ENCLOSURE 3

GE-HITACHI NUCLEAR ENERGY SAFETY ANALYSIS REPORT FOR COOPER NUCLEAR STATION THERMAL POWER OPTIMIZATION, NEDO-33385

APPENDIX K MEASUREMENT UNCERTAINTY RECAPTURE POWER UPRATE COOPER NUCLEAR STATION DOCKET NO. 50-298, DPR-46

NON-PROPRIETARY VERSION

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SAFETY ANALYSIS REPORT FOR COOPER NUCLEAR STATION THERMAL POWER OPTIMIZATION

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ACRONYNMS AND ABBREVIATIONS

Term	Definition
AC	Alternating Current
ADS	Automatic Depressurization System
AL	Analytical Limit
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
AOO	Anticipated Operational Occurrence
APRM	Average Power Range Monitor
ART	Adjusted Reference Temperature
ARTS	Average Power Range Monitor, Rod Block Monitor, Technical Specifications Improvement Program
ASDC	Alternate Shutdown Cooling
ASME	American Society Of Mechanical Engineers
ATWS	Anticipated Transient Without Scram
AV	Allowable Value
B&PV	Boiler and Pressure Vessel
BHP	Brake Horsepower
BOP	Balance of Plant
BWR	Boiling Water Reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Project
CD	Condensate Demineralizer
CFR	Code of Federal Regulations
CLTP	Current Licensed Thermal Power
CNS	Cooper Nuclear Station
CRD	Control Rod Drive
CS	Core Spray
CSC	Containment Spray Cooling
CSS	Core Support Structure
CUF	Cumulative Usage Factor
DBA	Design Basis Accident
DC	Direct Current
DG	Diesel Generator
ECCS	Emergency Core Cooling System
EFPY	Effective Full Power Years
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

Term	Definition
EOC	End of Cycle
EOL	End of Life
EOOS	Equipment Out-Of-Service
EOP	Emergency Operating Procedure
EPU	Extended Power Uprate
EQ	Environmental Qualification
FAC	Flow Accelerated Corrosion
FCV	Flow Control Valve
FIV	Flow-Induced Vibration
FPCCS	Fuel Pool Cooling And Cleanup System
fps	Feet Per Second
FW	Feedwater
FWHOOS	Feedwater Heater(s) Out-Of-Service
GDC	General Design Criteria
GE	General Electric Company
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
HVAC	Heating, Ventilation And Air Conditioning
HWC	Hydrogen Water Chemistry
IASCC	Irradiation Assisted Stress Corrosion Cracking
ICF	Increased Core Flow
IEEE	Institute Of Electrical And Electronics Engineers
IGSCC	Intergranular Stress Corrosion Cracking
IPE	Individual Plant Examination
IRM	Intermediate Range Monitor
kA	Kilo-amp
ksi	Kips Per Square Inch
kV	Kilovolt
kW	Kilowatt
LCO	Limiting Conditions For Operation
LHGR	Linear Heat Generation Rate
LOCA	Loss-Of-Coolant-Accident
LOOP	Loss Of Offsite Power
LPRM	Local Power Range Monitor

Term	Definition
LPSP	Low Power Setpoint
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
MLHGR	Maximum Linear Heat Generation Rate
MOV	Motor Operated Valve
MS	Main Steam
MSIV	Main Steam Isolation Valve
MSIVC	Main Steam Isolation Valve Closure
MSL	Main Steam Line
MSLB	Main Steam Line Break
MSLBA	Main Steam Line Break Accident
MVA	Million Volt Amps
MWe	Megawatt-Electric
MWt	Megawatt-Thermal
NPDES	National Pollutant Discharge Elimination System
NPPD	Nebraska Public Power District
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)
OLMCPR	Operating Limit Minimum Critical Power Ratio
OOS	Out-Of-Service
P-T	Pressure-Temperature
PCS	Pressure Control System
PCT	Peak Clad Temperature
PRFO	Pressure Regulator Failure Open – Maximum Steam Demand
PSA	Probabilistic Safety Assessment
psi	Pounds Per Square Inch
psia	Pounds Per Square Inch - Absolute
psid	Pounds Per Square Inch - Differential
psig	Pounds Per Square Inch - Gauge

Term	Definition
RBM	Rod Block Monitor
RCIC	Reactor Core Isolation Cooling
RCPB	Reactor Coolant Pressure Boundary
REC	Reactor Equipment Cooling
REM	Roentgen Equivalent Man (Radiation Dose Measurement)
RFP	Reactor Feed Pump
RG	Regulatory Guide
RHR	Residual Heat Removal
RIPD	Reactor Internal Pressure Difference
RIS	Regulatory Issue Summary
RPS	Reactor Protection System
RPT	Recirculation Pump Trip
RPV	Reactor Pressure Vessel
RTNDT	Reference Temperature Of Nil-Ductility Transition
RTP	Rated Thermal Power
RWCU	Reactor Water Cleanup
RWM	Rod Worth Minimizer
SAFER/GESTR-LOCA	A Computer Program, A Model For Analysis Of System Response To Loss-Of-Coolant Accident
SAR	Safety Analysis Report
SBO	Station Blackout
SBPCS	Steam Bypass Pressure Control System
SDC	Shutdown Cooling
SER	Safety Evaluation Report
SFP	Spent Fuel Pool
SGTS	Standby Gas Treatment System
SJAE	Steam Jet Air Ejector
SLCS	Standby Liquid Control System
SLMCPR	Safety Limit Minimum Critical Power Ratio
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
TAF	Top Of Active Fuel
TBCCW	Turbine Building Closed Cooling Water System
TCV	Turbine Control Valve
TFSP	Turbine First Stage Pressure

Term	Definition
T/G	Turbine-Generator
TIP	Traversing In-Core Probe
TLO	Two (Recirculation) Loop Operation
TLTP	TPO Licensed Thermal Power
TLTR	NEDC-32938P-A, Thermal Power Optimization Licensing Topical Report
TPO	Thermal Power Optimization
TS	Technical Specification
TSAR	Thermal Power Optimization Safety Analysis Report
TSV	Turbine Stop Valve
USAR	Updated Final Safety Analysis Report
UHS	Ultimate Heat Sink
USE	Upper Shelf Energy
VWO	Valves Wide Open
Wd	Recirculation Drive Flow

EXECUTIVE SUMMARY

This report summarizes the results of all significant safety evaluations performed that justify increasing the licensed thermal power at Cooper Nuclear Station (CNS) to 2419 MWt. The requested license power level is 1.62% above the current licensed thermal power (CLTP) level of 2381 MWt. The actual power increase is governed by the results of the core thermal power uncertainty calculation, which currently allows for an increase to 2419 MWt, 1.62% above CLTP. However, the significant safety evaluations were performed at 2421 MWt, i.e., 1.7% above CLTP.

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 (USAR) are not repeated. This report summarizes the results of the safety evaluations needed to justify a licensing 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 at CNS of 1.7%. 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 CNS can safely operate at a power level of 2421 MWt.

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

1. All safety aspects of the plant that are affected by a 1.7% increase in the thermal power level were evaluated, including the Nuclear Steam Supply System (NSSS) and Balance-of-Plant (BOP) systems.
2. Evaluations and reviews were based on licensing criteria, codes, and standards applicable to the plant at the time of the TSAR submittal. There is no change in the previously established licensing basis for the plant, except for the increased power level.
3. Evaluations and/or analyses were performed using NRC-approved or industry-accepted analysis methods for the USAR accidents, transients, and special events affected by TPO.
4. 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).
5. NSSS components and systems were reviewed to confirm that they continue to comply with the functional and regulatory requirements specified in the USAR and/or applicable reload license.
6. Any modification to safety-related or non-safety-related equipment will be implemented in accordance with 10 CFR 50.59.
7. 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.
8. A review was performed to assure that the increased thermal power level continues to comply with the existing plant environmental regulations.
9. 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.
10. A review of the latest USAR and of design changes / 10 CFR 50.59 evaluations implemented, but not yet shown in the USAR, 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.

1.0 INTRODUCTION

1.1 OVERVIEW

This document addresses a Thermal Power Optimization (TPO) power uprate of 1.62% of the current licensed thermal power (CLTP), consistent with the magnitude of the thermal power uncertainty reduction for the Cooper Nuclear Station (CNS) plant. While the significant safety evaluations performed at 2421 MWt, i.e., 1.7% above CLTP, the actual power increase is governed by the results of the core thermal power uncertainty calculation, which currently allows for an increase to 2419 MWt, 1.62% above CLTP. 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 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 CNS.

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 ($\leq$ 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 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 $\geq$ 102% safety analysis basis is reestablished above the uprated power level. Therefore, all GE 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

CNS was originally licensed at 2381 MWt. 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. Figures 1-1 (101.7% of CLTP) and 1-2 (101.62% of CLTP) illustrate the TPO power/flow-operating map for CNS. Figure 1-1 is the power/flow operating map for the bounding analysis at 101.7% of CLTP and Figure 1-2 is the power/flow operating map for the requested 101.62% of CLTP. The changes to the power/flow 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 CNS 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 coastdown 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 SLO operating domain as a result of the TPO uprate. Therefore, the SLO operating domain is not provided. For CNS the maximum reactor core thermal power for SLO operation remains at 1657.2 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 CNS. 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 scope of the evaluations are summarized in the following sections:

2.0 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.

3.0 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.

4.0 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, LOCA, and safety relief valve containment dynamic loads.

5.0 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.

6.0 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.

7.0 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.

8.0 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.

9.0 Reactor Safety Performance Evaluations

[[

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

10.0 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 IPE (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 impact on plant risk. Therefore, no risk information is requested to support such applications."

1.2.4 Exceptions to the TLTR

None.

1.2.5 Concurrent Changes Unrelated to TPO

None.

1.3 TPO PLANT OPERATING CONDITIONS

1.3.1 Reactor Heat Balance

The following typical heat balance diagrams at the TPO conditions are presented:

Figure 1-3 Reactor Heat Balance – 2421 MWt (101.7% of CLTP), 100% Core Flow

Figure 1-4 Reactor Heat Balance – 2419 MWt (101.62% of CLTP), 100% Core Flow

Figure 1-3 is the Reactor Heat Balance for the bounding analysis at 101.7% of CLTP and Figure 1-4 is the Reactor Heat Balance for the requested 101.62% of CLTP.

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 CNS 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 CNS 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 (76.9% of Rated Core Flow at TLTP)
3% Safety Relief Valve (SRV) Setpoint Tolerance
Turbine Bypass Valve (TBV) 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 feedwater 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 101.7% of CLTP. The strategy for achieving higher power is to 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
Reactor Heat Balance	ISCOR	09	Y (1)	NEDE-24011-P Rev 0 SER

* The application of these codes to the CNS TPO 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 extended power uprate programs.

Notes For Table 1-1:

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

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

Parameter	CLTP	TPO RTP (101.7% of CLTP)	TPO RTP (101.62% of CLTP)
Thermal Power (MWt) (Percent of Current Licensed Power)	2381.0 100.0	2421.0 101.7	2419.0 101.62
Steam Flow (Mlb/hr) (Percent of Current Rated)	9.556 100.0	9.716 101.7	9.707 101.6
FW Flow (Mlb/hr) (Percent of Current Rated)	9.521 100.0	9.681 101.7	9.672 101.6
Dome Pressure (psia)	1020	1020	1020
Dome Temperature (°F)	547.0	547.0	547.0
FW Temperature (°F)	367.1	367.1	367.1
Full Power Core Flow Range (Mlb/hr) (Percent of Current Rated)	55.1 to 77.2 75.0 to 105.0	56.5 to 77.2 76.9 to 105.0	56.4 to 77.2 76.8 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 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	~1.1°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 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 (30 psig), must stay within existing 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 the TPO (101.7% of CLTP)

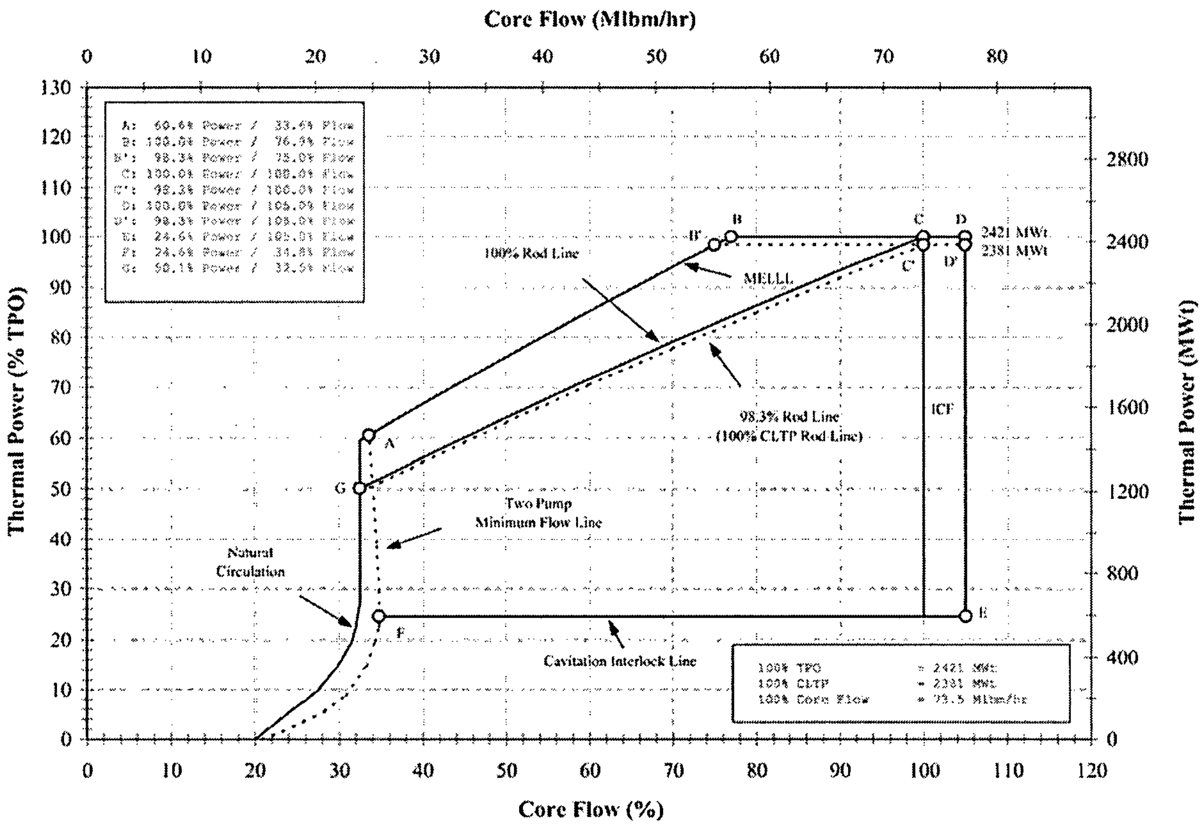


Figure 1-2 Power/Flow Map for the TPO (101.62% of CLTP)

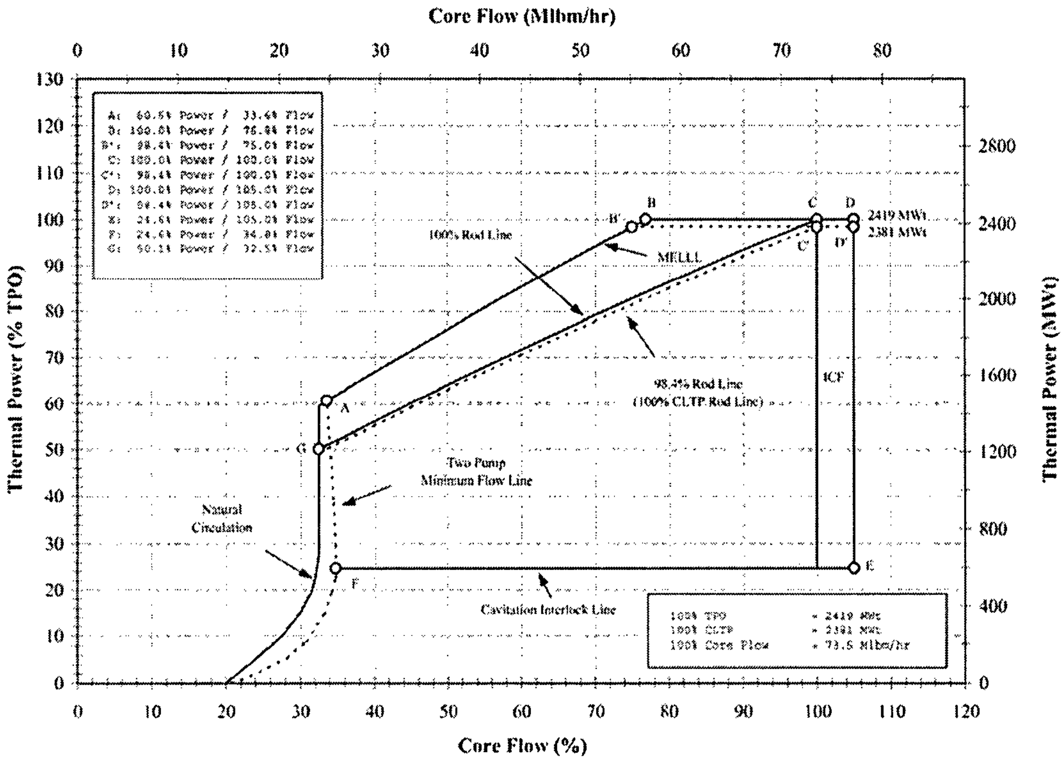
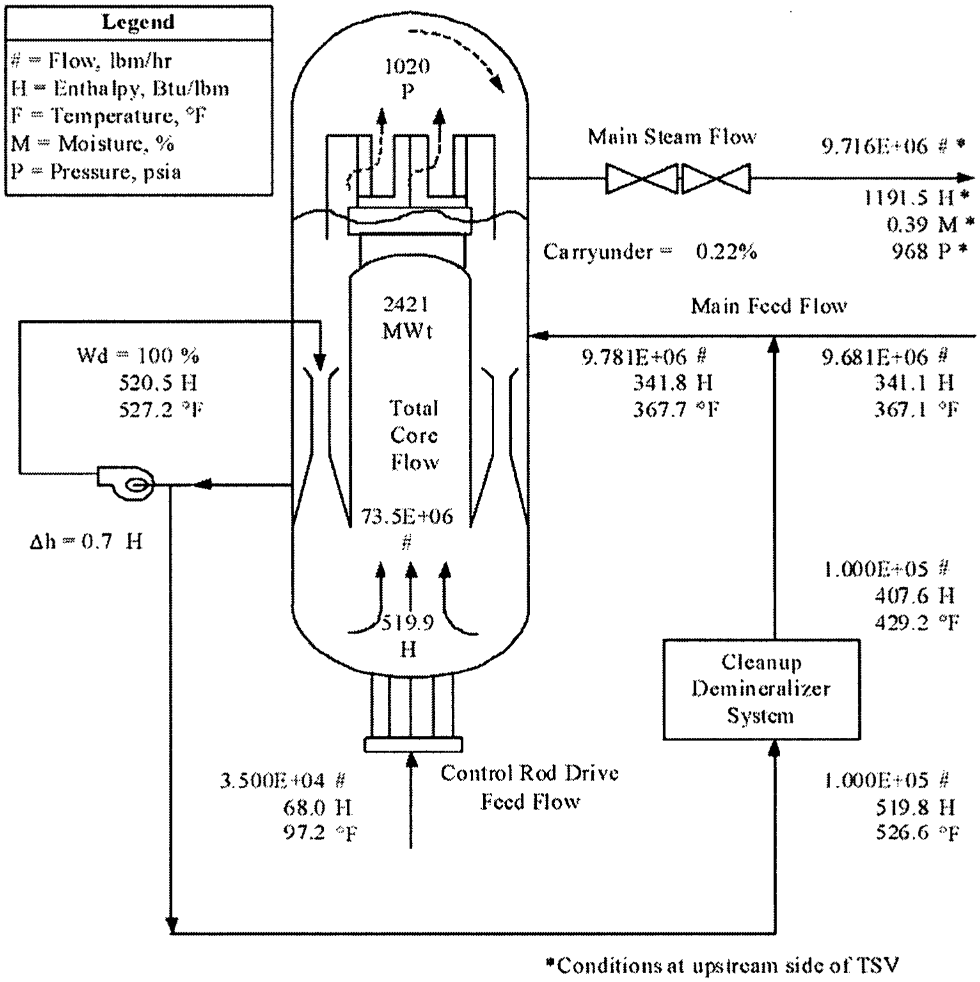
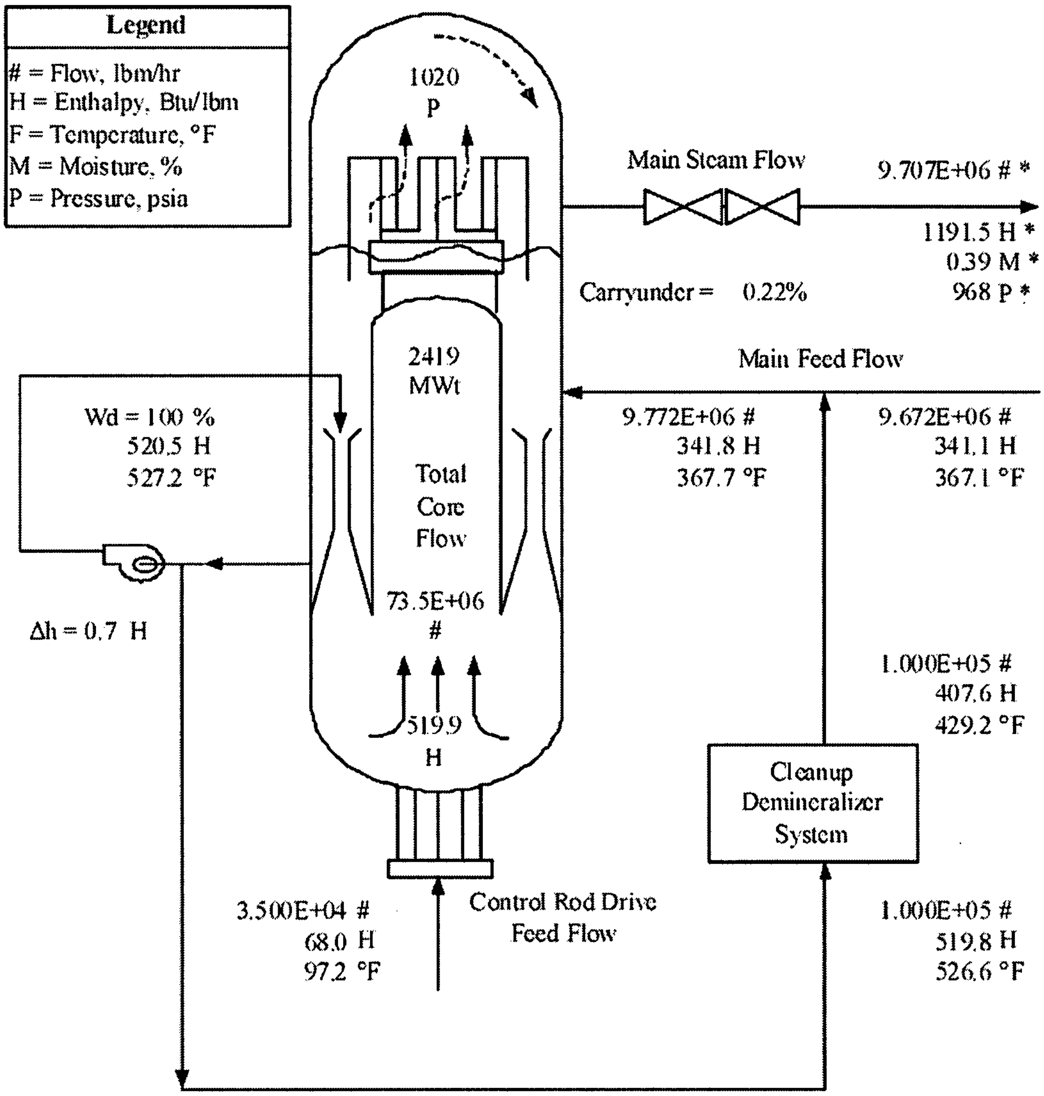


Figure 1-3 Reactor Heat Balance – TPO Power (101.7% of CLTP), 100% Core Flow



Core Thermal Power	2421.0
Pump Heating	7.4
Cleanup Losses	-3.3
Other System Losses	-0.6
Turbine Cycle Use	2424.5 MWt

Figure 1-4 Reactor Heat Balance – TPO Power (101.62% of CLTP), 100% Core Flow



*Conditions at upstream side of TSV

Core Thermal Power	2419.0
Pump Heating	7.4
Cleanup Losses	-3.3
Other System Losses	-0.6
Turbine Cycle Use	2422.5 MWt

2.0 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.

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, LOCA). This section addresses the effects of TPO on thermal limits. Cycle-specific core configurations, which are evaluated for each reload, 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 is based on [[

]] The historical 25% RTP value is a conservative basis, as described in the plant Technical Specifications, [[

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Therefore, the Safety Limit percent RTP basis, some thermal limits monitoring LCOs, and SR percent RTP thresholds remain at 25% RTP for the TPO uprate.

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. Consistent with approved practice, a revised SLMCPR is calculated for the first TPO fuel cycle and confirmed for each subsequent cycle. The historical uncertainty allowance and calculational methods are discussed in TLTR Section 5.7.2.1.

2.2.2 MCPR Operating Limit

TLTR Appendix E shows that the changes in the Operating Limit Minimum Critical Power Ratio (OLMCPR) for a TPO uprate [[

]] Because the cycle-specific SLMCPR is also defined, the actual required OLMCPR can be established. This ensures an adequate fuel thermal margin for TPO uprate operation.

2.2.3 MAPLHGR and Maximum LHGR Operating Limits

The Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) and maximum Linear Heat Generation Rate (LHGR) limits are maintained as described in TLTR Section 5.7.2.2. No significant change results due to TPO operation. The LHGR limits are fuel dependent and are not affected by the TPO. The ECCS performance is addressed in Section 4.3.

2.3 REACTIVITY CHARACTERISTICS

All minimum shutdown margin requirements apply to cold shutdown (≤ 212°F) conditions and are maintained without change. Checks of cold shutdown margin based on Standby Liquid Control System (SLCS) 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 in the 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

Option I-D is a solution combining prevention and detect-and-suppress elements (Reference 5). The prevention portion of the solution is an administratively controlled exclusion region. The exclusion region calculation is a confirmation that regional mode instabilities are not probable. The flow biased Average Power Range Monitor (APRM) scram provides automatic detection and suppression of core wide instabilities. This scram ensures the fuel cladding integrity safety limit is met for thermal hydraulic oscillations.

Thermal Power Optimization may affect the exclusion region slightly. However, the exclusion region is dependent upon the core loading, then reviewed and adjusted as required, for each reload core. The confirmation that regional mode reactor instability is not probable is also re-evaluated when the exclusion region is recalculated. These features will be analyzed for the first core reload analysis that incorporates the new rated power level.

Thermal Power Optimization may also affect the SLMCPR protection confirmation slightly. Changes to the nominal flow-biased APRM trip setpoint or the rated rod line require the hot channel oscillation magnitude portion of the detect-and-suppress calculation to be recalculated. This calculation is not dependent upon the core and fuel design. However, the SLMCPR protection calculation is dependent upon the core and fuel design and is performed for each reload. These features will be analyzed for the first reload analysis that incorporates the new rated power level. Therefore, a separate evaluation for Option I-D plants is not required for Thermal Power Optimization.

2.5 REACTIVITY CONTROL

The generic discussion in TLTR Sections 5.6.3 and Appendix J.2.3.3 applies to the CNS 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.

3.0 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 B&PV Code and plant Technical Specification requirements. There is no increase in nominal operating pressure for the CNS 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 greater than or equal to 1×10^{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 fluence at CLTP was scaled for use at TPO. This fluence is used to evaluate the vessel against the requirements of 10CFR50, Appendix G. The results of these evaluations indicate that:

(a) The upper shelf energy (USE) for the plate materials remains greater than 50 ft-lb for the design life of the vessel and maintains the margin requirements of 10CFR50 Appendix G. Equivalent margin for the weld material remains greater than the required 35 ft-lb per Code Case N-512. The maximum % decrease for the plate beltline materials is 21% of 32 EFPY and the USE is 43.67 ft-lb for the limiting weld.

(b) The beltline material reference temperature of the nil-ductility transition (RT_{NDT}) remains below the 200°F screening criteria as defined in Reference 6.

(c) The current P-T curves bound TPO operation up to 28 EFPY. CNS will revise the curves for operation beyond 28 EFPY.

(d) The 32 effective full power year (EFPY) shift is increased, and consequently, requires a change in the adjusted reference temperature (ART), which is the initial RT_{NDT} plus the shift. These values are provided in Table 3-1.

(e) The reactor vessel material surveillance program consists of three (3) capsules.

One capsule, at the 30° azimuth, containing Charpy specimens was removed and tested in 1985 after 6.8 EFPY of operation. A second capsule, at the 300° azimuth, was removed and tested in 1991 after 11.2 EFPY of operation. Specimens from this capsule were reconstituted and installed in the vessel in 1993; this capsule is scheduled to be removed in 2029. The remaining original capsule has been in the reactor vessel since plant startup. This capsule is scheduled to be removed in 2016.

TPO has no effect on the existing surveillance schedule.

The maximum normal operating dome pressure for TPO is unchanged from that for original power operation. Therefore, the hydrostatic and leakage test pressures 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

Certain reactor vessel components are generically dispositioned without detailed structural analysis. For components with no increase in flow, temperature, pressure, reactor internal pressure difference (RIPD), or other mechanical loads, no further evaluation is required. In addition, previous GE BWR TPO experience has demonstrated that, using the evaluation process documented in Appendix I of the TLTR, numerous components are below the 0.5 CUF criteria, thus requiring no further evaluation.

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		•]] The above components are unaffected by TPO operating conditions.

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Because the Recirculation Inlet Nozzle (N2), Steam Outlet Nozzle (N3), Core Spray Nozzle (N5), Top Head Spray (N6A), Top Head Instrumentation Nozzle (N6B), and Top Head Vent Nozzle & Bolts (N7), Jet Pump Instrumentation Nozzle (N8), CRD-HSR Nozzle (N9); Core ΔP and Liquid Control Nozzle (N10), 2" Instrumentation Nozzles (N11, N12, N16), Drain Nozzle (N15), Support Skirt, In-Core Housing Penetrations, Vessel Cylindrical Shell, Basin Seal Skirt, Stabilizer Bracket, Insulation Bracket, Top Head Lifting Lugs, Steam Dryer Hold Down Bracket, Guide Rod Bracket, Steam Dryer Bracket, Feedwater Sparger Bracket, Core Spray Bracket, Jet Pump Support Pads, and Surveillance Bracket, and IRM/SRM Dry Tube and Power Range Detector components have fatigue usages less than or equal to 0.5 or were originally exempt from fatigue requirements, these components are confirmed to be consistent with the generic disposition provided in the TLTR, thus requiring no further evaluation for TPO.

Seal Leak Detection Nozzles (N13, N14) were not considered to be a pressure boundary component 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 1965 Code with Addenda to and including Winter 1966, which is the code of construction, was used as the governing code. 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 Cooper Nuclear Station:

- Recirculation Outlet Nozzle (N1): This nozzle was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1983 Edition.

- Recirculation Inlet Nozzle (N2): This nozzle was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1983 Edition.

- Feedwater Nozzle (N4): This nozzle was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Summer 1976.

- Core Spray Nozzle (N5): This nozzle was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1983 Edition.

- Jet Pump Instrumentation Nozzle (N8): This nozzle was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1980 Edition with Addenda to and including Winter 1981.

- CRD Hydraulic System Return Nozzle (N9): This nozzle was modified (capped) and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition with Addenda to and including Winter 1975.

- Core ΔP & Liquid Control Nozzle (N10): This component was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1980 Edition with Addenda to and including Winter 1981.

- CRD Penetration: This component was modified and the governing Code for the evaluation/modification is the ASME Boiler and Pressure Vessel Code, Section III, 1965 Edition with Addenda to and including Winter 1966.

- IRM/SRM Dry Tube, 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, 1977 Edition with Addenda to and including Summer 1977.

Typically, "new" stresses are determined by scaling the "original" stresses based on the TPO conditions (pressure, temperature, and flow). The analyses were performed for the design, normal & upset, and emergency & faulted conditions. There are no changes in annulus pressurization, jet reaction, pipe restraint or fuel lift loads.

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 reactor coolant temperature and flows (except core flow) at TPO conditions are only slightly changed from those at current rated conditions. Evaluations were performed at conditions that bound the slight change in operating conditions. The type of evaluations 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, and Subsection NB for all components. Lastly, the fatigue usage was evaluated for the limiting location of components with a usage factor greater than 0.5. The fatigue analysis results for the limiting components are provided in Table 3-2. The analysis results for TPO show that all components meet their ASME Code requirements.

3.2.2.3 Emergency and Faulted Conditions

The stresses due to emergency and faulted conditions are based on loads such as peak dome pressure, which are unchanged. These loads remain unchanged and bound the TPO values. Therefore, ASME Code Section III requirements are met for all RPV components.

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 to be changed for the TPO uprate. The effect due to the changes in loads for both Normal and Upset conditions is reported in Section 3.3.2. 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% 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% CLTP.

Fuel Bundle Lift Margins are calculated for the Emergency and Faulted conditions for 102% 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. As an older plant, the Cooper licensing basis does not require the hydraulic lift forces to be combined with seismic loads. Thus, the hydraulic control rod guide tube (CRGT) lift forces are not calculated.

3.3.2 Reactor Internals Structural Evaluation

The RPV internals consist of the (Core Support Structures) CSS components and non-CSS components. The RPV Internals are not certified to the ASME Code; however, the requirements of the ASME Code are used as guidelines in their evaluations. The evaluations/stress reconciliation in support of the TPO was performed consistent with the design basis analysis of the components. The RPV Internals evaluated are:

Core Support Structure Components (CSS)

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

Non-Core Support Structure Components (Non-CSS)

- Steam Dryer
- Feedwater Sparger
- Jet Pump Assembly
- Core Spray Line and Sparger
- Access Hole Cover
- Shroud Head and Steam Separator Assembly
- In-core Housing and Guide Tube
- Jet Pump Instrument Penetration Seal
- Core DP/Standby Liquid Control System

The original configurations of the RPV internals 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 evaluations are based on GE-14 fuel.

The following loads were considered in the evaluation of the RPV internals.

- RPV design pressure
- Deadweight
- Seismic, loads
- RIPD
- Acoustic and flow induced loads
- Thermal effects

RPV design pressure remains unchanged. The temperature in the annulus changes insignificantly (< 0.5 °F). Seismic load remains unchanged. RIPD loads for normal, upset conditions decrease for all components except the shroud head and steam dryer. For the shroud head, they increase with respect to CLTP. However, remain bounded by the design basis RIPDs. For the steam dryer adequate stress margins exist in the normal and upset conditions to accommodate the increase in RIPDs. The faulted condition RIPD for all components remain unchanged. Acoustic and flow induced loads remain unaffected.

Based on the above, the governing stresses for all RPV internal components in the TPO condition remain bounded by their CLTP values or bounded by the current design basis (see Table 3-3). Therefore, the qualification of the RPV internals in the CLTP condition remains valid for the TPO condition.

3.3.3 Steam Separator and Dryer Performance

The steam separator and dryer performance evaluation is described in TLTR Section 5.5.1.6. As described in the TLTR, no additional evaluation of the steam separator and dryer performance is necessary unless the plant has been [[

]], the generic evaluation in the TLTR is applicable and no further evaluation is needed.

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 flow-induced vibration (FIV) on the reactor internals at TPO RTP 101.7% and rated core flow. The vibration levels for the TPO uprate conditions were estimated from vibration data recorded during startup testing of the NRC designated prototype plant (FitzPatrick) at CNS 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 Separator Steam Dryer	Steam flow at TPO RTP is ~2% greater than CLTP	Slight increase in FIV. Cooper core flow and steam flow at TPO conditions are less than the prototype plant core flow and steam flow at rated conditions. Prior to exceeding CLTP and ascension to TPO, CNS will ensure compliance with Reg. Guide 1.20.
Core Spray (CS) Line Low Pressure Coolant Injection (LPCI) Coupling Control Rod Guide Tube In-Core Guide Tubes	Core flow at TPO RTP is identical to CLTP	No change

Component(s)	Process Parameter(s)	TPO Evaluation
Fuel Channel LPRM/IRM Tubes	Core flow at TPO RTP is identical to CLTP No change in core flow distribution	No change
Jet Pumps	Jet pump flow at TPO RTP is identical to CLTP Fluid temperature increases ~ 1 °F	No meaningful change
Jet Pump Sensing Lines	Vane passing frequency of recirculation pumps	No change in possibility of resonance
FW Sparger	FW flow at TPO RTP is ~2% greater than CLTP	Slight increase in FIV. Cooper FW flow at TPO condition is less than the FW flow at the prototype plant at rated conditions.

The calculations for the TPO uprate conditions indicate that vibrations of all safety-related reactor internal components are within the GE acceptance criteria. The analysis is conservative for the following reasons:

- The GE criteria of 10,000 psi peak stress intensity is much more conservative than the ASME allowable peak stress intensity of 13,600 psi for service cycles equal to 10^{11}.
- The modes are absolute summed.
- The maximum vibration amplitude in each mode is used in the absolute sum process, whereas in reality the vibration amplitude fluctuates.

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 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 ~2°F temperature increase is insignificant. Prior to exceeding CLTP and ascension to TPO, CNS will ensure compliance with Reg. Guide 1.20.

The safety-related thermo wells and sample probes in the MS, FW, and Recirculation piping systems are also adequate for the TPO operating condition.

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 TLTR Appendix K. 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 nominal vessel dome pressure increase is negligible for the RCPB portion of all piping except for portions of the FW lines, MS lines, and piping connected to the FW and MS 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 increases ~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) / High Pressure Coolant Injection (HPCI) piping (Steam Side), 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 Minor decrease in main steam line (MSL) pressure < 2 psi	Plant specific evaluation performed 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)
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	Plant specific evaluation performed 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, HPCI piping, LPCI piping, CS piping, Standby Liquid Control System (SLCS) piping, and RWCU piping Pipe Stresses Pipe Supports FAC	Nominal dome pressure at TPO RTP is identical to CLTP Small Increase in core pressure drop of < 1 psi Recirculation fluid temperature increases ~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) 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 original 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 ANSI (USAS) B31.1, B31.7 Power Piping and ASME, Section III, Subsection 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 MS piping was evaluated 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. CNS has an established 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.

No changes to piping inspection scope and frequency are required to ensure adequate margin for the changing process conditions. 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 FW piping system (inside 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 small increases 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 original design analyses have sufficient 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 ANSI (USAS) B31.1, B31.7 Power Piping and ASME, Section III, Subsection ND-3600 requirements remain satisfied. Therefore, the TPO does not have an adverse effect on the FW piping design.

Pipe Supports

The TPO do not affect the FW piping snubbers, hangers, struts, and pipe whip restraints. 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. CNS 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.

No changes to piping inspection scope and frequency are required to ensure adequate margin exists for the TPO process conditions. 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 (Section 3.5.1).

Pipe Supports

Because there is no change in the MS temperature, there is no change in the MS pipe support loads. 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 stop valve closure transient was reviewed and determined to be bounded by the TPO uprate and the no new piping analysis was required.

For the FW system piping outside containment, no existing transient analysis that is impacted by the TPO was identified. A review of the increases in FW flow associated with the TPO indicates that piping load changes do not result in any load limit being exceeded.

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. CNS 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.

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 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 feedwater flow. This interlock is based on sub-cooling and thus is a function of absolute feedwater flow rate and feedwater 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 CNS. 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 within previous evaluations.

3.8 Main Steam Isolation Valves

The generic evaluation provided in TLTR Appendix J is applicable to CNS. The requirements for the main steam isolation valves (MSIVs) remain unchanged for TPO uprate conditions. All safety and operational aspects of the MSIVs are within 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 CNS. The TPO uprate does not affect the RCIC system operation, initiation, or capability requirements.

3.10 Residual Heat Removal System

The 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 J.2.3.13 is applicable to CNS.

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	Cooper 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 CNS. 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 3-1 Adjusted Reference Temperatures – 40 Year Life (32 EFPY)

Lower Shell

Thickness in inches = 6.38

32 EFPY Peak I.D. fluence = 1.23E+18 n/cm^2
32 EFPY Peak 1/4 T fluence = 8.39E+17 n/cm^2

Lower-Intermediate Shell and All Welds

Thickness in inches= 5.38

32 EFPY Peak I.D. fluence = 1.68E+18 n/cm^2
32 EFPY Peak 1/4 T fluence = 1.22E+18 n/cm^2

COMPONENT	HEAT	%Cu	%Ni	CF	Adjusted CF (1)	Initial RTndt °F	1/4 T Fluence n/cm^2	32 EFPY Δ RTndt °F	σ_I	σ_Δ	Margin °F	32 EFPY Shift °F	32 EFPY ART °F
PLATES:													
Lower													
G2803-1	C2274-1	0.20	0.68	153.0	241.7	14	8.39E+17	92.5	0	17	17	110	123.5
G2803-2	C2307-1	0.21	0.73	162.8	257.2	0	8.39E+17	98.4	0	17	17	115	115.4
G2803-3 (2)	C2274-2	0.20	0.68	153.0	241.7	-8	8.39E+17	92.5	0	17	17	110	101.5
Lower-Intermediate													
G2801-7	C2407-1	0.13	0.65	92.3	145.8	-10	1.22E+18	66.7	0	17	17	84	73.7
G2802-1	C2331-2	0.17	0.58	125.3	198.0	10	1.22E+18	90.5	0	17	17	108	117.5
G2802-2	C2307-2	0.21	0.73	162.8	257.2	-20	1.22E+18	117.6	0	17	17	135	114.6
WELDS:													
Lower Longitudinal													
2-233 (3)	12420-3708 3724	0.22	1.02	234.5	375.2	-50	8.39E+17	143.6	0	28	28	172	121.6
Lower-Intermediate Longitudinal													
1-233 (3)	27204 12008	0.19	0.97	215.7	345.0	-50	1.22E+18	157.8	0	28	28	186	135.8
Lower to Lower-Intermediate Circumferential													
1-240 (3)(4)	21935	0.20	0.69	175.3	280.5	-50	8.39E+17	107.3	0	28	28	135	85.3
INTEGRATED SURVEILLANCE PROGRAM (ISP)(5):													
Plate (6)	C2307-2	0.21	0.76	164.6	255.5	-20	1.22E+18	116.8	0	17	17	134	113.8
Plate (7)	C2331-2	0.16	0.62	118.5	158.1	10	1.22E+18	72.3	0	17	17	89	99.3
Weld (8)	20291	0.23	0.75	194.5		-50	1.22E+18	88.9	0	28	28	117	66.9

(1) CNS has removed 2 surveillance capsules. The adjusted CFs include factors determined per RG1.99 Position 2.1. Position 2.1 allows for the use of $0.5{*}\sigma_\Delta$ in the Margin Term.

(2) CNS adopted the ISP best estimate chemistry for this material, which is evaluated in the ISP section below. The upper portion of this table evaluates the vessel materials using the original material properties. The bottom portion of this table evaluates all surveillance materials using the ISP properties provided by NPPD.

(3) The adjusted CF is conservatively applied to all materials in order to remain consistent with the previously licensed approach..

(4) CNS previously used the lower-intermediate shell fluence; this evaluation uses the more-representative lower shell fluence for this location.

(5) Procedures defined in RG1.99 are applied to determine the ART considering the Integrated Surveillance Program. For the weld material, the higher fluence is used to be applicable to all weld locations.

(6) The ISP plate is the identical heat to that in the vessel and is presented using the ISP chemistry with the vessel plate Initial RT_{NDT} and fluence. As defined by ISP, as there are two (2) sets of credible capsule data available for this material, the CF is obtained from RG1.99 Position 2.1 and equals 258.35*(162.8/164.6) = 255.5.

(7) This ISP plate is the identical heat to a second plate in the vessel (although not one of the representative ISP materials) and is presented using the ISP chemistry with the vessel plate Initial RT_{NDT} and fluence. As defined in ISP, as there are six (6) sets of credible capsule data available for this material, the CF is obtained from RG1.99 Position 2.1. This material was included in SSP capsules, and not in the Cooper capsule or representative ISP capsule. The adjusted CF is equal to 149.52 * (125.3/118.5) = 158.1.

(8) The ISP weld is not the identical heat to that in the vessel and is presented using the ISP chemistry and CF and applied to the initial RT_{NDT} for the limiting CNS weld, which is Heat 27204 12008.

Table 3-2 P+Q Stresses and CUFs of Limiting Components [1]

	P + Q Stress (ksi)			CUF (ASME Code Allowable = 1.0)	
Component	CLTP (2381 MWt)	TPO[2] (2428 MWt)	Allowable (ASME Code Limit)	CLTP (2381 MWt)	TPO[2] (2428 MWt)
Recirculation Outlet Nozzle (Bimetal Weld)	40.5	40.5	47.4	0.839	0.02[4]
Feedwater Nozzle [9]					
Nozzle	48.9/10.8[3]	49.2/10.9[3]	40.05	0.63	0.71
Safe End	76.1/21.2[3]	76.6/21.3[3]	55.94	0.98	0.997
Nozzle/Shell Junction	59.7	60.1	80.1	0.87	0.3716[5]
CRD Penetration					
Stub Tube to Bottom Head	54.5	54.8	69.9[6]	0.92[6]	0.87[7]
Stub Tube Housing Junction	38.1	38.3	47.4		
Main Closure Region - Flange	78.5	78.5	80.0	1.008	0.10[4]
Main Closure Region – Bolts	129.2	129.2	129.9	0.82	0.98
Shroud Support	50.8[8]	50.8	69.9	0.567	0.02[4]

Notes:

1. Only the limiting components with CUF values > 0.5 are provided.
2. TPO was conservatively evaluated for 102% of OLTP, which bounds TPO operating conditions.
3. Thermal Bending included/Thermal bending removed. P + Q stresses are acceptable per CLTP elastic-plastic analysis, which is valid for TPO conditions.
4. This component was re-evaluated considering a more representative and less conservative treatment of the duty cycles.
5. The CUF values for the nozzle/shell junction include system cycling only. The total CUF (system plus rapid cycling) is greater than 1.0. Rapid cycling effects are managed using the inspection requirements defined in BWROG Letter BWROG-00068, "Alternate BWR Feedwater Nozzle Inspection Requirements", GE-NE-523-A71-0594-A, Revision 1, June 6, 2000, as approved by the NRC, consistent with a plant-specific fracture mechanics evaluation..
6. Previously listed as 60.0 ksi.
7. Only the limiting CUF is provided.
8. Previously listed as 26.2 ksi.
9. Values presented are the maximum CUF (total) for all nodes in that section (i.e. Nozzle, Safe End, Nozzle-Shell Junction).

Table 3-3 Summary of TPO Stresses for RPV Internal Components

Item	Evaluation	Load Level	TPO Result
1	Shroud	N, U, E, & F	Bounded by CLTP
2	Shroud Support	N, U, E, & F	Bounded by CLTP
3	Core Plate	N, U, E, & F	Bounded by CLTP
4	Top Guide	N, U, E, & F	Bounded by CLTP
5	Control Rod Drive Housing (CRDH)	N, U, E, & F	Bounded by CLTP
6	Control Rod Guide Tube (CRGT)	N, U, E, & F	Bounded by CLTP
7	Orificed Fuel Support (OFS).	N, U, E, & F	Bounded by CLTP
8	Fuel Channel	N, U, E, & F	Bounded by CLTP
9	Steam Dryer	N, U, E, & F	Bounded by current design basis
10	Feedwater (FW) Sparger	N, U, E, & F	Bounded by CLTP
11	Jet Pump Assembly	N, U, E, & F	Bounded by CLTP
12	Core Spray Line and Sparger	N, U, E, & F	Bounded by CLTP
13	Access Hole Cover (AHC).	N, U, E, & F	Bounded by CLTP
14	Shroud head and Separator Assembly	N, U, E, & F	Bounded by current design basis
15	In-core Housing and Guide Tube (ICHGT).	N, U, E, & F	Bounded by CLTP
16	Jet Pump Instrument Penetration Seal	N, U, E, & F	Bounded by CLTP
17	Core DP/Stand by Liquid Control System.	N, U, E, & F	Bounded by CLTP

Where: N - Normal, U - Upset, E – Emergency, F – Faulted

4.0 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 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 been performed at 102% of CLTP.

4.1.1 Generic Letter 89-10 Program

The motor-operated (MOV) requirements in the USAR were reviewed, and no changes to the functional requirements of the GL 89-10 MOVs are identified as a result of operating at the TPO RTP level. Because the previous analyses were based on 102% of CLTP, there are no increases in the pressure or temperature at which MOVs are required to operate. Therefore, the GL 89-10 MOVs remain capable of performing their design basis function.

4.1.2 Generic Letter 95-07 Program

The commitments relating to the 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, HPCI, and CS were included in the evaluation. Because the previous analyses were based on 102% of CLTP, 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 function.

4.1.3 Generic Letter 96-06

The CNS response to GL 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," was reviewed for the TPO uprate. The containment design temperatures and pressures in the current GL 96-06 evaluation are not exceeded under post-accident conditions for the TPO uprate. Therefore, the CNS response to GL 96-06 remains valid under TPO uprate conditions.

4.2 EMERGENCY CORE COOLING SYSTEMS

4.2.1 High Pressure Coolant Injection

The HPCI system is a turbine driven system designed to pump water into the reactor vessel over a wide range of operating pressures. For the TPO uprate, there is no change to the nominal reactor operating pressure or the SRV setpoints. The primary purpose of the HPCI is to maintain reactor vessel coolant inventory in the event of a small break LOCA that does not immediately depressurize the RPV. The generic evaluation of the HPCI system provided in TLTR Section 5.6.7 is applicable to CNS. The ability of the HPCI system to perform required safety functions is demonstrated with previous analyses based on 102% of CLTP. Therefore, all safety aspects of the HPCI system are within previous evaluations and the requirements are unchanged for the TPO uprate conditions.

4.2.2 High Pressure Core Spray

The High Pressure Core Spray system is not applicable to CNS.

4.2.3 Core Spray

The Core Spray (CS) system sprays water into the reactor vessel after it is depressurized. The primary purpose of the CS 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 CS system provided in TLTR Section 5.6.10 is applicable to CNS. The ability of the CS system to perform required safety functions is demonstrated with previous analyses based on 102% of

CLTP. Therefore, all safety aspects of the CS 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 CNS. 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 relief valves or SRVs to reduce the reactor pressure following a small break LOCA when it is assumed that the high-pressure systems have failed. This allows the CS 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 CNS. 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 CNS. The CLTP containment analyses were based on 102% of CLTP, 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 Emergency Core Cooling System (ECCS) is designed to provide protection against postulated Loss-of-Coolant Accidents (LOCA) caused by ruptures in the primary system piping. The current 10 CFR 50.46, or LOCA, analyses for the CNS plant has been performed at 102% of CLTP, consistent with Appendix K. Experience with power uprates up to 20% has shown that there is substantial margin to the 10CFR50.46 criteria, including PCT, local cladding oxidation, core wide metal water reaction, cool able geometry and long-term core cooling.

Reference 7 provides justification for the elimination of the 1600°F Upper Bound PCT limit and generic justification that the Licensing Basis PCT will be conservative with respect to the Upper Bound PCT. The NRC SER for Reference 7 accepted this position, noting that because plant-specific Upper Bound PCT calculations have been performed for all plants, other means may be used to demonstrate compliance with the original SER requirements.

These other means are acceptable provided there are no significant changes to a plant's configuration that would invalidate the existing Upper Bound PCT calculations. This is the case for the CNS TPO. There are no changes in the plant configuration that would affect the PCT and there is no change in the Licensing Basis PCT. Therefore, the requirements of Reference 7 are satisfied to disregard the Upper Bound PCT limit.

The analysis presented in the relevant report (Reference 8) demonstrates that for GE14 fuel, the limiting break and single failure combination is the maximum recirculation line break with battery failure for both Nominal and Appendix K assumptions. Based on the limiting large break and applying the SAFER/GESTR-LOCA methodology, the CNS ECCS-LOCA analysis was performed for the limiting LOCA event for GE14 fuel. The results are summarized in Table 4-1. These results meet all licensing limits of 10CFR50.46 and SAFER/GESTR methodology conditions in Reference 7.

Therefore, the pre-TPO SAFER/GESTR LOCA analysis for GE-supplied fuel bounds the 1.7% TPO uprate for CNS.

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 condition.

4.6 Main Steam Isolation Valve Leakage Control System

Cooper Nuclear Station does not have an MSIV Leakage Control system.

4.7 POST-LOCA COMBUSTIBLE GAS CONTROL SYSTEM

The Combustible Gas Control System (CGCS) maintains 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 Section J.2.3.10 is applicable to CNS. The metal available for reaction is unchanged by the TPO uprate and the hydrogen production due to radiolytic decomposition is unchanged because the system was previously evaluated for accident conditions from 102% of CLTP. Therefore, the current evaluation is valid for the TPO uprate.

Table 4-1 Cooper ECCS-LOCA Analysis Results for GE14

Parameter	MELLLA	Analysis Limit
Nominal PCT	1359°F	
Appendix K PCT	2027°F	
Licensing Basis PCT	2040°F	≤2200°*F
Maximum Local Oxidation	<1.0%	≤17%*
Core-Wide Metal-Water Reaction	<0.1%	≤1.0%*

* 10CFR50.46 ECCS-LOCA Analysis Acceptance Criteria

5.0 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 APRMs are re-calibrated to indicate 100% at the TPO RTP level of 2421.0 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 CNS TPO uprate follows the guidelines of TLTR Section 5.6.1 and Appendix F, which is consistent with the practice approved for GE 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 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 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 and instrumentation have sufficient range/adjustment capability for use at the TPO uprate conditions. 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 turbine utilizes a Digital Electro-Hydraulic (DEH) control system consisting of solid state governing devices, governor startup control devices, emergency devices for turbine and plant protection (over speed governor, master trip, vacuum trip, motoring protection, thrust bearing wear trip, low bearing oil pressure trip) and special control and test devices. The system operates the main stop valves, governor valves, bypass valves, reheat stop and interceptor valves, and other protective devices.

Satisfactory reactor pressure control by the turbine 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)). CNS has demonstrated acceptable pressure control performance at current rated conditions and has in excess of the ~2% steam flow margin needed for the TPO uprate. The existing DEH electronic controls as designed for the current 100% 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

CNS does not have an EHC system. The DEH system was discussed in Section 5.2.1. The existing DEH electronic controls as designed for the current 100% CLTP conditions are adequate and require no electronic component changes for the TPO uprate conditions.

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 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 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.

HPCI 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 HPCI system temperature or pressure, and thus, the HPCI temperature based leak detection system is not affected.

RHR 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 RHR system temperature or pressure, and thus, the RHR 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 GE setpoint methodologies (References 9 and 10) are used to generate the allowable values (AV) and nominal trip setpoints (NTSP) related to any 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 9.

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 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 Technical Specification AV of 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 AV 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 AV in terms of steam flow is decreased to approximately

- 141.6% (better estimate 142.1%) of the TPO rated steam flow at 101.7% CLTP
- 141.7% (better estimate 142.2%) of the TPO rated steam flow at 101.62% 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 (TLO) and 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 CNS. 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). In order to accommodate limits in the Stability Region, new APRM ALs were established that conservatively bound the entire operating envelope. There is no significant effect on the instrument errors or uncertainties from the TPO uprate. Therefore, the AV and NTSP are established by directly incorporating the change in the AL.

5.3.8 Rod Worth Minimizer Low Power Setpoint

The Rod Worth Minimizer (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 CNS. The RWM LPSP AL is rescaled by the CLTP RTP / TPO RTP ratio to maintain the AL in terms of absolute power.

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)

CNS does not have a flow-biased RBM system.

5.3.11 Main Steam Line High Radiation Isolation

The MSL normal radiation level increases approximately proportionally to power. The setpoint is based on normal operating background radiation level, and will be adjusted to provide the same level of protection at the TPO uprate conditions with no appreciable increase in spurious trip frequency. No change in the Technical Specifications is required. This approach is consistent with TLTR Section F.4.2.8.

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. Therefore, the final power level following a single FW pump trip at TPO uprate conditions would remain the same relative to the remaining FW flow as exists at CLTP.

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 may slightly increase condenser backpressure, but the increase would be insignificant (less than 0.1 in. HgA). The slight change in condenser vacuum after implementation of TPO will not adversely affect any trip signals associated with low condenser vacuum (turbine trip / MSIV closure).

5.3.16 TSV Closure Scram, TCV Fast Closure Scram Bypasses

The Turbine Stop Valve (TSV) closure scram and Turbine Control Valve (TCV) fast closure scram allow this scram to be bypassed, when reactor power is sufficiently low, such that the scram functions are not needed to mitigate a T/G trip. This power level is the AL for determining the actual trip setpoint, which comes from the turbine first-stage pressure (TFSP). The TFSP setpoint is chosen to allow operational margin so that scrams can be avoided, by transferring steam to the turbine bypass system during T/G trips at low power.

Based on the guidelines in TLTR Section F.4.2.3, the TSV closure scram and TCV fast closure scram AL in percent of RTP is reduced by the ratio of the power increase. The new AL does not change with respect to absolute thermal power. [[
]] The maneuvering range for plant startup is maximized.

No modifications to the CNS turbine are made for the TPO uprate, so there is no change in the first-stage pressure/steam flow relationship from previous operation.

Table 5-1 Analytical Limits that Change due to TPO

Parameter	Current	TPO
APRM High Neutron Flux Scram	123.0	No change
APRM Flow Biased Scram		
TLO Fixed (%RTP)	not applicable	not applicable
SLO Fixed (%RTP)	not applicable	not applicable
TLO Flow Biased (%RTP)[(1)(2)]	0.66Wd + 74.8	0.75Wd + 65.6
SLO Flow Biased (%RTP)[(1)(2)]	0.66(Wd-ΔW) + 74.8	0.75(Wd-ΔW) + 65.6
APRM Flow Biased Rod Block		
TLO Fixed (%RTP)	112.2	No change
SLO Fixed (%RTP)	112.2	No change
TLO Flow Biased (%RTP)[(1)(2)]	0.66Wd + 64.0	0.75Wd + 54.8
SLO Flow Biased (%RTP)[(1)(2)]	0.66(Wd-ΔW) + 64.0	0.75(Wd-ΔW) + 54.8
TSV & TCV Scram & RPT Bypasses (%RTP)	30	29.5
MSL High Flow Isolation % rated steam flow psid	**150** **121.24**	**TPO = 101.7% CLTP:** 147.5 (better estimate 148) 121.24 **TPO = 101.6% CLTP:** 147.6 (better estimate 148.2) 121.24
Rod Worth Minimizer LPSP (%RTP)	10	**TPO = 101.7% CLTP:** 9.84 **TPO = 101.6% CLTP:** 9.85

Notes:

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

(2) Wd is % recirculation drive flow where 100% drive flow is that required to achieve 100% core flow at 100% power, and ΔW is the difference between the TLO and SLO drive flow at the same core flow. The current value of ΔW is 6.73% and is not changed.

6.0 ELECTRICAL POWER AND AUXILIARY SYSTEMS

6.1 AC POWER

Plant electrical characteristics are given in Table 6-1.

6.1.1 Off-Site Power

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

Generator: 983 MVA, 22 kV, 0.85 power factor, 0.58 short-circuit ratio, 60 psig hydrogen pressure (maximum), 1800 rpm three-phase, 60 Hertz

Main Transformer: 900 MVA/1008 MVA, 3-300/336 MVA, FOA, 55/65°C, 345-20.9 kV, 60 Hz (3 normally in service – 1 spare)

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

- 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.

A grid stability analysis has been performed, considering the increase in electrical output, to demonstrate conformance to General Design Criteria 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 diesel generators. 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 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. These pumps experience 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 (emergency diesel generators) are based on BHP or running KW. The ECCS pumps use a conservatively high flow BHP. 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 uprate. 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.

6.2 DC Power

The direct current (DC) loading requirements in the USAR 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 overall conclusion is that the changes due to TPO are within the design limits of the systems and components, and the fuel pool cooling system meets the USAR requirements at the TPO conditions.

6.3.1 Fuel Pool Cooling

The Spent Fuel Pool (SFP) heat load increases slightly as a result of operation at the TPO condition. The TPO uprate does not affect the heat removal capability of the Fuel Pool Cooling and Cleanup System (FPCCS) as shown in Table 6-2. The TPO heat load is within the design basis heat load for the FPCCS, and does not result in a delay in removing the RHR system from service (i.e., the outage day the FPC System can maintain the SFP temperature below 150°F such that the Fuel Pool Assist Mode of the RHR system is not required).

The SFP cooling adequacy is determined by calculating the heat load generated by a full core discharge plus remaining spaces filled with used fuel discharged at regular intervals. The analysis assumes 18-month fuel cycle lengths as the basis. The existing analyses and continuing compliance with the commitment to maintain the pool design limits (i.e., maximum temperature and corresponding heat removal capacity) by controlling the rate of the discharge (fuel offload) to the spent fuel pool confirm the capability of the FPC System to maintain adequate fuel pool cooling for the TPO uprate.

The FPC heat exchangers are sufficient to remove the decay heat during normal refueling and under full core off-load conditions following operation at the TPO uprate conditions. The RHR system in Fuel Pool Cooling Assist mode is available, if needed, to maintain the SFP water temperature below 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 FPCCS.

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 Service Water (SW) system provides cooling water during and following a design basis accident. The safety-related performance of the SW system during and following the most demanding design basis event Loss of Coolant Accident (LOCA) does not change because the original LOCA analysis was based on 102% of CLTP (Section 4.3). Similarly, the containment response analysis in Section 4.1 is also based on 102% of CLTP. There is no change in the safety-related heat loads and the requirements are within the existing capacity of the RHR and associated SW system.

6.4.1.2 Nonsafety-Related Loads

The major service water heat load increases from the TPO reflect an increase in main generator losses rejected to the generator hydrogen coolers and the Turbine Equipment Cooling (TEC) System. 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 the TPO uprate operation is approximately proportional to the TPO (~1.7%). The design of these systems is adequate to handle the TPO uprate.

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 may 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 evaluation confirms that the condenser, circulating water system and heat sink are adequate for TPO operation.

6.4.2.1 Discharge Limits

The CNS Nebraska Department of Environmental Quality National Pollutant Discharge Elimination System (NPDES) Permit provides the effluent limitations and monitoring requirements for discharge wastewater at the site. The discharge limits on free available chlorine are 0.01 mg/l for the monthly average and 0.02 mg/l for the maximum. The discharge water temperature shall not exceed a maximum of 109.4°F. 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 discharges for the TPO uprate are shown in Table 6-3. This comparison demonstrates that the plant remains within the state discharge limits, during operation at TPO conditions.

6.4.3 Component Cooling Water System

The heat loads on the Reactor Equipment Cooling (REC) system do not increase significantly due to TPO because they depend on either reactor vessel water temperature or flow rates in the systems cooled by the REC. The change in reactor vessel water temperature is minimal and there is no change in the nominal reactor operating pressure. The REC system experiences a slight heat load increase in the Fuel Pool Coolers heat exchangers. However, the system has adequate design margin to remove the additional heat. Therefore, the REC system is acceptable for the TPO uprate.

6.4.4 Turbine Equipment Cooling System

The power-dependent heat loads on the Turbine Equipment Cooling (TEC) system that are increased by the TPO, are those related to the operation of the generator hydrogen coolers, the bus duct cooler and exciter coolers. The remaining TEC heat loads are not strongly dependent upon reactor power and do not significantly increase. The TEC 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 Cooper Nuclear Station is the Missouri River. The Service Water 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. 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 SLCS 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 sub critical condition. The generic evaluation presented in TLTR Sections 5.6.5 (SLCS) and L.3 (ATWS Evaluation) is applicable to the CNS TPO uprate. The TPO uprate does not affect shutdown or injection capability of the SLCS. Because the shutdown margin is reload dependent, the shutdown margin and the required reactor boron concentration are confirmed for each reload core.

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

The SLCS ATWS performance is evaluated in TSAR Section9.3.1. The evaluation shows that the TPO has no adverse effect on the ability of the SLCS to mitigate an ATWS.

6.6 POWER DEPENDENT HEATING, VENTILATION AND AIR CONDITIONING

The Heating Ventilation and Air Conditioning (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 drywell), and control building.

TPO results in a minor increase in the heat load caused by the slightly higher FW process temperature (~2°F). The increased heat load is within the margin of the steam tunnel area coolers. 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 are <2°F due to the increase in the FW process temperatures. In the reactor building, the increase in heat load due to a slight SFP cooling process temperature increase is within the margin 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 are no changes in physical plant configuration or combustible loading as a result of the TPO uprate. The safe shutdown systems and equipment used to achieve and maintain cold shutdown conditions do not change, and are adequate for the TPO uprate conditions. The operator actions required to mitigate the consequences of a fire are not affected. Therefore, the fire protection systems and analyses are not affected by 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 9°F to the clad temperature limit and 45.2 psi to the containment pressure limit. The current PCT of 1491°F was based on a conservative decay heat table that contains less data points for the period when the PCT occurs. The newly updated decay heat table with more data points (applicable for all BWRs) along with some SAFER model corrections would reduce the PCT by 50-150°F. Therefore, there is a significant margin (greater than 28°F as specified in TLTR) for Cooper TPO and the current PCT of 1491°F remains applicable for Cooper TPO. Therefore, the generic results are clearly applicable and no further plant specific Appendix R 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 CNS are confirmed to be consistent with the generic description provided in the TLTR.

Table 6-1 TPO Plant Electrical Characteristics

Parameter	Value
Guaranteed Generator Output (MWe)	830.4
Rated Voltage (kV)	22
Power Factor	0.58
Guaranteed Generator Output (MVA)	983.0
Current Output (kA)	25.797
Isolated Phase Bus Duct Rating:	
Main Section (kA)	28
Branch Section (kA)	1.2
Main Transformers Rating (MVA)	900

Table 6-2 Fuel Pool Cooling and Cleanup System Parameters

Parameter	Pre-TPO	TPO
System Component Design Temperature (°F)	150	150
System Component Design Pressure (psig)	150	150
Number of Fuel Pool Cooling Loops	2	2
Structural Design Temperature (°F)	150	150
Fuel Cycle (months)	18	18
Bulk Pool Temperature for a Full Core Off-load, Fuel Pool With Maximum Capacity, with Supplemental RHR Cooling (°F), if required.	< 150	< 150

Table 6-3 Effluent Discharge Comparison

Parameter	State Limit	Current	TPO
Discharge Temperature not to exceed (°F)	109.4°F	109.4°F	No change
Chlorine mg/L (Maximum TRC) [a]	0.02	0.02	No change

[(a)] – Monitoring for TRC is required only when chlorine is introduced into any waste-streams.

7.0 POWER CONVERSION SYSTEMS

7.1 TURBINE-GENERATOR

The CNS main T/G is designed with a maximum flow passing and generator capability in excess of rated conditions to ensure that the design rated output is achieved. The excess capacity ensures that the T/G can meet rated conditions for continuous operating capability with allowances for variations in flow coefficients from expected values, manufacturing tolerances, and other variables that may affect the flow-passing capability of the unit. The difference in the steam-passing capability between the current analyzed and rated conditions is called the flow margin.

The CNS turbine-generator has a flow margin of 10% at the rated throttle steam flow of 9,510,617 lb/hr at a throttle pressure of 970 psia and rated electrical power output of 828.971 MW at a generator capability of 983.000 MVA.

For the TPO uprate RTP of 2429 MWt (~102% of CLTP), the rated throttle steam flow is increased to 9,703,000 lb/hr at a throttle pressure of 968.0 psia. The evaluated increased throttle flow is approximately 102.0% of current rated. The evaluated increased throttle flow is due to the steam flow increase associated with operation at 102% CLTP conditions (~2%). The maximum uprated electrical output is 835.550 MW. Maximum expected reactive power at TLTP conditions is expected to be less than 300 MVAR. These conditions result in a maximum generator load (capability) of 887.770 MVA.

Steam specification calculations were performed to determine the TPO uprate turbine steam path conditions. These TPO uprate operating conditions are bounded by the previous analysis of the turbine and generator stationary and rotating components. Thus, the increased loadings, pressure drops, thrusts, stresses, overspeed capability and other design considerations resulting from operation at TLTP conditions are within existing design limits and operation therefore is acceptable at the TPO uprate condition. In addition, valves, control systems and other support systems were evaluated and TPO operating conditions are bounded by the existing analyses. 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 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 Steam Bypass Pressure Control System (SBPCS) was originally designed for a steam flow capacity of approximately 33% of the 100% rated flow at CLTP. The steam bypass capacity at the TPO RTP is approximately 32% of the 100% TPO RTP steam flow rate. The steam 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 since 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 CNS FW heaters, heater drains, condensate demineralizers, and the pumps (FW and condensate) 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. The review also concluded that the FW control valves and FW turbine controls can maintain water level control at the TPO uprate conditions. A review of the CNS heater drains demonstrated that the components are capable of supporting the slightly higher TPO uprate extraction flow rates. The plant will continue to operate with a reduction in cycle efficiency due to inadequate drain valve sizing on the No. 2 and No. 3 heater drain valves. However, there is no adverse impact on plant operation or safety.

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

- Pump NPSH
- Ability to avoid suction pressure trip
- Flow capacity
- Bearing cooling capability
- Rated motor horsepower
- Full load motor amps
- Vibration

The FW system run-out and loss of FW heating events would 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 1.8%. The condensate and FW systems were originally designed for approximately 105% warranted steam flows. 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.

The existing FW design pressure and temperature requirements are adequate. The FW heaters and associated regulating valves were originally designed for the original guarantee (100%) heat balance conditions. 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. There is no need for recertification of the feedwater heaters.

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. This is the same criterion that was applied to the original design. 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 FW pumps. The runback setting prevents a reactor low water level scram, and is sufficient to maintain adequate margin to the potential power/flow instability regions. Operation at the TPO condition does not degrade this capability.

7.4.3 Condensate Demineralizers

The effect of the TPO uprate on the condensate demineralizers (CDs) was reviewed. The CDs experience slightly higher loadings at the TPO RTP level which result in slightly reduced resin life. However, the reduced resin life is acceptable (refer to Section 8.0 for the effect on the radwaste systems). Because the system can accommodate (without bypass) TPO uprate operation with one vessel removed from service (when backwash/precoat is required), reduced resin life (more frequent backwash/precoat) of the units does not adversely affect CD operation.

8.0 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 CD and pre-coat (replacement of CD resins). The TPO uprate results in a ~2% increased flow rate through the CDs, resulting in a reduction in the average time between backwashes and pre-coating. The reduction of CD 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 CDs 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 effect the processing of liquid radwaste and there are no significant environmental affects.

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 steam jet air ejectors (SJAE) that discharge into the offgas system.

Building ventilation systems control airborne radioactive gases by using devices such as 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 off gas system was evaluated for the TPO uprate, including the effects of hydrogen water chemistry (HWC) and noble metal injection. Radiolysis of water in the core region, which forms H_2 and O_2, increases linearly with core power, thus increasing the heat load on the recombiner and related components. The Offgas system design basis H_2 is 31.8 lbs/hr (with a corresponding stoichiometric O_2 of 254 lbs/hr). The expected H_2 flow rate for the TPO uprate is 13.27 lbs/hr (106.20 lbs/hr of O_2). The increase in H_2 and O_2 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 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.

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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 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. The activation products in the steam and coolant are bounded by the existing design basis concentration.

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. However, the TPO uprate corrosion product concentrations are not expected to exceed the design basis concentrations. Therefore, no change is required in the design basis activated corrosion product concentrations for the TPO uprate.

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 with power level. This activity is the noble gas offgas that is included in the CNS design. The offgas rates 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. As is the case for the noble gases, there is no expectation that releases from the fuel increase due to the TPO uprate. Activity levels in the reactor water are expected to be approximately equal to current measured data, which are fractions of the design basis values. Therefore, the design basis values are unchanged.

8.5 Radiation Levels

Normal operation radiation levels increase slightly for the TPO uprate. CNS 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 less than 1% of the doses allowed by Technical Specification limits with the exception of the Site Boundary for maximum organ dose due to I-131, I-133, and particulates. The largest reported value during 2004 and 2005 for I-131, I-133 and particulates was 2.18% dose to bone (child) 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 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.

9.0 REACTOR SAFETY PERFORMANCE EVALUATIONS

9.1 ANTICIPATED OPERATIONAL OCCURRENCES

TLTR Appendix E provides a generic evaluation of the AOOs for TPO uprate plants. [[

]] Also included are the analytical methods to be used and operating conditions to be assumed. The AOO events are organized into two major groups: Fuel Thermal Margin Events, and Transient Overpressure Events.

TLTR Table E-2 illustrates the effect of a 1.5% power uprate on the OLMCPR. [[

]] The OLMCPR changes for the 1.7% uprate may be slightly larger than shown in Table E- 2, but the changes are expected to be within the normal cycle-to-cycle variation. The overpressure events and loss of FW transient are currently performed with the assumption of 2% overpower. Therefore, they are applicable and bounding for the TPO uprate.

The reload transient analysis includes the worst overpressure event, which is usually the closure of all MSIVs with high neutron flux scram.

The evaluations and conclusions of TLTR Appendix E are applicable to the CNS TPO uprate. Therefore, it is sufficient for the plant to perform the standard reload analyses at the first fuel cycle that implement the TPO uprate.

9.1.1 Alternate Shutdown Cooling Evaluation

Alternate Shutdown Cooling Mode is not part of the plant licensing basis.

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.

With the exception of the Main Steam Line Break Accident, radiological consequences due to postulated DBA events have been evaluated and analyzed to show that NRC regulations are met for 2% above the CLTP. The MSLBA was evaluated using the Technical Specification limit on reactor coolant activity. 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 RGs, the Standard Review Plan (SRP) (where applicable), and in previous Safety Evaluations (SEs).

9.3 SPECIAL EVENTS

9.3.1 Anticipated Transient Without Scram

CNS meets the following ATWS mitigation equipment requirements defined in 10 CFR 50.62:

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

There are no changes in the equipment for the TPO uprate. The performance characteristics of the equipment do not change because operating conditions (operating pressure, SRV setpoints, and maximum rod line) do not change.

The CNS-specific analysis at the CLTP demonstrates that the following ATWS acceptance criteria are met:

1. Peak vessel bottom pressure less than ASME Service Level C limit of 1500 psig;
2. Peak clad temperature within the 10 CFR 50.46 limit of 2200°F;
3. Peak clad oxidation within the requirements of 10 CFR 50.46;
4. Peak suppression pool temperature less than 197°F; and
5. Peak containment pressure less than 56 psig.

TLTR Section 5.3.5, 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, demonstrated a margin of 193 psi to the peak vessel bottom head pressure limit and a margin of 16°F to the pool temperature limit. [[

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9.3.2 Station Blackout

TLTR Appendix L 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 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 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 Emergency Procedure Guidelines. 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.

[[ ]] CNS currently has margins of 31,658 gallons to the available condensate storage inventory volume and 13°F to the containment peak temperature limit. [[ ]] Therefore, no CNS-specific SBO analysis is performed for the TPO uprate.

10.0 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. The recirculation lines increase < 1°F and < 1 psi due to the slightly higher core pressure drop. 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 analysis evaluation was made for all systems evaluated in the USAR. 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. A brief discussion of each break follows.

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 to the limits in the steam tunnel.

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

HPCI: Steam line breaks in the HPCI pump/turbine room and the MS tunnel 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 condition.

The HPCI 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. The original analysis was generally performed with conservative model assumptions. 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 Building Heating Line Breaks

Building heating lines are not connected to the reactor-turbine primary loop. Therefore, building heating lines are not affected.

10.1.2.7 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. Existing calculations supporting the dispositions of potential targets of pipe whip and jet impingement from postulated HELBs have been reviewed and determined to be adequate for the safe shutdown effects in the TPO RTP conditions. Existing pipe whip restraints, jet impingement shields, and their supporting structures are also adequate for the TPO uprate conditions.

10.1.2.8 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 CS, RHR, SLC, HPCI, RCIC, CRD, MS, FW, Sampling, RWCU, SW, Bleed Steam and Heating Steam. 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: Standby Liquid Control, Reactor Core Isolation Cooling, Residual Heat Removal, High Pressure Coolant Injection, Core Spray, Liquid Radwaste, Fuel Pool Cooling & Demineralizer, Reactor Equipment Cooling, Turbine Equipment Cooling, Service Water and Service Water Booster, Fire Protection, Makeup Water Treatment, Circulating Water, Condensate DI Units, Condensate - Feedwater, and Drainage.

No system operational modes evaluated for MELB are affected by the TPO uprate. Therefore, the plant internal flooding analysis and safe shutdown analysis are 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 MSLBA and/or 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 10.3. Evaluation of the safety-related mechanical equipment with non-metallic components for temperature and radiation is not part of CNS environmental qualification program licensing basis.

10.4 TESTING

The TPO uprate power ascension is based on the guidelines in TLTR 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 CNS.

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 condition. 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 power/flow map, flow-referenced setpoint, and the like, will be communicated through normal operator training. Simulator changes and validation for the TPO uprate will be performed in accordance with established CNS 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) 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. Plant Specific: The core internals see a slight increase in fluence, but the inspection strategy used at CNS, 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.

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 Emergency Operating Procedures (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 (IPE)

The IPE (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. 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 impact on plant risk. Therefore, no risk information is requested to support such applications."

11.0 REFERENCES

1. GE Nuclear Energy, "Generic Guidelines and Evaluations for General Electric Boiling Water Reactor Thermal Power Optimization," Licensing Topical Report, NEDC-32938P-A, Revision 2, Class III (Proprietary), May 2003.

2. GE Nuclear Energy, "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate," (ELTR1), Licensing Topical Reports NEDC-32424P-A, Class III (Proprietary), February 1999; and NEDO-32424, Class I (Non-proprietary), April 1995.

3. GE Nuclear Energy, "Generic Evaluations of General Electric Boiling Water Reactor Extended Power Uprate," (ELTR2), Licensing Topical Reports NEDC-32523P-A, Class III (Proprietary), February 2000; NEDC-32523P-A, Supplement 1 Volume I, February 1999; and Supplement 1 Volume II, April 1999.

4. NRC Regulatory Issue Summary 2002-03, "Guidance on the Content of Measurement Uncertainty Recapture Power Uprate Applications," dated January 31, 2002.

5. NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications," August 1996.

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

7. NEDE-23785P-A, "GESTR-LOCA and SAFER Models for Evaluation of Loss-of-Coolant Accident Volume III, Supplement 1 Additional Information for Upper Bound PCT Calculation", Supplement 1, Revision 1, March 2002.

8. GE-NE-0000-0037-8293-R0, "NPPD Cooper Nuclear Station SAFER/GESTR Loss-of-Coolant Accident ECCS Analysis with Elimination of 1600 F Upper Bound PCT Limit", September 2005.

9. GE Nuclear Energy, "Constant Pressure Power Uprate," Licensing Topical Report NEDC-33004P-A, Revision 4, Class III (Proprietary), June 2003.

10. GE Nuclear Energy, "General Electric Instrument Setpoint Methodology," NEDC-31336P-A, Class 3 (Proprietary), September 1996.

ENCLOSURE 6

AFFIDAVITS OF WITHHOLDING PURSUANT TO 10 CFR 2.390

CAMERON INTERNATIONAL CORPORATION

APPENDIX K MEASUREMENT UNCERTAINTY RECAPTURE POWER UPRATE COOPER NUCLEAR STATION DOCKET NO. 50-298, DPR-46

Measurement Systems

Caldon® Ultrasonics Technology Center
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CAMERON

September 19, 2007
CAW 07-18

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

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: Caldon® Ultrasonics Engineering Report: ER-592 Rev.2 "Bounding Uncertainty Analysis for Thermal Power Determination at Cooper NPPD Using the LEFM✓ + System"

Gentlemen:

This application for withholding is submitted by Cameron International Corporation, a Delaware Corporation (herein called "Cameron") on behalf of its operating unit, Caldon Ultrasonics Technology Center, pursuant to the provisions of paragraph (b)(1) of Section 2.390 of the Commission's regulations. It contains trade secrets and/or commercial information proprietary to Cameron and customarily held in confidence.

The proprietary information for which withholding is being requested is identified in the subject submittal. In conformance with 10CFR Section 2.390, Affidavit CAW 07-18 accompanies this application for withholding setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject information, which is proprietary to Cameron, be withheld from public disclosure in accordance with 10CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to this application for withholding or the accompanying affidavit should reference CAW 07-18 and should be addressed to the undersigned.

Very truly yours,

CR Hastings

Calvin R. Hastings
General Manager

Enclosures (Only upon separation of the enclosed confidential material should this letter and affidavit be released.)

September 18, 2007
CAW 07-19

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Calvin R. Hastings, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Cameron International Corporation, a Delaware Corporation (herein called "Cameron") on behalf of its operating unit, Caldon Ultrasonics Technology Center, and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

CR Hastings
Calvin R. Hastings
General Manager

Sworn to and subscribed before me

this 19th day of

September, 2007

Joann B. Thomas
Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Joann B. Thomas, Notary Public
Findlay Twp., Allegheny County
My Commission Expires July 28, 2011
Member, Pennsylvania Association of Notaries

1. I am the General Manager of Caldon Ultrasonics Technology Center, and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of Cameron.

2. I am making this Affidavit in conformance with the provisions of 10CFR Section 2.390 of the Commission's regulations and in conjunction with the Cameron application for withholding accompanying this Affidavit.

3. I have personal knowledge of the criteria and procedures utilized by Cameron in designating information as a trade secret, privileged or as confidential commercial or financial information. The material and information provided herewith is so designated by Cameron, in accordance with those criteria and procedures, for the reasons set forth below.

4. Pursuant to the provisions of paragraph (b) (4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

    (i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Cameron.

    (ii) The information is of a type customarily held in confidence by Cameron and not customarily disclosed to the public. Cameron has a rational basis for determining the types of information customarily held in confidence by it and, in that connection utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Cameron policy and provides the rational basis required. Furthermore, the information is submitted voluntarily and need not rely on the evaluation of any rational basis.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Cameron's competitors without license from Cameron constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, and assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Cameron, its customer or suppliers.

(e) It reveals aspects of past, present or future Cameron or customer funded development plans and programs of potential customer value to Cameron.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Cameron system, which include the following:

(a) The use of such information by Cameron gives Cameron a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Cameron competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Cameron ability to sell products or services involving the use of the information.

(c) Use by our competitor would put Cameron at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Cameron of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Cameron in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Cameron capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence, and, under the provisions of 10CFR Section 2. 390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld is the submittal titled Caldon® Ultrasonics Engineering Report: ER-592 Rev. 2 "Bounding Uncertainty Analysis for Thermal Power Determination at Cooper NPPD Using the LEFM ✓+ System" and is designated therein in accordance with 10CFR §§ 2.390(b)(1)(i)(A,B), with the reason(s) for confidential treatment noted in the submittal and further described in this affidavit. This information is voluntarily submitted for use by the NRC Staff in their review of the accuracy assessment of the proposed methodology for LEFM CheckPlus Systems used by Cooper NPPD for an MUR UPRATE.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Cameron because it would enhance the ability of competitors to provide similar flow and temperature measurement systems and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Cameron effort and the expenditure of a considerable sum of money.

In order for competitors of Cameron to duplicate this information, similar products would have to be developed, similar technical programs would have to be performed, and a significant manpower effort, having the requisite talent and experience, would have to be expended for developing analytical methods and receiving NRC approval for those methods.

Further the deponent sayeth not.

Measurement Systems

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CAMERON

September 19, 2007
CAW 07-19

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

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: Caldon® Ultrasonics Engineering Report: ER-614 Rev. 1 "LEFM✓ + Meter Factor Calculation and Accuracy Assessment for Cooper NPPD"

Gentlemen:

This application for withholding is submitted by Cameron International Corporation, a Delaware Corporation (herein called "Cameron") on behalf of its operating unit, Caldon Ultrasonics Technology Center, pursuant to the provisions of paragraph (b)(1) of Section 2.390 of the Commission's regulations. It contains trade secrets and/or commercial information proprietary to Cameron and customarily held in confidence.

The proprietary information for which withholding is being requested is identified in the subject submittal. In conformance with 10CFR Section 2.390, Affidavit CAW 07-19 accompanies this application for withholding setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject information, which is proprietary to Cameron, be withheld from public disclosure in accordance with 10CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to this application for withholding or the accompanying affidavit should reference CAW 07-19 and should be addressed to the undersigned.

Very truly yours,

C R Hastings

Calvin R. Hastings
General Manager

Enclosures (Only upon separation of the enclosed confidential material should this letter and affidavit be released.)

September 19, 2007
CAW 07-19

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Calvin R. Hastings, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Cameron International Corporation, a Delaware Corporation (herein called "Cameron") on behalf of its operating unit, Caldon Ultrasonics Technology Center, and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

C R Hastings
Calvin R. Hastings
General Manager

Sworn to and subscribed before me

this 19th day of

September, 2007

Joann B. Thomas
Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Joann B. Thomas, Notary Public
Findlay Twp., Allegheny County
My Commission Expires July 28, 2011
Member, Pennsylvania Association of Notaries

1. I am the General Manager of Caldon Ultrasonics Technology Center, and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of Cameron.

2. I am making this Affidavit in conformance with the provisions of 10CFR Section 2.390 of the Commission's regulations and in conjunction with the Cameron application for withholding accompanying this Affidavit.

3. I have personal knowledge of the criteria and procedures utilized by Cameron in designating information as a trade secret, privileged or as confidential commercial or financial information. The material and information provided herewith is so designated by Cameron, in accordance with those criteria and procedures, for the reasons set forth below.

4. Pursuant to the provisions of paragraph (b) (4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

   (i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Cameron.

   (ii) The information is of a type customarily held in confidence by Cameron and not customarily disclosed to the public. Cameron has a rational basis for determining the types of information customarily held in confidence by it and, in that connection utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Cameron policy and provides the rational basis required. Furthermore, the information is submitted voluntarily and need not rely on the evaluation of any rational basis.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Cameron's competitors without license from Cameron constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, and assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Cameron, its customer or suppliers.

(e) It reveals aspects of past, present or future Cameron or customer funded development plans and programs of potential customer value to Cameron.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Cameron system, which include the following:

(a) The use of such information by Cameron gives Cameron a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Cameron competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Cameron ability to sell products or services involving the use of the information.

(c) Use by our competitor would put Cameron at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Cameron of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Cameron in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Cameron capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence, and, under the provisions of 10CFR Section 2. 390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld is the submittal titled Caldon® Ultrasonics Engineering Report: ER-614 Rev. 1 "LEFM ✓+ Meter Factor Calculation and Accuracy Assessment for Cooper NPPD" and is designated therein in accordance with 10CFR §§ 2.390(b)(1)(i)(A,B), with the reason(s) for confidential treatment noted in the submittal and further described in this affidavit. This information is voluntarily submitted for use by the NRC Staff in their review of the accuracy assessment of the proposed methodology for LEFM CheckPlus Systems used by Cooper NPPD for an MUR UPRATE.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Cameron because it would enhance the ability of competitors to provide similar flow and temperature measurement systems and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Cameron effort and the expenditure of a considerable sum of money.

In order for competitors of Cameron to duplicate this information, similar products would have to be developed, similar technical programs would have to be performed, and a significant manpower effort, having the requisite talent and experience, would have to be expended for developing analytical methods and receiving NRC approval for those methods.

Further the deponent sayeth not.