin between calculated stresses and ASME Code allowable limits to justify operation at the TPO uprate conditions.

The design adequacy evaluation shows that the requirements of ASME, Section III, Subsection NB/NC/ND-3600 requirements remain satisfied. Therefore, the TPO does not have an adverse effect on the FW piping design.

Pipe Supports

The TPO does not affect the FW piping snubbers, hangers, and struts. A review of the increase in FW temperature and flow associated with the TPO indicates that piping load changes do not result in any load limit being exceeded at the TPO uprate conditions.

Erosion / Corrosion

The carbon steel FW piping can be affected by FAC. FAC in the FW piping is affected by changes in fluid velocity and temperature. LaSalle has an established program for monitoring pipe wall thinning in single and two-phase high-energy carbon steel piping. The variation in velocity and temperature resulting from the TPO uprate are minor changes to parameters affecting FAC. The FAC monitoring program includes the use of a predictive method to calculate wall thinning of components susceptible to FAC. For TPO, the evaluation of flow velocities in the FW piping indicates minimal effect.

Table 3-8 shows piping line segments that are recommended for additional review under the station FAC program.

The continuing inspection program will take into consideration adjustments to predicted material loss rates used to project the need for maintenance/replacement prior to reaching minimum wall thickness requirements. This program provides assurance that the TPO uprate has no adverse effect on high energy piping systems potentially susceptible to pipe wall thinning due to FAC.

3.5.2 Balance-of-Plant Piping Evaluation

This section addresses the adequacy of the BOP piping design (outside of the RCPB) for operation at the TPO conditions. The evaluation of the BOP piping and supports was performed in a manner similar to the evaluation of RCPB piping systems and supports.

Pipe Supports

Because there is no change in the MS temperature, there is no change in the MS pipe support loads weight and thermal expansion stress. The supports for piping that contains fluid that increases in temperature (e.g., the FW piping) have slightly increased pipe support loadings. However, when considering the loading combination with other loads that are not affected by the TPO uprate, such as seismic and deadweight, the combined support load increase is insignificant.

For the MS system piping outside containment, the turbine existing stop valve closure transient was reviewed and determined to bound the TPO uprate conditions and no new piping analysis was required.

For the FW system piping outside containment, the design does not explicitly evaluate transient loading. The FW system design includes use of tilting disc check valves on the Reactor Feed Pump (RFP) discharge lines to minimize transient loading associated with pump trip. Based on industry experience, for review of changes under TPO, potential transient loading is considered to be limited to this specific event, (i.e., RFP trip). A review of the change in potential loading (i.e., increase in differential pressure across the RFP) indicates a rise of 1.5% under TPO conditions. The changes to transient loading with TPO in the FW lines following an RFP trip, considering this minor increase in RFP differential head (1.5%), are considered to be insignificant.

Erosion / Corrosion

The integrity of high-energy piping systems is assured by proper design in accordance with the applicable codes and standards. Piping thickness of carbon steel components can be affected by FAC. LaSalle has an established program for monitoring pipe wall thinning in single phase and two-phase high-energy carbon steel piping. FAC rates may be influenced by changes in fluid velocity, temperature, and moisture content. The FAC monitoring program includes the use of a predictive method to calculate wall thinning of components susceptible to FAC. For TPO, the evaluation of flow velocities in the BOP piping indicates minimal effect. Table 3-8 shows piping line segments that are recommended for additional review under the station FAC program.

Operation at the TPO RTP results in some changes to parameters affecting FAC in those systems associated with the turbine cycle (e.g., condensate, FW, MS). The evaluation of and inspection for FAC in BOP systems is addressed by compliance with Generic Letter (GL) 89-08. The plant FAC program currently monitors the affected systems. Continued monitoring of the systems provides confidence in the integrity of susceptible high-energy piping systems. Appropriate changes to piping inspection frequency will be implemented to ensure adequate margin exists for those systems with changing process conditions. This action takes into consideration adjustments to predicted material loss rates used to project the need for maintenance/replacement prior to reaching minimum wall thickness requirements. This program provides assurance that the TPO has no adverse effect on high-energy piping systems potentially susceptible to pipe wall thinning due to FAC.

3.6 REACTOR RECIRCULATION SYSTEM

The Reactor Recirculation System (RRS) evaluation process is described in TLTR Section 5.6.2. The TPO uprate has a minor effect on the RRS and its components. The TPO uprate does not require an increase in the maximum core flow. No significant reduction of the maximum flow capability occurs due to the TPO uprate because of the small increase in core pressure drop (< 1 psi). The effect on pump Net Positive Suction Head (NPSH) at TPO conditions is negligible. An evaluation has confirmed that no significant increase in RRS vibration occurs from the TPO operating conditions.

The cavitation protection interlock for the recirculation pumps and jet pumps is expressed in terms of FW flow. This interlock is based on sub-cooling and thus is a function of absolute FW flow rate and FW temperature at less than full thermal power operating conditions. Therefore, the interlock is not changed by TPO.

3.7 MAIN STEAM LINE FLOW RESTRICTORS

The generic evaluation provided in TLTR Appendix J is applicable to LaSalle. The requirements for the MSL flow restrictors remain unchanged for TPO uprate conditions. No change in steam line break flow rate occurs because the operating pressure is unchanged. All safety and operational aspects of the MSL flow restrictors are bounded by previous evaluations.

3.8 MAIN STEAM ISOLATION VALVES

The generic evaluation provided in TLTR Appendix J.2.3.7 is applicable to LaSalle. The requirements for the main steam isolation valves (MSIVs) remain unchanged for TPO uprate conditions. All safety and operational aspects of the MSIVs are bounded by previous evaluations.

3.9 REACTOR CORE ISOLATION COOLING

The RCIC system provides inventory makeup to the reactor vessel when the vessel is isolated from the normal high-pressure makeup systems. The generic evaluation provided in TLTR Section 5.6.7 is applicable to LaSalle. The TPO uprate does not affect the RCIC system operation, initiation, or capability requirements.

3.10 RESIDUAL HEAT REMOVAL SYSTEM

The Residual Heat Removal System (RHR) system is designed to restore and maintain the coolant inventory in the reactor vessel and to remove sensible and decay heat from the primary system and containment following reactor shutdown for both normal and post accident conditions. The RHR system is designed to function in several operating modes. The generic evaluation provided in TLTR Sections 5.6.4 and Appendices J.2.3.1 and J.2.3.13 are applicable to LaSalle.

The following table summarizes the effect of the TPO on the design basis of the RHR system.

Operating Mode	Key Function	TPO Evaluation
LPCI Mode	Core Cooling	See Section 4.2.4
Suppression Pool Cooling (SPC) and Containment Spray Cooling (CSC) Modes	Normal SPC function is to maintain pool temperature below the limit. For abnormal events or accidents, the SPC mode maintains the long-term pool temperature below the design limit. The CSC mode sprays water into the containment to reduce post-accident containment pressure and temperature.	Containment analyses have been performed at 102% of CLTP.
Shutdown Cooling (SDC) Mode	Removes sensible and decay heat from the reactor primary system during a normal reactor shutdown.	The slightly higher decay heat has negligible effect on the SDC mode, which has no safety function.
Steam Condensing Mode	Decay Heat removal	LaSalle does not have a steam-condensing mode of RHR.
Fuel Pool Cooling Assist	Supplemental fuel pool cooling in the event that the fuel pool heat load exceeds the heat removal capability of the Fuel Pool Cooling system.	See Section 6.3.1

The ability of the RHR system to perform required safety functions is demonstrated with analyses based on 102% of CLTP. Therefore, all safety aspects of the RHR system are within previous evaluations. The requirements for the RHR system remain unchanged for TPO uprate conditions.

3.11 REACTOR WATER CLEANUP SYSTEM

The generic evaluation of the Reactor Water Cleanup (RWCU) system provided in TLTR Sections 5.6.6 and J.2.3.4 is applicable to LaSalle. The performance requirements of the RWCU system are negligibly affected by TPO uprate. There is no significant effect on operating temperature and pressure conditions in the high-pressure portion of the system. Steady power level changes for much larger power uprates have shown no effect on reactor water chemistry and the performance of the RWCU system. Power transients are the primary source of challenge to the system, so safety and operational aspects of water chemistry performance are not affected by the TPO.

Table 3-1a
Upper Shelf Energy for LaSalle Unit 1– 25 Year Life (20 EFPY)

Component	Heat	Initial Transverse USE (ft-lb)	Cu (%)	Fluence at Inner Diameter[1] ($x10^{19}n/cm^2$)	Thickness[2] (inch)	Fluence at 1/4T ($x10^{19}n/cm^2$)	Decrease USE[3] (%)	32 EFPY TPO Transverse USE[4] (ft-lb)
Plates:								
Lower	C5978-1	88.4	0.11	0.065	6.13	0.045	10	79
	C5978-2	78.0	0.11	0.065	6.13	0.045	10	70
	C5979-1	88.4	0.12	0.065	6.13	0.045	11	78
Lower-Intermediate	C6345-1[5]	107.3	0.15	0.065	6.13	0.045	12	94
	C6318-1	91.0	0.12	0.065	6.13	0.045	11	80
	C6345-2	104.7	0.15	0.065	6.13	0.045	12	92
Middle	A5333-1	100.8	0.12	0.065	6.13	0.045	11	89
	B0078-1	98.2	0.15	0.065	6.13	0.045	12	86
	C6123-2	98.2	0.13	0.065	6.13	0.045	11	87
Welds-Vertical:								
3-308	305424	92.0	0.273	0.065	6.13	0.045	21	72
	1P3571	79.0	0.283	0.065	6.13	0.045	21	62
4-308	305414[6]	92.0	0.337	0.065	6.13	0.045	27	67
	305414[7]	92.0	0.286	0.065	6.13	0.045	21	72
	12008[6]	92.0	0.235	0.065	6.13	0.045	19	74
	12008[7]	92.0	0.286	0.065	6.13	0.045	21	72
2-307	21935[6]	97.0	0.183	0.065	6.13	0.045	16	81
	21935[7]	97.0	0.213	0.065	6.13	0.045	18	79
	12008[6]	97.0	0.235	0.065	6.13	0.045	19	78
	12008[7]	97.0	0.213	0.065	6.13	0.045	18	79
Welds-Girth:								
6-308	6329637	103.0	0.205	0.065	6.13	0.045	17	85
1-313	4P6519	116.0	0.131	0.065	6.13	0.045	14	99
Forgings:								
LPCI Nozzle[9]	Q2Q22W[8]	73.0	0.10	0.016	6.13	0.011	7	67
Water Level Instrumentation Nozzle[10]	A5333-1	100.8	0.12	0.013	6.13	0.009	7	93
	B0078-1	98.2	0.15	0.013	6.13	0.009	8	90
	C6123-2	98.2	0.13	0.013	6.13	0.009	8	90
Integrated Surveillance Program[11]								
Plate	[[		]]	0.065	6.13	0.045	12	68
Weld	[[		]]	0.065	6.13	0.045	18	64

[1] For conservative result fluence = 0.065E+19 is considered except for forgings.

[2] For conservative result Thickness = 6.13 inch is considered.

[3] Values obtained from Figure 2 of RG 1.99 for 32 EFPY 1/4T fluence

[4] 32 EFPY Transverse USE = Initial Transverse USE * [1 - (% Decrease USE /100)]

[5] The initial transverse USE value is 65% of the highest 160°F data from Certified Material Test Reports (CMTRs)

[6] Single Wire

[7] Tandem Wire

[8] Average of Charpy V-Notch data for %Shear ≥ 70

[9] Ratio Peak/ Location = 0.244 for LPCI Nozzles.

[10] Ratio Peak/ Location = 0.20 for Water Level Instrumentation Nozzles

Table 3-1b
Upper Shelf Energy for LaSalle Unit 1– 40 Year Life (32 EFPY)

Component	Heat	Initial Transverse USE (ft-lb)	Cu (%)	Fluence at Inner Diameter[1] ($x10^{19}n/cm^2$)	Thickness[2] (inch)	Fluence at 1/4T ($x10^{19}n/cm^2$)	Decrease USE[3] (%)	32 EFPY TPO Transverse USE[4] (ft-lb)
Plates:								
Lower	C5978-1	88.4	0.11	0.104	6.13	0.072	11	78
	C5978-2	78.0	0.11	0.104	6.13	0.072	11	69
	C5979-1	88.4	0.12	0.104	6.13	0.072	11	78
Lower-Intermediate	C6345-1[5]	107.3	0.15	0.104	6.13	0.072	13	93
	C6318-1	91.0	0.12	0.104	6.13	0.072	11	80
	C6345-2	104.7	0.15	0.104	6.13	0.072	13	91
Middle	A5333-1	100.8	0.12	0.104	6.13	0.072	11	89
	B0078-1	98.2	0.15	0.104	6.13	0.072	13	85
	C6123-2	98.2	0.13	0.104	6.13	0.072	12	86
Welds-Vertical:								
3-308	305424	92.0	0.273	0.104	6.13	0.072	23	70
	1P3571	79.0	0.283	0.104	6.13	0.072	24	60
4-308	305414[6]	92.0	0.337	0.104	6.13	0.072	29	65
	305414[7]	92.0	0.286	0.104	6.13	0.072	24	69
	12008[6]	92.0	0.235	0.104	6.13	0.072	21	72
	12008[7]	92.0	0.286	0.104	6.13	0.072	24	69
2-307	21935[6]	97.0	0.183	0.104	6.13	0.072	18	79
	21935[7]	97.0	0.213	0.104	6.13	0.072	20	77
	12008[6]	97.0	0.235	0.104	6.13	0.072	21	76
	12008[7]	97.0	0.213	0.104	6.13	0.072	20	77
Welds-Girth:								
6-308	6329637	103.0	0.205	0.104	6.13	0.072	19	83
1-313	4P6519	116.0	0.131	0.104	6.13	0.072	15	98
Forgings:								
LPCI Nozzle[9]	Q2Q22W[8]	73.0	0.10	0.025	6.13	0.018	7	67
Water Level Instrumentation Nozzle[10]	A5333-1	100.8	0.12	0.021	6.13	0.014	8	92
	B0078-1	98.2	0.15	0.021	6.13	0.014	9	89
	C6123-2	98.2	0.13	0.021	6.13	0.014	8	90
Integrated Surveillance Program[11]								
Plate	[[		]]	0.104	6.13	0.072	12	68
Weld	[[		]]	0.104	6.13	0.072	19	63

[1] For conservative result fluence = 0.1040E+19 is considered except for forgings.
[2] For conservative result Thickness = 6.13 inch is considered.
[3] Values obtained from Figure 2 of RG 1.99 for 32 EFPY 1/4T fluence
[4] 32 EFPY Transverse USE = Initial Transverse USE * [1 - (% Decrease USE /100)]
[5] The initial transverse USE value is 65% of the highest 160°F data from CMTRs
[6] Single Wire
[7] Tandem Wire
[8] Average of Charpy V-Notch data for %Shear ≥ 70
[9] Ratio Peak/ Location = 0.244 for LPCI Nozzles.
[10] Ratio Peak/ Location = 0.20 for Water Level Instrumentation Nozzles
[11] Assume core beltline and use the lowest initial USE value that bounds Boiling Water Vessel and Internals Project (BWRVIP) 135 data (plate = 152.5 ft-lb, weld = 114.5 ft-lb), (Reference 20).

Table 3-2a
Upper Shelf Energy for LaSalle Unit 2– 25 Year Life (20 EFPY)

Location	Heat	Initial Transverse USE (ft-lb)	Cu (%)	Fluence at Inner Diameter[1] ($x10^{19}n/cm^2$)	Thickness (inch)	Fluence at 1/4T ($x10^{19}n/cm^2$)	Decrease USE[2] (%)	32 EFPY TPO Transverse USE[3] (ft-lb)
Plates:								
Lower	C9425-1	66.3	0.12	0.0695	6.19	0.048	11	59
	C9425-2	61.1	0.12	0.0695	6.19	0.048	11	54
	C9434-2	59.2	0.09	0.0695	6.19	0.048	9	53
Lower-Intermediate	C9481-1	95.5	0.11	0.0695	6.19	0.048	10	85
	C9404-2	75.4	0.07	0.0695	6.19	0.048	8	69
	C9601-2	69.6	0.12	0.0695	6.19	0.048	11	61
Welds-Vertical:								
Lower	3P4000	99	0.02	0.0695	6.19	0.048	8	91
Lower-intermediate	3P4966	84	0.026	0.0695	6.19	0.048	9	76
Girth:								
Lower to Lower-Intermediate	5P6771	61	0.04	0.0695	6.19	0.048	9	55
Nozzles:								
LPCI[4]	Q2Q36W	66	0.22	0.0170	6.19	0.012	12	58
Water Level	C9481-1	95.5	0.11	0.0139	6.19	0.010	7	88
Instrumentation	C9404-2	75.4	0.07	0.0139	6.19	0.010	6	70
Nozzle[5]	C9601-2	69.6	0.12	0.0139	6.19	0.010	8	64
Integrated Surveillance Program[6]								
Plate	[[		]]	0.0695	6.19	0.048	9	53
Weld	[[		]]	0.0695	6.19	0.048	8	56

[1] For conservative result fluence = 0.0695E+19 is considered except for forgings.

[2] Values obtained from Figure 2 of RG 1.99 Rev 2 for 32 EFPY 1/4T fluence

[3] 32 EFPY Transverse USE = Initial Transverse USE * [1 - (% Decrease USE /100)]

[4] Ratio Peak/ Location = 0.244 for LPCI Nozzles

[5] Ratio Peak/ Location = 0.20 for Water Level Instrumentation Nozzles

[6] Assume core beltline and use the lowest initial USE value that bounds BWRVIP 135 data (plate = 95.3 ft-lb, weld = 107.7 ft-lb), (Reference 20).

Table 3-2b
Upper Shelf Energy for LaSalle Unit 2– 40 Year Life (32 EFPY)

Location	Heat	Initial Transverse USE (ft-lb)	Cu (%)	Fluence at Inner Diameter[1] ($x10^{19} n/cm^2$)	Thickness (inch)	Fluence at 1/4T ($x10^{19} n/cm^2$)	Decrease USE[2] (%)	32 EFPY TPO Transverse USE[3] (ft-lb)
Plates:								
Lower	C9425-1	66.3	0.12	0.1112	6.19	0.077	11	59
	C9425-2	61.1	0.12	0.1112	6.19	0.077	11	54
	C9434-2	59.2	0.09	0.1112	6.19	0.077	10	53
Lower-Intermediate	C9481-1	95.5	0.11	0.1112	6.19	0.077	11	84
	C9404-2	75.4	0.07	0.1112	6.19	0.077	10	67
	C9601-2	69.6	0.12	0.1112	6.19	0.077	11	61
Welds-Vertical:								
Lower	3P4000	99	0.02	0.1112	6.19	0.077	10	89
Lower-intermediate	3P4966	84	0.026	0.1112	6.19	0.077	10	75
Girth:								
Lower to Lower-Intermediate	5P6771	61	0.04	0.1112	6.19	0.077	10	54
Nozzles:								
LPCI[4]	Q2Q36W	66	0.22	0.0271	6.19	0.019	12	58
Water Level Instrumentation Nozzle[5]	C9481-1	95.5	0.11	0.0222	6.19	0.015	8	87
	C9404-2	75.4	0.07	0.0222	6.19	0.015	7	70
	C9601-2	69.6	0.12	0.0222	6.19	0.015	8	64
Integrated Surveillance Program[6]								
Plate	[[		]]	0.1112	6.19	0.077	10	53
Weld	[[		]]	0.1112	6.19	0.077	10	54

[1] For conservative result fluence = 0.1112E+19 is considered except for forgings.

[2] Values obtained from Figure 2 of RG 1.99 Rev 2 for 32 EFPY 1/4T fluence

[3] 32 EFPY Transverse USE = Initial Transverse USE * [1 - (% Decrease USE /100)]

[4] Ratio Peak/ Location = 0.244 for LPCI Nozzles

[5] Ratio Peak/ Location = 0.20 for Water Level Instrumentation Nozzles

[6] Assume core beltline and use the lowest initial USE value that bounds BWRVIP 135 data (plate = 95.3 ft-lb, weld = 107.7 ft-lb), (Reference 20).

Table 3-3a
Adjusted Reference Temperatures for LaSalle Unit 1 – 25 Year Life (20 EFPY)

Middle & Lower-Intermediate Plates and Welds 3-308, 4-308, 6-308 & 1-313

Thickness in inches = 6.125	Ratio Peak/ Location = 1.00	32 EFPY Peak I.D. fluence =	1.04E+18 n/cm^2
		32 EFPY Peak 1/4 T fluence =	7.20E+17 n/cm^2
		20 EFPY Peak 1/4 T fluence =	4.50E+17 n/cm^2

Lower Plate and Welds 2-307

Thickness in inches= 7.125	Ratio Peak/ Location = 0.44	32 EFPY Peak I.D. fluence =	4.58E+17 n/cm^2
Location = 229 7/8" Elevation		32 EFPY Peak 1/4 T fluence =	2.98E+17 n/cm^2
		20 EFPY Peak 1/4 T fluence =	1.87E+17 n/cm^2

LPCI Nozzle

Thickness in inches= 6.13	Ratio Peak/ Location = 0.244	32 EFPY Peak I.D. fluence =	2.54E+17 n/cm^2
Location = ~355" Elevation		32 EFPY Peak 1/4 T fluence =	1.76E+17 n/cm^2
		20 EFPY Peak 1/4 T fluence =	1.10E+17 n/cm^2

Water Level Instrumentation Nozzle

Thickness in inches= 6.13	Ratio Peak/ Location = 0.200	32 EFPY Peak I.D. fluence =	2.08E+17 n/cm^2
Location = ~364.375" Elevation		32 EFPY Peak 1/4 T fluence =	1.44E+17 n/cm^2
		20 EFPY Peak 1/4 T fluence =	9.0E+16 n/cm^2

COMPONENT	HEAT OR HEAT/LOT	%Cu	%Ni	CF[1]	Initial RT_{NDT} °F	1/4 T Fluence n/cm^2	20 EFPY ΔRT_{NDT} °F	s_I	s_D	Margin °F	20 EFPY Shift °F	20 EFPY ART °F
PLATES:												
Lower Shell Assy 307-04												
G-5603-1	C5978-1	0.110	0.580	74	14	1.87E+17	12	0	6	12	24	39
G-5603-2	C5978-2	0.110	0.590	74	23	1.87E+17	12	0	6	12	24	48
G-5603-3	C5979-1	0.120	0.660	84	10	1.87E+17	14	0	7	14	28	38
Lower-Intermediate Shell Assy 308-06												
G5604-1	C6345-1	0.150	0.490	104	-20	4.50E+17	29	0	14	29	57	38
G5604-2	C6318-1	0.120	0.510	81	-20	4.50E+17	22	0	11	22	45	25
G5604-3	C6345-2	0.150	0.510	105	-20	4.50E+17	29	0	15	29	58	39
Middle Shell Assy 308-05												
G5605-1	A5333-1	0.120	0.540	82	-10	4.50E+17	23	0	11	23	45	36
G5605-2	B0078-1	0.150	0.500	105	-10	4.50E+17	29	0	15	29	58	49
G5605-3	C6123-2	0.130	0.680	93	-10	4.50E+17	26	0	13	26	51	42

COMPONENT	HEAT OR HEAT/LOT	%Cu	%Ni	CF[1]	Initial RT_{NDT} °F	1/4 T Fluence n/cm^2	20 EFPY Δ RT_{NDT} °F	s_I	s_D	Margin °F	20 EFPY Shift °F	20 EFPY ART °F
WELDS:												
Middle												
3-308 A,B,C	305424/3889	0.273	0.629	189.5	-50	4.50E+17	52	0	26	52	105	55
	1P3571/3958	0.283	0.755	212	-30	4.50E+17	59	0	28	56	115	85
Lower-Intermediate												
4-308 A,B,C	305414/3947	0.337	0.609	209	-50	4.50E+17	58	0	28	56	114	64
	12008/3947	0.235	0.975	233	-50	4.50E+17	64	0	28	56	120	71
	305414& 12008 Tandem	0.286	0.792	219	-50	4.50E+17	61	0	28	56	117	67
Lower												
2-307 A,B,C	21935/3889	0.183	0.704	172	-50	1.87E+17	28	0	14	28	57	7
	12008/3889	0.235	0.975	233	-50	1.87E+17	38	0	19	38	77	27
	21935& 12008 tandem	0.213	0.867	209	-50	1.87E+17	34	0	17	34	69	19
Girth												
6-308	6329637	0.205	0.105	98	-50	4.50E+17	27	0	14	27	54	5
1-313	4P6519	0.131	0.060	64	-52	4.50E+17	18	0	9	18	35	-16
FORGINGS:												
LPCI Nozzle	Q2Q22W	0.100	0.820	67	10	1.10E+17	8	0	4	8	16	26
Water Level Instrumentation Nozzle[2]												
G5605-1	A5333-1	0.120	0.540	82	-10	9.00E+16	8	0	4	8	17	7
G5605-2	B0078-1	0.150	0.500	105	-10	9.00E+16	11	0	5	11	21	12
G5605-3	C6123-2	0.130	0.680	93	-10	9.00E+16	9	0	5	9	19	9
Integrated Surveillance Program[3]												
Plate	[[				]]	4.50E+17	27	0	13	27	54	77
Weld	[[				]]	4.50E+17	52	0	26	52	104	75

[1] Chemistry Factor (CF)

[2] Ratio Peak/ Location = 0.20, Thickness = 6.13 inch (Shell #3)

[3] Assume core beltline region with thickness = 6.13 inch

Table 3-3b
Adjusted Reference Temperatures for LaSalle Unit 1 – 40 Year Life (32 EFPY)

Middle & Lower-Intermediate Plates and Welds 3-308, 4-308, 6-308 & 1-313

Thickness in inches = 6.13	Ratio Peak/ Location = 1.00	32 EFPY Peak I.D. fluence =	1.04E+18 n/cm^2
		32 EFPY Peak 1/4 T fluence =	7.20E+17 n/cm^2
		32EFPY Peak 1/4 T fluence =	7.20E+17 n/cm^2

Lower Plate and Welds 2-307

Thickness in inches= 7.13	Ratio Peak/ Location = 0.44	32 EFPY Peak I.D. fluence =	4.58E+17 n/cm^2
Location = 229 7/8" Elevation		32 EFPY Peak 1/4 T fluence =	2.98E+17 n/cm^2
		32 EFPY Peak 1/4 T fluence =	2.98E+17 n/cm^2

LPCI Nozzle

Thickness in inches= 6.13	Ratio Peak/ Location = 0.244	32 EFPY Peak I.D. fluence =	2.54E+17 n/cm^2
Location = ~355" Elevation		32 EFPY Peak 1/4 T fluence =	1.76E+17 n/cm^2
		32 EFPY Peak 1/4 T fluence =	1.76E+17 n/cm^2

Water Level Instrumentation Nozzle

Thickness in inches= 6.13	Ratio Peak/ Location = 0.200	32 EFPY Peak I.D. fluence =	2.08E+17 n/cm^2
Location = ~364.375" Elevation		32 EFPY Peak 1/4 T fluence =	1.44E+17 n/cm^2
		32 EFPY Peak 1/4 T fluence =	1.44E+17 n/cm^2

COMPONENT	HEAT OR HEAT/LOT	%Cu	%Ni	CF	Initial RT_{NDT} °F	1/4 T Fluence n/cm^2	32 EFPY Δ RT_{NDT} °F	s_I	s_D	Margin °F	32 EFPY Shift °F	32 EFPY ART °F
PLATES:												
Lower Shell Assy 307-04												
G-5603-1	C5978-1	0.110	0.580	74	14	2.98E+17	16	0	8	16	32	47
G-5603-2	C5978-2	0.110	0.590	74	23	2.98E+17	16	0	8	16	32	56
G-5603-3	C5979-1	0.120	0.660	84	10	2.98E+17	18	0	9	18	37	47
Lower-Intermediate Shell Assy 308-06												
G5604-1	C6345-1	0.150	0.490	104	-20	7.20E+17	37	0	17	34	71	51
G5604-2	C6318-1	0.120	0.510	81	-20	7.20E+17	29	0	14	29	57	38
G5604-3	C6345-2	0.150	0.510	105	-20	7.20E+17	37	0	17	34	71	52
Middle Shell Assy 308-05												
G5605-1	A5333-1	0.120	0.540	82	-10	7.20E+17	29	0	15	29	58	49
G5605-2	B0078-1	0.150	0.500	105	-10	7.20E+17	37	0	17	34	71	62
G5605-3	C6123-2	0.130	0.680	93	-10	7.20E+17	33	0	16	33	66	56

COMPONENT	HEAT OR HEAT/LOT	%Cu	%Ni	CF	Initial RT_{NDT} °F	1/4 T Fluence n/cm^2	32 EFPY Δ RT_{NDT} °F	s_I	s_D	Margin °F	32 EFPY Shift °F	32 EFPY ART °F
WELDS:												
Middle												
3-308 A,B,C	305424/3889	0.273	0.629	189.5	-50	7.20E+17	67	0	28	56	123	74
	1P3571/3958	0.283	0.755	212	-30	7.20E+17	75	0	28	56	131	102
Lower-Intermediate												
4-308 A,B,C	305414/3947	0.337	0.609	209	-50	7.20E+17	74	0	28	56	130	81
	12008/3947	0.235	0.975	233	-50	7.20E+17	83	0	28	56	139	89
	305414 & 12008 Tandem	0.286	0.792	219	-50	7.20E+17	78	0	28	56	134	84
Lower												
2-307 A,B,C	21935/3889	0.183	0.704	172	-50	2.98E+17	38	0	19	38	75	26
	12008/3889	0.235	0.975	233	-50	2.98E+17	51	0	26	51	102	53
	21935 & 12008 tandem	0.213	0.867	209	-50	2.98E+17	46	0	23	46	92	42
Girth												
6-308	6329637	0.205	0.105	98	-50	7.20E+17	35	0	17	35	69	20
1-313	4P6519	0.131	0.060	64	-52	7.20E+17	23	0	11	23	45	-6
FORGINGS:												
LPCI Nozzle	Q2Q22W	0.100	0.820	67	10	1.76E+17	11	0	5	11	21	32
Water Level Instrumentation Nozzle[1]												
G5605-1	A5333-1	0.120	0.540	82	-10	1.44E+17	11	0	6	11	23	13
G5605-2	B0078-1	0.150	0.500	105	-10	1.44E+17	15	0	7	15	29	20
G5605-3	C6123-2	0.130	0.680	93	-10	1.44E+17	13	0	6	13	26	16
Integrated Surveillance Program[2]												
Plate	[[				]]	7.20E+17	34	0	17	34	68	92
Weld	[[				]]	7.20E+17	67	0	28	56	123	93

[1] Ratio Peak/ Location = 0.20, Thickness = 6.13 inch (Shell #3)

[2] Assume core beltline region with thickness = 6.13 inch

Table 3-4a
Adjusted Reference Temperatures for LaSalle Unit 2 – 25 Year Life (20 EFPY)

Lower-Intermediate Plates and Welds BD, BE, BF

Thickness in inches = 6.19	Ratio Peak/ Location = 1.00	32 EFPY Peak I.D. fluence =	1.11E+18 n/cm^2
		32 EFPY Peak 1/4 T fluence =	7.67E+17 n/cm^2
		20EFPY Peak 1/4 T fluence =	4.79E+17 n/cm^2

Lower Plates and Welds BA, BB, BC, Girth Weld AB

Thickness in inches= 6.19	Ratio Peak/ Location = 0.88	32 EFPY Peak I.D. fluence =	9.78E+17 n/cm^2
Elevation ~227"		32 EFPY Peak 1/4 T fluence =	6.75E+17 n/cm^2
		20 EFPY Peak 1/4 T fluence =	4.22E+17 n/cm^2

LPCI Nozzle

Thickness in inches= 6.19	Ratio Peak/ Location = 0.244	32 EFPY Peak I.D. fluence =	2.71E+17 n/cm^2
Elevation ~355"		32 EFPY Peak 1/4 T fluence =	1.87E+17 n/cm^2
		20EFPY Peak 1/4 T fluence =	1.17E+17 n/cm^2

Water Level Instrumentation Nozzle

Thickness in inches= 6.19	Ratio Peak/ Location = 0.200	32 EFPY Peak I.D. fluence =	2.22E+17 n/cm^2
Elevation ~364.24"		32 EFPY Peak 1/4 T fluence =	1.53E+17 n/cm^2
		20 EFPY Peak 1/4 T fluence =	9.59E+16 n/cm^2

COMPONENT	HEAT OR HEAT/LOT	%Cu	%Ni	CF	Initial RT_{NDT} °F	1/4 T Fluence n/cm^2	20 EFPY Δ RT_{NDT} °F	σ_I	σ_D	Margin °F	20 EFPY Shift °F	20 EFPY ART °F
PLATES:												
Lower Shell												
21-1	C9425-2	0.120	0.510	81	30	4.22E+17	22	0	11	22	43	74
21-2	C9425-1	0.120	0.510	81	32	4.22E+17	22	0	11	22	43	76
21-3	C9434-2	0.090	0.510	58	10	4.22E+17	15	0	8	15	31	41
Lower-Intermediate Shell												
22-1	C9481-1	0.110	0.500	73	10	4.79E+17	21	0	10	21	42	52
22-2	C9404-2	0.070	0.490	44	52	4.79E+17	13	0	6	13	25	78
22-3	C9601-2	0.120	0.500	81	10	4.79E+17	23	0	12	23	46	57

COMPONENT	HEAT OR HEAT/LOT	%Cu	%Ni	CF	Initial RT_{NDT} °F	1/4 T Fluence n/cm^2	20 EFPY ΔRT_{NDT} °F	s_I	s_D	Margin °F	20 EFPY Shift °F	20 EFPY ART °F
WELDS:												
Lower Vertical												
BA, BB, BC	3P4000 / 3933	0.020	0.930	27	-50	4.22E+17	7	0	4	7	14	-35
Lower-Intermediate Vertical												
BD, BE, BF	3P4966 / 1214	0.026	0.920	41	-6	4.79E+17	12	0	6	12	23	18
Girth												
AB	5P6771 / 0342	0.040	0.940	54	-34	4.22E+17	14	0	7	14	29	-5
FORGINGS:												
LPCI	Q2Q36W	0.220	0.830	177	-6	1.17E+17	22	0	11	22	43	38
Water Level Instrumentation Nozzle[1]												
22-1	C9481-1	0.110	0.500	73	10	9.59E+16	8	0	4	8	16	26
22-2	C9404-2	0.070	0.490	44	52	9.59E+16	5	0	2	5	9	62
22-3	C9601-2	0.120	0.500	81	10	9.59E+16	9	0	4	9	17	28
Integrated Surveillance Program[2]												
Plate	[[				]]	4.79E+17	15	0	7	15	29	82
Weld	[[				]]	4.79E+17	8	0	4	8	15	10

[1] Ratio Peak/ Location = 0.20, Thickness = 6.19 inch (Shell #2)

[2] Assume core beltline region with thickness = 6.19 inch.

Table 3-4b
Adjusted Reference Temperatures for LaSalle Unit 2 – 40 Year Life (32 EFPY)

Lower-Intermediate Plates and Welds BD, BE, BF

Thickness in inches = 6.19	Ratio Peak/ Location = 1.00	32 EFPY Peak I.D. fluence =	1.11E+18 n/cm^2
		32 EFPY Peak 1/4 T fluence =	7.67E+17 n/cm^2
		32EFPY Peak 1/4 T fluence =	4.79E+17 n/cm^2

Lower Plates and Welds BA, BB, BC, Girth Weld AB

Thickness in inches= 6.19	Ratio Peak/ Location = 0.88	32 EFPY Peak I.D. fluence =	9.78E+17 n/cm^2
Elevation ~227"		32 EFPY Peak 1/4 T fluence =	6.75E+17 n/cm^2
		32 EFPY Peak 1/4 T fluence =	6.75E+17 n/cm^2

LPCI Nozzle

Thickness in inches= 6.19	Ratio Peak/ Location = 0.244	32 EFPY Peak I.D. fluence =	2.71E+17 n/cm^2
Elevation ~355"		32 EFPY Peak 1/4 T fluence =	1.87E+17 n/cm^2
		32EFPY Peak 1/4 T fluence =	1.87E+17 n/cm^2

Water Level Instrumentation Nozzle

Thickness in inches= 6.19	Ratio Peak/ Location = 0.200	32 EFPY Peak I.D. fluence =	2.22E+17 n/cm^2
Elevation ~364.24"		32 EFPY Peak 1/4 T fluence =	1.53E+17 n/cm^2
		32 EFPY Peak 1/4 T fluence =	1.53E+16 n/cm^2

COMPONENT	HEAT OR HEAT/LOT	%Cu	%Ni	CF	Initial RT_{NDT} °F	1/4 T Fluence n/cm^2	32 EFPY Δ RT_{NDT} °F	s_I	s_D	Margin °F	32 EFPY Shift °F	32 EFPY ART °F
PLATES:												
Lower Shell												
21-1	C9425-2	0.120	0.510	81	30	6.75E+17	28	0	14	28	56	86
21-2	C9425-1	0.120	0.510	81	32	6.75E+17	28	0	14	28	56	88
21-3	C9434-2	0.090	0.510	58	10	6.75E+17	20	0	10	20	40	50
Lower-Intermediate Shell												
22-1	C9481-1	0.110	0.500	73	10	7.67E+17	27	0	13	27	53	64
22-2	C9404-2	0.070	0.490	44	52	7.67E+17	16	0	8	16	32	85
22-3	C9601-2	0.120	0.500	81	10	7.67E+17	30	0	15	30	59	70

COMPONENT	HEAT OR HEAT/LOT	%Cu	%Ni	CF	Initial RT_{NDT} °F	1/4 T Fluence n/cm^2	32 EFPY Δ RT_{NDT} °F	s_I	s_D	Margin °F	32 EFPY Shift °F	32 EFPY ART °F
WELDS:												
Lower Vertical												
BA, BB, BC	3P4000 / 3933	0.020	0.930	27	-50	6.75E+17	9	0	5	9	19	-31
Lower-Intermediate Vertical												
BD, BE, BF	3P4966 / 1214	0.026	0.920	41	-6	7.67E+17	15	0	8	15	30	25
Girth												
AB	5P6771 / 0342	0.040	0.940	54	-34	6.75E+17	19	0	9	19	37	4
FORGINGS:												
LPCI	Q2Q36W	0.220	0.830	177	-6	1.87E+17	29	0	15	29	58	53
Water Level Instrumentation Nozzle[1]												
22-1	C9481-1	0.110	0.500	73	10	1.53E+17	11	0	5	11	21	32
22-2	C9404-2	0.070	0.490	44	52	1.53E+17	6	0	3	6	13	65
22-3	C9601-2	0.120	0.500	81	10	1.53E+17	12	0	6	12	24	34
Integrated Surveillance Program[2]												
Plate	[[				]]	7.67E+17	19	0	9	19	37	90
Weld	[[				]]	7.67E+17	10	0	5	10	20	14

[1] Ratio Peak/ Location = 0.20, Thickness = 6.19 inch (Shell #2)

[2] Assume core beltline region with thickness = 6.19 inch.

Table 3-5
TPO 32 EFPY Effects of Irradiation on RPV Circumferential Weld Properties

Parameter Description	**Unit 1 Parameters at 32 EFPY**	**Unit 2 Parameters at 32 EFPY**	**NRC Limiting Plant Specific Analysis at 32 EFPY**	
	CE[1] RPV	CB&I[2] RPV	CE RPV	CB&I RPV
Copper, wt. %	0.205	0.04	0.183	0.10
Nickel, wt. %	0.105	0.94	0.704	0.99
Chemistry Factor (CF)	98	54	172.2	134.9
End of Life Inside Diameter Fluence, x 10^{19} n/cm^2 (f)	0.104	0.1112	0.20	0.51
Initial (unirradiated) Reference Temperature $RT_{NDT(U)}$, °F	-50	-34	0	-65
Increase in Reference Temperature ΔRT_{NDT}, °F	41.7	23.7	98.1	109.5
Mean (irradiated) Reference Temperature $RT_{NDT(U)} + \Delta RT_{NDT}$, °F	-8.3	-10.3	98.1	44.5

[1] CE - Combustion Engineering (manufacturer of LaSalle Unit 1 RPV)
[2] CB&I - Chicago Bridge & Iron (manufacturer of LaSalle Unit 2 RPV)

Table 3-6
CUF and P+Q Stress Range of Limiting Components

	P + Q Stress (ksi)			CUF[5]		
Component[1, 6]	**Current (3489 MWt)**	**TPO (3559MWt)[3]**	**Allowable (ASME Code Limit)**	**Current (3489 MWt)**	**TPO (3559 MWt)[3,4]**	**Allowable (ASME Code Limit)**
FW Nozzle [7]	69.2/ 16.0[2]	69.2/ 16.0[2,6]	50.7	0.915	0.915 [6]	1.0

Notes:

1. There are no changes in operating conditions from CLTP to TPO. Therefore, the CLTP evaluation remains applicable for TPO. The FW nozzle is presented in this table, consistent with the approach for the previous stretch power uprate to demonstrate that the results remain unchanged from CLTP to TPO.
2. Thermal bending included/Thermal bending removed. P + Q stresses are acceptable per CLTP elastic-plastic analysis, which is valid for TPO conditions.
3. [[

   ]]
4. Only the limiting CUF and P+Q are presented.
5. Fatigue usage factors are for a 40-year license.
6. CLTP and TPO were [[ ]] Therefore, there is no change in values from CLTP to TPO.
7. Considering Normal Operating Conditions (i.e., does not consider FFWTR or Feedwater Heaters(s) Out-of-Service (FWHOOS)).

Table 3-7
Governing Stress Results for RPV Internal Components

Item	Component	Service Level	Stress/ Load Category	Unit	CLTP	TPO	Allowable
1	Shroud Support	U	Pm	ksi	17.35	17.57	23.30
			Pm+Pb	ksi	31.52	31.93	35.00
		F	Pm	ksi	24.98	24.98	28.10
			Pm+Pb	ksi	37.79	37.79	42.19
2	Shroud	U	Pm+Pb	ksi	19.79	19.79	21.45
		F	Pm+Pb	ksi	24.88	24.88	42.90
3	Core Plate	U	Pm+Pb	ksi	20.78	20.88	25.35
		E	Pm+Pb	ksi	18.53	18.62	38.03
		F	Pm+Pb	ksi	32.52	32.68	50.70
		U	Beam Buckling	Lb/ bundle	359	361	366
4	Top Guide	U	Pm+Pb	ksi	24.3	24.3	25.35
		F	Pm+Pb	ksi	46.2	46.2	50.70
5	Control Rod Drive Housing (CRDH)	U	Pm+Pb	ksi	6.17	6.17	25.70
		F	Pm+Pb	ksi	10.21	10.21	47.70
6	Control Rod Guide Tube (CRGT)	U	Buckling	P/P_c	NC	0.16	0.4
		F	Buckling	P/P_c	NC	0.50	0.8
		U	Buckling	p/p_c	NC	0.24	0.4
		F	Buckling	p/p_c	NC	0.25	0.8
7	Orificed Fuel Support (OFS)	U	Vertical Load	lb	NC	6800	49632

Item	Component	Service Level	Stress/ Load Category	Unit	CLTP	TPO	Allowable
		F	Vertical Load	lb	NC	20454	90240
		U	Horizon. Load	lb	NC	1625	4495
		F	Horizon. Load	lb	NC	2447	8172
8	Feedwater (FW) Sparger	Fatigue, CUF for 40 year life			NC	0.88	1
9(a)	Jet Pump - Riser Elbow	U	Pm+Pb	ksi	9.22	9.22	25.35
		E	Pm+Pb	ksi	9.42	9.42	38.03
		F	Pm+Pb	ksi	29.69	29.69	60.84
9(b)	Jet Pump - Diffuser	F	Pm+Pb	ksi	49.5	49.5	60.84
9(c)	Jet Pump – Riser Brace	U	Pm+Pb+Q	ksi	NC	21.60	50.70
		E	Pm+Pb	ksi	NC	13.22	38.03
		F	Pm+Pb	ksi	NC	50.49	60.84
10	Core Spray Line & Sparger (CSL&S)	Loads are unaffected by TPO. The component is qualified for TPO.					
11	Access Hole Cover (AHC)	Bounded by original design base loads. The component is qualified for TPO.					
12	Shroud Head Bolts	U	Pm	ksi	NC	18.29	23.30
		F	Pm	ksi	NC	47.35	55.92
13	In-core housing and Guide Tube (ICH&GT)	Loads are unaffected by TPO. The component is qualified for TPO.					
14	Vessel Head Cooling Spray Nozzle (VHCSN)	Loads are unaffected by TPO. The component is qualified for TPO.					
15	Core DP & Liquid Control Line (Core DP & LCL)	Loads are unaffected by TPO. The component is qualified for TPO.					
16	LPCI Coupling	Bounded by original design basis loads. The component is qualified for TPO.					

Notes:

1) U - upset condition, E - emergency condition, F - faulted condition, NC – not calculated.
2) Normal load cases are bounded by upset load cases.

Table 3-8
Piping Lines Recommended for FAC Review

Line Name	Comment
CD01AA 24 – CD01AD 24	These lines are predicted to exceed recommended flow velocity guidelines under TPO conditions. Flow velocities that exceed these guidelines are acceptable, provided the FAC program is updated to ensure adequate inspection frequencies. The station FAC program will be updated to include the effects of TPO conditions.
CB01BA 16 - CB01BD 16	
CB01CA 16 -CB01CC 16	
CB02AA 16 -CB02AC 16	
CB03AA 16 -CB03AC 16	
CB04AA 16 -CB04AC 16	
CB06B 36	
FW01EA 24 - FW01EB 24	
FW02DA 18 - FW02DB 18	
HD14AA 16 – HD14AD 16	
ES06B20	
ES08AA 20 - ES08AD 20 ES12AA 20 - ES12AD 20 ES02AA 20 - ES02AD 20	
MS32A 36	

4 ENGINEERED SAFETY FEATURES

4.1 CONTAINMENT SYSTEM PERFORMANCE

TLTR Appendix G presents the methods, approach, and scope for the TPO uprate containment evaluation for LOCA. The current containment evaluations were performed at 102% of CLTP. Although the nominal operating conditions change slightly because of the TPO uprate, the required initial conditions for containment analysis inputs remain the same as previously documented.

The following table summarizes the effect of the TPO uprate on various aspects of the containment system performance.

Topic	Key Parameters	TPO Effect
Short Term Pressure and Temperature Response		Current Analysis Based on 102% of CLTP
Gas Temperature	Break Flow and Energy	
Pressure	Break Flow and Energy	
Long-Term Suppression Pool Temperature Response		
Bulk Pool	Decay Heat	
Local Temperature with SRV Discharge	Decay Heat	
Containment Dynamic Loads		
Loss-of-Coolant Accident Loads	Break Flow and Energy	
Safety-Relief Valve Loads	Decay Heat	
Sub compartment Pressurization	Break Flow and Energy	
Containment Isolation Section 4.1.1 provides confirmation that Motor Operated Valves (MOVs) are capable of performing design basis functions at TPO conditions.		The ability of containment isolation valves and operators to perform their required functions is not affected because the evaluations have either been performed at 102% of CLTP, or the existing analyses or equipment settings remain bounding.

4.1.1 Generic Letter 89-10 Program

The motor-operated valve (MOV) requirements in the UFSAR were reviewed and no changes to the functional requirements of the GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," MOVs, are identified as a result of operating at the TPO RTP level. MOV calculations and associated equipment settings were reviewed to ensure that existing analyses or equipment settings remain bounding. Therefore, the GL 89-10 MOVs remain capable of performing their design basis function(s).

4.1.2 Generic Letter 95-07 Program

The commitments relating to GL 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," have been reviewed and no changes are identified as a result of operating at the TPO RTP level. Valves in the RHR, RCIC, HPCS, and LPCS were included in the evaluation. There is no change in the environmental conditions at which the valves are required to operate. The process parameters for these systems do not change as a result of the TPO uprate. Therefore, the valves remain capable of performing their design basis functions.

4.1.3 Generic Letter 96-06

The LaSalle evaluation of GL 96-06, "Assurance of Equipment Operability and Containment Integrity during Design-Basis Accident Conditions," performed for a previous uprate was reviewed for the TPO uprate. The containment temperature profile used in the previous evaluation remains bounding for TPO and there is no change in the effects of postulated main steam line breaks. Therefore, the LaSalle response to GL 96-06 remains valid under TPO uprate conditions.

4.1.4 Containment Coatings

The Service Level 1 coatings in primary containment are qualified such that they do not fail when exposed to the existing maximum post-accident primary containment operating conditions of 340°F, 45 psig, 100% relative humidity, and 2×10^8 rad total integrated dose. These post-accident conditions bound those, which are expected after implementation of TPO. Therefore, the containment coatings remain qualified at the design basis accident temperature and pressure at TPO conditions.

4.2 EMERGENCY CORE COOLING SYSTEMS

4.2.1 High Pressure Coolant Injection

The High Pressure Coolant Injection (HPCI) is not applicable to LaSalle.

4.2.2 High Pressure Core Spray

The HPCS is a motor driven high-pressure injection system designed to pump water into the reactor vessel over a wide range of operating pressures. The primary purpose of the HPCS is to maintain reactor vessel coolant inventory in the event of a small break LOCA that does not immediately depressurize the reactor vessel. The generic evaluation of the HPCS system provided in TLTR Section 5.6.7 is applicable to LaSalle. The ability of the HPCS system to perform required safety functions is demonstrated with previous analyses based on 102% of CLTP. Therefore, all safety aspects of the HPCS system are within previous evaluations and the requirements are unchanged for TPO uprate conditions.

4.2.3 Low Pressure Core Spray

The Low Pressure Core Spray (LPCS) system sprays water into the reactor vessel after it is depressurized. The primary purpose of the LPCS system is to provide reactor vessel coolant makeup for a large break LOCA and for any small break LOCA after the RPV has depressurized. It also provides spray cooling for long-term core cooling in the event of a LOCA. The generic evaluation of the LPCS system provided in TLTR Section 5.6.10 is applicable to LaSalle. The ability of the LPCS system to perform required safety functions is demonstrated with previous analyses based on 102% of CLTP. Therefore, all safety aspects of the LPCS system are within previous evaluations and the requirements are unchanged for the TPO uprate conditions.

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 vessel coolant makeup during a large break LOCA or small break LOCA after the RPV has depressurized. The generic evaluation of the LPCI mode provided in TLTR Section 5.6.4 is applicable to LaSalle. The ability of the RHR system to perform required safety functions required by the LPCI mode is demonstrated with previous analyses based on 102% of CLTP. Therefore, all safety aspects of the RHR system LPCI mode are within previous evaluations and the requirements are unchanged for the TPO uprate conditions.

4.2.5 Automatic Depressurization System

The Automatic Depressurization System (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 RPV. The ADS initiation logic and valve control is not affected by the TPO uprate. The generic evaluation of the ADS provided in TLTR Section 5.6.8 is applicable to LaSalle. The ability of the ADS system to perform required safety functions is demonstrated with previous analyses based on 102% of CLTP. Therefore, all safety aspects of the ADS are within previous evaluations and the requirements are unchanged for the TPO uprate conditions.

4.2.6 ECCS Net Positive Suction Head

The most limiting case for NPSH typically occurs at the peak long-term suppression pool temperature. The generic evaluation of the containment provided in TLTR Appendix G is applicable to LaSalle. The CLTP containment analyses were based on 102% of CLTP, and there is no change in the available NPSH for systems using suppression pool water. Therefore, the TPO uprate does not affect compliance to the ECCS pump NPSH requirements.

4.3 EMERGENCY CORE COOLING SYSTEM PERFORMANCE

The ECCS is designed to provide protection against a postulated LOCA caused by a rupture in the primary system piping. The current 10 CFR 50.46, or LOCA, analyses for the LaSalle plant have been performed at or above 102% of CLTP, consistent with Appendix K. Table 4-1 shows the results of the LaSalle ECCS-LOCA analysis using the Reference 21 methodology. Therefore, the CLTP LOCA analyses for the ATRIUM-10 fuel and ATRIUM-10XM LTAs remain applicable for the TPO uprate for LaSalle.

4.4 MAIN CONTROL ROOM ATMOSPHERE CONTROL SYSTEM

The Main Control Room atmosphere is not affected by the TPO uprate. Control Room habitability following a postulated accident at TPO conditions is unchanged because the Main Control Room Atmosphere Control System has previously been evaluated for radiation release accident conditions at 102% of CLTP. Therefore, the system remains capable of performing its safety function at the TPO conditions.

4.5 STANDBY GAS TREATMENT SYSTEM

The Standby Gas Treatment System (SGTS) minimizes the offsite and control room dose rates during venting and purging of the containment atmosphere under abnormal conditions. The current capacity of the SGTS was selected to maintain the secondary containment at a slightly negative pressure during such conditions. This capability is not changed by the TPO uprate conditions. The SGTS can accommodate design basis accident (DBA) conditions at 102% of CLTP. Therefore, the system remains capable of performing its safety function for the TPO uprate conditions.

4.6 MAIN STEAM ISOLATION VALVE LEAKAGE CONTROL SYSTEM

The MSIV Isolation Condenser Leakage Treatment Method (ICLTM), also called the MSIV Alternate Treatments Leakage Paths, replaced the MSIV – Leakage Control System (MSIV-LCS). The MSIV-LCS has been removed from Unit 2 and abandoned in place in Unit 1. The MSIV leakage rate is unchanged because the system was previously evaluated for accident conditions > 102% of CLTP. Therefore, the system remains acceptable for operation at TPO uprate conditions.

4.7 POST-LOCA COMBUSTIBLE GAS CONTROL SYSTEM

The original licensing basis of the Combustible Gas Control System (CGCS) was to maintain the post-LOCA concentration of oxygen or hydrogen in the containment atmosphere below the flammability limit. The generic evaluation of the CGCS provided in TLTR Sections J.2.3.10, and discussed in the NRC Safety Evaluation Section 5.12.3, is no longer applicable to LaSalle as the hydrogen combining function of the system has been eliminated and abandoned in place. This was in accordance with License Amendments 172 (Unit 1) and 158 (Unit 2). The blower and associated piping have not been abandoned and remain operational to maintain the drywell mixing function. Therefore, the current evaluation is valid for the TPO uprate.

Table 4-1
LaSalle LOCA-ECCS Analysis Results

Parameter	ATRIUM-10	ATRIUM-10XM LTAs	Analysis Limit
Licensing Basis Peak Clad Temperature (PCT)	1729°F	1608°F	≤2200°F*
Maximum Local Oxidation	<0.50%	<0.30%	≤17%*
Core-Wide Metal-Water Reaction	<0.16%	<0.16%	≤1.0%*

* 10 CFR 50.46 LOCA-ECCS Analysis Acceptance Criteria

5 INSTRUMENTATION AND CONTROL

5.1 NSSS MONITORING AND CONTROL

The instruments and controls that directly interact with or control the reactor are usually considered within the NSSS. The NSSS process variables and instrument setpoints that could be affected by the TPO uprate were evaluated.

5.1.1 Neutron Monitoring System

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

The Average Power Range Monitors (APRMs) are re-calibrated to indicate 100% at the TPO RTP level of 3,546 MWt. The APRM high flux scram and the upper limit of the rod block setpoints, expressed in units of percent of licensed power, are not changed. The flow-biased APRM trips, expressed in units of absolute thermal power (i.e., MWt), remain the same. However, in order to accommodate limits in the Stability Region, new flow-biased APRM Analytical Limits (ALs) were established that conservatively bound the entire operating envelope. This approach for the LaSalle TPO uprate follows the guidelines of TLTR Section 5.6.1 and Appendix F, which is consistent with the practice approved for GEH BWR uprates in ELTR1 (Reference 2).

For the TPO uprate, no adjustment is needed to ensure the Intermediate Range Monitors (IRMs) have adequate overlap with the Source Range Monitors (SRMs) and APRMs. However, normal plant surveillance procedures may be used to adjust the IRMs, the overlap with the SRMs and the APRMs. The IRM channels have sufficient margin to the upscale scram trip on the highest range when the APRM channels are reading near their downscale alarm trip because the change in APRM scaling is so small for the TPO uprate.

5.1.1.2 Local Power Range Monitors and Traversing In Core Probes

At the TPO RTP level, the flux at some Local Power Range Monitors (LPRMs) increases. However, the small change in the power level is not a significant factor to the neutronic service life of the LPRM detectors and radiation level of the traversing in core probes (TIPs). It does not change the number of cycles in the lifetime of any of the detectors. The LPRM accuracy at the increased flux is within specified limits, and the LPRMs are designed as replaceable components. The TIPs are stored in shielded rooms. The radiation protection program for normal plant operation can accommodate a small increase in radiation levels.

5.1.1.3 Rod Block Monitor

The Rod Block Monitor (RBM) instrumentation is referenced to an APRM channel. Because the APRM has been rescaled, there is only a small effect on the RBM performance due to the LPRM performance at the higher average local flux. The RBM instrumentation is not significantly affected by the TPO uprate conditions, and no change is needed.

5.1.2 Rod Worth Minimizer

The Rod Worth Minimizer (RWM) does not perform a safety-related function. The function of the RWM is to support the operator by enforcing rod patterns until reactor power has reached appropriate levels. The power-dependent setpoints for the RWM are included in Section 5.3.8.

5.2 BOP MONITORING AND CONTROL

Operation of the plant at the TPO RTP level has minimal effect on the BOP system instrumentation and control devices. The improved FW flow measurement, which is the basis for the reduction in power uncertainty, is addressed in Section 1.4. All of the control systems have sufficient range/adjustment capability for use at the TPO uprate conditions. Some BOP Instrumentation will require recalibration and/or replacement to maintain acceptable calibration range margin. No safety-related BOP system setpoint changes are required as a result of the TPO uprate. The plant-specific instrumentation and control design and operating conditions are bounded by those used in the evaluations contained in the TLTR.

5.2.1 Pressure Control System

The Pressure Control System (PCS) provides a fast and stable response to steam flow changes so that reactor pressure is controlled within allowable values. The PCS consists of the pressure regulation system, turbine control valve system and steam bypass valve system. The main turbine speed/load control function is performed by the main turbine-generator Electro-hydraulic Control (EHC) system. The steam bypass valve pressure control function is performed by the Turbine Bypass Control System (TBCS).

Satisfactory reactor pressure control by the pressure regulator and the turbine control valves (TCVs) requires an adequate flow margin between the TPO RTP operating condition and the steam flow capability of the TCVs at their maximum stroke (i.e., valves wide open (VWO)). LaSalle will modify or replace the first stage nozzle plate on the main turbine in order to maintain adequate flow margin at TPO conditions. The existing electronic controls as designed for the current 100% of CLTP conditions are adequate and require no electronic component changes for the TPO uprate conditions.

No modification is required to the steam bypass valves. No modifications are required to the operator interface indications, controls or alarm annunciators provided in the main control room. The required adjustments are limited to “tuning” of the control settings that may be required to operate optimally at the TPO uprate power level.

PCS tests, consistent with the guidelines in TLTR Appendix L, will be performed during the power ascension phase.

5.2.2 EHC Turbine Control System

The turbine EHC system was reviewed for the increase in core thermal power and associated ~2% increase in rated steam flow. The control system is expected to perform normally for TPO RTP operation. Normal operator controls are used in conjunction with the associated operating procedures. Confirmation testing will be performed during power ascension (Section 10.4)

5.2.3 Feedwater Control System

An evaluation of the ability of the FW/level control system, FW control valves, and/or FW turbine controls to maintain adequate water level control at the TPO uprate conditions has been performed. The ~2% increase in FW flow associated with TPO uprate is within the current control margin of these systems. No changes in the operating reactor water level or reactor water level trip set points are required for the TPO uprate. Per the guidelines of TLTR Appendix L, the performance of the FW/level control systems will be recorded at 95% and 100% of CLTP and confirmed at the TPO power during power ascension. These checks will demonstrate acceptable operational capability and will utilize the methods and criteria described in the original startup testing of these systems.

5.2.4 Leak Detection System

The setpoints associated with leak detection have been evaluated with respect to the ~2% higher steam flow and ~2°F increase in FW temperature for the TPO uprate. Each of the systems, where leak detection potentially could be affected, is addressed below.

Main Steam Tunnel Temperature Based Leak Detection

The ~2°F increase in FW temperature for the TPO uprate decreases the leak detection trip avoidance margin. As described in TLTR Section F.4.2.8, the high steam tunnel temperature setpoint remain unchanged.

RWCU System Temperature Based Leak Detection

There is no significant effect on RWCU system temperature or pressure due to the TPO uprate. Therefore, there is no effect on the RWCU system temperature based leak detection.

RCIC System Temperature Based Leak Detection

The TPO uprate does not increase the nominal vessel dome pressure or temperature. Therefore, there is no change to the RCIC system temperature or pressure, and thus, the RCIC temperature based leak detection system is not affected.

Non-Temperature Based Leak Detection

The non-temperature based leak detection systems are not affected by the TPO uprate.

5.3 TECHNICAL SPECIFICATION INSTRUMENT SETPOINTS

The determination of instrument setpoints is based on plant operating experience, conservative licensing analyses or limiting design/operating values. Standard GEH setpoint methodologies (References 19 and 22) are used to generate the allowable values (AV) and nominal trip setpoints (NTSP) related to any analytical limits (AL) change, as applicable. Each actual trip setting is established to preclude inadvertent initiation of the protective action, while assuring adequate allowances for instrument accuracy, calibration, drift and applicable normal and accident design basis events.

Table 5-1 lists the ALs that change based on results from the TPO evaluations and safety analyses. In general, if the AL does not change in the units shown in the Technical Specifications, then no change in its associated plant AV and NTSP is required, as shown in the Technical Specifications. Changes in the setpoint margins due to changes in instrument accuracy and calibration errors caused by the change in environmental conditions around the instrument due to the TPO uprate are negligible. Maintaining constant nominal dome pressure for the TPO uprate minimizes the potential effect on these instruments by maintaining the same fluid properties at the instruments. The setpoint evaluations are based on the guidelines in TLTR Sections 5.8 and F.4 and on Section 5.3 of Reference 19.

5.3.1 High-Pressure Scram

The high-pressure scram terminates a pressure increase transient not terminated by direct or high flux scram. Because there is no increase in nominal reactor operating pressure with the TPO uprate, the scram AL on reactor high pressure is unchanged.

5.3.2 Hydraulic Pressure Scram

The AL for the turbine hydraulic pressure that initiates the Turbine-Generator (T/G) trip scram at high power remains the same as for the CLTP. No modifications are being made to the turbine hydraulic control systems for TPO; actuation of these safety functions remains unchanged from the current operation.

5.3.3 High-Pressure Recirculation Pump Trip

The anticipated transient without scram recirculation pump trip (ATWS-RPT) trips the pumps during plant transients with increases in reactor vessel dome pressure. The ATWS-RPT provides negative reactivity by reducing core flow during the initial part of an ATWS. The evaluation in Section 9.3.1 demonstrates that the current high pressure ATWS-RPT AL is acceptable for the TPO uprate.

5.3.4 Safety Relief Valve

Because there is no increase in reactor operating dome pressure, the SRV ALs are not changed.

5.3.5 Main Steam Line High Flow Isolation

The AL for this function is expressed in terms of percent steam flow rate. The corresponding differential pressure, and therefore absolute steam flow rate is not changed. Therefore this AL is decreased for the TPO uprate. Although the MS flow increases by ~2%, the main steam line (MSL) flow element AL ΔP setpoint is not changed for the TPO uprate. The corresponding setpoint AL in terms of steam flow is decreased to approximately 137.4% of the TPO rated steam flow at 101.65% of CLTP

Because of the large spurious trip margin, sufficient margin to the trip setpoint exists to allow for normal plant testing of the MSIVs and turbine stop and control valves. This is consistent with TLTR Section F.4.2.5.

5.3.6 Fixed APRM Scram

The fixed APRM ALs, for both Two (recirculation) Loop Operation (TLO) and Single Loop Operation (SLO), expressed in percent of RTP do not change for the TPO uprate. The generic evaluation and guidelines presented in TLTR Section F.4.2.2 are applicable to LaSalle. The limiting transient that relies on the fixed APRM trip is the MSIV closure transient with indirect scram. This event has been analyzed assuming 102% of CLTP and is reanalyzed on a cycle specific basis.

5.3.7 APRM Flow-Biased Scram

The flow-referenced APRM ALs, for both TLO and SLO, are unchanged in units of absolute core thermal power versus recirculation drive flow. Because the setpoints are expressed in percent of RTP, they decrease in proportion to the power uprate or CLTP RTP / TPO RTP. This is the same approach taken for generic BWR uprates described in ELTR1 (Reference 2). The AVs are recalculated based on the revised ALs.

5.3.8 Rod Worth Minimizer Low Power Setpoint

The RWM Low Power Setpoint (LPSP) is used to enforce the rod patterns established for the control rod drop accident at low power levels. The generic guidelines in TLTR Section F.4.2.9 are applicable to LaSalle. The RWM LPSP AL is kept the same in terms of percent power, and is therefore higher in terms of absolute power. This new higher absolute power is conservative for the RWM LPSP.

5.3.9 Rod Block Monitor

The severity of the Rod Withdrawal Error (RWE) during power operation event is dependent upon the RBM rod block setpoint. The power-dependent ALs are maintained at the same percent power. The cycle specific reload analysis is used to determine any changes in the rod block setpoint.

5.3.10 Flow-Biased Rod Block Monitor (%RTP)

The RBM instrumentation setpoints in terms of percent power and flow are unaffected by TPO conditions because the rod withdrawal error transient is analyzed without credit for the RBM.

5.3.11 Main Steam Line High Radiation Isolation

Deleted per License Amendment 115 (Unit 1) and Amendment 100 (Unit 2).

5.3.12 Low Steam Line Pressure MSIV Closure (RUN Mode)

The purpose of this function is to initiate MSIV closure on low steam line pressure when the reactor is in the RUN mode. This AL is not changed for the TPO as discussed in TLTR Section F.4.2.7.

5.3.13 Reactor Water Level Instruments

As described in TLTR Section F.4.2.10, the TPO uprate does not result in a significant increase in the possibility of a reactor scram, equipment trip, or ECCS actuation. Use of the current ALs maintains acceptable safety system performance. The low reactor water level Technical Specification setpoints for scram, high-pressure injection, and ADS/ECCS are not changed for the TPO uprate. The high water level ALs for trip of the main turbine, FW pumps, and reactor scram are not changed for the TPO uprate.

Water level change during operational transients (e.g., trip of a recirculation pump, FW controller failure, loss of one FW pump) is slightly affected by the TPO uprate. The plant response following the trip of one FW pump does not change significantly, because the maximum operating rod line is not being increased.

5.3.14 Main Steam Line Tunnel High Temperature Isolations

As noted in Section 5.2.4 above, the high steam tunnel temperature AL remains unchanged for the TPO uprate.

5.3.15 Low Condenser Vacuum

In order to produce more electrical power, the amount of heat discharged to the main condenser increases slightly. This added heat load will slightly increase condenser backpressure, but the increase would be insignificant (< 0.15 in. HgA). The slight change in condenser vacuum after implementation of TPO will not affect the trip setpoints associated with low condenser vacuum (turbine trip / MSIV closure). The condenser low vacuum alarm setpoint is being raised slightly to provide additional margin to expected operating conditions.

5.3.16 TSV Closure Scram, TCV Fast Closure Scram, and EOC-RPT Bypasses

The TSV closure scram, TCV fast closure scram, and EOC-RPT bypass signals allow these functions to be bypassed when reactor power is sufficiently low that the scram and EOC-RPT functions are not necessary in order to maintain adequate safety margins following a T/G trip. This bypass setpoint is specified in percent RTP and is automatically accomplished by pressure switches sensing turbine first-stage pressure (TFSP).

The guidelines in TLTR Section F.4.2.3 state that the TSV closure scram, TCV fast closure scram, and EOC-RPT bypass setpoint will be kept the same in terms of absolute main turbine steam flow. This approach minimizes potential changes to the plant instrumentation, and maintains the same steam flow range of trip avoidance as previous operation (within the unchanged turbine steam bypass system). The basis for this approach, as stated in the TLTR, is as follows:

> No modifications to the turbine are expected to be made for a TPO uprate, so there will be no change in the first-stage pressure/steam flow relationship from previous plant operation.
>
> The setpoint is chosen to allow operational margin so that a scram may be avoided by transferring turbine steam to the turbine bypass system during T/G trips at low power. The transient events associated with operation just below this setpoint have been shown to be non-limiting from a safety viewpoint and are not usually specifically analyzed in the UFSAR or in current reloads because they generally have ample margin.

As discussed in Section 7.1, “Turbine-Generator,” the LaSalle turbine is being modified to install new high-pressure turbine first stage nozzle plates. Because turbine modifications were not assumed in the TLTR, the basis for following the TLTR approach was re-evaluated.

Based on this review, the bypass setpoint will not be reduced as described in the TLTR and will remain at the current value of 25% RTP. Although this will result in enabling these trip functions at a slightly higher thermal power under TPO, this is acceptable for the following reasons:

> With the installation of the new high-pressure turbine first stage nozzle plate, maintaining the setpoint at 25% RTP minimizes changes to plant instrumentation and maintains an acceptable steam flow range for trip avoidance. This is consistent with the intended outcomes of the TLTR approach.
>
> The purpose for the TSV closure and TCV fast closure scrams is to reduce the amount of energy required to be absorbed and, along with the actions of the EOC-RPT system, ensure that the MCPR Safety Limit (SL) is not exceeded. As discussed in Technical Specification (TS) Bases Section 3.3.1.1-1, part 8, “Turbine Stop Valve - Closure,” these functions are not required when thermal power is below the threshold for which thermal

margin monitoring is required (< 25% RTP) because the Reactor Vessel Steam Dome Pressure - High and the Average Power Range Monitor Fixed Neutron Flux - High Functions are adequate to maintain the necessary safety margins. Monitoring of thermal limits below 25% RTP is unnecessary due to the inherent margin that ensures that the MCPR SL is not exceeded even if a limiting transient occurs. At 25% RTP, significant margin to fuel cladding integrity safety limits exists as described in the TS Bases Section 2.1.1.1, "Fuel Cladding Integrity," which states that fuel assembly critical power at this low power and flow is approximately 3.35 MWt. Considering the design peaking factors, this corresponds to a thermal power > 50% RTP. Thus, a thermal power limit of 25% RTP is very conservative. For TPO, the TS Bases for Safety Limits, TSV Closure scram, TCV fast closure scram, and EOC-RPT scram remain valid without reducing the 25% RTP bypass setpoint.

Table 5-1
Analytical Limits that Change due to TPO

Parameter	Current	TPO	Justification
APRM High Neutron Flux Scram (%RTP)	123.69	Unchanged	
APRM Flow-biased Scram			
TLO Fixed (%RTP) (1)	119.19	Unchanged	(3)
SLO Fixed (%RTP) (1)	113.8	Unchanged	(3)
TLO Flow-biased (%RTP)(1)(2)	0.62W + 70.9	0.61W + 69.76	(3)
SLO Flow-biased (%RTP)(1)(2)	0.55W + 58.33	0.54W + 57.39	(3)
APRM Flow-biased Rod Block			
TLO Fixed (%RTP)	112.2	Unchanged	
SLO Fixed (%RTP)	112.2	Unchanged	
TLO Flow-biased (%RTP)(1)(2)	0.62W + 59.47	0.61W + 58.51	(3)
SLO Flow-biased (%RTP)(1)(2)	0.55W + 46.9	0.54W + 46.14	(3)
TSV & TCV Scram & EOC-RPT Bypasses (psig)	104.1 psig	Unchanged	(4)
MSL High Flow Isolation % rated steam flow psid	 140% 146.3 psid	 137.4% 146.3 psid	(4)
Rod Worth Minimizer LPSP (%RTP)	10	Unchanged	(5)

Notes:

(1) No credit is taken in any safety analysis for the flow-biased setpoints.

(2) W is % recirculation drive flow where 100% drive flow is that required to achieve 100% core flow at 100% power.

(3) These changes to the ALs are based upon the methodology approved by the NRC in Reference 1.

(4) All limits scaled for an uprate of 1.65% thermal. There is no change to the AL as expressed in psid.

(5) The RWM LPSP AL is conservatively kept the same in terms of percent power.

6 ELECTRICAL POWER AND AUXILIARY SYSTEMS

6.1 AC POWER

Plant electrical characteristics are given in Table 6-1.

A detailed comparison of existing ratings with uprated ratings and the effect of the power uprate on the main generator, main power transformer, unit auxiliary transformer, and system auxiliary transformer are shown in Tables 6-2, 6-3, 6-4, and 6-5.

6.1.1 Off-Site Power

The generator, main transformer and isolated phase bus nameplate ratings are listed below:

Generator: The generator is a direct-driven, 3-phase, 60-HZ, 25,000-Volt, 1800-rpm, hydrogen inner-cooled, synchronous generator rated for: 1,300,300 kVA at a 0.90 power factor, with a 0.58 short circuit ratio at a maximum hydrogen pressure of 75 psig.

Main Transformer: Each Main Power Transformer (MPT) consists of two half-size, three-phase, 345kV Y-23.75kV Δ, oil immersed, forced air cooled, outdoor Westinghouse 7000 Series transformers. Each transformer is rated for 625/700 MVA at a 55/65°C rise.

Isolated Phase Bus Duct: The isolated phase bus duct continuous current rating is based on a 65°C rise above a 40°C ambient, and is 17,750A/32,000A OA/FA. The momentary fault current rating is 360,000A with a voltage rating of 25,000V. The forced cooling is produced by two air-handling units with a design heat transfer capacity of 1,200,000 Btu/hr.

The review of the existing off-site electrical equipment concluded the following:

The Main Generators will be operating within the existing generating capability curve for TPO uprate. For summer operations, the gross generator MWe output is able to operate on the existing generator capability curve with less than a 0.90 PF, which meets the PJM Interconnect, LLC operational requirements. For winter conditions, the MWe output is higher, and under full MWe output the lowest achievable power factor (PF) will be 0.937 PF. Under these conditions, it may be necessary to decrease MWe output to stay within the generator capability curve if the plant is required to supply more Million Volt Amps Reactive (MVARs).

The isolated phase bus duct is adequate for both rated voltage and low voltage current output.

The main transformers and the associated switchyard components (rated for maximum transformer output) are adequate for the TPO uprate-related transformer output. The Main Power Transformers have been rated based on the Main Generator's full output capability. Because the Main Generator is not changing for TPO, the MPT rating is adequate for the TPO.

A grid stability analysis has been performed, considering the increase in electrical output, to demonstrate conformance to General Design Criteria (GDC) 17 (10 CFR 50, Appendix A).

GDC 17 addresses on-site and off-site electrical supply and distribution systems for safety-related components. There is no significant effect on grid stability or reliability. There are no modifications associated with the TPO uprate, which would increase electrical loads beyond those levels previously included or revise the logic of the distribution systems.

6.1.2 On-Site Power

The on-site power distribution system consists of transformers, numerous buses, and switchgear. Alternating current (AC) power to the distribution system is provided from the transmission system or from onsite emergency diesel generators (EDGs). The on-site power distribution system loads were reviewed under both normal and emergency operating scenarios. In both cases, loads are computed based primarily on equipment nameplate data or brake horsepower (BHP). These loads are used as inputs for the computation of load, voltage drop, and short circuit current values. Operation at the TPO RTP level is achieved in both normal and emergency conditions by operating equipment at or below the nameplate rating running kilowatt (kW) or BHP. Therefore, there are negligible changes to the load, voltage drop or short circuit current values.

Station loads under normal operation/distribution conditions are computed based on equipment nameplate data with conservative demand factors applied. The only identifiable change in electrical load demand is associated with condensate and condensate booster pumps and heater drain pumps. These pumps must deliver increased flow and pressure due to the TPO uprate conditions. Because these changes are small, the motor demand for each of these loads remains bounded by the existing design. Accordingly, there are negligible changes in the on-site distribution system design basis loads or voltages due to the TPO conditions. The system environmental design bases are unchanged. Operation at the TPO RTP level is achieved by utilizing existing equipment operating at or below the nameplate rating; therefore, under normal conditions, the electrical supply and distribution components (e.g., switchgear, motor control centers (MCCs), cables) are adequate.

Station loads under emergency operation and distribution conditions (i.e., EDG operations) are based on BHP or running KW. Emergency operation at the TPO RTP level is achieved by utilizing existing equipment operating at or below the nameplate rating and within the calculated BHP for the stated pumps; therefore, under emergency conditions the electrical supply and distribution components are adequate.

No increase in flow or pressure is required of any AC-powered ECCS equipment for the TPO. Therefore, the amount of power required to perform safety-related functions (pump and valve loads) does not increase, and the current emergency power system remains adequate. The systems have sufficient capacity to support all required loads for safe shutdown, to maintain a safe shutdown condition, and to operate the engineered safety feature equipment following postulated accidents.

Because the duty cycle and duration for design basis EDG loads is based on analytical power levels of at least 102% of the current licensed thermal power, these will remain unchanged by TPO. Therefore, the required reserve volume of emergency fuel oil is not changed and the useable emergency fuel oil reserves will be adequate to support TPO.

6.2 DC POWER

The direct current (DC) loading requirements in the UFSAR were reviewed, and no reactor power-dependent loads were identified. The DC power distribution system provides control and motive power for various systems and components. In both normal and emergency operating scenarios, loads are computed based on equipment nameplate data or BHP. These loads are used as inputs for the computation of load, voltage drop, and short circuit current values. Operation at the TPO RTP level is achieved in both normal and emergency conditions by operating equipment at or below the nameplate rating running kW or BHP. Additionally, operation at the TPO RTP level does not increase any loads or revise control logic. Therefore, there are no changes to the load, voltage drop or short circuit current values.

6.3 FUEL POOL

The following subsections address fuel pool cooling, crud and corrosion products in the fuel pool, radiation levels and structural adequacy of the fuel racks. The changes due to TPO are within the design limits of the systems and components. The fuel pool cooling system meets the FSAR requirements at the TPO conditions.

6.3.1 Fuel Pool Cooling

The Spent Fuel Pool (SFP) heat load remains within the capability of the Fuel Pool Cooling and Cleanup system (FPCC) as assured by cycle specific calculations to verify heat load is less than or equal to that previously analyzed. The TPO uprate does not affect the heat removal capability of the FPCC as shown in Table 6-6. The TPO heat load is within the design basis heat load for the FPCC.

The SFP cooling adequacy is maintained by controlling the timing of the discharge (fuel offload) to the spent fuel pool to ensure the capability of the FPCC to maintain adequate fuel pool cooling for the TPO uprate.

The FPCC heat exchangers are sufficient to remove the decay heat during normal refueling and full-core offloads. Additionally, for a full-core or batch offload, the Residual Heat Removal (RHR) system in Fuel Pool Cooling Assist mode is available to maintain the bulk SFP water temperature below the design limit.

6.3.2 Crud Activity and Corrosion Products

The crud activity and corrosion products associated with spent fuel can increase very slightly due to the TPO. The increase is insignificant and SFP water quality is maintained by the FPCC.

6.3.3 Radiation Levels

The normal radiation levels around the SFP may increase slightly during fuel handling operation. This increase is acceptable and does not significantly increase the operational doses to personnel or equipment.

6.3.4 Fuel Racks

There is no effect on the design of the fuel racks, because the maximum allowable spent fuel temperature is not being increased.

6.4 WATER SYSTEMS

The safety-related and non-safety-related cooling water loads potentially affected by TPO are addressed in the following sections. The environmental effects of TPO are controlled such that none of the present limits (e.g., maximum allowed cooling water discharge temperature) are increased.

6.4.1 Service Water Systems

6.4.1.1 Safety-Related Loads

The safety-related Core Standby Cooling System / Equipment Cooling Water (CSCS/ECW) system provides cooling water to essential equipment during and following a design basis accident, such as a Loss-of-Offsite Power (LOOP) or LOCA. The performance of the CSCS / ECW system during these events does not change for TPO because the current LOCA analysis and containment response analysis were based on 102% of CLTP, the bounding power level for the TPO analysis. The increases in the heat loads to equipment cooled by CSCS / ECW are within the existing capacity of the system.

6.4.1.2 Non-safety Related Loads

The major operational heat load increases to the Service Water system from TPO reflect an operational increase in main generator losses rejected to the generator hydrogen coolers, generator stator coolers, and exciter air cooler. The thermal efficiency of the power generation cycle is not expected to change. Therefore, the increase in service water heat loads from these sources due to TPO is proportional to and bounded by 2%. The increases in heat loads to equipment cooled by the Service Water system are insignificant and the design of the system is adequate to accommodate to TPO.

6.4.2 Main Condenser/Circulating Water/Normal Heat Sink Performance

The main condenser, circulating water, and normal heat sink systems are designed to remove the heat rejected to the condenser and thereby maintain adequately low condenser pressure as recommended by the turbine vendor. TPO operation increases the heat rejected to the condenser and will slightly reduce the difference between the operating pressure and the required minimum condenser vacuum. The performance of the main condenser was evaluated for operation at the TPO RTP. The condenser low vacuum alarm setpoint is being raised slightly to provide additional margin to expected operating conditions. The evaluation confirms that the condenser, circulating water system and heat sink are adequate for TPO operation.

6.4.2.1 Discharge Limits

The Illinois Department of Environmental Quality National Pollutant Discharge Elimination System (NPDES) Permit provides the effluent limitations and monitoring requirements for discharges at the site. The daily maximum discharge limits on total residual chlorine and residual oxidants are 0.2 mg/l and 0.05 mg/l (respectively). The discharge from the Cooling Pond Blowdown shall not increase the ambient river temperature more than 5°F over its current temperature. Frequent monitoring of these parameters ensures that permit limits are not exceeded. The TPO uprate has minimal effect on the parameters, and no changes to NPDES permit requirements are needed.

The state thermal discharge limits, the current discharges, and bounding analysis for the TPO uprate are shown in Table 6-7. This comparison demonstrates that the plant remains within the state discharge limits, during operation at TPO conditions.

6.4.3 Reactor Building Closed Cooling Water System

The heat loads on the Reactor Building Closed Cooling Water (RBCCW) system do not increase significantly due to TPO. The main power-dependent heat loads on the RBCCW system are those related to the operation of the Reactor Water Cleanup non-regenerative heat exchangers, off-gas building Heating, Ventilation and Air Conditioning (HVAC) system, and the reactor recirculation pumps. The design of the RBCCW heat exchangers is adequate to accommodate an estimated heat load increase of < 1% for TPO. This minimal increase in heat load will result in a negligible temperature increase of < 0.1°F for the RBCCW system. Therefore, the RBCCW system is acceptable for TPO.

6.4.4 Turbine Building Closed Cooling Water System

The power-dependent heat loads on the Turbine Building Closed Cooling Water (TBCCW) system that are increased by the TPO are those related to the operation of the condensate and condensate booster pumps, the bus duct cooler, penetration coolers and station air compressor coolers. The remaining TBCCW heat loads are not strongly dependent upon reactor power and do not significantly increase. The TBCCW system has sufficient capacity to assure that adequate heat removal capability is available for TPO operation.

6.4.5 Ultimate Heat Sink

The ultimate heat sink (UHS) for LaSalle is a cooling pond that remains after the main dike of the cooling lake is breached. The UHS cooling pond is designed to hold approximately 460 acre-feet of water at a surface elevation of 690 ft. The CSCS-ECW System provides the ultimate heat sink for equipment cooling throughout the plant. As a result of operation at the TPO RTP level, the post-LOCA heat load increases slightly, primarily due to higher reactor decay heat. However, the ability of the UHS to perform required safety functions is demonstrated with previous analyses based on 102% of CLTP which bounds the expected TPO RTP level. Therefore, all safety aspects of the UHS are within previous evaluations and the requirements are unchanged for TPO uprate conditions. The current Technical Specifications for UHS limits are adequate due to conservatism in the current design.

6.5 STANDBY LIQUID CONTROL SYSTEM

The SBLC is designed to shut down the reactor from rated power conditions to cold shutdown in the postulated situation that all or some of the control rods cannot be inserted. It is a manually operated system that pumps a highly enriched sodium pentaborate solution into the vessel to achieve a subcritical condition. The generic evaluation presented in TLTR Sections 5.6.5 (SBLC) and Appendix L.3 (ATWS Evaluation) is applicable to the LaSalle TPO uprate. The TPO uprate does not affect shutdown or injection capability of the SBLC. Because the shutdown margin is reload dependent, the shutdown margin and the required reactor boron concentration are confirmed for each reload core.

The SBLC relief valve margin is adequate for the TPO uprate because the SBLC system prior to the TPO uprate has a confirmed minimum relief valve margin of 70 psi (measured between the inlet to the SBLC relief valve and the minimum SBLC relief valve opening setpoint accounting for setpoint tolerance).

The SBLC ATWS performance is evaluated in TSAR Section 9.3.1. The evaluation shows that the TPO has no adverse effect on the ability of the SBLC to mitigate an ATWS.

6.6 POWER-DEPENDENT HEATING, VENTILATION AND AIR CONDITIONING

The HVAC system that are potentially affected by the TPO uprate consist mainly of heating, cooling supply, exhaust, and recirculation units in the turbine building, reactor building (including steam tunnel), and primary containment.

TPO results in a minor increase in the heat load caused by the slightly higher FW process temperature (~3°F). The increased heat load in the steam tunnel is within the capability of the Reactor Building HVAC system. In the drywell, the increase in heat load due to the FW process temperature is within the system capacity. In the turbine building, the maximum temperature increases due to the increase in the FW process temperatures and new pump motor heat loads are expected to be very low. This is because the seven chiller units provide supply air at 65°F, instead of the 83°F used in the original design calculations. In the reactor building, the increase in heat load caused by the slightly higher FW process temperature is within the capability of the area coolers. Other areas are unaffected by the TPO because the process temperatures and electrical heat loads remain constant.

Therefore, the power-dependent HVAC systems are adequate to support the TPO uprate.

6.7 FIRE PROTECTION

Operation of the plant at the TPO RTP level does not affect the fire suppression or detection systems. There is no change in the physical plant configuration and the potential for minor changes to combustible loading as a result of the TPO uprate are addressed by controlled design change procedures (e.g., the new FW Ultrasonic Flow Meter equipment). The safe shutdown systems and equipment used to achieve and maintain cold shutdown conditions do not change, and are adequate for the TPO uprate.

The operator manual actions that are being used for compliance with the post-fire safe shutdown analysis were reviewed. No operator manual actions have been identified in areas where environmental conditions, such as heat, would challenge the operator. Because this uprate is being performed at a constant pressure and temperature, the normal temperature environments are not affected by TPO. Therefore, the operator manual actions required to mitigate the consequences of a fire are not affected.

A review was conducted of the Fire Protection Program as related to administrative controls, fire barriers, fire protection responsibilities of plant personnel and resources necessary for systems required to achieve and maintain safe-shutdown. The review looked at the effect of TPO uprate and how it would affect these areas. The TPO uprate will have no effect on fire protection administrative controls, fire barriers, fire protection responsibilities of plant personnel and resources necessary for systems required to achieve and maintain safe-shutdown.

A review was conducted of all repair activities that are credited to obtain and maintain cold shutdown. The LaSalle post-fire safe shutdown analysis demonstrates that the station can reach cold shutdown with significant margin to the 72-hour requirements in 10 CFR 50 Appendix R, Sections III.G.1.b and III.L. No "time-critical" repairs would be required to reach or maintain cold shutdown. The TPO and the additional decay heat removal would not affect the ability to reach and maintain cold shutdown within 72 hours.

Therefore, the fire protection systems and analyses are not affected by the TPO uprate.

6.7.1 10 CFR 50 Appendix R Fire Event

TLTR Section L.4 presents a generic evaluation of Appendix R events for an increase of 1.5% of CLTP. [[

]] The current analysis based on CLTP has an available margin of 908°F to the clad temperature limit and > 1.1 psi to the containment pressure limit.

Therefore, the generic results are clearly applicable and no further plant specific Appendix R - related analysis is necessary for the TPO uprate.

6.8 Systems Not Affected By TPO Uprate

Based on experience and previous NRC reviews, all systems that are significantly affected by TPO are addressed in this report. Other systems not addressed by this report are not significantly affected by TPO. The systems unaffected by TPO at LaSalle are confirmed to be consistent with the generic description provided in the TLTR.

Table 6-1
TPO Plant Electrical Characteristics

Parameter	Value
Generator Output (MWe)	1170
Rated Voltage (kV)	25
Power Factor	0.90
Generator Output (Million Volt Amps (MVA))	1300.3
Generator Output (Amps)	30,029
Isolated Phase Bus Duct Rating AA/FA: (Amps) (main section)	17,750 / 32,000
Main Transformers Rating (MVA)	700 @ 65°C rise (two parallel)

Table 6-2
Main Generator Ratings Comparison

Power Level	Design	Max. Nominal	
	MVA @ 75 psig H2	MWe @ 75 psig H2	MVAR @ 75 psig H2
Existing	1300.3	1170	567
Uprated(1)	1300.3	1170	567

(1) Operation at the uprated condition is not expected to have any effect on the operation of the Main Generator. Operation in this range is still within the operating boundaries specified in station design analysis and operating procedures.

Table 6-3
Main Power Transformer Ratings Comparison

Power Level	Design MVA @ 65°C	MVA Loading
Existing	1400	1300.3
Uprated (1)	1400	1300.3

(1) Operation at the uprated condition is not expected to have any effect on the operation of the Main Power Transformer. The generator MWe will increase and MVAR will decrease, thus MVA will remain the same. Operation in this range is still within the operating boundaries specified in station design analysis and operating procedures.

Table 6-4
Unit Auxiliary Transformer Ratings Comparison

Power Level	Design MVA @ 65°C	Existing MVA Loading	TPO MVA Loading(1)
UAT 141 X-Winding (Unit 1)	40.3	35.27	35.33
UAT 141 Y-Winding (Unit 2)	32.5	26.32	26.41
UAT 241 X-Winding (Unit 1)	40.3	35.27	35.33
UAT 241 Y-Winding (Unit 2)	32.5	26.32	26.41

(1) Operation at the uprated condition is not expected to have any effect on the operation of the Unit Auxiliary Transformer (UAT). Operation in this range is still within the operating boundaries specified in station design analysis and operating procedures.

Table 6-5
System Auxiliary Transformer Ratings Comparison

Power Level	Rated MVA @ 65°C	Existing MVA Loading	TPO MVA Loading(1)
SAT 142 X-Winding (Unit 1)	40.3	35.27	35.33
SAT 142 Y-Winding (Unit 2)	32.5	26.32	26.41
SAT 242 X-Winding (Unit 1)	40.3	35.27	35.33
SAT 242 Y-Winding (Unit 2)	32.5	26.32	26.41

(1) Operation at the uprated condition is not expected to have any effect on the operation of the System Auxiliary Transformer (SAT). Operation in this range is still within the operating boundaries specified in station design analysis and operating procedures.

Table 6-6
Fuel Pool Cooling and Cleanup System Parameters

Parameter	CLTP	TPO
Number of FPCC trains	2	2
FPCC pump flow rate (single pump)	3,000 gpm	3,000 gpm
Design heat removal capacity of 1 FPCC heat exchanger	14.5 MBTU/hr	14.5 MBTU/hr
Heat removal capacity (two heat exchangers)	26.53 MBTU/hr	26.53 MBTU/hr
Fuel Cycle (months)	24	24
Bulk SFP temperature for a batch offload, with one train of FPCC in operation.	< 140°F	< 140°F
Bulk SFP temperature for a full-core offload, with two trains of FPCC operation, with supplemental RHR cooling, if required.	< 212°F	< 212°F

Table 6-7
Effluent Discharges: Current and TPO

Parameter	State Limit	Current	TPO
Maximum River Temperature Rise (°F)	5°F	1.7	No change
Daily Maximum Residual Chlorine (mg/L) (Maximum TRC) [(1)]	0.2	0.08 [(2)]	No change

(1) Monitoring for Total Residual Chlorine (TRC) in the Cooling Pond Blowdown discharge is required only when chlorine is used for treatment in the Circulating or Service Water systems.

(2) Per February 2009 Discharge Monitoring Report

7 POWER CONVERSION SYSTEMS

7.1 TURBINE-GENERATOR

General Electric Energy Services (GEES) performed the evaluation of the steam turbine, valves, turbine auxiliary systems, cross around relief valves and piping for the TPO condition. A summary of the results of the evaluation are presented as follows:

> For the turbine high-pressure (HP) section, the existing nozzle plates are not able to pass the required additional steam flow at the TPO operation point and still maintain sufficient flow margin of 3% for reactor pressure control. New first stage nozzle plates designed with increased flow area are required; these modified nozzle plates will allow the HP turbine to maintain flow margin of at least 3% and thus maintain adequate pressure control. All other components in the HP section are within allowable design limits and no other changes are recommended or required.
>
> The turbine low-pressure (LP) section rotor and all LP components are within allowable design margins and no changes are recommended or required.
>
> Main stop valves, control valves, and combined intermediate valves are all within allowable design margins to operate at the TPO flow condition.

Other components were evaluated, including the HP and LP steam-path, HP turbine shell, horizontal joint bolting, LP inner casing, LP inner casing horizontal joint bolting, rotor torsional loads, main steam inlet piping, cross-around relief valves, cross-around piping, valves, LP section hood, atmospheric relief diaphragms, thrust bearing, journal bearings, and auxiliary systems. The results of these evaluations show that no modifications are needed to support operation at the TPO uprate condition.

The existing rotor missile analysis was performed at 120% design overspeed conditions. The low-pressure turbine casing is designed to prevent rupture due to disc failure at 120% design overspeed conditions. The TPO uprate does not change turbine rated speed. Therefore, there is no change in the missile generation probability (a missile does not escape from the turbine casing) and thus, the missile generation probability remains unchanged and is therefore acceptable.

The overspeed evaluation addressed the sensitivity of the rotor train for the capability of overspeeding. Although the entrapped energy increases slightly for the TPO uprate conditions, no change in the overspeed trip settings is required because the existing analysis bounds the TPO uprate conditions.

7.2 CONDENSER AND STEAM JET AIR EJECTORS

The main condenser capability was evaluated for performance at the TPO uprate conditions in section 6.4.2. The design margin in the condenser heat removal capability can accommodate the additional heat rejected for operation at the TPO uprate conditions. Air leakage into the condenser does not increase as a result of the TPO uprate. The small increase in hydrogen and oxygen flows from the reactor does not affect the Steam Jet Air Ejectors (SJAE) capacity because the design was based on operation at greater than required flows at uprate conditions. Therefore, the condenser air removal system is not affected by the TPO uprate and the mechanical vacuum pumps and SJAEs are adequate for operation at the TPO uprate conditions.

7.3 TURBINE STEAM BYPASS

The Turbine Bypass System is designed for a steam flow capacity of 23.6% of the 100% rated flow at CLTP. The steam bypass capacity at TPO RTP is approximately 23.0% of the 100% TPO RTP steam flow rate. The Turbine Bypass System is non-safety related. While the bypass capacity as a percent of rated steam flow is reduced, the actual steam bypass capacity is unchanged. The transient analyses that credit the Turbine Bypass System use a bypass capacity that is less than the actual capacity. Therefore, the turbine bypass capacity remains adequate for TPO operation because the actual capacity (unchanged) continues to bound the value used in the analyses.

7.4 FEEDWATER AND CONDENSATE SYSTEMS

The FW and Condensate systems are designed to provide FW at the temperature, pressure, quality, and flow rate required by the reactor. These systems are not safety-related; however, their performance may have an effect on plant availability and the capability to operate reliably at the TPO uprate condition.

A review of the LaSalle FW heaters, heater drains, condensate demineralizers and the FW and condensate pumps demonstrated that the components are capable of performing in the proper design range to provide the slightly higher TPO uprate FW flow rate at the desired temperature and pressure. A review of the LaSalle heater drains demonstrated that the components are capable of supporting the slightly higher TPO uprate extraction flow rates.

Performance evaluations were based on an assessment of the capability of the condensate and FW systems and equipment to remain within the design limitations of the following parameters:

- Pump NPSH
- Ability to avoid suction pressure trip
- Flow capacity
- Rated driver horsepower
- Vibration

The FW system run-out and loss of FW heating events would be expected to see very small changes from the TPO uprate as shown by the experience with substantially larger power uprates.

7.4.1 Normal Operation

System operating flows for the TPO uprate increase approximately 2%. Operation at the TPO RTP level does not significantly affect operating conditions of these systems. Discharge pressure of the condensate pumps decreases due to the pump head characteristics at increased flows. Discharge pressure of the FW pumps will increase to compensate for the increase in FW friction losses due to higher flow. To accomplish this function, opening the flow control valves to the feed pump turbine increases the feed pump speed. During steady-state conditions, the condensate and FW systems have available NPSH for all of the pumps to operate without cavitation at the TPO uprate conditions. Adequate margin during steady-state conditions exists between the calculated minimum pump suction pressure and the minimum pump suction pressure trip set points. An adjustment to the condensate booster pump suction alarm setpoint may be considered to avoid nuisance alarms.

The existing FW design pressure and temperature requirements bound operating conditions with adequate margin. The FW heaters are ASME Section VIII pressure vessels. The heaters were analyzed and verified to be acceptable for the slightly higher FW heater temperatures and pressure for the TPO uprate.

7.4.2 Transient Operation

To account for FW demand transients, the condensate and FW systems were evaluated to ensure that sufficient margin above the TPO uprated flow is available. For system operation with all system pumps available, the predicted operating parameters were acceptable and within the component capabilities.

Following a single FW pump trip, the reactor recirculation system would runback recirculation flow, such that the steam production rate is within the flow capacity of the remaining turbine driven FW pump and the motor driven FW pump. The runback setting prevents a reactor low water level scram, and is sufficient to maintain adequate margin to the potential P/F instability regions. Operation at the TPO Conditions does not degrade this capability.

7.4.3 Condensate Demineralizers

The effect of the TPO uprate on the condensate prefilters and the condensate polishers was reviewed. The condensate polishers experience slightly higher loadings at the TPO RTP level which result in slightly reduced resin life. However, the reduced resin life is acceptable. Because the system can accommodate (without bypass) TPO uprate operation with one vessel removed from service (when backwash/resin replacement is required), reduced resin life (more frequent backwash/resin replacement) of the units does not adversely affect condensate polisher operation.

8 RADWASTE AND RADIATION SOURCES

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, discharge, or shipment. The single largest source of liquid and wet solid waste is from backwash of the condensate filter/demineralizer (CF/D). The TPO uprate results in a ~1.2% increased flow rate through the CF/Ds, resulting in a reduction in the average time between backwashes. The reduction of CF/D service time does not affect plant safety. The RWCU filter demineralizer may also require more frequent backwashes due to slightly higher levels of activation and fission products.

The floor drain collector subsystem and the waste collector subsystem both receive periodic inputs from a variety of sources. Neither subsystem experiences a significant increase in volume due to operation at the TPO uprate condition.

The activated corrosion products in the waste stream are expected to increase proportionally to the TPO uprate. However, the total volume of processed waste is not expected to increase appreciably because the only significant increase in processed waste is due to the more frequent backwashes of the CF/Ds and RWCU filter demineralizers. A review of plant operating effluent reports and the slight increase expected from the TPO uprate, leads to the conclusion that the requirements of 10 CFR 20 and 10 CFR 50, Appendix I continue to be met. Therefore, the TPO uprate does not adversely affect the processing of liquid radwaste and there are no significant environmental effects.

8.2 GASEOUS WASTE MANAGEMENT

The gaseous waste systems collect, control, process, and dispose of gaseous radioactive waste generated during normal operation and abnormal operational occurrences. The gaseous waste management systems include the offgas system and various building ventilation systems. The systems are designed to meet the requirements of 10 CFR 20 and 10 CFR 50, Appendix I.

Non-condensable radioactive gas from the main condenser normally contains activation gases (principally N-16, O-19 and N-13) and fission product radioactive noble gas parents. This is the major source of radioactive gas, which is greater than all other sources combined. These non-condensable gases, along with non-radioactive air in leakage, are continuously removed from the main condensers by the SJAE that discharge into the offgas system.

Building ventilation systems control airborne radioactive gases by using devices such as High Energy Particulate Air (HEPA) and charcoal filters, and radiation monitors that activate isolation dampers or trip supply and exhaust fans, or by maintaining negative or positive air pressure to limit migration of gases. The activity of airborne effluents released through building vents does not increase significantly due to the TPO uprate because:

- The amount of fission products released into the coolant depends on the number and nature of the fuel rod defects and is not dependent on reactor power; and
- The concentration of coolant activation products remains unchanged because the increase in production of these products is offset by the increase in the steaming rate.

The release limit is an administratively controlled variable and is not a function of core power. The gaseous effluents are well within limits at CLTP operation and remain well within limits following implementation of the TPO uprate. There are no significant environmental effects due to the TPO uprate.

The offgas system was evaluated for the TPO uprate. Radiolysis of water in the core region, which forms H2 and O2, increases linearly with core power, thus increasing the heat load on the recombiner and related components. The offgas system design basis H2 is 42.9 lbs/hr. The expected H2 flow rate for the TPO uprate is 25.8 lbs/hr. The increase in H2 and O2 due to the TPO uprate remains well with the capacity of the system. The system radiological release rate is administratively controlled, and is not changed with operation power. Therefore, the TPO uprate does not affect the offgas system design or operation.

8.3 RADIATION SOURCES IN THE REACTOR CORE

TLTR Appendix H describes the methodology and assumptions for the evaluation of radiological effects for the TPO uprate.

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 reactions as a secondary result of fission. Historically, these sources have been defined in terms of energy released per unit of reactor power. Therefore, for TPO, the percent increase in the operating source terms is no greater than the percent increase in power. The source term increases due to the TPO uprate are bounded by the safety margins of the design basis sources.

The post-operation radiation sources in the core are primarily the result of accumulated fission products. Two separate forms of post-operation source data are normally applied. The first is the core gamma-ray source, which is used in shielding calculations for the core and for individual fuel bundles. This source term is defined in terms of Million electron Volts (MeV)/sec per watt of reactor thermal power (or equivalent) at various times after shutdown. Therefore, the total gamma energy source increases in proportion to reactor power.

The second set of post-operation source data consists primarily of nuclide activity inventories for fission products in the fuel. These are needed for post-accident and spent fuel pool evaluations, which are performed in compliance with regulatory guidance that applies different release and transport assumptions to different fission products. The core fission product inventories for these evaluations are based on an assumed fuel irradiation time, which develops "equilibrium" activities in the fuel (typically three years). Most radiologically significant fission products reach equilibrium within a 60-day period. The calculated inventories are approximately proportional to core thermal power. Consequently, for TPO, the inventories of those radionuclides, which reached or approached equilibrium, are expected to increase in proportion to the thermal power increase. The inventories of the very long-lived radionuclides, which did not approach equilibrium, are both power and exposure dependent. They are expected to increase proportionally with power if the fuel irradiation time remains within the current basis. Thus, the long-lived radionuclides are expected to increase proportionally to power. The radionuclide inventories are provided in terms of Curies per megawatt of reactor thermal power at various times after shutdown.

8.4 RADIATION SOURCES IN REACTOR COOLANT

8.4.1 Coolant Activation Products

During reactor operation, the coolant passing through the core region becomes radioactive as a result of nuclear reactions. The coolant activation, especially N-16 activity, is the dominant source in the turbine building and in the lower regions of the drywell. Because these sources are produced by interactions in the core region, their rates of production are proportional to power. However, the concentration in the steam remains nearly constant, because the increase in activation production is balanced by the increase in steam flow. As a result, the activation products, observed in the reactor water and steam, increase in approximate proportion to the increase in thermal power.

8.4.2 Activated Corrosion Products

The reactor coolant contains activated corrosion products from metallic materials entering the water and being activated in the reactor region. Under the TPO uprate conditions, the FW flow increases with power, the activation rate in the reactor region increases with power, and the filter efficiency of the condensate demineralizers may decrease as a result of the FW flow increase. The net result may be an increase in the activated corrosion product production. The total TPO uprate corrosion product concentration is bounded by the design basis concentration.

8.4.3 Fission Products

Fission products in the reactor coolant are separable into the products in the steam and the products in the reactor water. The activity in the steam consists of noble gases released from the core plus carryover activity from the reactor water. The noble gases released during plant operation result from the escape of minute fractions of the fission products from the fuel rods. Noble gas release rates increase approximately proportional to power level. This activity is the noble gas offgas that is included in the LaSalle design. The offgas activity for TPO uprate operations are well below the original design basis. Therefore, the design basis release rates are bounding for the TPO uprate.

The fission product activity in the reactor water, like the activity in the steam, is the result of minute releases from the fuel rods. The total TPO uprate fission product activity in the reactor water is bounded by the design basis value.

8.5 RADIATION LEVELS

Normal operation radiation levels increase slightly for the TPO uprate. LaSalle was designed with substantial conservatism for higher-than-expected radiation sources. Thus, the increase in radiation levels does not affect radiation zoning or shielding in the various areas of the plant because it is offset by conservatism in the design, source terms, and analytical techniques.

Post-operation radiation levels in most areas of the plant increase by no more than the percentage increase in power level. In a few areas near the SFP cooling system piping and the reactor water piping, where accumulation of corrosion product crud is expected, as well as near some liquid radwaste equipment, the increase could be slightly higher. Regardless, individual worker exposures will be maintained within acceptable limits by the site As Low As is Reasonably Achievable (ALARA) program, which controls access to radiation areas. Procedural controls compensate for increased radiation levels.

The change in core activity inventory resulting from the TPO uprate (Section 8.3) increases post-accident radiation levels by no more than approximately the percentage increase in power level. The slight increase in the post-accident radiation levels has no significant effect on the plant or the habitability of the on-site Emergency Response facilities. A review of areas requiring post-accident occupancy concluded that access needed for accident mitigation is not significantly affected by the TPO uprate.

Section 9.2 addresses the Main Control Room doses for the worst-case accident.

8.6 NORMAL OPERATION OFF-SITE DOSES

The Technical Specification limits implement the guidelines of 10 CFR 50, Appendix I. A review of the normal radiological effluent doses shows that at CLTP, the annual doses are a small fraction of the doses allowed by Technical Specification limits with the exception of the Site Boundary for whole body dose. The average reported value during 2004 - 2006 was 2.04% of the allowed dose to the whole body at the site boundary. The TPO uprate does not involve significant increases in the offsite dose from noble gases, airborne particulates, iodine, tritium or liquid effluents. In addition, radiation from shine is not a significant exposure pathway. Present offsite radiation levels are a negligible portion of background radiation. Therefore, the normal offsite doses are not significantly affected by operation at the TPO RTP level and remain below the limits of 10 CFR 20 and 10 CFR 50, Appendix I.

9 REACTOR SAFETY PERFORMANCE EVALUATIONS

9.1 ANTICIPATED OPERATIONAL OCCURRENCES

AOOs are the result of a single equipment failures or an operator error that can be reasonably expected to occur during operation. The events are categorized based on the potential initiating cause of the threat to the fuel and reactor system. Analysis results for the potentially limiting AOOs are used to establish operating limits to ensure that the acceptance criteria are met. The THERMEX methodology (Reference 7) is used to establish the OLMCPRs based on the cycle-specific results of the limiting transient and safety limit MCPR analyses.

The effect of the TPO uprate of ~1.7% is expected to have only a small effect on the OLMCPR (< 0.01), similar to cycle-to-cycle variations. Because the effect is small, no plant-specific transient analyses are provided in this report. Plant-specific analyses for all potentially limiting events will be performed on a cycle-specific basis as part of the reload licensing process prior to the implementation of the TPO uprate.

A review of the LaSalle licensing basis was performed to identify the potentially limiting AOOs that need to be evaluated to establish the operating limits at TPO conditions. The results of the review are presented in Table 9-1. These limiting events will be reanalyzed for the TPO uprate at the time of the normal reload preparation for the first fuel cycle to employ the uprate. That analysis is to include all events that establish the core operating limits and the events that show conformance to other transient protection criteria (e.g., ASME overpressure limits).

Table 9-1 also presents the computer models used for the analysis of each event. Pressurization transients (Generator Load Rejection No Bypass (LRNB), Turbine Trip No Bypass (TTNB), Feedwater Controller Failure (FWCF) and Main Steam Isolation Valve Closure (MSIVC)) are analyzed using the approved transient analysis methodology documented in References 7 through 10. The quasi-steady state events (RWE, Loss of Feedwater Heater (LFWH) and slow flow run up) use the 3D core simulator MICROBURN-B2 (Reference 5) or the XCOBRA methodology (Reference 9). The maximum power level at which the events are analyzed is also presented in Table 9-1.

Flow-dependent multipliers are applied to the LHGR limits when the plant is operating at less than 100% core flow. Flow-dependent MCPR limits are also provided. The flow-dependent multipliers and limits are based on the results of the slow recirculation flow increase analysis and are established each cycle.

Power-dependent multipliers are applied to the LHGR limits when the plant is operating at less than 100% power. Power-dependent MCPR limits are also provided. The power-dependent limits are based on the results of the transient analyses performed each cycle.

In summary, the effect of the TPO uprate on the limiting transient events is small. As a result, no plant-specific transient analysis results are presented. Cycle specific analyses for the potentially limiting transients will be performed using the cycle-specific core loading and previous exposure history. The potentially limiting events and the approach presented here is consistent with the approach discussed in Reference 1.

9.2 DESIGN BASIS ACCIDENTS

The radiological consequences of a DBA are basically proportional to the quantity of radioactivity released to the environment. This quantity is a function of the fission products released from the core as well as the transport mechanisms from the core to the release point. The radiological releases at the TPO uprate power are generally expected to increase in proportion to the core inventory increase, which is in proportion to the power increase.

Radiological consequences due to postulated DBA events have been evaluated and analyzed to show that NRC regulations are met for 2% above the CLTP. DBA events have either been previously analyzed at 102% of CLTP or are not dependent on core thermal power. The limit on reactor coolant activity is unchanged for the TPO uprate condition. Therefore, the radiological consequences associated with a postulated DBA from TPO uprate conditions are bounded by these analyses. The evaluation/analysis was based on the methodology, assumptions, and analytical techniques described in the Regulatory Guides, the Standard Review Plan (SRP) (where applicable), and in previous Safety Evaluations (SEs).

9.3 SPECIAL EVENTS

9.3.1 Anticipated Transient Without Scram

TLTR Section 5.3.5 and TLTR Appendix L, present a generic evaluation of the sensitivity of an ATWS to a change in power typical of the TPO uprate. The evaluation is based on previous analyses for power uprate projects. For a TPO uprate, if a plant has sufficient margin for the projected changes in peak parameters given in TLTR Section L.3.5, [[

]] The previous ATWS analysis, performed at 100% of CLTP, did not demonstrate the required margins for generic evaluation to the peak vessel bottom head pressure limit and to the pool temperature limit. [[

]]

NEDC-33004P-A, Revision 4, "Constant Pressure Power Uprate," Class III, July 2003 (also referred to as CLTR) was approved by the NRC as an acceptable method for evaluating the effects of Constant Pressure Power Uprates. Section 9.3.1 of the CLTR addresses the effect of Constant Pressure Power Uprate on ATWS. The CLTR methodology was used to analyze and evaluate the LaSalle ATWS event.

[[ ]]ATWS analysis is required for CLTP and for TPO RTP to ensure that the following ATWS acceptance criteria are met:

- 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 less than the design pressure (45 psig) and temperature (206°F) of the containment structure).
- Maintain coolable core geometry.

The TPO RTP ATWS analysis is performed using the NRC approved code ODYN (see Table 1-1). The key inputs to the ATWS analysis are provided in Table 9-2. The results of the analysis are provided in Table 9-3.

The ATWS analyses are performed based on ATRIUM-10 and GE14 fuel designs with GNF/GEH design methodology. The ATWS analyses are based on the core design from LaSalle Unit 2, Cycle 11. This core is representative for addressing any cores of ATRIUM-10 and / or GNF fuel.

The results of the ATWS analysis meet the above ATWS acceptance criteria. Therefore, the LaSalle response to an ATWS event at TPO RTP is acceptable. The potential for thermal-hydraulic instability in conjunction with ATWS events is evaluated in Section 9.3.1.4.

LaSalle also meets the ATWS mitigation requirements defined in 10 CFR 50.62:

- Installation of an Alternate Rod Insertion (ARI) system;
- Boron injection equivalent to 86 gpm; and
- Installation of automatic RPT logic (i.e., ATWS-RPT).

The 86 gpm boron injection equivalency requirement of 10 CFR 50.62 is satisfied via the following relationship:

$$(Q/86) \times (M251/M) \times (C/13) \times (E/19.8) \geq 1$$

where:

Q = Expected SBLC flow rate (gpm)

M251/M = Mass of water in a 251-inch diameter reactor vessel (lbs) / mass of water in the reactor vessel and recirculation system at hot rated condition (lbs)

C = Sodium pentaborate solution concentration (weight percent)

E = Boron-10 isotope enrichment (19.8% [natural boron – 10 isotope abundance])

For LaSalle,

Q = 41.2 gpm

M251/M = 1 (because LaSalle has a 251-inch diameter reactor vessel)

C = 12.0 %

E = 45.0 %

Therefore, the 86 gpm equivalency requirement is satisfied as follows:

$(Q/86) \times (M251/M) \times (C/13) \times (E/19.8) \geq 1$

$(41.2/86) \times (1) \times (12.0/13) \times (45.0/19.8) = 1.0 \geq 1$

There are no changes to the assumed operator actions for the TPO RTP ATWS analysis.

When required by changes in plant configuration (as identified by the design change process), changes to Emergency Operating Procedures (EOPs), including changes to EOP calculations and plant data, are developed and implemented in accordance with plant administrative procedure for EOP program maintenance.

LaSalle performs EOP calculations consistent with the BWR Owners Group Emergency Procedure Guidelines (EPGs) / Severe Accident Guidelines (SAGs) Appendix C. Critical software is verified and validated by Design Engineering to generate EOP results. The EOP calculation input and output data is reviewed and verified by Design Engineering. Changes to the EOP calculation outputs are forwarded to Operations for use in revising the EOP Procedures/Flow Charts and the SAGs and supporting documents. Finally, the EOP flow charts are verified and validated by Operations, including trial use in the simulator.

The ATWS mitigation strategy is based on the BWROG EPGs, which are incorporated in the existing LaSalle EOPs. TPO implementation does not change operator strategy on ATWS level reduction or early boron injection. TPO may affect some of the calculated curves, but does not affect stability mitigation actions. The changes due to TPO do not require modification of operator instructions.

LaSalle meets all CLTR dispositions and the results in this evaluation are described below. The topics addressed in this evaluation are:

Topic	CLTR Disposition	LaSalle Result
ATWS (Overpressure) - Event Selection	[[	Meets CLTR Disposition
ATWS (Overpressure) – Limiting Events		Meets CLTR Disposition
ATWS (Suppression Pool Temperature) - Event Selection		Meets CLTR Disposition
ATWS (Suppression Pool Temperature) – Limiting Events		Meets CLTR Disposition
ATWS (Peak Cladding Temperature)	]]	Meets CLTR Disposition

9.3.1.1 ATWS (Overpressure)

As stated in Section 9.3.1 of the CLTR, the higher operating steam flow may result in higher peak vessel pressures. The higher power and decay heat will result in higher suppression pool temperatures. The increased core power and reactor steam flow rates, in conjunction with the SRV capacity and response times, could affect the capability of the SBLC to mitigate the consequences of an ATWS event.

The overpressure evaluation includes consideration of the most limiting RPV overpressure case. Previous evaluations considered four ATWS events: [[

]] The ATWS (Overpressure) – Event Selection meets all CLTR dispositions.

The MSIVC and PRFO cases were performed for LaSalle. The analysis results are given in Table 9-3. The MSIVC and PRFO sequence of events are given in Tables 9-4 and 9-5, respectively. The short-term and long-term transient response to the MSIVC and PRFO ATWS events is presented in Figures 9-1 through 9-16. ATWS (Overpressure) – Limiting Events meet all CLTR dispositions.

9.3.1.2 ATWS (Suppression Pool Temperature)

As stated in Section 9.3.1 of the CLTR, the higher operating steam flow will result in higher peak vessel pressures. The higher power and decay heat may result in higher suppression pool temperatures. The increased core power and reactor steam flow rates, in conjunction with the SRV capacity and response times, could affect the capability of the SBLC to mitigate the consequences of an ATWS event.

The suppression pool temperature evaluation includes consideration of the most limiting RHR pool cooling capability case. Previous evaluations considered four ATWS events: [[

]] The analysis results are given in Table 9-3. [[
]]
The ATWS (Suppression Pool Temperature) – Event Selection meets all CLTR dispositions.

The MSIVC and PRFO cases were performed for LaSalle. The MSIVC and PRFO sequence of events are given in Tables 9-4 and 9-5, respectively. The ATWS (Suppression Pool Temperature) – Limiting Events meet all CLTR dispositions.

9.3.1.3 ATWS (Peak Cladding Temperature)

The TLTR in Appendix L.3 states that power uprate has a negligible effect on the PCT or local cladding oxidation. [[

]]

For ATWS events, the acceptance criteria for peak cladding temperature and local cladding oxidation for emergency core cooling systems, defined in 10 CFR 50.46, are adopted to ensure an ATWS event does not impede core cooling.

Coolable core geometry is assured by meeting the 2200ºF PCT and the 17% local cladding oxidation acceptance criteria stated in 10 CFR 50.46.

For TPO, PCT and local cladding oxidation are not required to be explicitly analyzed per Appendix L.3 of TLTR.

Therefore, ATWS PCT is in compliance with the acceptance criteria of 10 CFR 50.46.

9.3.1.4 ATWS with Core Instability

The CLTR in Section 9.3.3 states that the ATWS with core instability event occurs at natural circulation following a RPT. Therefore, it is initiated at approximately the same power level as a result of TPO operation because the MELLLA upper boundary is not increased. The core design necessary to achieve TPO operations may affect the susceptibility to coupled thermal-hydraulic/neutronic core oscillations at the natural circulation condition, but would not significantly affect the event progression.

Several factors affect the response of an ATWS instability event, including operating power and flow conditions and core design. The limiting ATWS core instability evaluation presented in References 23 and 24 was performed for an assumed plant initially operating at OLTP and the MELLLA minimum flow point. [[

]]

TPO allows plants to increase their operating thermal power but does not allow an increase in control rod line. [[

]]

[[

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Initial operating conditions of FWHOOS and FFWTR do not significantly affect the ATWS instability response reported in References 23 and 24. The limiting ATWS evaluation assumes that all FW heating is lost during the event and the injected FW temperature approaches the lowest achievable main condenser hot well temperature. [[

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[[

]] Therefore, the TPO effect on ATWS with core instability at LaSalle meets all CLTR dispositions.

9.3.1.5 SBLC System Performance and Hardware

Based on the results of the [[ ]] ATWS analysis, the maximum reactor lower plenum pressure following the limiting ATWS event reaches 1225 psig (1240 psia) during the time the SBLC is analyzed to be in operation. Consequently, there is a corresponding increase in the maximum pump discharge pressure to 1284.3 psig during injection and a decrease in the operating pressure margin for the pump discharge relief valves. Consideration was given to relief valve tolerance, system flow, head losses for during full injection, and cyclic pressure pulsations due to the positive displacement pump operation in determining the pressure margin to the opening set point for the pump discharge relief valves. Adequate relief valve setpoint margin has been confirmed. The pump discharge relief valves are periodically tested to maintain this tolerance. Therefore, the current SBLC process parameters associated with the minimum boron injection rate are not changed.

In the event that the SBLC is initiated before the time that the reactor pressure recovers from the first transient peak, resulting in opening of the SBLC relief valves, the valves will close only when the SBLC pump discharge pressure reduces to lower than the reseating pressure of the SBLC pump relief valves. Based on the result of the multiple ATWS transients, it is expected that the SBLC relief valves will close prior to the analyzed SBLC start time should they open during the unlikely event of early initiation.

The SBLC ATWS performance is evaluated for a representative core design for TPO. The evaluation shows that TPO has no adverse effect on the ability of the SBLC to mitigate an ATWS. Therefore, the system performance and hardware meets all CLTR dispositions.

9.3.1.6 Suppression Pool Temperature following ATWS Event

As stated in Section 6.5 of the CLTR, changes in the fuel design for TPO may require modifications to the SBLC as a result of the increase in the suppression pool temperature for the limiting ATWS event.

The boron injection rate requirement for maintaining the peak suppression pool water temperature limits, following the limiting ATWS event with SBLC injection, is not significantly affected (i.e., < 1ºF change) for TPO. Therefore, the Suppression Pool temperature following an ATWS event meets all CLTR dispositions.

9.3.1.7 Equipment Out-of-Service and Flexibility Options

MELLLA - The TPO ATWS analyses were performed along the MELLLA boundary. Therefore, this task continues to support this performance improvement feature.

SRV OOS - The TPO ATWS analyses were performed with one SRV OOS. Therefore, this task continues to support this Equipment Out-of-Service (EOOS) option.

MSIV OOS - The TPO ATWS analyses bound the MSIV OOS condition for TPO. LaSalle operation with MSIV OOS is limited to ≤ 75% rated power. With this restriction, the severity of the limiting ATWS events is reduced. The lower initial steaming rate reduces the peak vessel pressure, peak power, PCT, and integrated SRV flow. The reduction in integrated SRV flow thereby reduces the peak suppression pool temperature and containment pressure.

FWHOOS and FFWTR are operational flexibility options that allow continued operation with reduced FW temperature. Initial power is unchanged for both the FWHOOS and FFWTR conditions – the additional reactivity associated with the reduced FW temperature is typically offset with control rods, as needed. This makes the core less reactive due to the lower void fraction. Thus, use of normal feed water temperature is conservative for ATWS analyses.

The remaining EOOS and Performance Improvement features not specifically delineated above, but still licensed for LaSalle Units 1 and 2, continue to be supported at TPO conditions with respect to the ATWS analyses performed for TPO conditions.

9.3.2 Station Blackout

TLTR Appendix L.5 provides a generic evaluation of a potential loss of all alternating current power supplies based on previous plant response and coping capability analyses for typical power uprate projects. The previous power uprate evaluations have been performed according to the applicable bases for the plant (e.g., the bases, methods, and assumptions of RG 1.155 and/or Nuclear Utilities Management And Resources Council (NUMARC) 87-00). This evaluation is for confirmation of continued compliance to 10 CFR 50.63. It is recognized that this evaluation is dependent upon many plant-specific design and equipment parameters.

Specifically, the following main considerations were evaluated:

- The adequacy of the condensate/reactor coolant inventory.
- The capacity of the Class 1E batteries.
- The Station Blackout (SBO) compressed Nitrogen requirements.
- The ability to maintain containment integrity.
- The effect of loss of ventilation on rooms that contain equipment essential for plant response to a SBO event.

Applicable operator actions have previously been assumed consistent with the plant EPGs. These are the currently accepted procedures for each plant and SBO analysis. For the TPO uprate, there is no significant change in the time available for the operator to perform these assumed actions.

[[

]] LaSalle currently has margins of 621,358 gallons to the available suppression pool inventory volume and 3.5°F to the containment peak temperature limit. [[

]] Therefore, no LaSalle-specific SBO analysis is performed for the TPO uprate.

Table 9-1
Transient Events Evaluated for LaSalle TPO Reload Analysis

Event	Evaluation Model	Maximum Analysis Power Level (% of CLTP)
Fuel Thermal Margin Events		
Generator Load Rejection with Turbine Bypass Valves inoperable	Transient Models [1]	101.7%
Turbine Trip with Turbine Bypass Valves inoperable	Transient Models	101.7%
Feedwater Controller Failure – Maximum Demand	Transient Models	101.7%
Loss of Feedwater Heater	MICROBURN-B2	101.7%
Rod Withdrawal Error	MICROBURN-B2	101.7%
Slow Recirculation Flow Increase	XCOBRA and MICROBURN-B2	Power at maximum flow capability
Limiting Transient Overpressure Events		
Main Steam Isolation Valve Closure with High Flux Scram	COTRANSA2	102%

Notes:

1. Transient models signify the COTRANSA2, XCOBRA, XCOBRA-T and RODEX2 analysis codes. References for these codes are presented in Table 1-1.

Table 9-2
Key Inputs for ATWS Analysis

Input Variable	CLTP	TPO RTP
Reactor power (MWt)	3489	3548*
Reactor dome pressure (psia)	1020	1020
Each SRV capacity at 1150 psig (Mlbm/hr)	0.8654	0.8654
High pressure ATWS-RPT (psig)	1150	1150
Number of SRVs Out-of-service	1	1

* performed at 101.7% of CLTP

Table 9-3
Results for ATWS Analysis

Acceptance Criteria	CLTP [1, 2]	TPO RTP[1]
Peak vessel bottom pressure (psig)	1474	1491
Peak suppression pool temperature (°F)	204	204
Peak containment pressure (psig)	14.6	14.6
Peak cladding temperature (°F)	Generic Assessment	Generic Assessment
Local cladding oxidation (%)	Generic Assessment	Generic Assessment

Notes:

1. Cladding temperature and oxidation calculations are not required per Appendix L.3 of TLTR.
2. To maximize the effect of TPO, a baseline is established at the CLTP level, assuming the current licensed equipment performance assumptions and plant parameters.

Table 9-4
MSIVC Sequence of Events

Item	Event	TPO RTP BOC Event Time (sec)	TPO RTP EOC Event Time (sec)
1	MSIV Isolation Initiated	0.0	0.0
2	MSIVs Fully Closed	4.0	4.0
3	Peak Neutron Flux	4.1	4.0
4	High Pressure ATWS Setpoint	4.5	4.4
5	Start Opening of the First Relief Valve	4.4	4.4
6	Recirculation Pumps Trip	4.8	4.8
7	Peak Heat Flux	4.9	4.9
8	Peak Vessel Pressure	15.2	14.5
9	BIIT[1] Reached	16.0	16.0
10	FW Reduction Initiated	30.0	30.0
11	SBLC Pumps Start	124.5	124.4
12	RHR Cooling Initiated	660	660
13	Peak Suppression Pool Temperature	1683	1669
14	Hot Shutdown Achieved (Neutron Flux Remains < 0.1%)	1745	1830

[1] BIIT – Boron Injection Initiation Temperature

Table 9-5
PRFO Sequence of Events

Item	Event	TPO RTP BOC Event Time (sec)	TPO RTP EOC Event Time (sec)
1	TCV and Bypass Valves Start Open	0.1	0.1
2	MSIV Closure Initiated by Low Steamline Pressure	10.0	9.6
3	MSIVs Fully Closed	14.0	13.6
4	Peak Neutron Flux	14.2	14.4
5	High Pressure ATWS Setpoint	17.0	16.8
6	Start Opening of the First Relief Valve	17.0	16.7
7	Peak Heat Flux	17.4	17.2
8	Recirculation Pumps Trip	17.4	17.2
9	Peak Vessel Pressure	27.8	27.0
10	BIIT Reached	29.0	28.0
11	FW Reduction Initiated	40.0	39.6
12	SBLC Pumps Start	136.7	136.6
13	RHR Cooling Initiated	660	660
14	Peak Suppression Pool Temperature	1867	1691
15	Hot Shutdown Achieved (Neutron Flux Remains < 0.1%)	1914	1761

Figure 9-1
TPO RTP MELLLA BOC MSIVC (Short Term)

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Figure 9-2
TPO RTP MELLLA BOC MSIVC (Long Term-A)

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Figure 9-3
TPO RTP MELLLA BOC MSIVC (Long Term-B)

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[[

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Figure 9-4
TPO RTP MELLLA BOC MSIVC (Long Term-C)

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Figure 9-5
TPO RTP MELLLA BOC PRFO (Short Term)

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Figure 9-6
TPO RTP MELLLA BOC PRFO (Long Term-A)

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Figure 9-7
TPO RTP MELLLA BOC PRFO (Long Term-B)

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Figure 9-8
TPO RTP MELLLA BOC PRFO (Long Term-C)

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Figure 9-9
TPO RTP MELLLA EOC MSIVC (Short Term)

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Figure 9-10
TPO RTP MELLLA EOC MSIVC (Long Term-A)

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Figure 9-11
TPO RTP MELLLA EOC MSIVC (Long Term-B)

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Figure 9-12
TPO RTP MELLLA EOC MSIVC (Long Term-C)

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Figure 9-13
TPO RTP MELLLA EOC PRFO (Short Term)

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Figure 9-14
TPO RTP MELLLA EOC PRFO (Long Term-A)

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Figure 9-15
TPO RTP MELLLA EOC PRFO (Long Term-B)

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Figure 9-16
TPO RTP MELLLA EOC PRFO (Long Term-C)

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10 OTHER EVALUATIONS

10.1 HIGH ENERGY LINE BREAK

Because the TPO uprate system operating temperatures and pressures change only slightly, there is no significant change in High Energy Line Break (HELB) mass and energy releases. The FW lines, near the pump discharge, increase ~2°F and < 5 psi. Vessel dome pressure and other portions of the RCPB remain at current operating pressure or lower. Therefore, the consequences of any postulated HELB would not significantly change. The postulated break locations remain the same because the piping configuration does not change due to the TPO uprate.

The HELB evaluation was performed for all systems evaluated in the UFSAR. At the TPO RTP level, HELBs outside the drywell would result in an insignificant change in the sub-compartment pressure and temperature profiles. The evaluation shows that the affected building and cubicles that support safety-related functions are designed to withstand the resulting pressure and thermal loading following an HELB at the TPO RTP.

10.1.1 Steam Line Breaks

The critical parameter affecting the high-energy steam line break analysis is the reactor vessel dome pressure. Because there is no pressure increase for the TPO, the MSL pressure decreases and there is a slight decrease in the Main Steam Line Break (MSLB) blowdown rate. The MSLB is used with a concurrent FW line break to establish the peak pressure and the temperature environment in the MS tunnel. The TPO uprate increases the FW temperature ~2°F and pressure < 5 psi, which results in an insignificant increase in the FW mass and energy release. Design margins within the HELB analysis for a MSLB with a concurrent FW line break provide adequate margin for TPO conditions.

10.1.2 Liquid Line Breaks

10.1.2.1 Feedwater Line Breaks

FW line breaks are assumed concurrently with an MSLB, as discussed in Section 10.1.1.

10.1.2.2 ECCS Line Breaks

The HPCS and other ECCS lines are normally isolated from the reactor vessel, and a failure of one of these lines would result in a non-limiting break inside drywell, which would be bounded by other line breaks. Because these lines are normally isolated, the TPO uprate does not affect their line break analyses, for breaks outside drywell.

10.1.2.3 RCIC System Line Breaks

Steam line breaks in the RCIC pump/turbine room are the limiting breaks for structural design and equipment qualification. Because there is no increase in the reactor dome pressure relative to the original analysis, the mass flow rate does not increase. Therefore, the previous HELB analysis is bounding for the TPO uprate conditions.

10.1.2.4 RWCU System Line Breaks

The RWCU system line breaks are the limiting breaks for structural design and equipment qualification in several areas of the plant. As a result of the small increase in recirculation temperature with no pressure increase, the blowdown rate decreases slightly and the energy increases slightly. These conservatisms more than offset the effects of the temperature change, so the original HELB analysis is bounding.

10.1.2.5 CRD System Line Breaks

The CRD pipe rupture analysis is not affected by the TPO uprate.

10.1.2.6 Pipe Whip and Jet Impingement

Because there is no change in the nominal vessel dome pressure, pipe-whip and jet impingement loads do not significantly change.

The FW pump discharge pressure will increase slightly, but whip and jet loads are controlled by steady state pressure sources, such as the reactor vessel, rather than the initial line pressures. FW breaks close to the reactor vessel are controlled by the vessel pressure, but this does not increase. Breaks close to the feed water pumps are controlled by the FW pump pressure, which immediately reduces with increased flow rate, as pump flow tries to keep up with the break flow.

Because the pipe whip and jet impingement loads do not significantly change, the existing pipe whip restraints, jet impingement shields, and their supporting structures are unaffected by the TPO uprate conditions. Therefore, potential targets of pipe whip and jet impingement from postulated HELBs will continue to function and the safe shutdown function will be unaffected by the TPO RTP conditions.

10.1.2.7 Internal Flooding from HELB

None of the plant flooding zones contains a potential HELB location affected by the reactor operating conditions changed for the TPO uprate. The systems containing potential HELBs in the plant flooding areas are the RHR, SBLC, HPCS, LPCS, CRD, MS, FW, and RWCU. The systems' operational modes evaluated for HELB are not affected by the TPO uprate, nor are the plant internal flooding analysis or safe shutdown analysis.

10.2 MODERATE ENERGY LINE BREAK

None of the plant flooding zones contains a potential Moderate Energy Line Break (MELB) location affected by the reactor operating conditions changed for the TPO uprate. The following systems contain potential MELB locations in plant flooding zones: Clean Condensate, Cycled Condensate Storage, Core Standby Cooling System, Diesel Oil System, Fire Protection, Hydrogen and Carbon Dioxide System, High Pressure Core Spray, Low Pressure Core Spray, Reactor Building Equipment Drains, Residual Heat Removal, Reactor Core Isolation Cooling, Station Heat Recovery, Primary Containment Chiller Water Coolers, Reactor Building Closed Cooling Water, and Service Water.

No new moderate energy lines are identified. Protection requirements for safe-shutdown equipment for a postulated MELB are not dependent on power level. All sources of or protection measures against flooding are independent of power level. Internal flooding will not alter the ability of the plant to reach safe shutdown under TPO. Therefore, the plant internal flooding analysis is not affected.

10.3 ENVIRONMENTAL QUALIFICATION

Safety-related components must be qualified for the environment in which they operate. The TPO increase in power level increases the radiation levels experienced by equipment during normal operation and accident conditions. Because the TPO uprate does not increase the nominal vessel dome pressure, there is a very small effect on pressure and temperature conditions experienced by equipment during normal operation and accident conditions. The resulting environmental conditions are bounded by the existing environmental parameters specified for use in the environmental qualification program.

10.3.1 Electrical Equipment

The safety-related electrical equipment was reviewed to ensure that the existing qualification for the normal and accident conditions expected in the area where the devices are located remain adequate. Conservatisms in the equipment qualifications were originally applied to the environmental parameters, and no change is needed for the TPO uprate.

10.3.1.1 Inside Containment

Environmental qualification (EQ) for safety-related electrical equipment located inside the containment is based on Main Steam Line Break Accident (MSLBA) and DBA-LOCA conditions and their resultant temperature, pressure, humidity and radiation consequences, and includes the environments expected to exist during normal plant operation. The current accident conditions for temperature and pressure are based on analyses initiated from ≥ 102% of CLTP. Normal temperatures may increase slightly near the FW and reactor recirculation lines and will be evaluated through the EQ temperature monitoring program, which tracks such information for equipment aging considerations. The current radiation levels under normal plant conditions also increase slightly. The current plant environmental envelope for radiation is not exceeded by the changes resulting from the TPO uprate.

10.3.1.2 Outside Containment

Accident temperature, pressure, and humidity environments used for qualification of equipment outside containment result from an MSLB in the pipe tunnel, or other HELBs, whichever is limiting for each area. The HELB pressure and temperature profiles bound the TPO uprate conditions. There is adequate margin in the qualification envelopes to accommodate the small changes due to TPO conditions. Maximum accident radiation levels used for qualification of equipment outside containment are from a DBA-LOCA.

10.3.2 Mechanical Equipment With Non-Metallic Components

Operation at the TPO RTP level increases the normal process temperature very slightly in the FW and reactor recirculation piping. The slight increase in normal and accident radiation was evaluated in Section 8.5. Evaluation of the safety-related mechanical equipment with non-metallic components for temperature and radiation is not part of the LaSalle environmental qualification program licensing basis.

10.3.3 Mechanical Component Design Qualification

The increase in power level increases the radiation levels experienced by equipment during normal operation. However, where the previous accident analyses have been based on 102% of CLTP, the accident pressures, temperatures and radiation levels do not change. In those cases where the previous accident analyses have been based on < 102% of CLTP, the accident pressure, temperatures and radiation levels remain bounding for TPO RTP. The mechanical design of equipment/components (valves, heat exchangers, pumps, snubbers, etc.) in certain systems is affected by operation at the TPO RTP level because of the slightly increased temperature and sometimes flow rate. The revised operating conditions do not significantly affect the cumulative usage fatigue factors of mechanical components.

The effects of increased fluid induced loads on safety-related components are described in Section 3.4. As stated in Section 4.1, the containment loads for the TPO uprate are bounded by previous analyses at 102% of CLTP. Increased nozzle loads and component support loads due to the revised operating conditions were evaluated in the piping assessments in Section 3.5. These increased loads are insignificant, and become negligible when combined with the dynamic loads. Therefore, the mechanical components and component supports are adequately designed for the TPO uprate conditions.

10.4 TESTING

The TPO uprate power ascension is based on the guidelines in TLTR Appendix L Section L.2. Pre-operational tests are not needed because there are no significant changes to any plant systems or components that require such testing.

In preparation for operation at TPO uprate conditions, routine measurements of reactor and system pressures, flows, and selected major rotating equipment vibration are taken near 95% and 100% of CLTP, and at 100% of TPO RTP. The measurements will be taken along the same rod pattern line used for the increase to TPO RTP. Core power from the APRMs is re-scaled to the TPO RTP before exceeding the CLTP and any necessary adjustments will be made to the APRM alarm and trip settings.

The turbine pressure controller setpoint will be readjusted at ≤ 95% of CLTP and held constant. The setpoint is reduced so the reactor dome pressure is the same at TPO RTP as for the CLTP. Adjustment of the pressure setpoint before taking the baseline power ascension data establishes a consistent basis for measuring the performance of the reactor and the turbine control valves.

Demonstration of acceptable fuel thermal margin will be performed prior to and during power ascension to the TPO RTP at each steady-state heat balance point defined above. Fuel thermal margin will be projected to the TPO RTP point after the measurements taken at 95% and 100% of CLTP to show the estimated margin. The thermal margin will be confirmed by the measurements taken at full TPO RTP conditions. The demonstration of core and fuel conditions will be performed with the methods currently used at LaSalle.

Performance of the pressure and FW/level control systems will be recorded at each steady-state point defined above. The checks will utilize the methods and criteria described in the original startup testing of these systems to demonstrate acceptable operational capability. Water level changes of ±3 inches and pressure setpoint step changes of ±3 psi will be used. If necessary, adjustments will be made to the controllers and actuator elements.

The increase in power for the TPO uprate is sufficiently small that large transient tests are not necessary. High power testing performed during initial startup demonstrated the adequacy of the safety and protection systems for such large transients. Operational occurrences have shown the unit response is clearly bounded by the safety analyses for these events. [[

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10.5 OPERATOR TRAINING AND HUMAN FACTORS

No additional training (apart from normal training for plant changes) is required to operate the plant in the TPO uprate conditions. For TPO uprate conditions, operator response to transient, accident, and special events is not affected. Operator actions for maintaining safe shutdown, core cooling, containment cooling, etc., do not change for the TPO uprate. Minor changes to the P/F map, flow-referenced setpoint, and other associated changes, will be communicated through normal operator training. Simulator changes and validation for the TPO uprate will be performed in accordance with established LaSalle plant certification testing procedures.

10.6 PLANT LIFE

Two degradation mechanisms may be influenced by the TPO uprate: (1) Irradiation Assisted Stress Corrosion Cracking (IASCC) and (2) Flow Accelerated Corrosion (FAC). The increase in irradiation of the core internal components influences IASCC. The increases in steam and FW flow rate influence FAC. However, the sensitivity to the TPO uprate is small and various programs are currently implemented to monitor the aging of plant components, including EQ, FAC, and In-service Inspection. EQ is addressed in Section 10.3, and FAC is addressed in Section 3.5. These programs address the degradation mechanisms and do not change for the TPO uprate. The core internals see a slight increase in fluence, but the inspection strategy used at LaSalle, based on the Boiling Water Reactor Vessel and Internals Project (BWRVIP), is sufficient to address the increase. The Maintenance Rule also provides oversight for the other mechanical and electrical components, important to plant safety, to guard against age-related degradation.

Irradiation embrittlement of the RPVs is addressed in Section 3.2.1

The longevity of most equipment is not affected by the TPO uprate because there is no significant change in the operating conditions. No additional maintenance, inspection, testing, or surveillance procedures are required.

10.7 NRC AND INDUSTRY COMMUNICATIONS

NRC and Industry communications are generically addressed in the TLTR, Section 10.8. Per the TLTR, it is not necessary to review prior dispositions of NRC and industry communications and no additional information is required in this area.

10.8 PLANT PROCEDURES AND PROGRAMS

Plant procedures and programs are in place to:

1. Monitor and maintain instrument calibration during normal plant operation to assure that instrument uncertainty is not greater than the uncertainty used to justify the TPO uprate;
2. Control the software and hardware configuration of the associated instrumentation;
3. Perform corrective actions, where required, to maintain instrument uncertainty within limits;
4. Report deficiencies of the associated instruments to the manufacturer; and
5. Receive and resolve the manufacturer's deficiency reports.

10.9 EMERGENCY OPERATING PROCEDURES

The EOP action thresholds are plant unique and will be addressed using standard procedure updating processes. It is expected that the TPO uprate will have a negligible or no effect on the operator action thresholds and to the EOPs in general.

10.10 INDIVIDUAL PLANT EXAMINATION

LaSalle maintains and regularly updates a station probabilistic risk assessment (PRA) model. Use of the model is integrated with station operations and decision-making.

The PRA model and analysis will not be specifically updated for TPO, because the change in plant risk from the subject power uprate is insignificant. This conclusion is supported by NRC Regulatory Issue Summary (RIS) 2002-03. In response to feedback received during the public workshop held on August 23, 2001, the NRC wrote, “The NRC has generically determined that measurement uncertainty recapture power uprates have an insignificant effect on plant risk. Therefore, no risk information is requested to support such applications.”

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