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SOUTHERN COMPANY
Energy to Serve Your World[SM]

October 30, 2001

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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 (OTDT) REACTOR TRIP FUNCTION

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) Table 3.3.1-1, "Reactor Trip System Instrumentation" and the associated Bases B 3.3.1.

A limit or "clamp" on the Over Temperature Delta Temperature (OTDT) reactor trip function is proposed to address design issues related to fuel rod design under transient conditions. The OTDT reactor trip function setpoint equation contains a term that compensates for changes in reactor coolant loop average temperature from the loop reference temperature. In transients that result in a cooldown of the reactor coolant, the OTDT setpoint increases. The proposed change to the OTDT reactor trip function will clamp the magnitude of the setpoint increase during cooldown transients. To accomplish this clamp, a separate summator card will be installed in the Westinghouse 7300 process protection system racks to limit the impact of the cooldown transients for which the OTDT reactor trip function provides protection. The summator card will be set such that the temperature contribution will be clamped to a value three degrees lower than the reference temperature for the associated loop.

A001

The VEGP Relaxed Axial Offset Control (RAOC) licensing basis band is -20% Axial Flux Difference (AFD) at 100% Rated Thermal Power (RTP); -35% AFD at 50% RTP on the negative side; and +10% AFD at 100% RTP; +26% AFD at 50% RTP on the positive side. Typically, the negative side of the RAOC band affects fuel rod design criteria, and the positive side of the RAOC band affects departure from nucleate boiling (DNB) design criteria. The proposed change addresses the impact of changes to the negative side of the RAOC band. The positive side of the RAOC band is unaffected by these changes.

The negative side of the above RAOC band was initially determined to yield acceptable clad stress results due to a simplistic modeling of the OTDT trip function used to calculate the Condition II transient limits. The modeling did not include the K_2 (temperature compensation) and K_3 (pressure compensation) components of the OTDT trip function. Modeling the complete OTDT trip function could result in exceeding the clad stress limit for some transients. In order to meet the clad stress criterion, the RAOC band was reduced initially to -15% and -30% AFD at 100% and at 50% RTP, respectively. To address cycle-to-cycle fuel management variations and continue to meet the clad stress criterion, the RAOC band was further reduced to -12% and -25% AFD at 100% and 50% RTP, respectively. These reduced values are currently controlled by the Core Operating Limits Report (COLR).

Implementation of the clamp on the OTDT reactor trip function will generate sufficient clad stress margin to allow relaxation of the reduced RAOC band back to -15% AFD at 100% RTP and -30% AFD at 50% RTP. In addition, to meet the clad stress criterion, the OTDT reactor trip function axial flux difference modifier f_1(AFD) is being revised to reduce the deadband and increase the gain for negative values of AFD. The gain for positive values of AFD is being reduced.

In addition to the above-described changes, additional minor editorial revisions to Bases B3.3.1 are included: grammatical correction, inclusion of reference numbers in the text, and correction of the revision number of a reference.

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. 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.

SNC requests that the proposed changes be approved by February 14, 2002. The changes are planned to be implemented during the Unit 1 refueling outage in Spring 2002 and the Unit 2 refueling outage in Fall 2002.

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 30th day of October 2001.

Glenda C. Spinks
Notary Public

My commission expires: 11/10/02

JBB/RJF

Enclosures

1. Basis for Change Request
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
Mr. J. T. Gasser
Mr. M. Sheibani
SNC Document Management

U. S. Nuclear Regulatory Commission
Mr. L. A. Reyes, Regional Administrator
Mr. R. R. Assa, Senior Project Manager, NRR
Mr. John Zeiler, Senior Resident Inspector, Vogtle

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) REACTOR TRIP FUNCTION

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) Table 3.3.1-1, "Reactor Trip System Instrumentation" and the associated Bases B 3.3.1.

A limit or "clamp" on the Over Temperature Delta Temperature (OTDT) reactor trip function is proposed to address design issues related to fuel rod design under transient conditions. The OTDT reactor trip function setpoint equation contains a term that compensates for changes in reactor coolant loop average temperature from the loop reference temperature. In transients that result in a cooldown of the reactor coolant, the OTDT setpoint increases. The proposed change to the OTDT reactor trip function will clamp the magnitude of the setpoint increase during cooldown transients. To accomplish this clamp, a separate summator card will be installed in the Westinghouse 7300 process protection system racks to limit the impact of the cooldown transients for which the OTDT reactor trip function provides protection. The summator card will be set such that the temperature contribution will be clamped to a value three degrees lower than the reference temperature for the associated loop.

The VEGP Relaxed Axial Offset Control (RAOC) licensing basis band is -20% Axial Flux Difference (AFD) at 100% Rated Thermal Power (RTP); -35% AFD at 50% RTP on the negative side; and +10% AFD at 100% RTP; +26% AFD at 50% RTP on the positive side. Typically, the negative side of the RAOC band affects fuel rod design criteria, and the positive side of the RAOC band affects departure from nucleate boiling (DNB) design criteria. The proposed change addresses the impact of changes to the negative side of the RAOC band. The positive side of the RAOC band is unaffected by these changes.

The negative side of the above RAOC band was initially determined to yield acceptable clad stress results due to a simplistic modeling of the OTDT trip function used to calculate the Condition II transient limits. The modeling did not include the K_2 (temperature compensation) and K_3 (pressure compensation) components of the OTDT trip function. Modeling the complete OTDT trip function could result in exceeding the clad stress limit for some transients. In order to meet the clad stress criterion, the RAOC band was reduced initially to -15% and -30% AFD at 100% and at 50% RTP, respectively. To address cycle-to-cycle fuel management variations and continue to meet the clad stress criterion, the RAOC band was further reduced to -12% and -25% AFD at 100% and 50% RTP, respectively. These reduced values are currently controlled by the Core Operating Limits Report (COLR).

Implementation of the clamp on the OTDT reactor trip function will generate sufficient clad stress margin to allow relaxation of the reduced RAOC band back to -15% AFD at 100% RTP and -30% AFD at 50% RTP. In addition, to meet the clad stress criterion, the OTDT reactor trip function axial flux difference modifier f_1(AFD) is being revised to reduce the deadband and increase the gain for negative values of AFD. The gain for positive values of AFD is being reduced.

In addition to the above-described changes, additional minor editorial revisions to Bases B3.3.1 are included: grammatical correction, inclusion of reference numbers in the text, and correction of the revision number of a reference.

BASIS FOR PROPOSED CHANGE

Introduction

A limit or "clamp" on the OTDT function is proposed to address design issues related to fuel rod design under transient conditions. To accomplish this clamp, a separate summator card will be installed in the 7300 process protection system racks to limit the impact of the cooldown transients for which the OTDT reactor trip function provides protection. The OTDT reactor trip function has two temperature parts: 1) the OTDT setpoint that is determined based on the reactor coolant loop average temperature, and 2) the compensated measured reactor coolant loop temperature rise (Delta-T). The OTDT setpoint value must be less than or equal to the compensated Delta-T value for a reactor trip to occur. The setpoint value increases when the reactor coolant loop average temperature decreases, and setpoint value decreases when the reactor coolant loop average temperature increases. The summator card will be set such that the temperature contribution to the setpoint will be clamped to a value three degrees lower than the reference temperature for the associated loop. The clamp provided by the summator card will limit the impact of the cooldown transients to the value at which it is set.

Evaluation

<u>Fuel Clad Stress</u>

10CFR50, Appendix A, Criterion 10 requires the reactor core and associated coolant, control, and protection systems to be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation (Condition I), including the effects of anticipated operational occurrences (Condition II).

Clad stress is a fuel rod design criterion (i.e., calculated stress < yield stress). It is evaluated or analyzed on a cycle-specific basis to prevent stress failure of the fuel rod cladding for Condition I and Condition II events. This demonstrates compliance with Criterion 10, i.e., that the specified acceptable fuel design limits are not exceeded.

Compliance with this stress criterion is confirmed by calculations for both Condition I and Condition II operating conditions. This is accomplished by the use of parameters defined as "transient limits" which are input to the fuel performance code. Transient limits define the increase in local fuel power (relative to Condition I operation) during Condition II transients, which the fuel performance code uses to calculate the increase in local clad stress. The following Condition II transients are modeled:

1. Rod bank malfunctions
2. Boration/dilution accidents
3. Cooldown events (-10, -20, and -30°F from 50%, 75%, and 100% RTP, respectively).

These Condition II transients are terminated by physical constraints or by a reactor trip.

The VEGP Relaxed Axial Offset Control (RAOC) licensing basis band is -20% AFD at 100% RTP; –35% at 50% RTP on the negative side; and +10% AFD at 100% RTP; +26% at 50% RTP on the positive side. Typically, the negative side of the RAOC band affects fuel rod design criteria, and the positive side of the RAOC band affects DNB. This evaluation addresses the impact of changes to the negative side of the RAOC band. The positive side of the RAOC band is unaffected by these changes.

The OTDT trip function was originally modeled using the following simplistic equation, in which the temperature and pressure components were not considered:

$$\Delta T/\Delta T_0 \leq K_1 - f_1(AFD) \qquad \text{(Equation 1)}$$

The revised program models the OTΔT trip function using the following more detailed equation:

$$\Delta T/\Delta T_0 \leq K_1 - K_2(T-T') - K_3(P'-P) - f_1(AFD) \qquad \text{(Equation 2)}$$

The terms in these equations are defined in TS Table 3.3.1-1.

The negative side of the above RAOC band was initially determined to yield acceptable clad stress results due to the simplistic modeling of the OTDT trip function in the program used to calculate the Condition II transient limits. The previous versions of this program did not include the K_2 and K_3 components of the OTDT trip function (Equation 1). Modeling the OTDT trip function using Equation 2 resulted in violations of the clad stress limit in some conditions. As can be seen from Equation 1, as the power shape becomes more negatively skewed during the Condition II event, the OTDT setpoint is reduced by the AFD modifier f_1(AFD), resulting in a reactor trip for sufficiently skewed power shapes. The modeling of the OTDT trip function was revised to incorporate the K2 (temperature compensation) and K3 (pressure compensation) components. As can be seen from Equation 2, as the reactor coolant loop temperature decreases during the Condition II cooldown event, the OTDT setpoint increases. The magnitude of the AFD modifier f_1(AFD) may not be sufficient to cause a reactor trip to terminate the event. The resultant Condition II power shape may result in exceeding the clad stress limit. By introducing a clamp on the temperature compensation component, the increase in the OTDT setpoint is clamped, thus resulting in a reactor trip when required.

In order to meet the clad stress criterion, the RAOC band was reduced initially to –15% and -30% AFD at 100% and 50% RTP, respectively. To address cycle-to-cycle fuel management variations and continue to meet the clad stress criterion, the RAOC band was further reduced to -12% and -25% AFD at 100% and at 50% RTP, respectively. These reduced values are currently controlled by the COLR.

Implementation of the clamp described above will generate sufficient clad stress margin to allow relaxation of the reduced RAOC band back to -15% AFD at 100% of RTP and -30% AFD at 50% RTP. In addition, to meet the clad stress criterion it was necessary to revise values for the AFD modifier f_1(AFD). The revised f_1(AFD) values are discussed below.

The transient limits for the fuel rod design clad stress calculations generated for VEGP Units 1 and 2 are based on the following assumptions:

1. The OTDT setpoint values for K_1, K_2, and K_3 are unchanged from the values contained in the current Technical Specifications. The revised f_1(AFD) values are provided below:

    a) for AFD between –23% and +10%, f_1(AFD) = 0% RTP
    b) for each % AFD is below –23%, the trip setpoint shall be reduced by 3.3% RTP
    c) for each % AFD is above +10%, the trip setpoint shall be reduced by 1.95% RTP.

2. A RAOC band of +10%, -15% AFD at 100% RTP and of +26%, -30% AFD at 50% RTP.

3. Implementation of the changes to the OTDT trip function such that the maximum contribution of the temperature component of the OTDT trip function due to a cooldown event is limited to K_2 times 3°F on a loop-specific basis.

Based upon this new set of transient limits, the local power increase during the Condition II events is significantly reduced. This results in a significant increase in the margins to the fuel rod design limits during Condition II events, specifically the cladding stress analysis. This increase in fuel rod design margins allows the implementation of the above RAOC band in place of the current reduced RAOC band. The proposed RAOC band will become the licensing basis RAOC band.

The limiting fuel rod design analysis which is impacted the most by the change in transient local powers is the cladding stress criterion. The addition of a temperature clamp on the OTDT trip function results in a reduced number of severe Condition II cooldown shapes that are included in the generation of the transient limits, thereby reducing the resulting clad stress.

The clamp on the OTDT function, along with revised AFD modifier f_1(AFD), will provide the clad with sufficient clad stress margin, allowing the RAOC band to be restored back to -15% AFD at 100% of RTP and -30% AFD at 50% of RTP. The positive side of the RAOC band is unaffected by this change.

<u>Non-LOCA Safety Analyses</u>

The non-LOCA safety analyses specifically credit the OTDT reactor trip function to provide primary protection for several events. The non-LOCA events which credit the OTDT reactor trip function as the primary reactor trip function include the Uncontrolled Bank Withdrawal at Power event (FSAR Section15.4.2), 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 OTDT setpoint and eventually result in a reactor trip. That is, the events result in an increase in the reactor coolant system (RCS) temperature (heatup events) or a reduction in pressurizer pressure (RCS depressurization event) which tend to reduce the OTDT setpoint. The proposed clamp limits how much the OTDT setpoint can increase as a result of decreases in the RCS temperature. Since the non-LOCA analyses in general result in a reduction in the OTDT setpoint, and the clamp limits the amount that the OTDT setpoint can increase, the non-LOCA safety analyses will not be adversely affected by the proposed clamp. Note that the design basis of the OTDT reactor trip setpoint is to ensure DNB protection and to preclude vessel exit boiling. The installation of the OTDT clamp would continue to ensure this same protection and that the

OTDT design basis would remain unaffected. The introduction of the OTDT clamp would not create any new transients nor would it invalidate the OTDT design basis. In addition, there are no transients analyzed in the VEGP FSAR that result in a reduction in the RCS temperature which rely on OTDT as the primary reactor trip function, as cooldown events tend to be non-limiting with respect to the criterion of DNB and, therefore, trip on other trip functions such as the high-high steam generator water level trip function for the feedwater malfunction event. Furthermore, since the non-LOCA safety analyses do not credit the AFD modifier f_1(AFD), the proposed changes to f_1(AFD) will not adversely affect these analyses. Therefore, the current non-LOCA safety analyses remain bounding, and the conclusions of the VEGP FSAR remain valid.

CONCLUSION

Based on the above, the proposed change can be implemented without adverse impact to the safety analyses and plant systems. Implementation of the clamp on the OTDT reactor trip function, along with the corresponding changes to the AFD modifier f_1(AFD) and RAOC band, will ensure the prevention of stress failure of the fuel rod cladding for Condition I and II RCS cooldown events. This demonstrates continued compliance with 10 CFR 50, Appendix A, Criterion 10, i.e., that the specified acceptable fuel design limits are not exceeded.

ENCLOSURE 2

VOGTLE ELECTRIC GENERATING PLANT
REQUEST TO REVISE TECHNICAL SPECIFICATIONS
REACTOR TRIP SYSTEM INSTRUMENTATION OVER TEMPERATURE DELTA TEMPERATURE (OTDT) REACTOR TRIP FUNCTION

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) Table 3.3.1-1, "Reactor Trip System Instrumentation" and the associated Bases B 3.3.1.

A limit or "clamp" on the Over Temperature Delta Temperature (OTDT) reactor trip function is proposed to address design issues related to fuel rod design under transient conditions. The OTDT reactor trip function setpoint equation contains a term that compensates for changes in reactor coolant loop average temperature from the loop reference temperature. In transients that result in a cooldown of the reactor coolant, the OTDT setpoint increases. The proposed change to the OTDT reactor trip function will clamp the magnitude of the setpoint increase during cooldown transients. To accomplish this clamp, a separate summator card will be installed in the Westinghouse 7300 process protection system racks to limit the impact of the cooldown transients for which the OTDT reactor trip function provides protection. The summator card will be set such that the temperature contribution will be clamped to a value three degrees lower than the reference temperature for the associated loop.

The VEGP Relaxed Axial Offset Control (RAOC) licensing basis band is -20% Axial Flux Difference (AFD) at 100% Rated Thermal Power (RTP);-35% AFD at 50% RTP on the negative side; and +10% AFD at 100% RTP; +26% AFD at 50% RTP on the positive side. Typically, the negative side of the RAOC band affects fuel rod design criteria, and the positive side of the RAOC band affects departure from nucleate boiling (DNB) design criteria. The proposed change addresses the impact of changes to the negative side of the RAOC band. The positive side of the RAOC band is unaffected by these changes.

The negative side of the above RAOC band was initially determined to yield acceptable clad stress results due to a simplistic modeling of the OTDT trip function used to calculate the Condition II transient limits. The modeling did not include the K_2 (temperature compensation) and K_3 (pressure compensation) components of the OTDT trip function. Modeling the complete OTDT trip function could result in exceeding the clad stress limit for some transients. In order to meet the clad stress criterion, the RAOC band was a reduced initially to -15% and -30% AFD at 100% and at 50% RTP, respectively. To address cycle-to-cycle fuel management variations and continue to meet the clad stress criterion, the RAOC band was further reduced to -12% and -25% AFD at 100% and 50% RTP, respectively. These reduced values are currently controlled by the Core Operating Limits Report (COLR).

Implementation of the clamp on the OTDT reactor trip function will generate sufficient clad stress margin to allow relaxation of the reduced RAOC band back to -15% AFD at 100% RTP and -30% AFD at 50% RTP. In addition, to meet the clad stress criterion, the OTDT reactor trip function axial flux difference modifier f_1(AFD) is being revised to reduce the deadband and increase the gain for negative values of AFD. The gain for positive values of AFD is being reduced.

In addition to the above-described changes, additional minor editorial revisions to Bases B3.3.1 are included: grammatical correction, inclusion of reference numbers in the text, and correction of the revision number of a reference.

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 clamp on the OTDT reactor trip function is not credited in the safety analyses. Implementation of the limit or "clamp" on the OTDT reactor trip function, along with the corresponding changes to the AFD modifier f_1(AFD) and RAOC band, will ensure the prevention of stress failure of the fuel rod cladding for Condition I and II reactor coolant system cooldown events. This demonstrates continued compliance with 10 CFR 50, Appendix A, Criterion 10, i.e., that the specified acceptable fuel design limits are not exceeded.

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 modification 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 clamp on the OTDT reactor trip function is not credited in the safety analyses. Implementation of the limit or "clamp" on the OTDT reactor trip function, along with the corresponding changes to the AFD modifier f_1(AFD) and RAOC band, will ensure the prevention of stress failure of the fuel rod cladding for Condition I and II reactor coolant system cooldown events.

The design basis of the OTDT reactor trip setpoint is to ensure DNB protection and to preclude vessel exit boiling. The installation of the OTDT clamp would continue to ensure this same protection and that the OTDT design basis would remain unaffected. The introduction of the OTDT clamp would not create any new transients nor would it invalidate the OTDT design basis. In addition, there are no transients analyzed in the VEGP FSAR that result in a reduction in the reactor coolant temperature which rely on OTDT as the primary reactor trip function, as cooldown events tend to be non-limiting with respect to the criterion of DNB.

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 clamp on the OTDT reactor trip function is not credited in the safety analyses. Implementation of the limit or "clamp" on the OTDT reactor trip function, along with the corresponding changes to the AFD modifier f_t(AFD) and RAOC band, will ensure the prevention of stress failure of the fuel rod cladding for Condition I and II RCS cooldown events. This demonstrates continued compliance with 10 CFR 50, Appendix A, Criterion 10, i.e., that the specified acceptable fuel design limits are not exceeded.

The design basis of the OTDT reactor trip setpoint is to ensure DNB protection and to preclude vessel exit boiling. The installation of the OTDT clamp would continue to ensure this same protection and that the OTDT design basis would remain unaffected.

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) REACTOR TRIP FUNCTION

MARKED-UP TECHNICAL SPECIFICATION AND BASES PAGES

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.

(0)

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

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: $\tau_1 \ge 8$ seconds, $\tau_2 \le 3$ 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 seconds
	K_1	fundamental setpoint, $\le 112\%$ 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 seconds
	T'	indicated loop specific RCS average temperature at RTP, ≤ 588.4 degrees F
	K_3	modifier for pressure, = 0.115% 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):

-23% -23% 3.3%

1. for AFD between ~~-32%~~ and +10%, = 0% RTP
2. for each % AFD is below ~~-32%~~, the trip setpoint shall be reduced by ~~3.25%~~ RTP
3. for each % AFD is above +10%, the trip setpoint shall be reduced by ~~2.7%~~ RTP

1.95%

Insert 1 →

Insert 1

(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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

6. Overtemperature ΔT (continued)

has the same effect on ΔT as a power increase. The Overtemperature ΔT trip Function uses each loop's ΔT as a measure of reactor power and is compared with a setpoint that is automatically varied with the following parameters:

- reactor coolant average temperature — the Trip Setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature;

- pressurizer pressure — the Trip Setpoint is varied to correct for changes in system pressure; and

- axial power distribution — f(AFD)x, the f(AFD) Function is used in the calculation of the Overtemperature ΔT trip. It is a function of the indicated difference between the upper and lower NIS power range detectors. This Function measures the axial power distribution. The Overtemperature ΔT Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the NIS upper and lower power range detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower NIS power range detectors, the Trip Setpoint is reduced in accordance with Note 1 of Table 3.3.1-1.

Dynamic compensation is included for RTD response time delays.

The Overtemperature ΔT trip Function is calculated for each loop as described in Note 1 of Table 3.3.1-1. A trip ~~Trip~~ occurs if Overtemperature ΔT is indicated in two loops. Since the pressure and temperature signals are used for other control functions, the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABLITY

6. Overtemperature ΔT (continued)

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}.

Insert 2

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 setpoint is consistent with the assumptions of the safety analyses, it is necessary to verify during the CHANNEL OPERATIONAL TEST that the 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 2

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.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.15 (continued)

Response time may be verified by actual response time tests in any series of sequential, overlapping, or total channel measurements; or by the summation of allocation sensor, signal processing, and actuation logic response times with actual response time tests on the remainder of the channel. Allocations for sensor response times may be obtained from: (1) historical records based on acceptable resonse time tests (hydraulic, noise, or power interrupt tests), (2) in place, onsite, or offsite (e.g., vendor) test measurements, or (3) using vendor engineering specifications. WCAP-13632-P-A Revision 2, "Elimination of Pressure Sensor Response Time Testing Requirements", (Ref. 10), provides the basis and methodology for using allocated sensor response times in the overall verification of the channel response time for specific sensors identified in the WCAP. Response time verification for other sensor types must be demonstrated by test.

WCAP-14036-P Revision 1, "Elimination of Periodic Protection Channel Response Time Tests", (Ref. 11), provides the basis and methodology for using allocated signal processing and actuation logic response times in the overall verification of the protection system channel response time. The allocations for sensor, signal conditioning and actuation logic response times must be verified prior to placing the component in operational service and re-verified following maintenance that may adversely affect response time. In general, electrical repair work does not impact response time provided the parts used for repair are of the same type and value. Specific components identified in the WCAP may be replaced without verification testing. One example where response time could be affected is replacing the sensing assembly of a transmitter.

As appropriate, each channel's response must be verified every 18 months on a STAGGERED TEST BASIS. Testing of the final actuation devices is included in the testing. Response times cannot be determined during unit operation because equipment operation is required to measure response

(continued)

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.

Insert 3

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 ~~1~~ 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.

Insert 3

- 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.

ENCLOSURE 4

VOGTLE ELECTRIC GENERATING PLANT
REQUEST TO REVISE TECHNICAL SPECIFICATIONS
REACTOR TRIP SYSTEM INSTRUMENTATION OVER TEMPERATURE DELTA TEMPERATURE (OTDT) REACTOR TRIP FUNCTION

TYPED REVISED TECHNICAL SPECIFICATION AND BASES PAGES

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.

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

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: $\tau_1 \geq 8$ seconds, $\tau_2 \leq 3$ 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 seconds
	K_1	fundamental setpoint, $\leq 112\%$ 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, = 0 seconds
	T'	indicated loop specific RCS average temperature at RTP, ≤ 588.4 degrees F
	K_3	modifier for pressure, = 0.115% 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

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: $\tau_1 \ge 8$ seconds, $\tau_2 \le 3$ 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 seconds
	K_4	fundamental setpoint, ≤ 109.5% 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, = 0 seconds
	K_6	modifier for temperature: ≥ 0.20% 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

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

6. Overtemperature ΔT (continued)

has the same effect on ΔT as a power increase. The Overtemperature ΔT trip Function uses each loop's ΔT as a measure of reactor power and is compared with a setpoint that is automatically varied with the following parameters:

- reactor coolant average temperature — the Trip Setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature;
- pressurizer pressure — the Trip Setpoint is varied to correct for changes in system pressure; and
- axial power distribution — f(AFD)x, the f(AFD) Function is used in the calculation of the Overtemperature ΔT trip. It is a function of the indicated difference between the upper and lower NIS power range detectors. This Function measures the axial power distribution. The Overtemperature ΔT Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the NIS upper and lower power range detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower NIS power range detectors, the Trip Setpoint is reduced in accordance with Note 1 of Table 3.3.1-1.

Dynamic compensation is included for RTD response time delays.

The Overtemperature ΔT trip Function is calculated for each loop as described in Note 1 of Table 3.3.1-1. A trip occurs if Overtemperature ΔT is indicated in two loops. Since the pressure and temperature signals are used for other control functions, the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABLITY

6. Overtemperature ΔT (continued)

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. 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 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.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.15 (continued)

Response time may be verified by actual response time tests in any series of sequential, overlapping, or total channel measurements; or by the summation of allocation sensor, signal processing, and actuation logic response times with actual response time tests on the remainder of the channel. Allocations for sensor response times may be obtained from: (1) historical records based on acceptable resonse time tests (hydraulic, noise, or power interrupt tests), (2) in place, onsite, or offsite (e.g., vendor) test measurements, or (3) using vendor engineering specifications. WCAP-13632-P-A Revision 2, "Elimination of Pressure Sensor Response Time Testing Requirements," (Ref. 10), provides the basis and methodology for using allocated sensor response times in the overall verification of the channel response time for specific sensors identified in the WCAP. Response time verification for other sensor types must be demonstrated by test.

WCAP-14036-P Revision 1, "Elimination of Periodic Protection Channel Response Time Tests," (Ref. 11), provides the basis and methodology for using allocated signal processing and actuation logic response times in the overall verification of the protection system channel response time. The allocations for sensor, signal conditioning and actuation logic response times must be verified prior to placing the component in operational service and re-verified following maintenance that may adversely affect response time. In general, electrical repair work does not impact response time provided the parts used for repair are of the same type and value. Specific components identified in the WCAP may be replaced without verification testing. One example where response time could be affected is replacing the sensing assembly of a transmitter.

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(continued)

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:

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   - 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.

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   - 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.

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)

BASES

REFERENCES (continued)

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.