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SOUTHERN COMPANY
Energy to Serve Your World℠

May 8, 2002

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Docket Nos. 50-424
50-425

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

VOGTLE ELECTRIC GENERATING PLANT REQUEST TO REVISE TECHNICAL SPECIFICATIONS REACTOR TRIP SYSTEM INSTRUMENTATION OVER TEMPERATURE DELTA TEMPERATURE (OTΔT) AND OVERPOWER DELTA TEMPERATURE (OPΔT) REACTOR TRIP FUNCTIONS

Ladies and Gentlemen:

In accordance with the requirements of 10 CFR 50.90, Southern Nuclear Operating Company (SNC) proposes to revise Vogtle Electric Generating Plant (VEGP) Unit 1 and Unit 2 Technical Specifications (TS) Figure 2.1.1-1, "Reactor Core Safety Limits"; Table 3.3.1-1, "Reactor Trip System Instrumentation"; and the associated Bases B2.1.1 and B 3.3.1.

Both VEGP units have experienced steady-state aperiodic hot leg temperature fluctuations. This is not a unique VEGP phenomenon. Similar effects have been noted at other Westinghouse plants. Although no definitive causes for the temperature fluctuations have been identified, they are believed to be caused by the upper plenum flow anomalies. Three resistance temperature detectors (RTDs) are used to account for temperature streaming in order to provide an average temperature in each hot leg. Since the average of the three RTDs is used to represent the hot leg temperature (T_{hot}), temperature fluctuation from any RTD can adversely affect the calculation of the average T_{hot} temperature. This, in turn, impacts the average reactor coolant system (RCS) temperature (T_{avg}) and RCS differential temperature (ΔT) and therefore reduces the steady-state operating margins to Overtemperature Delta Temperature (OTΔT) and Overpower Delta Temperature (OPΔT) trip setpoints. The temperature fluctuations of interest are fluctuations in the increasing direction.

To address the impact of the temperature fluctuations on operating margin, VEGP has implemented a number of changes to improve operating margin. These changes include: increasing the OTΔT and OPΔT reference temperature to above the RCS average temperature, reducing the turbine runback setpoint, adding a filter to the measured RCS differential temperature, and adding a filter to the temperature signal to the rod control system to reduce the frequency of spurious rod stepping.

To accommodate the effects of streaming and the associated hot leg temperature fluctuations, SNC proposes to increase the OTΔT and OPΔT setpoints. This program to increase the setpoints is referred to as the OTΔT and OPΔT Setpoint Margin Recovery Program (or MRP for short). The intent of the MRP is to revise the OTΔT and OPΔT setpoints to increase operating margin. This is accomplished by increasing the steady-state setpoints and by revising the dynamic compensation time constants in the setpoint equations. The setpoint allowable values and core safety limits were also revised to support the MRP.

The analyses supporting the MRP assume a revision to the Relaxed Axial Offset Control (RAOC) band and the inclusion of a limit or clamp on the compensated temperature difference term in the OTΔT trip setpoint. The revision to the RAOC band and the limit or clamp on the compensated temperature difference term in the OTΔT trip setpoint are currently under review by the Staff. These revisions were submitted for review in a separate amendment request (SNC letter LCV-1563 dated October 30, 2001). Implementation of the MRP setpoint changes is contingent upon approval of the amendment request for the revised RAOC band and clamp.

Enclosure 1 provides the basis for the proposed change. Pursuant to 10 CFR 50.92, Enclosure 2 demonstrates that the proposed change does not involve a significant hazards consideration. Enclosure 3 contains a mark-up of the affected pages from the current VEGP Technical Specifications and Bases as well as pages from the amendment request described in the previous paragraph. Enclosure 4 contains the typed version of the revised Technical Specification and Bases pages. SNC has determined that the proposed license amendment will not significantly affect the quality of the environment.

Upon approval of the amendment request in SNC letter LCV-1563, SNC will re-submit the marked-up and typed pages in Enclosures 3 and 4 to reflect what will become of the current Technical Specification and Bases pages.

SNC requests that the proposed changes be approved by September 15, 2002. The changes are planned to be implemented during the next Unit 2 refueling outage in Fall 2002 and the next Unit 1 refueling outage in Fall 2003.

Mr. J. B. Beasley, Jr., states that he is a Vice President of Southern Nuclear Operating Company and is authorized to execute this oath on behalf of Southern Nuclear Operating Company and that, to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

J. B. Beasley, Jr.

Sworn to and subscribed before me this 8th *day of* May *2002.*

Notary Public

My commission expires: 11/10/02

JBB/RJF

Enclosures

1. Basis for Proposed Change
2. 10 CFR 50.92 Significant Hazards Evaluation
3. Marked-Up Technical Specification and Bases Pages
4. Typed Revised Technical Specification and Bases Pages

cc: Southern Nuclear Operating Company
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U. S. Nuclear Regulatory Commission
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State of Georgia
Mr. L. C. Barrett, Commissioner, Department of Natural Resources

ENCLOSURE 1

VOGTLE ELECTRIC GENERATING PLANT
REQUEST TO REVISE TECHNICAL SPECIFICATIONS
REACTOR TRIP SYSTEM INSTRUMENTATION OVER TEMPERATURE DELTA TEMPERATURE (OTDT) AND OVERPOWER DELTA TEMPERATURE (OPDT) REACTOR TRIP FUNCTIONS

BASIS FOR PROPOSED CHANGE

PROPOSED CHANGE

In accordance with the requirements of 10 CFR 50.90, Southern Nuclear Operating Company (SNC) proposes to revise Vogtle Electric Generating Plant (VEGP) Unit 1 and Unit 2 Technical Specifications (TS) Figure 2.1.1-1, “Reactor Core Safety Limits”; Table 3.3.1-1, “Reactor Trip System Instrumentation”; and the associated Bases B2.1.1 and B 3.3.1.

Both VEGP units have experienced steady-state aperiodic hot leg temperature fluctuations. This is not a unique VEGP phenomenon. Similar effects have been noted at other Westinghouse plants. Although no definitive causes for the temperature fluctuations have been identified, they are believed to be caused by the upper plenum flow anomalies. Three resistance temperature detectors (RTDs) are used to account for temperature streaming in order to provide an average temperature in each hot leg. Since the average of the three RTDs is used to represent the hot leg temperature (T_{hot}), temperature fluctuation from any RTD can adversely affect the calculation of the average T_{hot} temperature. This, in turn, impacts the average reactor coolant system (RCS) temperature (T_{avg}) and RCS differential temperature (ΔT) and therefore reduces the steady-state operating margins to Overtemperature Delta Temperature (OTΔT) and Overpower Delta Temperature (OPΔT) trip setpoints. The temperature fluctuations of interest are fluctuations in the increasing direction.

To address the impact of the temperature fluctuations on operating margin, VEGP has implemented a number of changes to improve operating margin. These changes include: increasing the OTΔT and OPΔT reference temperature to above the RCS average temperature, reducing the turbine runback setpoint, adding a filter to the measured RCS differential temperature, and adding a filter to the temperature signal to the rod control system to reduce the frequency of spurious rod stepping.

To accommodate the effects of streaming and the associated hot leg temperature fluctuations, SNC proposes to increase the OTΔT and OPΔT setpoints. This program to increase the setpoints is referred to as the OTΔT and OPΔT Setpoint Margin Recovery Program (or MRP for short). The intent of the MRP is to revise the OTΔT and OPΔT setpoints to increase operating margin. This is accomplished by increasing the steady-state setpoints and by revising the dynamic compensation time constants in the setpoint equations. The setpoint allowable values and core safety limits were also revised to support the MRP.

The analyses supporting the MRP assume a revision to the Relaxed Axial Offset Control (RAOC) band and the inclusion of a limit or clamp on the compensated temperature difference term in the OTΔT trip setpoint. The revision to the RAOC band and the limit or clamp on the compensated temperature difference term in the OTΔT trip setpoint are currently under review by the Staff. These revisions were submitted for review in a separate amendment request (SNC letter LCV-1563 dated October 30, 2001). Implementation of the MRP setpoint changes is contingent upon approval of the amendment request for the revised RAOC band and clamp.

BASIS FOR PROPOSED CHANGE

1.0 INTRODUCTION

The Margin Recovery Program (MRP) initially focused on the revision of the OTΔT and OPΔT trip setpoints to increase operating margins. The MRP also included revising the Relaxed Axial Offset Control (RAOC) band (negative side), revising core thermal limits, revising dynamic compensation terms in the OTΔT and OPΔT equations, increasing filter time constants, increasing RTD response times, and placing a limit or clamp on the compensated temperature difference term in the OTΔT setpoint. Technical Specifications allowable values were recalculated and reformatted.

The increase of the OTΔT and OPΔT setpoints has been achieved by means of revised core thermal analyses and revised core thermal limits. The revised OTΔT and OPΔT setpoints and dynamic compensations are provided in Section 2.0. Section 3.1 provides a detailed discussion of the revised core analyses and revised core thermal limits.

The revision to the RAOC band and the limit or clamp on the compensated temperature difference term in the OTΔT trip setpoint are currently under review by the Staff. These revisions were submitted for review in a separate amendment request (SNC letter LCV-1563 dated October 30, 2001). The analyses supporting the MRP are based on the revised RAOC band and the clamp on the OTΔT trip setpoint. Implementation of the MRP setpoint changes is contingent upon approval of the amendment request referenced above.

2.0 REVISED OTΔT AND OPΔT SETPOINTS

The revised OTΔT and OPΔT setpoint parameters for both VEGP units are shown below. The setpoint equations and terms in the setpoint equations are defined in Technical Specification Table 3.3.1-1.

OTΔT SETPOINT PARAMETERS

Parameter	Current	Revised
K_1	1.12	1.149
K_2	0.0224/°F	0.0224/°F
K_3	0.00115/psi	0.00177/psi
τ_1	8 sec	0 sec
τ_2	3 sec	0 sec
τ_3	2 sec	6 sec
τ_4	28 sec	28 sec
τ_5	4 sec	4 sec
τ_6	0 sec	6 sec
f_1(AFD) penalty Breakpoints	-32%, +10%	-23%, +10% (1)
Negative slope	3.25%/%AFD	3.3%/%AFD (1)
Positive slope	2.7%/%AFD	1.95%/%AFD (1)

Note 1

These values were used in the analyses supporting the MRP. They are being changed under a separate amendment request (SNC letter LCV-1563 dated October 30, 2001) currently under review by the Staff.

OPΔT SETPOINT PARAMETERS

Parameter	Current	Revised	Comment
K_4	1.095	1.10	
K_5	0.02/°F 0.0	0.02/°F 0.0	for increasing T_{avg} for decreasing T_{avg}
K_6	0.002/°F 0.0	0.00244/°F 0.0	$T > T''$ $T \leq T''$
τ_7	10 sec	10 sec	
τ_1	8 sec	0 sec	
τ_2	3 sec	0 sec	
τ_3	2 sec	6 sec	
τ_6	0 sec	6 sec	
f_2(AFD) penalty	0.0%	0.0%	

3.0 ANALYSES AND EVALUATIONS

3.1 CORE THERMAL-HYDRAULIC, NUCLEAR, AND FUEL ROD DESIGN ANALYSES

3.1.1 Introduction and Background

This section describes the core thermal-hydraulic, nuclear, and fuel rod design analyses inputs provided to support the Margin Recovery Program (MRP) for Vogtle Electric Generating Plant (VEGP) Units 1 and 2.

3.1.2 Core Thermal-Hydraulic Design

The main purpose of the VEGP MRP was to increase the OTΔT and OPΔT reactor trip setpoints and the associated dynamic compensation. To support the increase of the OTΔT and OPΔT setpoints, revised thermal-hydraulic design analyses were performed which included the elimination of overly conservative assumptions in the analyses as well as the reallocation of margins built into the current analyses.

The revised analysis parameters for the VEGP MRP are more representative of current VEGP conditions, i.e., the minimum measured flow for the departure from nucleate boiling (DNB) analyses is consistent with the current limit in the Technical Specifications, the revised bypass flow fraction is consistent with the use of thimble plugs in both VEGP cores, and the reduced LOPAR $F_{\Delta H}$ limit will be bounding for VEGP reload core designs which have only used a limited number of reinserted LOPAR assemblies located in lower power core positions. The DNB analyses for the VEGP MRP assume that future VEGP core designs are primarily VANTAGE+ fuel. The DNB analyses to support the continued reinsertion of the LOPAR fuel into low power core positions is addressed in Section 3.1.2.2.3.

The core inlet temperature used in the DNB analyses for the MRP is based on the upper bound of the RCS temperature range which was analyzed for the VEGP Rerate Program (Amendment 60 for Unit 1 and Amendment 39 for Unit 2 dated March 22, 1993). Use of the upper bound temperature conservatively addresses the temperature range for the MRP DNB analyses.

3.1.2.1 Description of Thermal-Hydraulic Calculational Methods

The thermal-hydraulic design criteria and methods for the VEGP MRP remain the same as those presented in the VEGP Updated Final Safety Analysis Report (UFSAR). As discussed in the UFSAR, the primary DNB correlation used in the analysis of the VANTAGE+ fuel is the WRB-2 DNB correlation. The WRB-1 DNB correlation is used for the analysis of the LOPAR fuel. The W-3 DNB correlation is used where the primary DNB correlations are not applicable. The improved THINC-IV PWR design modeling method (WCAP-12330-A, "Improved THINC-IV Modeling for PWR Core Design," September 1991) continues to be used in the DNB ratio (DNBR) analyses for the Vogtle units.

As discussed in the VEGP UFSAR, the design method employed to meet the DNB design basis for the VANTAGE+ fuel and LOPAR fuel is the Revised Thermal Design Procedure (RTDP) (WCAP-11397-P-A, "Revised Thermal Design Procedure," April 1989) for treating uncertainties in reactor power, primary coolant temperature, pressurizer pressure, and RCS flow. The RTDP design limit DNBR values specified in the VEGP UFSAR for VEGP Units 1 and 2 are unchanged for the MRP (1.24 and 1.23 for the typical and thimble cells, respectively, for VANTAGE+ fuel, and 1.23 and 1.22 for the typical and thimble cells, respectively, for LOPAR fuel).

In addition to the above considerations for uncertainties, additional DNBR margin was maintained by performing the safety analyses to DNBR limits higher than the design limit DNBR values. Sufficient DNBR margin was maintained in the safety analysis DNBR limits to offset the known DNBR penalties. The net remaining DNBR margin, after consideration of the DNBR penalties, is available for operating and design flexibility (e.g., VANTAGE+ transition core DNBR penalty associated with the limited insertion of LOPAR fuel) as discussed in VEGP UFSAR Section 4.4.1.

3.1.2.2 DNB Performance

The DNB analyses which were performed to support the VEGP MRP are addressed below.

3.1.2.2.1 Revised Core Thermal Limits

To support the revised OTΔT and OPΔT trip setpoints for the VEGP MRP, the DNB core thermal limit lines for VEGP were revised from the current limits. For the current VEGP DNB core thermal limits, the LOPAR fuel is the most limiting fuel design. The revised DNB core thermal limits for the VEGP MRP are based on VANTAGE+ as the most limiting fuel design. The $F_{\Delta H}$ limit for the VANTAGE+ fuel remains at the current value of 1.65. The VANTAGE+ safety analysis DNBR limits for the MRP analysis were reduced by decreasing the DNBR margin which was retained in the current safety analysis DNBR limits. The DNBR margin (approximately 17%) which was previously retained was necessary to offset the transition core DNBR penalty associated with the first LOPAR-to-VANTAGE-5 transition cycle. Since the current VEGP core designs are primarily VANTAGE+ (or all VANTAGE+), the amount of retained DNBR margin needed to address any limited reinsertion of LOPAR fuel assemblies is significantly reduced. The new reduced VANTAGE+ safety analysis DNBR limits resulted in less restrictive DNB core thermal limits to support the improved OTΔT trip setpoints.

The DNB analyses to support the continued reinsertion of the LOPAR fuel into low power core positions is addressed in Section 3.1.2.2.3.

3.1.2.2.2 Revised RAOC Band

The RAOC band used in the MRP analyses is +10% and -15% AFD at 100% power and +26% and -30% AFD at 50% power. As discussed in Section 1.0, this is the same RAOC band used to support the amendment request currently under review by the Staff (SNC letter LCV-1563 dated October 30, 2001).

3.1.2.2.3 LOPAR Fuel

The DNBR analyses for the revised core limits assumed that the VEGP core designs are primarily VANTAGE+ fuel. To ensure that the LOPAR fuel is not limiting with respect to DNB, the LOPAR $F_{\Delta H}$ limit was reduced from the current limit of 1.53 in the Core Operating Limits Report (COLR) to a value of 1.30. Only a limited number of LOPAR fuel assemblies may be reinserted in low power core locations in future VEGP core designs. Operation with a mixed core of VANTAGE+ and LOPAR fuel is still addressed using the transition core DNB methodology described in VEGP UFSAR Section 4.4.2.

The LOPAR safety analysis DNBR limits are unchanged from the limits in the current safety analyses. The mixed core DNBR effect of the LOPAR fuel on the VANTAGE+ DNBR analyses will continue to be addressed by the application of available DNBR margin. The maximum number of LOPAR fuel assemblies that can be reinserted in a mixed core design is limited by the VANTAGE+ DNBR margin which is available for the specific cycle to offset the transition core DNBR penalty. This will be evaluated on a cycle-specific basis during the reload core design.

3.1.2.3 Hydraulic Evaluation

The VEGP MRP does not impact the hydraulic analyses. The fraction of flow that bypasses the core through the thimble guide tubes was changed for the DNB analyses to reflect operation with thimble plugs in place. However, the VEGP fuel assembly lift forces that were evaluated in support of the power uprate (Amendment 60 for Unit 1 and Amendment 39 for Unit 2 dated March 22, 1993) bounded operation with or without the use of thimble plugging devices. Therefore, the fuel assembly lift force analysis is not affected by the VEGP MRP.

3.1.2.4 Fuel Temperatures

The fuel temperatures currently used in the safety analyses are applicable to the VEGP MRP.

3.1.3 Nuclear Analysis Input

3.1.3.1 RAOC Band For the VEGP MRP

The RAOC band used in the MRP analyses is +10% and -15% AFD at 100% power and +26% and -30% AFD at 50% power. As discussed in Section 1.0, this is the same RAOC band used to support the amendment request currently under review by the Staff (SNC letter LCV-1563 dated October 30, 2001).

3.1.4 Fuel Rod Design Considerations

Fuel rod design considerations can typically impact the negative side of the RAOC band. In fuel rod design analysis using the PAD code (WCAP-10851-P-A, "Improved Fuel Performance Models for Westinghouse Fuel Rod design and Safety Evaluations," August 1988), individual fuel rod power histories are evaluated to determine the best-estimate, steady-state fuel rod performance parameters. At certain times during the depletion, the rod powers are increased to the appropriate overpower (transient) limits to determine the cladding stress and strain, fuel rod internal pressure, and cladding temperatures. These conservative transient evaluations are performed to verify adherence to the design criteria of no rod failures considering the effects of transient power increases during Condition I and II events.

The following two sections describe the fuel rod design considerations which, in part, determined the final Vogtle MRP RAOC band.

3.1.4.1 PAD Yield Stress Limit Confirmation

The stress analysis, using the transient limits for the MRP, exhibits sufficient margin to the 0.2 percent offset yield stress and, therefore, sufficient margin to the cladding stress and strain design limits. The use of the clamp on the compensated temperature difference term in the OTΔT trip setpoint has generated sufficient margin that it is unlikely the cladding yield stress limit will be challenged in future VEGP cycles.

The clamp on the compensated temperature difference term in the OTΔT trip setpoint is currently under review by the Staff in a separate amendment request (SNC letter LCV-1563 dated October 30, 2001).

3.1.4.2 Other Fuel Rod Design Criteria Related to Transient Limits

The rod internal pressure analyses must consider the additional fission gas released during a Condition I or Condition II event during each cycle of fuel irradiation. Also, the cladding corrosion criteria include a limit on the cladding temperature during Condition II events. The transient limits generated during the

MRP are significantly less limiting than the current transient limits. Since the rod internal pressure design limit and cladding temperature limit are met with the current transient limits, these criteria will also be met with the MRP transient limits.

3.1.5 Core Thermal-Hydraulic, Nuclear, and Fuel Rod Design Conclusions

As discussed in Sections 3.1.2, 3.1.3, and 3.1.4, all DNB, peaking factor, centerline melt, and fuel rod design related limits are met with sufficient margin so as to provide confidence that the MRP RAOC band can be supported for future VEGP cycles. It should be noted that standard methods (WCAP-10216-P-A, Revision 1A, "Relaxation of Constant Axial Offset Control – F_Q Surveillance Technical Specification," February 1994) will be used on a cycle-specific basis to confirm this.

The above conclusion regarding the validity of the MRP RAOC band assumes the clamp on the compensated temperature difference term in the OTΔT trip function, currently under review by the Staff in a separate amendment request (SNC letter LCV-1563 dated October 30, 2001), is approved.

3.2 NON-LOSS OF COOLANT ACCIDENT (NON-LOCA) TRANSIENTS

The VEGP MRP incorporates changes that affect the VEGP UFSAR Chapter 15 non-LOCA analyses. The changes are primarily related to the revised OTΔT and OPΔT reactor trip functions. Specifically, the setpoints are revised to account for the new core limits and a revised RAOC band. The dynamic compensation terms are modified to include 6 second filters on measured T_{avg} and measured ΔT, a 5.5 second RTD response time, and the time constants on the lead/lag function on measuredΔT changed from 8/3 to 0/0. A summary of the current and revised OTΔT and OPΔT setpoint constants and dynamic compensation terms was provided in Section 2.0.

Each of the MRP features as related to the VEGP UFSAR Chapter 15 safety analyses are discussed in Section 3.2.1. The UFSAR Chapter 15 non-LOCA event analyses and evaluations performed to support the MRP are listed in Section 3.2.2.

3.2.1 Margin Recovery Program Analysis Changes

3.2.1.1 Revised Core Thermal Limits

Revised core thermal limits were calculated for the VEGP MRP. The core limits are revised to account for a higher Minimum Measured Flow to be consistent with the current reactor coolant system flow measurement uncertainty, a decrease in the core bypass flow (assumes thimble plugs installed), the removal of the fuel transition core penalty (core limits are applicable to VANTAGE-5 and VANTAGE+ fuel), and an overpower limit increase from 118% to 120%.

The revised core limits continue to be based on the Revised Thermal Design Procedure (RTDP) (WCAP-11397-P-A, "Revised Thermal Design Procedure," April 1989). The RTDP methodology statistically convolutes the random uncertainties on the plant operating parameters (power, temperature, pressure, and flow) into the design limit DNBR value. The random uncertainties are unchanged from those used in the Vogtle VANTAGE-5 and Rerating Programs (Amendments 43 and 44 for Unit 1 and Amendments 23 and 24 for Unit 2, dated September 19, 1991, for the use of VANTAGE-5 fuel; Amendment 60 for Unit 1 and Amendment 39 for Unit 2, dated March 22, 1993, for the rerating).

Additional details concerning the development of the core thermal limits are included in Section 3.1.2.2.1.

3.2.1.2 Reactor Trip Setpoints

The core limits based on the revised analysis assumptions, described above, were used to calculate the safety analysis limit OTΔT and OPΔT setpoints. The safety analysis limit setpoints are calculated using the approved methodology described in WCAP-8745-P-A (WCAP-8745-P-A, "Design Bases for the Thermal Overpower ΔT and Thermal Overtemperature ΔT Trip Functions," September 1986).

Included in the calculation of K_1 and K_4, the fundamental OTΔT and OPΔT setpoints, respectively, is an allowance for 6.1°F of uncertainty on the reactor coolant system average temperature (T_{avg}) measurement. The allowance accounts for burndown, loop asymmetry, mismatch between protection and control system reference temperatures, and upper plenum anomaly effects.

3.2.1.3 Reactor Coolant System Average Temperature (T_{avg}) Clamping in OTΔT Trip Function

The non-LOCA safety analyses specifically credit the OTΔT reactor trip function to provide primary protection for several events. The non-LOCA events which credit the OTΔT reactor trip function as the primary reactor trip function include the Uncontrolled Bank Withdrawal at Power event (FSAR Section 15.4.2), the RCS Depressurization event (FSAR 15.6.1), the Loss of Load/Turbine Trip event (FSAR 15.2.3), and the Uncontrolled Boron Dilution event (FSAR Section 15.4.6). In general, the thermal hydraulic conditions that occur for these transients tend to reduce the OTΔT setpoint, and eventually result in a reactor trip. That is, the events result in an increase in the RCS T_{avg} (heatup events) or a reduction in pressurizer pressure (RCS depressurization event) which tends to reduce the OTΔT setpoint.

The proposed clamp on the compensated temperature difference term in the OTΔT trip function will limit how much the OTΔT setpoint can increase as a result of decreases in the RCS T_{avg}. Since the non-LOCA analyses, in general, result in a reduction in the OTΔT setpoint, and the clamp limits the amount that the OTΔT setpoint can increase, the non-LOCA safety analyses will not be adversely affected by the proposed clamp.

The clamp on the compensated temperature difference term in the OTΔT trip setpoint is currently under review by the Staff in a separate amendment request (SNC letter LCV-1563 dated October 30, 2001).

3.2.1.4 OTΔT and OPΔT Dynamic Compensation and Trip Response Time

The Margin Recovery Program incorporates significant changes to the dynamic compensation of the OTΔT and OPΔT trip functions. The time constants, τ_1 and τ_2, for the lead/lag function on measured ΔT are changed from 8/3 to 0/0. The filter time constant on measured ΔT, τ_3, is increased from the current value of 2 seconds to 6 seconds. A filter time constant on measured T_{avg}, τ_6, of 6 seconds is added. Also the RTD response time assumed in the analyses is increased from 4 to 5.5 seconds.

3.2.2 Non-LOCA Event Analyses and Evaluations

The Margin Recovery Program assumptions as related to the non-LOCA analyses were described in Section 3.2.1. The changes are primarily related to the revised OTΔT and OPΔT reactor trip setpoints and dynamic compensation. With the exception of the minimum measured flow, other key analysis parameters are unchanged from the current licensing basis.

The following VEGP Units 1 and 2 UFSAR Chapter 15 safety analyses rely on OTΔT and OPΔT for primary protection and were reanalyzed or evaluated to incorporate the MRP features.

- Uncontrolled Rod Cluster Control Assembly Bank Withdrawal at Power (UFSAR Section 15.4.2, credits OTΔT trip function)
- Uncontrolled Boron Dilution (UFSAR Section 15.4.6, indirectly credits OTΔT trip function)
- Loss of External Electrical Load and/or Turbine Trip (UFSAR Section 15.2.2 and 15.2.3, credits OTΔT trip function)
- Accidental Depressurization of the Reactor Coolant System (UFSAR Section 15.6.1, credits OTΔT trip function)
- Steamline Break Core Response at Power (UFSAR Section 15.1.5, credits OPΔT trip function)

3.2.3 Non-LOCA Computer Codes

Consistent with the current licensing basis analyses presented in the VEGP UFSAR, the non-LOCA events analyzed for the Margin Recovery Program utilized the LOFTRAN computer code (WCAP-7907-P-A, "LOFTRAN Code Description," April 1984).

3.2.4 Conclusions

The results of all of the analyses and evaluations demonstrate that applicable safety analysis acceptance criteria have been satisfied at the MRP conditions described in Section 3.2.1. The analysis results for the non-LOCA transients are summarized in Table 1.

Table 1 Summary of Results of Non-LOCA Event Analyses and Evaluations

Event	Acceptance	Calculated Results	Comments
Uncontrolled RCCA Withdrawal at Power (UFSAR Section 15.4.2)	1. DNBR > safety analysis limits 2. RCS pressure < 2748.5 psia 3. Secondary pressure < 1318.5 psia	1. > limit value 2. < 2748.5 psia 3. < 1318.5 psia	DNBR for the limiting case calculated with THINC.
Uncontrolled Boron Dilution – Mode 1 – manual rod control case (UFSAR Section 15.4.6)	Time available to prevent a complete loss of shutdown margin. For the event in Mode 1, the acceptance criterion is >15 minutes from time of event indication until complete loss of shutdown margin.	Calculated minimum operator action time of 30.5 minutes.	Indication of the event is in progress is an OTDT signal.
Loss of External Electric Load and/or Turbine Trip (UFSAR Section 15.2.2 and 1.5.2.3)	1. DNBR > safety analysis limits 2. RCS pressure < 2748.5 psia 3. Secondary pressure < 1318.5 psia	1. > limit value 2. < 2748.5 psia 3. < 1318.5 psia	LOFTRAN calculated DNBR based on limiting Thimble cell DNBR limit only.
Accidental Depressurization of the Reactor Coolant System (UFSAR Section 15.6.1)	1. DNBR > safety analysis limits	1. > limit value	LOFTRAN calculated DNBR based on limiting Thimble cell DNBR limit only.
Steam System Piping Failure (UFSAR Section 15.1.5)	1. DNBR > safety analysis limits 2. No fuel melting	1. >limit values 2. Maximum kW/ft < value at which fuel melting is predicted.	Analysis acceptance criteria are conservatively based on ANS Condition II acceptance criteria.

3.3 OTΔT AND OPΔT UNCERTAINTY EVALUATIONS

Westinghouse has performed instrument uncertainty calculations for the OTΔT and OPΔT reactor trips. To perform these calculations, Westinghouse was provided with the following information: RCS process temperatures, rack calibration and drift data, calibration procedures, pressurizer pressure transmitter calibration and drift data, and the effects of steamline break elevated temperature environment on cable insulation resistance.

From this information, Westinghouse evaluated the following parameters: ΔT and T_{avg} variation with burnup; ΔT and T_{avg} variation due to upper plenum anomaly (UPA) transients; loop-to-loop temperature asymmetries; process rack drifts for the ΔT, T_{avg}, pressurizer pressure, and axial flux difference (AFD) portions of the channels; and pressurizer pressure transmitter drift.

Using the above as well as the secondary-side power calorimetric uncertainty and a maximum mismatch between the protection and control system reference temperatures, the uncertainties were determined for the OTΔT and OPΔT trip functions.

The Allowable Value magnitude and approach has been determined for the OTΔT and OPΔT reactor trips after an evaluation of the channel calibration procedures and statistical evaluations of process rack calibration data and drift data. A review of the plant calibration procedures notes that the OTΔT and OPΔT channels are calibrated based on the appropriate input parameters. The uncertainty calculations performed for these two functions explicitly reflect these plant procedures. The evaluation of process rack calibration data concluded that loop calibration of the appropriate instrument strings for OTΔT and OPΔT is acceptable. The evaluation of process rack drift data concluded that the performance of the process racks was within expectations and the recommendations of Westinghouse Technical Bulletin ESBU-TB-97-02, "Analog Process Rack Operability Determination Criteria." The Allowable Values provided reflect the calibration accuracies of the channel parameter inputs. Thus, the Allowable Values are directly linked to the plant calibration and verification procedures, are consistent with Westinghouse operability recommendations, and reflect parameter magnitudes explicitly modeled in the instrument uncertainty calculations for these two protection functions.

3.4 OTΔT and OPΔT SETPOINTS OPERATING MARGINS EVALUATION

In order to show the effectiveness of the revised OTΔT and OPΔT setpoints, a plant data analysis was performed. The limiting Condition I transient, a 50% load rejection from 100% power, was analyzed with the revised OTΔT and OPΔT setpoints.

3.4.1 Plant Data Analysis and Results

Since the plant data may not capture the worst temperature fluctuations, Westinghouse typically uses a "hypothetical" spike superimposed on the plant data for the data analysis. A review of the recent plant data showed no significant temperature fluctuations as it may not have captured the worst fluctuations. As such, a "hypothetical" hot leg temperature spike was superimposed on the plant data to result in a conservative bounding temperature fluctuation. This "hypothetical" data was used to demonstrate the effectiveness of the revised setpoints in recovering the steady-state operating margins.

By replaying the RTD data through a simulation of the OTΔT and OPΔT trip systems, improvement in the steady-state OTΔT and OPΔT operating margins for the revised setpoints was evaluated.

The minimum margins to OTΔT and OPΔT reactor trips with the current setpoints are about 0.1% and 3.1%, respectively, for the "hypothetical" data. With the revised setpoints and time constants, the minimum margins to OTΔT and OPΔT reactor trips have increased to about 13% and 7.5%, respectively, for the "hypothetical" data. Therefore, with the revised setpoints, the net gains in the OTΔT and OPΔT setpoint margins are about 13% and 4.5%, respectively. Note that the margin is defined as the difference between the setpoint and the compensated measured ΔT expressed in % of full power ΔT.

3.4.2 50% Load Rejection From 100% Power

The 50% load rejection transient is the most severe design basis Condition I transient that the plant is expected to sustain without an automatic reactor trip. For both VEGP units, this is equivalent to a 50% turbine load change. The RCS average temperature and the secondary side steam temperature and pressure increase rapidly following this transient. Steam dump to the condenser is required to prevent both reactor trip and steam generator safety valve actuation.

This transient was analyzed using the LOFTRAN computer code (WCAP-7907-P-A, "LOFTRAN Code Description," April 1984).

With the revised setpoints, the minimum OTΔT and OPΔT margins to the trip setpoints were 12% and 8% of full power ΔT, respectively. For current setpoints, the minimum OTΔT and OPΔT margins were 3% and 7% of full power ΔT, respectively.

3.4.3 Conclusions

The revised OTΔT and OPΔT setpoints will provide sufficient steady-state operating margin to the OPΔT and OTΔT trips. If a given RTD measured temperature spike is no worse than the hypothetical data, the expected net gains in the steady-state operating margins are about 13% for OTΔT and 4.5% for OPΔT with the revised setpoints and time constants. These increased operating margins will allow the OTΔT and OPΔT turbine runback and alarm setpoints to be returned to 3% below the OTΔT and OPΔT trip setpoints.

The revised OTΔT setpoint will provide significantly higher transient margin to trip setpoint for a 50% load rejection transient (limiting operational transient). The transient margin to OPΔT trip setpoint has improved slightly.

3.5 MAIN STEAMLINE BREAK OUTSIDE CONTAINMENT

3.5.1 Identification of Causes and Accident Description

Steamline ruptures occurring outside the reactor containment structure may result in significant releases of high-energy fluid to the equipment surrounding the steam systems. Superheated steam blowdowns following the steamline break have the potential to raise compartment temperatures outside containment. The impact of the steam releases on this equipment depends on the mass (flow rate) and energy (enthalpy) of the steam which is determined by the plant configuration at the time of the break, the plant response to the break, as well as the size and location of the break.

Because of the interrelationship among many of the factors (including the OTΔT and OPΔT setpoints) which influence steamline break mass and energy releases, an appropriate determination of a single limiting case with respect to mass and energy releases cannot be made. Therefore, it is necessary to analyze the steamline break event outside containment for a range of conditions.

3.5.2 Input Parameters and Assumptions

A spectrum of mass and energy releases was calculated for a range of initial power levels ranging from 102% to 0% power and break sizes ranging and from 1.0 ft^2 to 0.1 ft^2.

The break flows and enthalpies of the steam release through the steamline break outside containment are analyzed with the LOFTRAN computer code (WCAP-7907-P-A, "LOFTRAN Code Description," April 1984). Blowdown mass and energy releases determined using LOFTRAN include the effects of core power generation, main and auxiliary feedwater additions, engineered safeguards systems, reactor coolant system thick-metal heat storage, and reverse steam generator heat transfer.

The Vogtle NSSS is analyzed using LOFTRAN to determine the transient steam mass and energy releases outside containment following a steamline break event. The mass and energy releases are used as input conditions to the environmental evaluation of safety-related electrical equipment in the main steam isolation valve compartment. The environmental conditions were evaluated using the GOTHIC code. The GOTHIC code has been benchmarked against the COMPACT code. The previous main steam isolation valve compartment analyses were performed using the COMPACT code as discussed in the VEGP UFSAR.

A series of mass and energy releases was calculated minimizing the secondary side inventory by minimizing the steam generator fluid mass and assuming main feedwater isolation at the time of reactor trip, which leads to earlier steam generator tube bundle uncovery. This maximizes the enthalpy of the steam released through the faulted loop.

A series of mass and energy releases was calculated maximizing the secondary side inventory by maximizing the steam generator fluid mass and assuming continued main feedwater addition with steam flow increase prior to reactor trip with a flow coastdown after trip or receipt of a feedwater isolation signal. These cases maximize the amount of steam released out the break (though steam enthalpy may be reduced) while still allowing for steam generator tube bundle uncovery and the production of superheated steam.

Because AFW flow can have a significant affect on the time of steam generator tube uncovery, several cases were run to assess the effect of AFW flow on the overall analysis results. Cases were run with the following AFW flow assumptions: two AFW pumps operating at minimum flow, three AFW pumps operating at minimum flow, and three AFW pumps operating at maximum flow. The results of these cases are included in the spectrum of cases that were considered.

The reactor trip functions modeled were: low-low steam generator water level, low pressurizer pressure, power range high neutron flux, OTΔT, OPΔT, and safety injection. The proposed revised OTΔT and OPΔT setpoints were used in these analyses.

3.5.3 Results and Conclusion

The mass and energy releases were used to evaluate the qualification of equipment in the main steam valve room area outside containment. The required equipment was determined to be qualified for operation in the calculated environmental conditions with the proposed OTΔT and OPΔT setpoints.

CONCLUSION

Based on the above, the proposed change can be implemented without adverse impact to the safety analyses and plant systems. Implementation of the revised VEGP OTΔT and OPΔT reactor trip setpoints will continue to ensure that fuel melt and DNB criteria are met. In addition, the setpoint changes will improve operating margin to the OTΔT and OPΔT reactor trip setpoints.

ENCLOSURE 2

VOGTLE ELECTRIC GENERATING PLANT
REQUEST TO REVISE TECHNICAL SPECIFICATIONS
REACTOR TRIP SYSTEM INSTRUMENTATION OVER TEMPERATURE DELTA TEMPERATURE (OTDT) AND OVERPOWER DELTA TEMPERATURE (OPDT) REACTOR TRIP FUNCTIONS

10 CFR 50.92 SIGNIFICANT HAZARDS EVALUTION

PROPOSED CHANGE

In accordance with the requirements of 10 CFR 50.90, Southern Nuclear Operating Company (SNC) proposes to revise Vogtle Electric Generating Plant (VEGP) Unit 1 and Unit 2 Technical Specifications (TS) Figure 2.1.1-1, "Reactor Core Safety Limits"; Table 3.3.1-1, "Reactor Trip System Instrumentation"; and the associated Bases B2.1.1 and B 3.3.1.

Both VEGP units have experienced steady-state aperiodic hot leg temperature fluctuations. This is not a unique VEGP phenomenon. Similar effects have been noted at other Westinghouse plants. Although no definitive causes for the temperature fluctuations have been identified, they are believed to be caused by the upper plenum flow anomalies. Three resistance temperature detectors (RTDs) are used to account for temperature streaming in order to provide an average temperature in each hot leg. Since the average of the three RTDs is used to represent the hot leg temperature (T_{hot}), temperature fluctuation from any RTD can adversely affect the calculation of the average T_{hot} temperature. This, in turn, impacts the average reactor coolant system (RCS) temperature (T_{avg}) and RCS differential temperature (ΔT) and therefore reduces the steady-state operating margins to Overtemperature Delta Temperature (OTΔT) and Overpower Delta Temperature (OPΔT) trip setpoints. The temperature fluctuations of interest are fluctuations in the increasing direction.

To address the impact of the temperature fluctuations on operating margin, VEGP has implemented a number of changes to improve operating margin. These changes include: increasing the OTΔT and OPΔT reference temperature to above the RCS average temperature, reducing the turbine runback setpoint, adding a filter to the measured RCS differential temperature, and adding a filter to the temperature signal to the rod control system to reduce the frequency of spurious rod stepping.

To accommodate the effects of streaming and the associated hot leg temperature fluctuations, SNC proposes to increase the OTΔT and OPΔT setpoints. This program to increase the setpoints is referred to as the OTΔT and OPΔT Setpoint Margin Recovery Program (or MRP for short). The intent of the MRP is to revise the OTΔT and OPΔT setpoints to increase operating margin. This is accomplished by increasing the steady-state setpoints and by revising the dynamic compensation time constants in the setpoint equations. The setpoint allowable values and core safety limits were also revised to support the MRP.

The analyses supporting the MRP assume a revision to the Relaxed Axial Offset Control (RAOC) band and the inclusion of the limit or clamp on the compensated temperature difference term in the OTΔT trip setpoint. The revision to the RAOC band and the limit or clamp on the compensated temperature difference term in the OTΔT trip setpoint are currently under review by the Staff. These revisions were submitted for review in a separate amendment request (SNC letter

LCV-1563 dated October 30, 2001). Implementation of the MRP setpoint changes is contingent upon approval of the amendment request for the revised RAOC band and clamp.

Pursuant to 10 CFR 50.92, Southern Nuclear Operating Company (SNC) has reviewed the proposed change to determine if a significant hazards consideration is involved. The proposed change, as defined below, has been reviewed and deemed not to involve any significant hazards considerations as defined in 10 CFR 50.92. The basis for this determination follows.

EVALUATION

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   The proposed change can be implemented without adverse impact to the safety analyses and plant systems. Implementation of the revised VEGP OTΔT and OPΔT reactor trip setpoints will continue to ensure that fuel melt and departure from nucleate boiling (DNB) criteria are met. In addition, the setpoint changes will improve operating margin to the OTΔT and OPΔT reactor trip setpoints. The setpoints provide reactor protection and are not event initiators and therefore do not affect the probability of occurrence of an accident previously evaluated.

   There is no change in the radiological consequences of any accident since the fuel clad, the reactor coolant system pressure boundary, and the containment are not changed, nor will the integrity of these physical barriers be challenged. In addition, the proposed change will not change, degrade, or prevent any reactor trip system actuations.

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   The proposed change can be implemented without adverse impact to the safety analyses and plant systems. Implementation of the revised VEGP OTΔT and OPΔT reactor trip setpoints will continue to ensure that fuel melt and departure from nucleate boiling (DNB) criteria are met. In addition, the setpoint changes will improve operating margin to the OTΔT and OPΔT reactor trip setpoints. The revised OTΔT and OPΔT reactor trip setpoints would not create any new transients nor would they invalidate the OTΔT and OPΔT design bases.

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in the margin of safety?

   The proposed change can be implemented without adverse impact to the safety analyses and plant systems. Implementation of the revised VEGP OTΔT and OPΔT reactor trip setpoints will continue to ensure that fuel melt and departure from nucleate boiling (DNB) criteria are met. In addition, the setpoint changes will improve operating margin to the OTΔT and OPΔT reactor trip setpoints. The margin of safety provided by the Technical Specifications is not significantly affected because the proposed changes are based on the same accident acceptance limits, i.e., the OTΔT and OPΔT design bases continue to be met.

Therefore, the proposed change does not involve a significant reduction in the margin of safety.

CONCLUSION

Based on the preceding evaluation, Southern Nuclear has determined that the proposed change meets the requirements of 10 CFR 50.92(c) and does not involve a significant hazards consideration.

ENVIRONMENTAL EVALUATION

Southern Nuclear has evaluated the proposed changes and determined they do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the proposed changes meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental assessment of the proposed changes is not required.

ENCLOSURE 3

VOGTLE ELECTRIC GENERATING PLANT
REQUEST TO REVISE TECHNICAL SPECIFICATIONS
REACTOR TRIP SYSTEM INSTRUMENTATION OVER TEMPERATURE DELTA TEMPERATURE (OTDT) AND OVERPOWER DELTA TEMPERATURE (OPDT) REACTOR TRIP FUNCTIONS

MARKED-UP TECHNICAL SPECIFICATION AND BASES PAGES

Marked-up Pages	**Note**
Figure 2.1.1-1	1
Page 3.3.1-20	2
Page 3.3.1-21	2
Figure B2.1.1-1	1
Page B3.3.1-19	2
Page B3.3.1-21	1
Page B3.3.1-65	2

NOTES

1. Mark-up of current Technical Specification or Bases pages.

2. Mark-up of Technical Specification or Bases pages submitted for review in a separate amendment request (SNC letter LCV-1563 dated October 30, 2001). This amendment request is currently under review by the Staff.

INSERT A

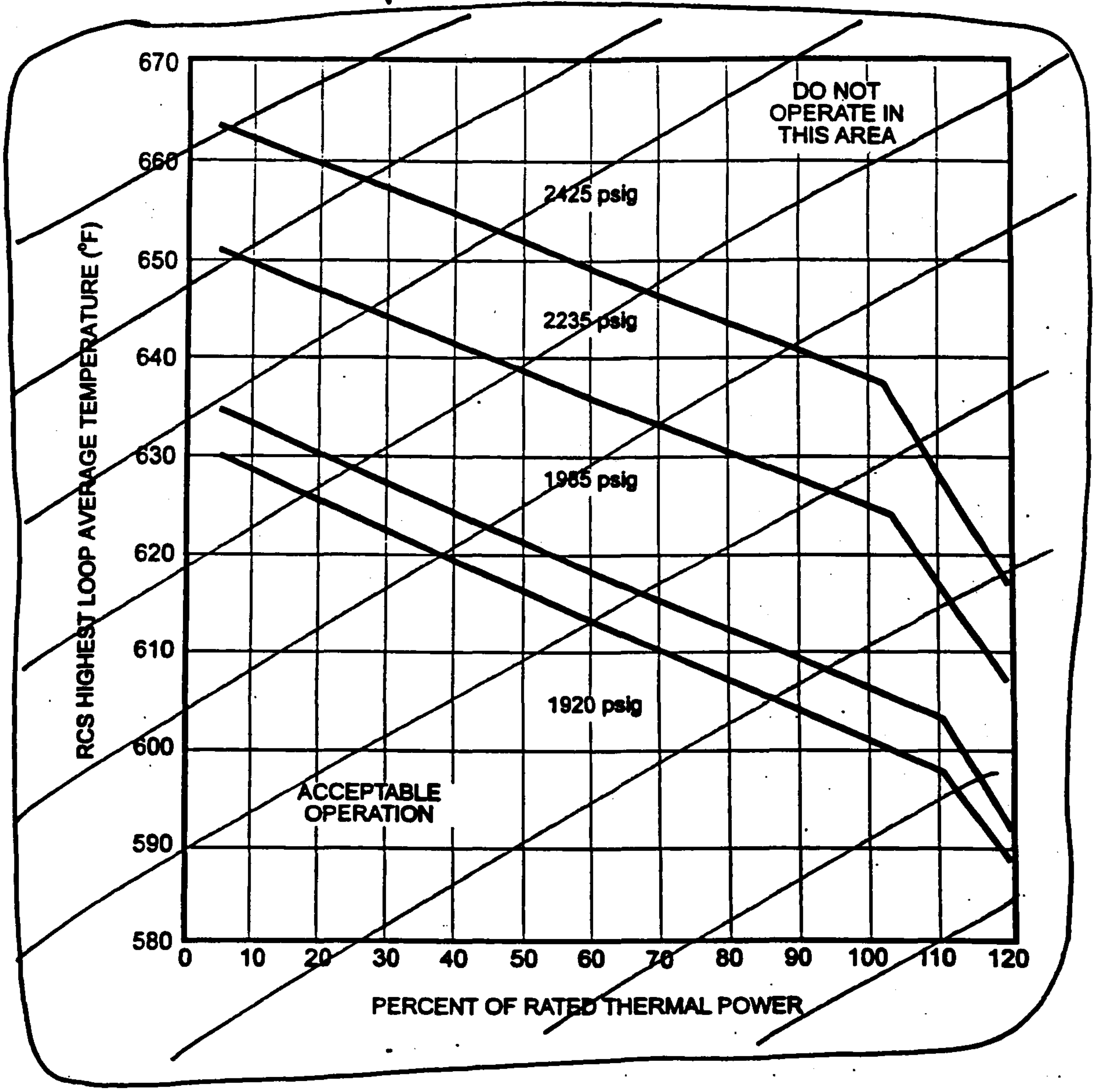

Figure 2.1.1-1
Reactor Core Safety Limits

INSERT A

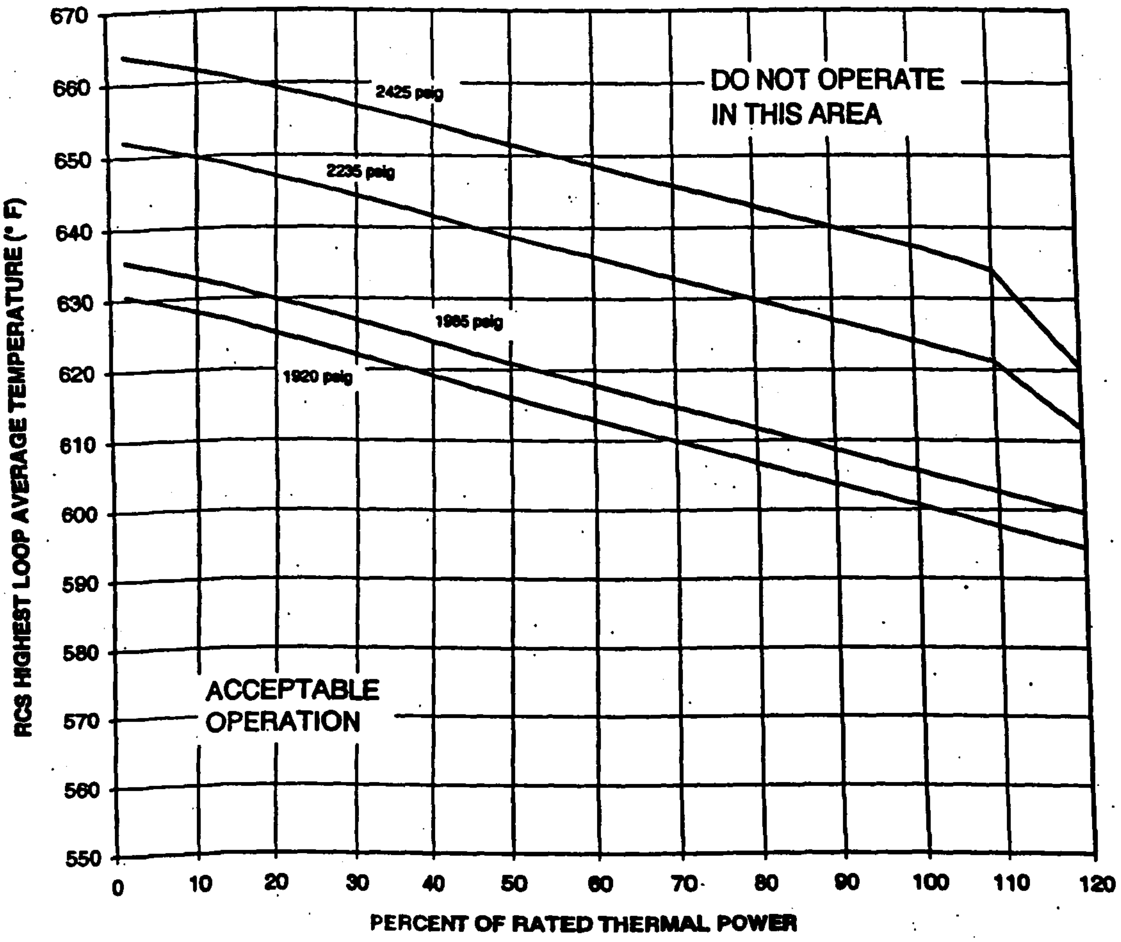

Figure 2.1.1-1
Reactor Core Safety Limits

INSERT 1

Table 3.3.1-1 (page 7 of 8)
Reactor Trip System Instrumentation

Note 1: Overtemperature Delta-T

~~The Overtemperature Delta-T Function Allowable Value shall not exceed the Nominal Trip Setpoint defined by the following equation by more than 2.25% of RTP.~~

$$\left[100\frac{\Delta T}{\Delta T_0}\frac{\{1+\tau_1 s\}}{\{1+\tau_2 s\}}\frac{1}{\{1+\tau_3 s\}}\right] \le \left[K_1 - K_2\frac{\{1+\tau_4 s\}}{\{1+\tau_5 s\}}\left[T\frac{1}{\{1+\tau_6 s\}} - T'\right]^{(o)} - K_3\{P' - P\} - f_1(AFD)\right]$$

Where:	ΔT	measured loop specific RCS differential temperature, degrees F
	ΔT_0	indicated loop specific RCS differential at RTP, degrees F
	$\frac{1+\tau_1 s}{1+\tau_2 s}$	lead-lag compensator on measured differential temperature
	τ_1, τ_2	time constants utilized in lead-lag compensator for differential temperature: τ_1 ~~≥ 8~~ =0 seconds, τ_2 ~~≤ 3~~ =0 seconds
	$\frac{1}{1+\tau_3 s}$	lag compensator on measured differential temperature
	τ_3	time constant utilized in lag compensator for differential temperature, ~~≤ 2~~ ≤6 seconds
	K_1	fundamental setpoint, ~~≤ 112~~ ≤114.9% RTP
	K_2	modifier for temperature, = 2.24% RTP per degree F
	$\frac{1+\tau_4 s}{1+\tau_5 s}$	lead-lag compensator on dynamic temperature compensation
	τ_4, τ_5	time constants utilized in lead-lag compensator for temperature compensation: $\tau_4 \ge 28$ seconds, $\tau_5 \le 4$ seconds
	T	measured loop specific RCS average temperature, degrees F
	$\frac{1}{1+\tau_6 s}$	lag compensator on measured average temperature
	τ_6	time constant utilized in lag compensator for average temperature, ~~= 0~~ ≤ 6 seconds
	T'	indicated loop specific RCS average temperature at RTP, ≤ 588.4 degrees F
	K_3	modifier for pressure, ~~= 0.115~~ =0.177% RTP per psig
	P	measured RCS pressurizer pressure, psig
	P'	reference pressure, ≥ 2235 psig
	s	Laplace transform variable, inverse seconds
	f_1(AFD)	modifier for Axial Flux Difference (AFD): 1. for AFD between -23% and +10%, = 0% RTP 2. for each % AFD is below -23%, the trip setpoint shall be reduced by 3.3% RTP 3. for each % AFD is above +10%, the trip setpoint shall be reduced by 1.95% RTP

Insert 1

The Allowable Value of each input to the Overtemperature Delta-T Function as defined by the equation below shall not exceed its as-left value by more than the following:

(1) 0.5 % ΔT span for the ΔT channel
(2) 0.5 % ΔT span for the T_{avg} channel
(3) 0.5 % ΔT span for the pressurizer pressure channel
(4) 0.5 % ΔT span for the f_1(AFD) channel

INSERT 2

Table 3.3.1-1 (page 8 of 8)
Reactor Trip System Instrumentation

Note 1: Overtemperature Delta-T (continued)

(o) The compensated temperature difference $\frac{\{1+\tau_4 s\}}{\{1+\tau_5 s\}}\left[T\frac{1}{\{1+\tau_6 s\}}-T'\right]$ shall be no more negative than 3 degrees F.

Note 2: Overpower Delta-T

~~The Overpower Delta-T Function ALLOWABLE VALUE shall not exceed the Nominal Trip Setpoint defined by the following equation by more than 2.85% of RTP.~~

$$\left[100\frac{\Delta T}{\Delta T_0}\frac{\{1+\tau_1 s\}}{\{1+\tau_2 s\}}\frac{1}{\{1+\tau_3 s\}}\right]\le\left[K_4-\left[K_5\frac{\{\tau_7 s\}}{\{1+\tau_7 s\}}\frac{1}{\{1+\tau_6 s\}}T\right]-K_6\left[T\frac{1}{\{1+\tau_6\}}-T''\right]-f_2(AFD)\right]$$

Where:	ΔT	measured loop specific RCS differential temperature, degrees F
	ΔT_0	indicated loop specific RCS differential at RTP, degrees F
	$\frac{1+\tau_1 s}{1+\tau_2 s}$	lead-lag compensator on measured differential temperature
	τ_1, τ_2	time constants utilized in lead-lag compensator for differential temperature: τ_1 ~~≥ 8~~ =0 seconds, τ_2 ~~≤ 3~~ =0 seconds
	$\frac{1}{1+\tau_3 s}$	lag compensator on measured differential temperature
	τ_3	time constant utilized in lag compensator for differential temperature, ~~≤ 2~~ ≤6 seconds
	K_4	fundamental setpoint, ~~≤ 109.5~~ ≤110 % RTP
	K_5	modifier for temperature change: ≥ 2% RTP per degree F for increasing temperature, ≥ 0% RTP per degree F for decreasing temperature
	$\frac{\tau_7 s}{1+\tau_7 s}$	rate-lag compensator on dynamic temperature compensation
	τ_7	time constant utilized in rate-lag compensator for temperature compensation, ≥ 10 seconds
	T	measured loop specific RCS average temperature, degrees F
	$\frac{1}{1+\tau_6 s}$	lag compensator on measured average temperature
	τ_6	time constant utilized in lag compensator for average temperature, ~~≤ 6~~ ≤6 seconds
	K_6	modifier for temperature: ~~≥ 0.20~~ ≥0.244 % RTP per degree F for T > T'', = 0% RTP for T ≤ T''
	T''	indicated loop specific RCS average temperature at RTP, ≤ 588.4 degrees F
	s	Laplace transform variable, inverse seconds
	f_2(AFD)	modifier for Axial Flux Difference (AFD), = 0% RTP for all AFD

Insert 2

The Allowable Value of each input to the Overpower Delta-T Function as defined by the equation below shall not exceed its as-left value by more than the following:

(1) 0.5 % ΔT span for the ΔT channel
(2) 0.5 % ΔT span for the T_{avg} channel

INSERT B

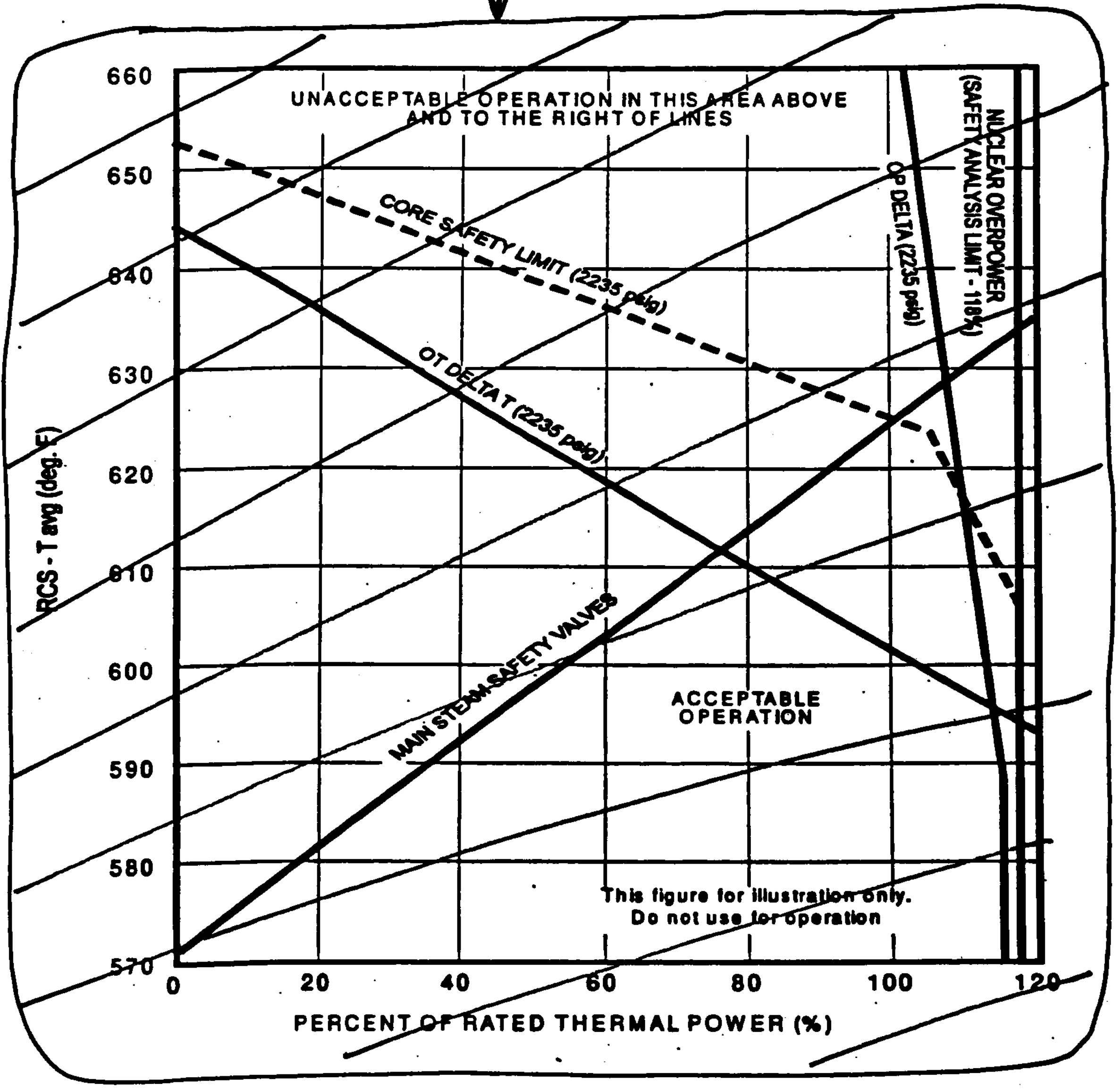

Figure B 2.1.1-1 (page 1 of 1)
REACTOR CORE SAFETY LIMITS VS. BOUNDARY OF PROTECTION

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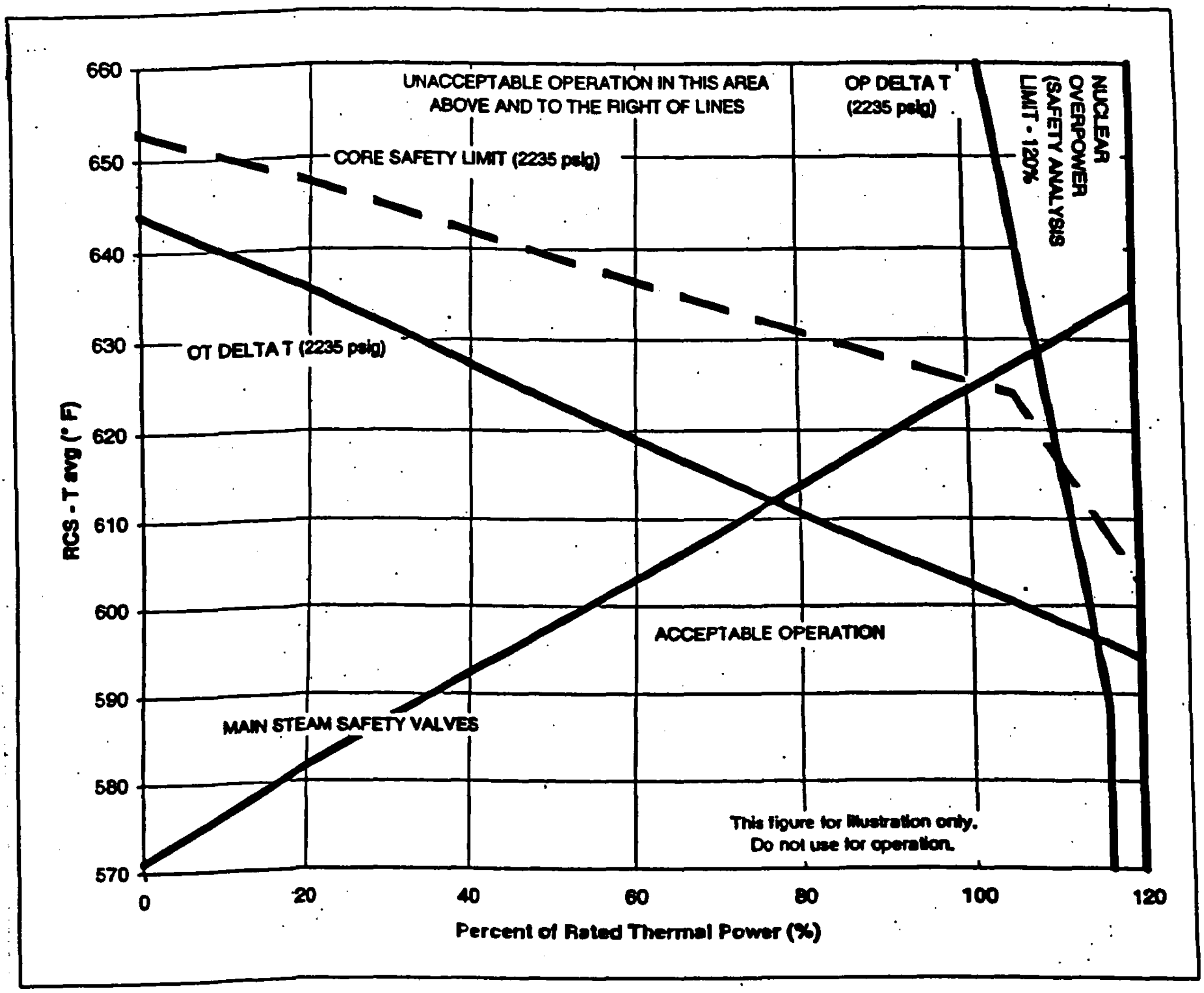

Figure B 2.1.1-1 (page 1 of 1)
REACTOR CORE SAFETY LIMITS VS. BOUNDARY OF PROTECTION

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABLITY

6. Overtemperature ΔT (continued) INSERT 3

as close as possible to 588.4° F. ~~The value of T' for the remaining RCS loops will be set appropriately less than 588.4°F based on the actual loop specific indicated T_{avg}.~~ In the case of decreasing temperature, the compensated temperature difference shall be no more negative than 3 °F to limit the increase in the setpoint during cooldown transients. The engineering scaling calculations use each of the referenced parameters as an exact gain or reference value. Tolerances are not applied to the individual gain or reference parameters. Tolerances are applied to each calibration module and the overall string calibration. INSERT 4 In order to ensure that the Overtemperature ΔT ~~setpoint is~~ consistent with the assumptions of the safety analyses, it is necessary to verify during the CHANNEL OPERATIONAL TEST that the INSERT 5 ~~Overtemperature ΔT setpoint is~~ within the appropriate calibration tolerances for the defined calibration conditions (Ref. 9).

The LCO requires all four channels of the Overtemperature ΔT trip Function to be OPERABLE. Note that the Overtemperature ΔT Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

In MODE 1 or 2, the Overtemperature ΔT trip must be OPERABLE to prevent DNB. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about DNB.

(continued)

Insert 3

The instrument uncertainty calculations and safety analyses, in combination, have accounted for loop variation in loop specific, full power, indicated ΔT and T_{avg}. With respect to T_{avg}, a value for T' common to all four loops is permissible within the limits identified in the uncertainty calculations. Outside of those limits, the value of T' will be set appropriately to reflect indicated, loop specific, full power values.

Insert 4

instrument channel is performing in a manner

Insert 5

magnitude of instrument drift from the as left condition is within limits, and that the input parameters to the trip function are

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

7. Overpower ΔT (continued)

Delta-T_0, as used in the overtemperature and overpower ΔT trips, represents the 100% RTP value as measured for each loop. This normalizes each loop's ΔT trips to the actual operating conditions existing at the time of measurement, thus forcing the trip to reflect the equivalent full power conditions as assumed in the accident analyses. These differences in RCS loop ΔT can be due to several factors, e.g., difference in RCS loop flows and slightly asymmetric power distributions between quadrants. While RCS loop flows are not expected to change with cycle life, radial power redistribution between quadrants may occur, resulting in small changes in loop specific ΔT values. Therefore, loop specific ΔT_0 values are measured as needed to ensure they represent actual core conditions.

The value for T" is a key reference parameter corresponding directly to plant safety analyses initial conditions assumptions for the Overpower ΔT function. For the purposes of performing a CHANNEL CALIBRATION, the values for K_4, K_5, K_6, and T" are utilized in the safety analyses without explicit tolerances, but should be considered as nominal values for instrument settings. That is, while an exact setting is not expected, a setting as close as reasonably possible is desired. Note that for T", the value for the hottest RCS loop will be set as close as possible to 588.4° F. ~~The value of T" for the remaining RCS loops will be set appropriately less than 588.4°F based on the actual loop specific indicated T_{avg}.~~ The engineering scaling calculations use each of the referenced parameters as an exact gain or reference value. Tolerances are not applied to the individual gain or reference parameters. Tolerances are applied to each calibration module and the overall string calibration. In order to ensure that the Overpower ΔT ~~setpoint is~~ consistent with the assumptions of the safety analyses, it is necessary to verify during the CHANNEL OPERATIONAL TEST that the ~~Overpower ΔT setpoint is~~ within the appropriate calibration tolerances for defined calibration conditions (Ref. 9). Note that for the parameter K_5,

INSERT 6

INSERT 4

INSERT 5

(continued)

Insert 6

The instrument uncertainty calculations and safety analyses, in combination, have accounted for loop variation in loop specific, full power, indicated ΔT and T_{avg}. With respect to T_{avg}, a value for T" common to all four loops is permissible within the limits identified in the uncertainty calculations. Outside of those limits, the value of T" will be set appropriately to reflect indicated, loop specific, full power values.

BASES

REFERENCES (continued)

2. FSAR, Chapter 6.

3. FSAR, Chapter 15.

4. IEEE-279-1971.

5. 10 CFR 50.49.

6. WCAP-11269, Westinghouse Setpoint Methodology for Protection Systems; as supplemented by:

   - Amendments 34 (Unit 1) and 14 (Unit 2), RTS Steam Generator Water Level – Low Low, ESFAS Turbine Trip and Feedwater Isolation SG Water Level – High High, and ESFAS AFW SG Water Level – Low Low.
   - Amendments 48 and 49 (Unit 1) and Amendments 27 and 28 (Unit 2), deletion of RTS Power Range Neutron Flux High Negative Rate Trip.
   - Amendments 60 (Unit 1) and 39 (Unit 2), RTS Overtemperature ΔT setpoint revision.
   - Amendments 57 (Unit 1) and 36 (Unit 2), RTS Overtemperature and Overpower ΔT time constants and Overtemperature ΔT setpoint.
   - Amendments 43 and 44 (Unit 1) and 23 and 24 (Unit 2), revised Overtemperature and Overpower ΔT trip setpoints and allowable values.
   - Amendments 104 (Unit 1) and 82 (Unit 2), revised RTS Intermediate Range Neutron Flux, Source Range Neutron Flux, and P-6 trip setpoints and allowable values.
   - Amendments _____ (Unit 1) and _____ (Unit 2), revised Overtemperature ΔT trip setpoint to limit value of the compensated temperature difference and revised the modifier for axial flux difference.

INSERT 7 →

7. WCAP-10271-P-A, Supplement 1, May 1986.

8. FSAR, Chapter 16.

9. Westinghouse Letter GP-16696, November 5, 1997.

10. WCAP-13632-P-A Revision 2, "Elimination of Periodic Sensor Response Time Testing Requirements," January 1996.

(continued)

INSERT 7

- Amendments ______ (Unit 1) and ______ (Unit 2), revised Overtemperature ΔT and Overpower ΔT trip setpoints to increase the fundamental setpoints K_1 and K_4, and to modifiy coefficients and dynamic compensation terms.

ENCLOSURE 4

VOGTLE ELECTRIC GENERATING PLANT
REQUEST TO REVISE TECHNICAL SPECIFICATIONS
REACTOR TRIP SYSTEM INSTRUMENTATION OVER TEMPERATURE DELTA TEMPERATURE (OTDT) AND OVERPOWER DELTA TEMPERATURE (OPDT) REACTOR TRIP FUNCTIONS

TYPED REVISED TECHNICAL SPECIFICATION AND BASES PAGES

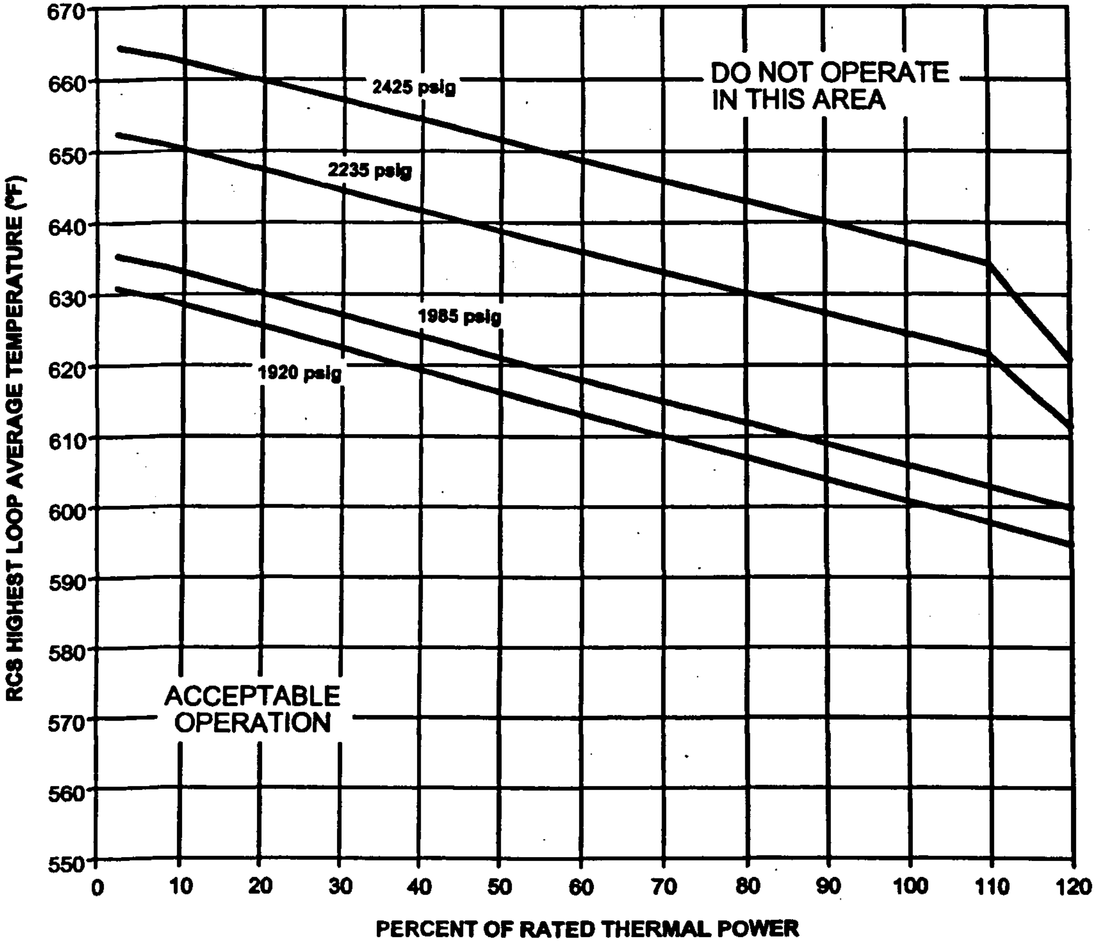

Figure 2.1.1-1
Reactor Core Safety Limits

Table 3.3.1-1 (page 1 of 9)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT(n)
1. Manual Reactor Trip	1,2	2	B	SR 3.3.1.13	NA	NA
	3(a), 4(a), 5(a)	2	C	SR 3.3.1.13	NA	NA
2. Power Range Neutron Flux						
a. High	1,2	4	D	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.7 SR 3.3.1.11 SR 3.3.1.15	≤ 111.3% RTP	109% RTP
b. Low	1(b),2	4	E	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11 SR 3.3.1.15	≤ 27.3% RTP	25% RTP
3. Power Range Neutron Flux High Positive Rate	1,2	4	E	SR 3.3.1.7 SR 3.3.1.11	≤ 6.3% RTP with time constant ≥ 2 sec	5% RTP with time constant ≥ 2 sec
4. Intermediate Range Neutron Flux	1(b), 2(c)	2	F,G	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11	≤ 41.9% RTP	25% RTP
	2(d)	2	H	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11	≤ 41.9% RTP	25% RTP

(continued)

(a) With Reactor Trip Breakers (RTBs) closed and Rod Control System capable of rod withdrawal.

(b) Below the P-10 (Power Range Neutron Flux) interlocks.

(c) Above the P-6 (Intermediate Range Neutron Flux) interlocks.

(d) Below the P-6 (Intermediate Range Neutron Flux) interlocks.

(n) A channel is OPERABLE with an actual Trip Setpoint value outside its calibration tolerance band provided the Trip Setpoint value is conservative with respect to its associated Allowable Value and the channel is readjusted to within the established calibration tolerance band of the Nominal Trip Setpoint. A Trip Setpoint may be set more conservative than the Nominal Trip Setpoint as necessary in response to plant conditions.

Table 3.3.1-1 (page 2 of 9)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT(n)
5. Source Range Neutron Flux	2(d)	2	I,J	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11	≤ 1.7 E5 cps	1.0 E5 cps
	3(a), 4(a), 5(a)	2	J,K	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.11	≤ 1.7 E5 cps	1.0 E5 cps
	3(e), 4(e), 5(e)	1	L	SR 3.3.1.1 SR 3.3.1.11	NA	NA
6. Overtemperature ΔT	1,2	4	E	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.6 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	Refer to Note 1 (Page 3.3.1-20)	Refer to Note 1 (Page 3.3.1-20)
7. Overpower ΔT	1,2	4	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	Refer to Note 2 (Page 3.3.1-21)	Refer to Note 2 (Page 3.3.1-21)

(continued)

(a) With RTBs closed and Rod Control System capable of rod withdrawal.

(d) Below the P-6 (Intermediate Range Neutron Flux) interlocks.

(e) With the RTBs open. In this condition, source range Function does not provide reactor trip but does provide input to the High Flux at Shutdown Alarm System (LCO 3.3.8) and indication.

(n) A channel is OPERABLE with an actual Trip Setpoint value outside its calibration tolerance band provided the Trip Setpoint value is conservative with respect to its associated Allowable Value and the channel is readjusted to within the established calibration tolerance band of the Nominal Trip Setpoint. A Trip Setpoint may be set more conservative than the Nominal Trip Setpoint as necessary in response to plant conditions.

Table 3.3.1-1 (page 3 of 9)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT$^{(n)}$
8. Pressurizer Pressure						
a. Low	$1^{(f)}$	4	M	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	≥ 1950 psig	$1960^{(g)}$ psig
b. High	1,2	4	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	≤ 2395 psig	2385 psig
9. Pressurizer Water Level - High	$1^{(f)}$	3	M	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10	≤ 93.9%	92%
10. Reactor Coolant Flow - Low						
a. Single Loop	$1^{(h)}$	3 per loop	N	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	≥ 89.4%	90%
b. Two Loops	$1^{(i)}$	3 per loop	M	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	≥ 89.4%	90%

(continued)

(f) Above the P-7 (Low Power Reactor Trips Block) interlock.

(g) Time constants utilized in the lead-lag controller for Pressurizer Pressure-Low are 10 seconds for lead and 1 second for lag.

(h) Above the P-8 (Power Range Neutron Flux) interlock.

(i) Above the P-7 (Low Power Reactor Trips Block) interlock and below the P-8 (Power Range Neutron Flux) interlock.

(n) A channel is OPERABLE with an actual Trip Setpoint value outside its calibration tolerance band provided the Trip Setpoint value is conservative with respect to its associated Allowable Value and the channel is readjusted to within the established calibration tolerance band of the Nominal Trip Setpoint. A Trip Setpoint may be set more conservative than the Nominal Trip Setpoint as necessary in response to plant conditions.

Table 3.3.1-1 (page 4 of 9)
Reactor Trip System Instrumentation

	FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT$^{(n)}$
11.	Undervoltage RCPs	$1^{(f)}$	2 per bus	M	SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.15	≥ 9481 V	9600 V
12.	Underfrequency RCPs	$1^{(f)}$	2 per bus	M	SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.15	≥ 57.1 Hz	57.3 Hz
13.	Steam Generator (SG) Water Level - Low Low	1,2	4 per SG	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	≥ 35.9%	37.8%

(continued)

(f) Above the P-7 (Low Power Reactor Trips Block) interlock.

(n) A channel is OPERABLE with an actual Trip Setpoint value outside its calibration tolerance band provided the Trip Setpoint value is conservative with respect to its associated Allowable Value and the channel is readjusted to within the established calibration tolerance band of the Nominal Trip Setpoint. A Trip Setpoint may be set more conservative than the Nominal Trip Setpoint as necessary in response to plant conditions.

Table 3.3.1-1 (page 5 of 9)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT(n)
14. Turbine Trip						
a. Low Fluid Oil Pressure	1(j)	3	O	SR 3.3.1.10 SR 3.3.1.16	≥ 500 psig	580 psig
b. Turbine Stop Valve Closure	1(j)	4	P	SR 3.3.1.10 SR 3.3.1.14	≥ 90% open	96.7% open
15. Safety Injection (SI) Input from Engineered Safety Feature Actuation System (ESFAS)	1,2	2 trains	Q	SR 3.3.1.13	NA	NA
16. Reactor Trip System Interlocks						
a. Intermediate Range Neutron Flux, P-6	2(d)	2	R	SR 3.3.1.11 SR 3.3.1.12	≥ 1.2E-5% RTP	2.0E-5% RTP
b. Low Power Reactor Trips Block, P-7	1	1 per train	S	SR 3.3.1.5	NA	NA
c. Power Range Neutron Flux, P-8	1	4	S	SR 3.3.1.11 SR 3.3.1.12	≤ 50.3% RTP	48% RTP
d. Power Range Neutron Flux, P-9	1	4	S	SR 3.3.1.11 SR 3.3.1.12	≤ 52.3% RTP	50% RTP
e. Power Range Neutron Flux, P-10 and input to P-7	1,2	4	R	SR 3.3.1.11 SR 3.3.1.12	(l,m)	(l,m)
f. Turbine Impulse Pressure, P-13	1	2	S	SR 3.3.1.10 SR 3.3.1.12	≤ 12.3% Impulse Pressure Equivalent turbine	10% Impulse Pressure Equivalent turbine

(continued)

(d) Below the P-6 (Intermediate Range Neutron Flux) interlocks.
(j) Above the P-9 (Power Range Neutron Flux) interlock.
(l) For the P-10 input to P-7, the Allowable Value is ≤ 12.3% RTP and the Nominal Trip Setpoint is 10% RTP.
(m) For the Power Range Neutron Flux, P-10, the Allowable Value is ≥ 7.7% RTP and the Nominal Trip Setpoint is 10% RTP.
(n) A channel is OPERABLE with an actual Trip Setpoint value outside its calibration tolerance band provided the Trip Setpoint value is conservative with respect to its associated Allowable Value and the channel is readjusted to within the established calibration tolerance band of the Nominal Trip Setpoint. A Trip Setpoint may be set more conservative than the Nominal Trip Setpoint as necessary in response to plant conditions.

Table 3.3.1-1 (page 6 of 9)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT[(n)]
17. Reactor Trip Breakers[(k)]	1,2	2 trains	T,V	SR 3.3.1.4	NA	NA
	3[(a)], 4[(a)], 5[(a)]	2 trains	C	SR 3.3.1.4	NA	NA
18. Reactor Trip Breaker Undervoltage and Shunt Trip Mechanisms	1,2	1 each per RTB	U,V	SR 3.3.1.4	NA	NA
	3[(a)], 4[(a)], 5[(a)]	1 each per RTB	C	SR 3.3.1.4	NA	NA
19. Automatic Trip Logic	1,2	2 trains	Q,V	SR 3.3.1.5	NA	NA
	3[(a)], 4[(a)], 5[(a)]	2 trains	C	SR 3.3.1.5	NA	NA

(a) With RTBs closed and Rod Control System capable of rod withdrawal.

(k) Including any reactor trip bypass breakers that are racked in and closed for bypassing an RTB.

(n) A channel is OPERABLE with an actual Trip Setpoint value outside its calibration tolerance band provided the Trip Setpoint value is conservative with respect to its associated Allowable Value and the channel is readjusted to within the established calibration tolerance band of the Nominal Trip Setpoint. A Trip Setpoint may be set more conservative than the Nominal Trip Setpoint as necessary in response to plant conditions.

Table 3.3.1-1 (page 7 of 9)
Reactor Trip System Instrumentation

Note 1: Overtemperature Delta-T

The Allowable Value of each input to the Overtemperature Delta-T function as defined by the equation below shall not exceed its as-left value by more than the following:

(1) 0.5% ΔT span for the ΔT channel
(2) 0.5% ΔT span for the T_{avg} channel
(3) 0.5% ΔT span for the pressurizer pressure channel
(4) 0.5% ΔT span for the f_1 (AFD) channel

$$\left[100\frac{\Delta T}{\Delta T_0}\frac{\{1+\tau_1 s\}}{\{1+\tau_2 s\}}\frac{1}{\{1+\tau_3 s\}}\right] \leq \left[K_1 - K_2\frac{\{1+\tau_4 s\}}{\{1+\tau_5 s\}}\left[T\frac{1}{\{1+\tau_6 s\}} - T'\right]^{(o)} - K_3\{P' - P\} - f_1(AFD)\right]$$

Where:	ΔT	measured loop specific RCS differential temperature, degrees F
	ΔT_0	indicated loop specific RCS differential at RTP, degrees F
	$\frac{1+\tau_1 s}{1+\tau_2 s}$	lead-lag compensator on measured differential temperature
	τ_1, τ_2	time constants utilized in lead-lag compensator for differential temperature: $\tau_1 = 0$ seconds, $\tau_2 = 0$ seconds
	$\frac{1}{1+\tau_3 s}$	lag compensator on measured differential temperature
	τ_3	time constant utilized in lag compensator for differential temperature, ≤ 6 seconds
	K_1	fundamental setpoint, ≤ 114.9% RTP
	K_2	modifier for temperature, = 2.24% RTP per degree F
	$\frac{1+\tau_4 s}{1+\tau_5 s}$	lead-lag compensator on dynamic temperature compensation
	τ_4, τ_5	time constants utilized in lead-lag compensator for temperature compensation: $\tau_4 \geq 28$ seconds, $\tau_5 \leq 4$ seconds
	T	measured loop specific RCS average temperature, degrees F
	$\frac{1}{1+\tau_6 s}$	lag compensator on measured average temperature
	τ_6	time constant utilized in lag compensator for average temperature, ≤ 6 seconds
	T′	indicated loop specific RCS average temperature at RTP, ≤ 588.4 degrees F
	K_3	modifier for pressure, = 0.177% RTP per psig
	P	measured RCS pressurizer pressure, psig
	P′	reference pressure, ≥ 2235 psig
	s	Laplace transform variable, inverse seconds

Table 3.3.1-1 (page 8 of 9)
Reactor Trip System Instrumentation

Note 1: Overtemperature Delta-T (continued)

f_1(AFD) modifier for Axial Flux Difference (AFD):

1. for AFD between -23% and +10%, = 0% RTP
2. for each % AFD is below -23%, the trip setpoint shall be reduced by 3.3% RTP
3. for each % AFD is above +10%, the trip setpoint shall be reduced by 1.95% RTP

(o) The compensated temperature difference $\frac{\{1 + \tau_4 s\}}{\{1 + \tau_5 s\}} \left[T \frac{1}{\{1 + \tau_6 s\}} - T' \right]$ shall be no more negative than 3 degrees F.

Note 2: Overpower Delta-T

The Allowable Value of each input to the Overpower Delta-T Function as defined by the equation below shall not exceed its as-left value by more than the following:

(1) 0.5% ΔT span for the ΔT channel
(2) 0.5% ΔT span for the T_{avg} channel

$$\left[100 \frac{\Delta T}{\Delta T_0} \frac{\{1 + \tau_1 s\}}{\{1 + \tau_2 s\}} \frac{1}{\{1 + \tau_3 s\}} \right] \le \left[K_4 - \left[K_5 \frac{\{\tau_7 s\}}{\{1 + \tau_7 s\}} \frac{1}{\{1 + \tau_8 s\}} T \right] - K_6 \left[T \frac{1}{\{1 + \tau_6\}} - T'' \right] - f_2(\text{AFD}) \right]$$

Where:	ΔT	measured loop specific RCS differential temperature, degrees F
	ΔT_0	indicated loop specific RCS differential at RTP, degrees F
	$\frac{1+\tau_1 s}{1+\tau_2 s}$	lead-lag compensator on measured differential temperature
	τ_1, τ_2	time constants utilized in lead-lag compensator for differential temperature: τ_1 = 0 seconds, τ_2 = 0 seconds
	$\frac{1}{1+\tau_3 s}$	lag compensator on measured differential temperature
	τ_3	time constant utilized in lag compensator for differential temperature, ≤ 6 seconds
	K_4	fundamental setpoint, ≤ 110% RTP
	K_5	modifier for temperature change: ≥ 2% RTP per degree F for increasing temperature, ≥ 0% RTP per degree F for decreasing temperature
	$\frac{\tau_7 s}{1+\tau_7 s}$	rate-lag compensator on dynamic temperature compensation
	τ_7	time constant utilized in rate-lag compensator for temperature compensation, ≥ 10 seconds
	T	measured loop specific RCS average temperature, degrees F
	$\frac{1}{1+\tau_6 s}$	lag compensator on measured average temperature

Table 3.3.1-1 (page 9 of 9)
Reactor Trip System Instrumentation

Note 2: Overtemperature Delta-T (continued)

τ_6	time constant utilized in lag compensator for average temperature, ≤ 6 seconds
K_6	modifier for temperature: ≥ 0.244% RTP per degree F for $T > T''$, = 0% RTP for $T \leq T''$
T''	indicated loop specific RCS average temperature at RTP, ≤ 588.4 degrees F
s	Laplace transform variable, inverse seconds
f_2(AFD)	modifier for Axial Flux Difference (AFD), = 0% RTP for all AFD

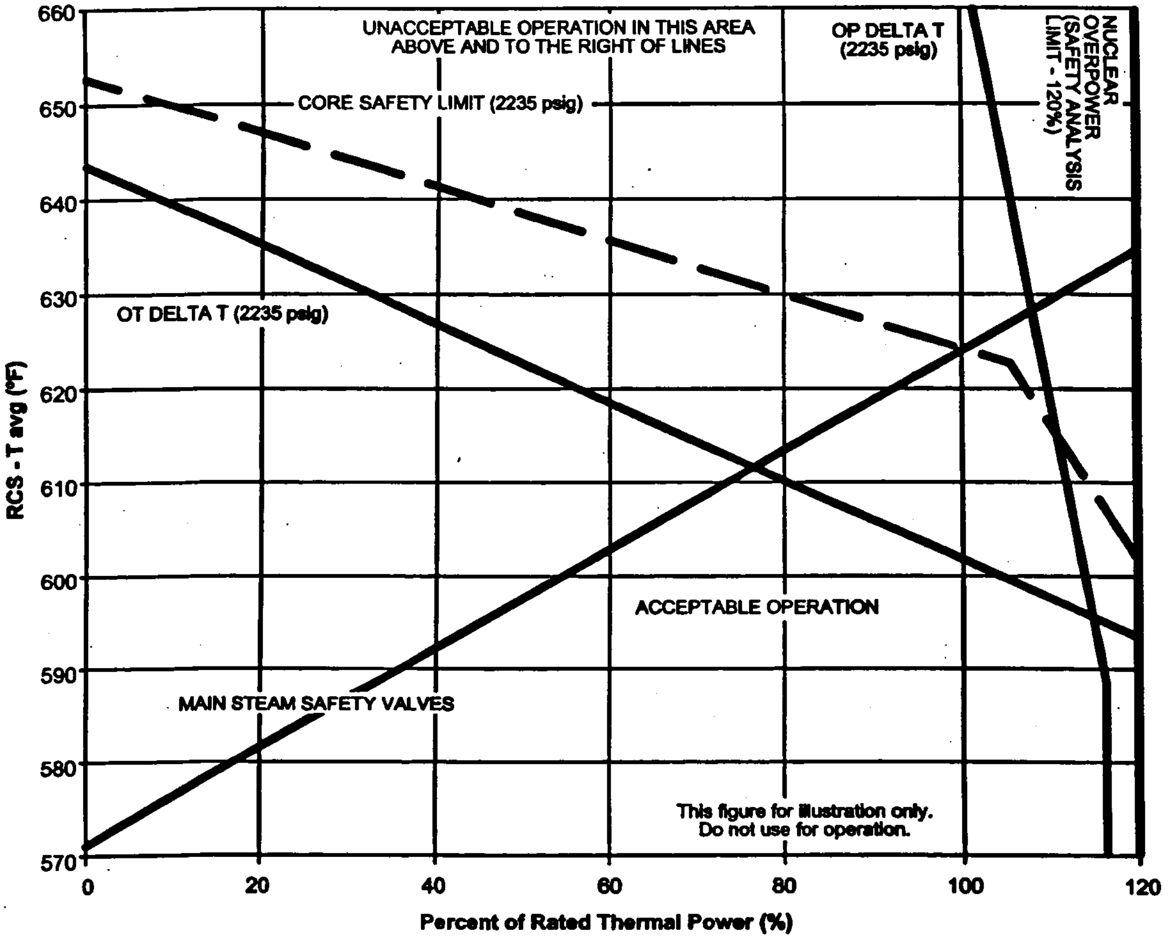

Figure B 2.1.1-1 (page 1 of 1)
REACTOR CORE SAFETY LIMITS VS. BOUNDARY OF PROTECTION

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABLITY

6. Overtemperature ΔT (continued)

as close as possible to 588.4 °F. The instrument uncertainty calculations and safety analyses, in combination, have accounted for loop variation in loop specific, full power, indicated ΔT and T_{avg}. With respect to T_{avg}, a value for T′ common to all four loops is permissible within the limits identified in the uncertainty calculations. Outside of those limits, the value of T′ will be set appropriately to reflect indicated, loop specific, full power values. In the case of decreasing temperature, the compensated temperature difference shall be no more negative than 3 °F to limit the increase in the setpoint during cooldown transients. The engineering scaling calculations use each of the referenced parameters as an exact gain or reference value. Tolerances are not applied to the individual gain or reference parameters. Tolerances are applied to each calibration module and the overall string calibration. In order to ensure that the Overtemperature ΔT instrument channel is performing in a manner consistent with the assumptions of the safety analyses, it is necessary to verify during the CHANNEL OPERATIONAL TEST that the magnitude of instrument drift from the as-left condition is within limits, and that the input parameters to the trip function are within the appropriate calibration tolerances for the defined calibration conditions (Ref. 9).

The LCO requires all four channels of the Overtemperature ΔT trip Function to be OPERABLE. Note that the Overtemperature ΔT Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

In MODE 1 or 2, the Overtemperature ΔT trip must be OPERABLE to prevent DNB. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about DNB.

(continued)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

7. Overpower ΔT (continued)

Delta-T_0, as used in the overtemperature and overpower ΔT trips, represents the 100% RTP value as measured for each loop. This normalizes each loop's ΔT trips to the actual operating conditions existing at the time of measurement, thus forcing the trip to reflect the equivalent full power conditions as assumed in the accident analyses. These differences in RCS loop ΔT can be due to several factors, e.g., difference in RCS loop flows and slightly asymmetric power distributions between quadrants. While RCS loop flows are not expected to change with cycle life, radial power redistribution between quadrants may occur, resulting in small changes in loop specific ΔT values. Therefore, loop specific ΔT_0 values are measured as needed to ensure they represent actual core conditions.

The value for T'' is a key reference parameter corresponding directly to plant safety analyses initial conditions assumptions for the Overpower ΔT function. For the purposes of performing a CHANNEL CALIBRATION, the values for K_4, K_5, K_6, and T'' are utilized in the safety analyses without explicit tolerances, but should be considered as nominal values for instrument settings. That is, while an exact setting is not expected, a setting as close as reasonably possible is desired. Note that for T'', the value for the hottest RCS loop will be set as close as possible to 588.4 °F. The instrument uncertainty calculations and safety analyses, in combination, have accounted for loop variation in loop specific, full power, indicated ΔT and T_{avg}. With respect to T_{avg}, a value for T'' common to all four loops is permissible within the limits identified in the uncertainty calculations. Outside of those limits, the value of T'' will be set appropriately to reflect indicated, loop specific, full power values. The engineering scaling calculations use each of the referenced parameters as an exact gain or reference value. Tolerances are not applied to the individual gain or reference parameters. Tolerances are applied to each calibration module and the overall string calibration. In order to ensure that the Overpower ΔT instrument channel is performing in a manner consistent with the assumptions of the safety analyses, it is necessary to verify during the CHANNEL OPERATIONAL TEST that the magnitude of instrument drift from the as-left condition is within limits, and that the input parameters to the trip function are within the appropriate calibration tolerances for defined calibration conditions (Ref. 9). Note that for the parameter K_5,

(continued)

REFERENCES (continued)

2. FSAR, Chapter 6.
3. FSAR, Chapter 15.
4. IEEE-279-1971.
5. 10 CFR 50.49.
6. WCAP-11269, Westinghouse Setpoint Methodology for Protection Systems; as supplemented by:
    - Amendments 34 (Unit 1) and 14 (Unit 2), RTS Steam Generator Water Level – Low Low, ESFAS Turbine Trip and Feedwater Isolation SG Water Level – High High, and ESFAS AFW SG Water Level – Low Low.
    - Amendments 48 and 49 (Unit 1) and Amendments 27 and 28 (Unit 2), deletion of RTS Power Range Neutron Flux High Negative Rate Trip.
    - Amendments 60 (Unit 1) and 39 (Unit 2), RTS Overtemperature ΔT setpoint revision.
    - Amendments 57 (Unit 1) and 36 (Unit 2), RTS Overtemperature and Overpower ΔT time constants and Overtemperature ΔT setpoint.
    - Amendments 43 and 44 (Unit 1) and 23 and 24 (Unit 2), revised Overtemperature and Overpower ΔT trip setpoints and allowable values.
    - Amendments 104 (Unit 1) and 82 (Unit 2), revised RTS Intermediate Range Neutron Flux, Source Range Neutron Flux, and P-6 trip setpoints and allowable values.
    - Amendments _____ (Unit 1) and _____ (Unit 2), revised Overtemperature ΔT trip setpoint to limit value of the compensated temperature difference and revised the modifier for axial flux difference.
    - Amendments _____ (Unit 1) and _____ (Unit 2), revised Overtemperature ΔT and Overpower ΔT trip setpoints to increase the fundamental setpoints K_1 and K_4, and to modify coefficients and dynamic compensation terms.
7. WCAP-10271-P-A, Supplement 1, May 1986.
8. FSAR, Chapter 16.
9. Westinghouse Letter GP-16696, November 5, 1997.

(continued)

BASES

REFERENCES (continued)

10. WCAP-13632-P-A Revision 2, "Elimination of Periodic Sensor Response Time Testing Requirements," January 1996.
11. WCAP-14036-P-A Revision 1, "Elimination of Periodic Protection Channel Response Time Tests," October 1998.
12. WCAP-14333-P-A, Rev. 1, October 1998.
13. WCAP-10271-P-A, Supplement 2, Rev. 1, June 1990.