Union Electric

One Ameren Plaza
1901 Chouteau Avenue
PO Box 66149
St. Louis, MO 63166-6149
314.621.3222

November 7, 2001

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, D.C. 20555

ULNRC-04557

Gentlemen:

DOCKET NUMBER 50-483
UNION ELECTRIC COMPANY
CALLAWAY PLANT
REVISION TO TECHNICAL SPECIFICATION SURVEILLANCE REQUIREMENTS 3.3.1.2 AND 3.3.1.3 IN LCO 3.3.1, "REACTOR TRIP SYSTEM INSTRUMENTATION"

Ameren UE

Union Electric Company herewith transmits an application for amendment to Facility Operating License No. NPF-30 for the Callaway Plant.

This amendment application would revise Surveillance Requirements (SRs) 3.3.1.2 and 3.3.1.3 of Technical Specification (TS) 3.3.1, "Reactor Trip System (RTS) Instrumentation." These SRs are only applicable to Functions 2.a and 6 of TS Table 3.3.1-1, Power Range Neutron Flux High and Overtemperature ΔT. The change to SR 3.3.1.2 responds to a concern raised by Westinghouse Technical Bulletin ESBU-TB-92-14-R1 and is consistent with traveler TSTF-371 and amendments issued to the Farley Units as discussed in Attachment 1. The change to SR 3.3.1.3 is editorial in nature.

In accordance with NRC Administrative Letter 98-10, administrative controls were implemented soon after the discovery of the issue involving SR 3.3.1.2. The additional restrictions imposed by Reference 10 in the SR 3.3.1.2 Bases have been imposed since that time.

Union Electric Company is submitting this license amendment application in conjunction with an industry consortium of five plants as a result of a mutual agreement known as Strategic Teaming and Resource Sharing (STARS). The STARS group consists of the five plants operated by TXU Electric, Union Electric Company, Wolf Creek Nuclear Operating Corporation, Pacific Gas and Electric, and STP Nuclear Operating Company. Some of the other members of the above group can be expected to submit license amendment requests similar to this one.

A001

The Callaway Plant Onsite Review Committee and the Nuclear Safety Review Board have reviewed this amendment application. Attachments 1 through 4 provide the Evaluation, Markup of Technical Specifications, Retyped Technical Specifications, and Proposed Technical Specification Bases Changes, respectively, in support of this amendment request. Attachment 4 is provided for information only. Final Bases changes will be implemented pursuant to TS 5.5.14, Technical Specifications (TS) Bases Control Program. Appendix A provides the Callaway-specific evaluation of this issue. There are no collateral commitments associated with this amendment application.

It has been determined that this amendment application does not involve a significant hazard consideration as determined per 10CFR50.92. Pursuant to 10CFR51.22(b), no environmental impact statement or environmental assessment needs to be prepared in connection with the issuance of this amendment.

Approval of this amendment application is requested by September 1, 2002 so that this change can be implemented during the startup from Callaway's Refuel 12. Once approved, the amendment will be implemented within 60 days. In accordance with 10CFR50.91, a copy of this amendment application is being provided to the designated Missouri State official. If you have any questions on this amendment application, please contact us.

Very truly yours,

JBlosser

John D. Blosser
Manager-Regulatory Affairs

Attachments:

1 - Evaluation
2 - Markup of Technical Specifications
3 - Retyped Technical Specifications
4 - Proposed Technical Specification Bases Changes (for information only)

Appendix A

STATE OF MISSOURI)
) S S
CITY OF ST. LOUIS)

John D. Blosser, of lawful age, being first duly sworn upon oath says that he is Manager Regulatory Affairs, for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Blosser
John D. Blosser
Manager Regulatory Affairs

SUBSCRIBED and sworn to before me this 7th day of November, 2001.

Melissa L. Orr

MELISSA L. ORR
Notary Public - Notary Seal
STATE OF MISSOURI
City of St. Louis
My Commission Expires: June 23, 2003

cc: M. H. Fletcher
Professional Nuclear Consulting, Inc.
19041 Raines Drive
Derwood, MD 20855-2432

Regional Administrator
U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive
Suite 400
Arlington, TX 76011-8064

Senior Resident Inspector
Callaway Resident Office
U.S. Nuclear Regulatory Commission
8201 NRC Road
Steedman, MO 65077

Mr. Jack Donohew (2)- **OPEN BY ADDRESSEE ONLY**
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
1 White Flint, North, Mail Stop OWFN 7E1
11555 Rockville Pike
Rockville, MD 20852-2738

Manager, Electric Department
Missouri Public Service Commission
P.O. Box 360
Jefferson City, MO 65102

Ron Kucera
Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

Denny Buschbaum
TU Electric
P.O. Box 1002
Glen Rose, TX 76043

Pat Nugent
Pacific Gas & Electric
Regulatory Services
P.O. Box 56
Avila Beach, CA 93424

Scott Bauer
Palo Verde Public Service Company
Mail Station 7636
P.O. Box 52034
Phoenix, AZ 85072-2034

ATTACHMENT ONE

EVALUATION

EVALUATION

1.0 INTRODUCTION

1.1 This amendment application would revise Surveillance Requirements (SRs) 3.3.1.2 and 3.3.1.3 of Technical Specification (TS) 3.3.1, "Reactor Trip System (RTS) Instrumentation." These SRs are only applicable to Functions 2.a and 6 of TS Table 3.3.1-1, Power Range Neutron Flux High and Overtemperature ΔT. The change to SR 3.3.1.2 responds to a concern raised by Westinghouse Technical Bulletin ESBU-TB-92-14-R1, "Decalibration Effects of Calorimetric Power Measurements on the NIS High Power Reactor Trip at Power Levels less than 70 % RTP," dated February 6, 1996 (Reference 1), and is consistent with traveler TSTF-371 (Reference 2) and amendments issued to the Farley Units (see Section 9.0). References are listed in Section 10 of this Evaluation. The change to SR 3.3.1.3 is editorial in nature.

These changes are requested to address the potential effects of decalibrating the nuclear instrumentation system (NIS) power range channels at part-power operation, as discussed in Westinghouse Technical Bulletin ESBU-TB-92-14-R1. In addition, moving the content of SR 3.3.1.2 Note 1 to the body of the SR and using the "power range channel" terminology would provide consistency with the other Owners Groups' Standard Technical Specifications (STS) NUREGs. Associated SR 3.3.1.2 Bases changes provide a summary justification for the surveillance change and clarify when channel adjustments must be made. SR 3.3.1.3 would also be revised to move the content of its Note 1 to the body of the SR for consistency. Associated SR 3.3.1.3 Bases changes reflect the relocation of its Note 1.

A plant-specific evaluation based on the guidance in Westinghouse Technical Bulletin ESBU-TB-92-14-R1 was performed to determine the power level below which power range channel adjustments in a decreasing power direction become a concern. This evaluation is documented in Appendix A to this amendment application.

1.2 Final Safety Analysis Report (FSAR) Section

No changes to the FSAR are required for this amendment application.

2.0 DESCRIPTION OF PROPOSED AMENDMENT

SR 3.3.1.2 currently states: "Compare results of calorimetric heat balance calculation to Nuclear Instrumentation System (NIS) channel output." Note 1 of SR 3.3.1.2 currently states: "Adjust NIS channel if absolute difference is > 2%." Note 2 of SR 3.3.1.2 currently states: "Not required to be performed until 24 hours after THERMAL POWER is ≥ 15% RTP."

This amendment application would revise SR 3.3.1.2 to move the content of Note 1 to the body of the SR. SR 3.3.1.2 would be revised to state:

> "Compare results of calorimetric heat balance calculation to power range channel output. Adjust power range channel output if calorimetric heat balance calculation results exceed power range channel output by more than + 2% RTP."

Corresponding Bases changes are also required. The Bases changes provide a summary justification for the surveillance change and clarify when channel adjustments must be made. Specifically, the first paragraph of the Bases for SR 3.3.1.2 would be revised as follows:

> "SR 3.3.1.2 compares the calorimetric heat balance calculation to the power range channel output every 24 hours. If the calorimetric heat balance calculation results exceed the power range channel output by more than + 2% RTP, the power range channel is not declared inoperable, but must be adjusted. The power range channel output shall be adjusted consistent with the calorimetric heat balance calculation results if the calorimetric calculation exceeds the power range channel output by more than + 2% RTP. If the power range channel output cannot be properly adjusted, the channel is declared inoperable."

The following two paragraphs would be inserted between the first paragraph and second paragraph of the current Bases for SR 3.3.1.2:

> "If the calorimetric is performed at part-power (< 40% RTP), adjusting the power range channel indication in the increasing power direction will assure a reactor trip below the power range high safety analysis limit (SAL) of ≤ 118% RTP in FSAR Table 15.0-4 (Reference 10). Making no adjustment to the power range channel in the decreasing power direction due to a part-power calorimetric assures a reactor trip consistent with the safety analyses.

This allowance does not preclude making indicated power adjustments, if desired, when the calorimetric heat balance calculation power is less than the power range channel output. To provide close agreement between indicated power and to preserve operating margin, the power range channels are normally adjusted when operating at or near full power during steady-state conditions. However, discretion must be exercised if the power range channel output is adjusted in the decreasing power direction due to a part-power calorimetric (< 40% RTP). This action could introduce a non-conservative bias at higher power levels which could delay an NIS reactor trip until power is above the power range high SAL. The cause of the non-conservative bias is the decreased accuracy of the calorimetric at reduced power conditions. The primary error contributor to the instrument uncertainty for a secondary side power calorimetric measurement is the feedwater flow measurement, which is determined by a ΔP measurement across a feedwater venturi. While the measurement uncertainty remains constant in ΔP span as power decreases, when translated into flow the uncertainty increases as a square term. Thus, a 1% flow error at 100% power can approach a 10% flow error at 30% RTP even though the ΔP error has not changed. To assure a reactor trip below the power range high SAL, the power range neutron flux - high trip setpoint is first set at ≤ 85% RTP prior to adjusting the power range channel output in the decreasing power direction whenever the calorimetric power is ≥ 20% RTP and < 40% RTP. To assure a reactor trip below the power range high SAL, the power range neutron flux - high trip setpoint is first set at ≤ 70% RTP prior to adjusting the power range channel output in the decreasing power direction whenever the calorimetric power is ≥ 15% RTP and < 20% RTP. Adjustments in the increasing power direction do not require a prior decrease in the trip setpoint. Following a plant shutdown, it is permissible to reduce the power range neutron flux - high trip setpoint prior to startup. This would anticipate the potential need for a decreasing power direction adjustment, thereby obviating the need to suspend power escalation for the purpose of first reducing the trip setpoint. Before the power range neutron flux - high trip setpoint is re-set to its nominal full power value (≤ 109% RTP), the power range channel calibration must be confirmed based on a calorimetric performed at ≥ 40% RTP."

The second paragraph of the current Bases for SR 3.3.1.2 would be revised for consistency with the surveillance wording changes proposed in the first SR 3.3.1.2 Bases paragraph, precipitated by the incorporation of SR 3.3.1.2 Note 1 into the body of the SR text. In addition, the Bases information pertaining to the rationale for not requiring performance of a secondary power calorimetric measurement until reaching 15% rated thermal power (RTP) would be changed to reflect the correct licensing basis for Westinghouse pressurized water reactors. The power level of 15% RTP was chosen as the minimum power level for the NIS power range daily surveillance based on the Westinghouse nuclear steam supply system design basis capability of being able to achieve stable control system operation in the automatic control mode. The revision is as follows:

> "The Note to SR 3.3.1.2 clarifies that this Surveillance is required only if reactor power is ≥ 15% RTP and that 24 hours is allowed for performing the first Surveillance after reaching 15% RTP. A power level of 15% RTP is chosen based on plant stability, i.e., automatic rod control capability (manual rod control is normally used at Callaway) and the turbine generator synchronized to the grid."

The third paragraph of the current Bases for SR 3.3.1.2 would also be revised for consistency with the surveillance wording changes proposed in the first SR 3.3.1.2 Bases paragraph as follows:

> "The Frequency of every 24 hours is adequate. It is based on unit operating experience, considering instrument reliability and operating history data for instrument drift. Together these factors demonstrate that a difference between the calorimetric heat balance calculation and the power range channel output of more than + 2% RTP is not expected in any 24 hour period."

The fourth paragraph of the current Bases for SR 3.3.1.2 will not be revised.

This amendment application would also revise SR 3.3.1.3 to move the content of Note 1 to the body of the SR for consistency with the change made to SR 3.3.1.2. SR 3.3.1.3 would be revised to state:

> "Compare results of the incore detector measurements to Nuclear Instrumentation System (NIS) AFD. Adjust NIS channel if absolute difference is ≥ 2%."

The SR 3.3.1.3 Bases are similarly revised to reflect moving the text of Note 1 to the body of the SR.

Attachments 2 and 3 provide the TS markups and the retyped TS. Attachment 4 provides the proposed TS Bases changes.

3.0 BACKGROUND

Westinghouse Technical Bulletin ESBU-TB-92-14-R1 (Reference 1) identified potential effects of decalibrating the NIS power range channels at part-power operation. The decalibration can occur due to the increased uncertainty of the secondary side power calorimetric when performed at power levels less than 40% RTP. This power level was determined on a plant-specific basis following the guidance of the Technical Bulletin (see Appendix A). When NIS channel indication is reduced to match calculated power, the decalibration potentially results in a non-conservative bias. The proposed amendment to the Technical Specifications removes the requirement to adjust the NIS power range channels in the decreasing power direction when the indicated power is greater than the calorimetric heat balance calculation by more than 2% RTP.

Westinghouse originally issued Technical Bulletin NSD-TB-92-14, "Instrumentation Calibration at Reduced Power," on January 18, 1993. NSD-TB-92-14 was revised as a result of a Westinghouse review of ABB-CE Infobulletin 94-01, "Potential Nonconservative Treatment of Power Measurement Uncertainty," dated June 21, 1994. Both vendors' bulletins addressed the potential decalibration effects on NIS power range indications and reactor trip setpoints due to increased uncertainties associated with secondary side power calorimetric measurements performed at low power levels. After review of the ABB-CE bulletin, Westinghouse determined that further information and clarification would be advisable and issued ESBU-TB-92-14-R1.

The primary error contributor to the instrument uncertainty for a secondary side power calorimetric measurement is the feedwater flow measurement, which is determined by a ΔP measurement across a feedwater venturi. While the measurement uncertainty remains constant in ΔP span as power decreases, when translated into flow the uncertainty increases as a square term. Thus, a 1% flow error at 100% power can approach a 10% flow error at 30% RTP even though the ΔP error has not changed. ESBU-TB-92-14-R1 discussed how the potential effects of this error increase at lower power levels. In the example presented, for a 10% error in the secondary side power calorimetric, the NIS power range could be sufficiently biased in the non-conservative direction to preclude a reactor trip within the assumptions of the safety analyses. One of affected analyses is the rod withdrawal from 10% RTP discussed in FSAR Section 15.4.2.2.

Westinghouse Technical Bulletin ESBU-TB-92-14-R1 recommends that caution be exercised if the NIS power range channels are adjusted in the decreasing power direction when the power range channels indicate a higher power than the secondary side power calorimetric measurement at power levels below a plant-specific power level (40% RTP at Callaway, as discussed in Appendix A). This recommendation is in conflict with the power range daily SR 3.3.1.2, which currently requires channel adjustment whenever the absolute difference is > 2% and the plant is operating at ≥ 15% RTP.

Need for Change

Compliance with SR 3.3.1.2 may result in a non-conservative channel calibration during reduced power operations. This amendment application would resolve this undesirable condition by requiring adjustment of the NIS power range channels only when the calorimetric heat balance calculated power is greater than the power range indicated power by more than + 2% RTP.

Callaway implemented interim administrative controls to address this conflict within the Technical Specifications via Reference 10 in the current SR 3.3.1.2 Bases. That reference was included in the ITS conversion, License Amendment 133, and contains trip setpoint adjustment requirements now being explicitly detailed in the SR 3.3.1.2 Bases. This has been an open issue since Westinghouse Technical Bulletin ESBU-TB-92-14-R1 was issued in 1996. For long-term resolution, the Westinghouse Owners Group (WOG) initiated a program to obtain NRC approval to revise the present STS surveillance requirement to always adjust NIS power range channels whenever indicated power differs from calorimetric heat balance calculated power by an absolute value greater than 2% RTP. A license amendment request was submitted by Southern Nuclear Operating Company for Farley Units 1 and 2 on November 6, 1998. NRC approved the proposed change for the Farley Units in License Amendment Nos. 144 (Unit 1)/135 (Unit 2), dated October 1, 1999. A traveler, TSTF-371, is currently under NRC review to revise the Westinghouse STS NUREG-1431, Revision 2.

4.0 REGULATORY REQUIREMENTS AND GUIDANCE

The regulatory bases and guidance documents associated with the systems discussed in this amendment application include:

GDC-13 requires that instrumentation shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems.

GDC-20 requires that the protection system(s) shall be designed (1) to initiate automatically the operation of appropriate systems including the reactivity control systems, to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences and (2) to sense accident conditions and to initiate the operation of systems and components important to safety.

GDC-21 requires that the protection system(s) shall be designed for high functional reliability and testability.

GDC-22 through GDC-25 and GDC-29 require various design attributes for the protection system(s), including independence, safe failure modes, separation from control systems, requirements for reactivity control malfunctions, and protection against anticipated operational occurrences.

Regulatory Guide 1.22 discusses an acceptable method of satisfying GDC-20 and GDC-21 regarding the periodic testing of protection system actuation functions. These periodic tests should duplicate, as closely as practicable, the performance that is required of the actuation devices in the event of an accident.

10CFR50.55a(h) requires that the protection systems meet IEEE 279-1971. Sections 4.9 - 4.11 of IEEE 279-1971 discuss testing provisions for protection systems.

5.0 TECHNICAL ANALYSIS

Design Basis and Safety Analysis Considerations

When gain adjustments are performed during a power escalation, the NIS power range daily surveillance results in the power range channels reflecting the calorimetric heat balance calculation with increasing accuracy up to approximately 100% RTP. When gain adjustments are performed at steady-state 100% RTP conditions, the NIS power range daily surveillance will adjust the power range channel for variations in indicated power due to changes in core power distributions with increasing burnup.

Normally, adjustment of the NIS power range channel output in the decreasing power direction will be performed for operational reasons, such as when operating at 100% RTP to restore operational margin to the power range high neutron flux high reactor trip setpoint. Another example is when the plant is decreasing power and approaching permissive P-10 reset (which automatically reinstates the power range high neutron flux low setpoint reactor trip) and there is a mismatch between NIS power range and NIS intermediate range indicated power levels. Adjustment of NIS power range channel output in the decreasing power direction to more closely match the calorimetric heat balance calculation will result in a closer agreement between the NIS power range and intermediate range channels, thus decreasing the possibility of an adverse interaction.

To assure that the power range high neutron flux high setpoint reactor trip signal will be generated prior to the safety analysis limit in the event that operating conditions suggest that the indicated power be decreased to match calorimetric heat balance calculated power based on data obtained below 40% RTP, plant operating procedures will continue to implement Reference 10 in the current SR 3.3.1.2 Bases. This requires that the power range high neutron flux high reactor trip setpoint be first reduced to ≤ 85% RTP on all channels whenever calorimetric power is ≥ 20% RTP and < 40% RTP, and be first reduced to ≤ 70% RTP whenever calorimetric power is ≥ 15% RTP and < 20% RTP, before the power range channels are adjusted in the decreasing power direction. The proposed Bases changes explicitly detail these administrative control requirements.

The purpose of the following analysis is to assess the impact of the proposed NIS power range daily surveillance change on the licensing basis and demonstrate that the change will not adversely affect the safe operation of the plant.

<u>NIS Power Range Indication and RTS Design Functions</u>

When operating at or above 15% RTP, each power range channel is normalized (i.e., calibrated) on a daily basis to match the thermal power calculation results based on the secondary heat balance (i.e., calorimetric). The calibration is accomplished by adjusting the gain of each channel summing amplifier such that the NIS power range channel output matches the calorimetric heat balance calculated power. The amplifier output (0% to 120% RTP) provides the input signals to the associated channel reactor trip, permissive, and control interlock bistables as well as the associated power level indicators. Therefore, the proposed change to the NIS power range daily surveillance potentially impacts the following power range circuits:

- power range indications;
- power range RTS trip functions (high flux high setpoint, high flux low setpoint, and high positive rate) and permissive functions (P-8, P-9, and P-10);
- power range control system functions (control interlock C-2 power range high flux rod stop and automatic reactor control system nuclear power input - the automatic rod withdrawal feature was eliminated at Callaway and manual rod control is normally used at Callaway); and
- miscellaneous alarm functions (power range channel deviation and Quadrant Power Tilt Ratio alarms).

Power Range Indications

Reactor power is monitored by the plant operators to assure that the unit is operated within the limits of the operating license and the safety analyses. The revision to the criteria for implementation of the daily surveillance will have a conservative effect on the power range channel indication (i.e., indicated power will be verified to be greater than or equal to actual power or will be adjusted in the increasing power direction). With regard to the core safety limits, reactor power is one of four operating parameters with uncertainties explicitly used in the Improved Thermal Design Procedure (ITDP). As discussed in FSAR Section 4.4.1.1, plant parameter uncertainties, including a reactor power uncertainty of ± 2% RTP, are used to statistically derive a design DNBR limit which must be met in those plant safety analyses that use the ITDP. For those non-ITDP accidents listed in FSAR Table 15.0-2, a ± 2% RTP power uncertainty is assumed in the analyses' initial conditions, as discussed in FSAR Section 15.0.3.2. Plant-specific setpoint calculations demonstrate that the secondary side power calorimetric measurement uncertainty at full power conditions is less than this ± 2% RTP assumption. Since these plant-specific setpoint calculations are not invalidated by the proposed power range surveillance method change, the uncertainty assumption of ± 2% RTP continues to be a bounding allowance for the core safety limits and safety analyses. Therefore, the NIS power range indications are not adversely impacted by the proposed change.

Power Range RTS Trip Functions and Permissive Functions

The setpoint uncertainty assumptions associated with the methodology used to calculate the RTS trip setpoints account for the NIS power range daily calibration specified by the Technical Specifications. The setpoint uncertainty calculations demonstrate conservative margin between the associated nominal trip setpoints and the corresponding safety analysis limits. Since the daily calibration will continue to be performed and the maximum error will continue to be ≤ 2% RTP, the power range high and low reactor trip setpoint calculations and applicable safety analysis limits are not affected by the surveillance change. With respect to the power range high positive rate reactor trip, this trip function is generated by time-delay relative comparison circuits. As such, the NIS power range high positive rate trip is not affected by the proposed change.

One potential non-conservative impact on the NIS RTS functions could occur when the power range channel indication is greater than the calorimetric heat balance calculated power during a unit shutdown. In this situation, the proposed change to no longer require adjustment of the power range channels in the decreasing power direction could delay the reset of permissive P-10. Reset of permissive P-10 (at ≈ 8% RTP) is required to enable the power range high neutron flux low setpoint reactor trip function which provides reactor protection for uncontrolled reactivity transients from subcritical and low power conditions (i.e., < 10% RTP). It is unlikely that a subcritical condition would be achieved before P-10 would reset. Nevertheless, if the NIS power range channel output is greater than calorimetric heat balance calculated power by a sufficient magnitude (resulting in subcriticality without P-10 reset), the time duration until P-10 reset would be very short. During this brief time interval, the power range high neutron flux high setpoint reactor trip would provide core protection, as demonstrated by event-specific analyses. Based on an analysis of a Westinghouse 3-loop plant, and an evaluation of 2-loop and 4-loop plants, the proposed scenario is less limiting than the conditions currently considered and bounded by existing FSAR rod withdrawal from subcritical (RWFS) and hot zero power (HZP) rod ejection analyses (the only FSAR Chapter 15 events that explicitly credit the power range high neutron flux low setpoint trip function). The P-10 reset evaluation documented below is applicable to any Westinghouse PWR such as Callaway with Technical Specifications requiring all reactor coolant loops to be in operation in MODES 1 and 2, and whose current licensing basis RWFS and HZP rod ejection analyses bound lower MODES of operation by specifically assuming only two of four RCS loops are in operation for a 4-loop plant. Diverse protection is also provided by the power range high positive rate, OTΔT, OPΔT, high pressurizer pressure, and high pressurizer water level reactor trip functions. In addition, administrative controls which require trip setpoint changes prior to channel adjustments in the decreasing power direction will continue to be imposed and the controls will be explicitly detailed in the SR 3.3.1.2 Bases. Therefore, the NIS power range RTS trip functions and permissive functions are not adversely affected by the proposed change.

Power Range Control System Functions

The power range channels also provide input to the C-2 control interlock (i.e., power range high flux rod stop) which blocks automatic and manual control rod withdrawal (the automatic rod withdrawal feature was eliminated at Callaway) and provide the nuclear power input signal to the power mismatch circuits associated with automatic reactor control as shown in FSAR Figure 7.7-1 (manual rod control is normally used at Callaway).

These control system functions are not required for plant safety, as discussed in FSAR Section 7.7. Nevertheless, the proposed NIS power range daily surveillance change continues to limit the maximum allowed non-conservative calibration error; therefore, the change will not adversely impact the NIS power range control system functions.

Miscellaneous Alarm Functions

Miscellaneous alarm functions also use input signals from the NIS power range channels. These alarm functions are the power range channel deviation and Quadrant Power Tilt Ratio (QPTR) alarms. The channel deviation and QPTR alarms are generated by comparison of the power range channel output signals. Since these are relative comparisons between channels, these NIS power range alarm functions are not adversely affected by the proposed daily calibration change.

LOCA and LOCA-Related Analyses

The following LOCA and LOCA-related analyses are not adversely affected by the proposed change to the NIS power range daily surveillance:

- large and small break LOCA;
- reactor vessel and loop LOCA blowdown forces;
- post-LOCA long term core cooling subcriticality;
- post-LOCA long term core cooling minimum flow; and
- hot leg switchover to prevent boron precipitation.

The proposed amendment does not affect the normal plant operating parameters, the safeguards systems actuation and accident mitigation capabilities important to LOCA mitigation, or the assumptions used in the LOCA-related analyses. The surveillance change does not create conditions more limiting than those assumed in these analyses. In addition, the proposed amendment does not affect the steam generator tube rupture (SGTR) analysis methodology or assumptions, and it does not alter the SGTR event analysis results.

Non-LOCA Related Analyses

The non-LOCA safety analyses presented in FSAR Chapter 15 are not adversely affected by the proposed NIS power range daily surveillance change (see P-10 reset evaluation below). This amendment does not affect normal plant operating parameters, accident mitigation capabilities, assumptions used in the non-LOCA transients, or create conditions more limiting than those enveloped by the current non-LOCA analyses. Therefore, the conclusions presented in the FSAR remain valid.

P-10 Reset Evaluation

The FSAR Chapter 15 inadvertent bank withdrawal and rod ejection analyses are performed to bound all MODES of operation. For example, the cases assume the reactor is critical or just subcritical in MODE 2, at the no-load temperature of 557°F, with less than all the reactor coolant loops in operation (MODES 3, 4 and 5). This evaluation assumes that indicated power is greater than actual core power and that a P-10 reset does not occur until shortly after the reactor reaches the subcritical condition, but does occur prior to entering MODE 3. Therefore, the reactor is initially either in MODE 1 below P-10 or in MODE 2 with all reactor coolant pumps in operation and full thermal design flow.

The RWFS and HZP rod ejection transients were reanalyzed for a three loop plant by crediting the power range high neutron flux high setpoint reactor trip with a safety analysis setpoint of 118% RTP. Both the RWFS and HZP rod ejection events are characterized by a sudden and rapid increase in nuclear power. The power increase is limited by the Doppler feedback, with the event being terminated by the power range high neutron flux high setpoint reactor trip. The limiting event conditions occur around the time of reactor trip, with the reactor trip preventing a violation of the applicable event criteria.

The reanalysis demonstrated that all the applicable acceptance criteria are met for the RWFS and HZP rod ejection events. For the RWFS event, the very small increase in peak heat flux (approximately 1.5% of nominal) is more than offset by the 50% increase in reactor coolant system flow. For the HZP rod ejection transient, the 50% increase in reactor coolant system flow results in significantly lower fuel temperatures and improved results when compared to all acceptance criteria. For both the RWFS and HZP rod ejection events, the existing FSAR analyses bound the hypothesized evaluation scenario. These results were confirmed by Westinghouse to also apply to Callaway, as discussed previously.

Mechanical Components and Systems

The surveillance change as described does not affect RCS component integrity or the ability of any system to perform its intended safety function. The proposed amendment does not affect the integrity of plant auxiliary fluid systems or the ability of those auxiliary systems to perform their design functions.

I&C Protection and Control Systems

With the specific exception of the NIS power range reactor trip and indication functions discussed above, the proposed NIS power range daily surveillance change does not involve other electrical systems, components, or instrumentation considerations. Direct effects as well as indirect effects on equipment important to safety have been considered. Indirect effects include conditions or activities which involve non-safety-related electrical equipment which may affect Class 1E, post-accident monitoring (PAM), or plant control systems. Consideration has been given to seismic and environmental qualification, design and performance criteria per IEEE standards, functional requirements, and Technical Specifications.

The proposed amendment does not affect systems that respond to design transients or maintain the margin to trip setpoints, nor does the proposed amendment affect the cold overpressure mitigation system.

An evaluation has determined that the proposed surveillance change will assure the continued performance of the NIS power range high neutron flux high setpoint reactor trip function consistent with the safety analysis assumptions. Deletion of the requirement to adjust the power range channels in a decreasing power direction when their output is greater than calorimetric heat balance calculated power allows the channels to not be adjusted in a non-conservative direction at part-power conditions. This prevents the introduction of an error that has not been accounted for in the setpoint uncertainty calculations and the safety analyses associated with the power range high neutron flux high setpoint reactor trip function. If NIS power range channel output is decreased to match a part-power calorimetric performed below 40% RTP, administrative controls as described in the proposed TS Bases changes will assure the power range high neutron flux high setpoint is first reduced depending upon the initial power level.

RTS and ESFAS Setpoints

With the specific exception of the NIS power range reactor trip and indication functions discussed above, the proposed change to the NIS power range daily surveillance does not affect the RTS or the Engineered Safety Feature Actuation System (ESFAS) setpoints. This proposed amendment does not alter the current trip setpoints or instrument operability requirements identified in the Technical Specifications. This amendment will assure the continued operability of the NIS power range high neutron flux high setpoint reactor trip function at part-power conditions consistent with the safety analysis assumptions. Therefore, the proposed amendment has no effect on the RTS and ESFAS safety functions.

Other Safety-Related Areas and Analyses

The following safety-related areas and analyses are not affected by the proposed surveillance change:

- containment integrity analyses (short term/long term LOCA release);
- main steamline break (MSLB) mass and energy release;
- radiological analyses; and
- emergency response procedures.

Probabilistic Risk Assessment (PRA) Evaluation

There is no impact on the Callaway PRA since that study is concerned mainly with time-averaged equipment functionality, not actions to be taken in response to an individual surveillance result. In any event, functional capabilities of the instrumentation will continue to be demonstrated by the surveillance requirements listed in TS Table 3.3.1-1 for Function 2.a. Revising SR 3.3.1.2 for Function 2.a of TS Table 3.3.1-1 will continue to assure that the NIS power range channels perform their intended function. The editorial change to SR 3.3.1.3 has no PRA impact.

Summary/Conclusion

The proposed amendment changes the NIS power range daily surveillance requirement by only requiring a calibration adjustment when power range indicated power is less than the calculated secondary calorimetric power by > 2% RTP. The analyses presented above assess the potential impact of the proposed daily surveillance change on applicable safety analyses and NIS power range indications, RTS trip functions and permissives, control system functions, and alarms. The assessments demonstrate that the change will not adversely affect the design basis, safety analyses, NIS power range functions, or the safe operation of the plant.

6.0 REGULATORY ANALYSIS

There have been no changes to the RTS instrumentation design such that any of the regulatory requirements and guidance documents in Section 4.0 would come into question. This amendment application revises surveillance testing requirements on the NIS power range neutron flux channels consistent with those requirements and guidance documents. The evaluation performed by Union Electric Company in Section 5.0 concludes that Callaway Plant will continue to comply with all applicable regulatory requirements.

Based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

7.0 NO SIGNIFICANT HAZARDS CONSIDERATION (NSHC)

The proposed change to the TS will revise SR 3.3.1.2 to move the content of Note 1 to the body of the SR and revise the SR to state:

"Compare results of calorimetric heat balance calculation to power range channel output. Adjust power range channel output if calorimetric heat balance calculation results exceed power range channel output by more than + 2% RTP."

Associated Bases changes provide a summary justification for the surveillance change and clarify when channel adjustments must be made. These changes are made to address potential effects of decalibrating the NIS power range channels at part-power operation as identified in Westinghouse Technical Bulletin ESBU-TB-92-14-R1. Moving the contents of Note 1 in SR 3.3.1.2 and explicitly specifying the power range portion of the NIS provides consistency with the other Owners Groups' STS NUREGs. SR 3.3.1.3 is also revised to move the text of Note 1 to the body of the SR for consistency. Associated SR 3.3.1.3 Bases changes reflect the relocation of Note 1.

The detailed analyses presented above assess the potential impact of the proposed daily surveillance change on applicable safety analyses and NIS power range indications, RTS trip and permissive functions, control system functions, and alarms. The analyses also assess the potential impact on the power range high neutron flux high setpoint reactor trip function and the associated safety analysis limit when channel adjustments are made during specific operating conditions. The assessments demonstrate that the proposed changes will not adversely affect the design basis safety analyses, power range safety functions, or the safe operation of the plant.

The proposed amendment changes the TS surveillance requirements to reflect potential uncertainties at part-power conditions. The proposed changes do not involve a significant hazards consideration for Callaway Plant based on the three standards set forth in 10CFR50.92(c) as discussed below:

(1) Do the proposed changes involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No

Overall protection system performance will remain within the bounds of the previously performed accident analyses since there are no hardware changes. The RTS instrumentation will be unaffected. Protection systems will continue to function in a manner consistent with the plant design basis. All design, material, and construction standards that were applicable prior to the request are maintained.

The probability and consequences of accidents previously evaluated in the FSAR are not adversely affected because the change to the NIS power range channel daily surveillance assures the conservative response of the channel even at part-power levels.

The proposed changes modify the NIS power range channel daily surveillance requirement to assure the NIS power range functions are tested in a manner consistent with the safety analysis and licensing basis.

The proposed changes will not affect the probability of any event initiators. There will be no degradation in the performance of, or an increase in the number of challenges imposed on, safety-related equipment assumed to function during an accident situation. There will be no change to normal plant operating parameters or accident mitigation performance.

The proposed changes will not alter any assumptions or change any mitigation actions in the radiological consequence evaluations in the FSAR.

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

(2) Do the proposed changes create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

There are no hardware changes nor are there any changes in the method by which any safety-related plant system performs its safety function. This amendment will not affect the normal method of plant operation or change any operating parameters. No performance requirements or response time limits will be affected; however, the proposed TS Bases changes impose explicit NIS power range high trip setpoint adjustment requirements prior to adjusting indicated power in a decreasing power direction. These requirements are consistent with assumptions made in the safety analysis and licensing basis.

No new accident scenarios, transient precursors, failure mechanisms, or limiting single failures are introduced as a result of this amendment. There will be no adverse effect or challenges imposed on any safety-related system as a result of this amendment.

This amendment does not alter the design or performance of the 7300 Process Protection System, Nuclear Instrumentation System, or Solid State Protection System used in the plant protection systems.

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

(3) Do the proposed changes involve a significant reduction in a margin of safety?

Response: No

The proposed changes require a revision to the criteria for implementation of NIS power range channel adjustments based on secondary power calorimetric calculations; however, the changes do not eliminate any RTS surveillances or alter the frequency of surveillances required by the Technical Specifications. The revision to the criteria for implementation of the daily surveillance will have a conservative effect on the performance of the NIS power range channels, particularly at part-power conditions. The nominal trip setpoints specified in the Technical Specification Bases and the safety analysis limits assumed in the transient and accident analyses are unchanged. None of the acceptance criteria for any accident analysis is changed.

There will be no effect on the manner in which safety limits or limiting safety system settings are determined nor will there be any effect on those plant systems necessary to assure the accomplishment of protection functions. There will be no impact on the overpower limit, departure from nucleate boiling ratio (DNBR) limits, heat flux hot channel factor (F_Q), nuclear enthalpy rise hot channel factor ($F\Delta H$), loss of coolant accident peak cladding temperature (LOCA PCT), peak local power density, or any other margin of safety. The radiological dose consequence acceptance criteria listed in the Standard Review Plan will continue to be met.

The imposition of appropriate surveillance testing requirements will not reduce any margin of safety since the changes will assure that safety analysis assumptions on equipment operability are verified on a periodic frequency.

Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Conclusion:

Based on the above, Union Electric Company concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c) and, accordingly, a finding of "no significant hazards consideration" is justified.

8.0 ENVIRONMENTAL CONSIDERATION

Union Electric Company has determined that the proposed amendment would change requirements with respect to the installation or use of a facility component located within the restricted area, as defined in 10CFR20, or would change an inspection or surveillance requirement. Union Electric Company has evaluated the proposed amendment and has determined that the amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amount of effluent that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10CFR51.22 (c)(9). Therefore, pursuant to 10CFR51.22 (b), an environmental assessment of the proposed amendment is not required.

9.0 PRECEDENT

The change to SR 3.3.1.2 was previously approved for Southern Nuclear Operating Company's Farley Units 1 and 2, as documented in Farley License Amendment Nos. 144 (Unit 1) and 135 (Unit 2) dated October 1, 1999.

10.0 REFERENCES

1. Westinghouse Technical Bulletin ESBU-TB-92-14-R1, "Decalibration Effects of Calorimetric Power Measurements on the NIS High Power Reactor Trip at Power Levels less than 70% RTP," dated February 6, 1996.

2. TSTF-371, "NIS Power Range Channel Daily SR TS Change to Address Low Power Decalibration," (currently under NRC review).

ATTACHMENT TWO

MARKUP OF TECHNICAL SPECIFICATIONS

SURVEILLANCE REQUIREMENTS

---NOTE---

Refer to Table 3.3.1-1 to determine which SRs apply for each RTS Function.

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.1.2	------------------------------NOTE~~S~~------------------------------ ~~1. Adjust NIS channel if absolute difference is > 2%.~~ ~~2.~~ Not required to be performed until 24 hours after THERMAL POWER is ≥ 15% RTP. -- Compare results of calorimetric heat balance calculation to ~~Nuclear Instrumentation System (NIS) channel output.~~ power range channel output. Adjust power range channel output if calorimetric heat balance calculation results exceed power range channel output by more than +2% RTP.	24 hours
SR 3.3.1.3	------------------------------NOTE~~S~~------------------------------ ~~1. Adjust NIS channel if absolute difference is ≥ 2%.~~ ~~2.~~ Not required to be performed until 24 hours after THERMAL POWER is ≥ 50% RTP. -- Compare results of the incore detector measurements to ~~NIS AFD.~~ Nuclear Instrumentation System (NIS) AFD. Adjust NIS channel if absolute difference is ≥ 2%.	31 effective full power days (EFPD)

(continued)

ATTACHMENT THREE

RETYPED TECHNICAL SPECIFICATIONS

SURVEILLANCE REQUIREMENTS

--NOTE--
Refer to Table 3.3.1-1 to determine which SRs apply for each RTS Function.

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.1.2	--------------------------------NOTE-------------------------- Not required to be performed until 24 hours after THERMAL POWER is ≥ 15% RTP. --- Compare results of calorimetric heat balance calculation to power range channel output. Adjust power range channel output if calorimetric heat balance calculation results exceed power range channel output by more than +2% RTP.	24 hours
SR 3.3.1.3	--------------------------------NOTE-------------------------- Not required to be performed until 24 hours after THERMAL POWER is ≥ 50% RTP. --- Compare results of the incore detector measurements to Nuclear Instrumentation System (NIS) AFD. Adjust NIS channel if absolute difference is ≥ 2%.	31 effective full power days (EFPD)

(continued)

ATTACHMENT FOUR

PROPOSED TECHNICAL SPECIFICATION BASES CHANGES

BASES

SURVEILLANCE REQUIREMENTS (continued)

Similarly, Train A and Train B must be examined when testing Channel II, Channel III, and Channel IV. The CHANNEL CALIBRATIONs and COTs are performed in a manner that is consistent with the assumptions used in analytically calculating the required channel accuracies.

SR 3.3.1.1

Performance of the CHANNEL CHECK once every 12 hours ensures that gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the unit staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit.

The Frequency is based on operating experience that demonstrates channel failure is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.

SR 3.3.1.2

INSERT 1 →

SR 3.3.1.2 compares the calorimetric heat balance calculation to the NIS power indications every 24 hours. If the calorimetric exceeds the NIS power indications by > 2% RTP, the NIS is not declared inoperable, but the excore channel gains must be adjusted consistent with calorimetric power. If the NIS power indication cannot be properly adjusted, the channel is declared inoperable.

INSERT 2 →

Two Notes modify SR 3.3.1.2. The first Note indicates that the NIS power indications shall be adjusted consistent with the calorimetric results if the absolute difference between the NIS power indications and the

INSERT 3 →

(continued)

INSERT 1

SR 3.3.1.2 compares the calorimetric heat balance calculation to the power range channel output every 24 hours. If the calorimetric heat balance calculation results exceed the power range channel output by more than + 2% RTP, the power range channel is not declared inoperable, but must be adjusted. The power range channel output shall be adjusted consistent with the calorimetric heat balance calculation results if the calorimetric calculation exceeds the power range channel output by more than + 2% RTP. If the power range channel output cannot be properly adjusted, the channel is declared inoperable.

INSERT 2

If the calorimetric is performed at part-power (< 40% RTP), adjusting the power range channel indication in the increasing power direction will assure a reactor trip below the power range high safety analysis limit (SAL) of ≤ 118% RTP in FSAR Table 15.0-4 (Reference 10). Making no adjustment to the power range channel in the decreasing power direction due to a part-power calorimetric assures a reactor trip consistent with the safety analyses.

This allowance does not preclude making indicated power adjustments, if desired, when the calorimetric heat balance calculation power is less than the power range channel output. To provide close agreement between indicated power and to preserve operating margin, the power range channels are normally adjusted when operating at or near full power during steady-state conditions. However, discretion must be exercised if the power range channel output is adjusted in the decreasing power direction due to a part-power calorimetric (< 40% RTP). This action could introduce a non-conservative bias at higher power levels which could delay an NIS reactor trip until power is above the power range high SAL. The cause of the non-conservative bias is the decreased accuracy of the calorimetric at reduced power conditions. The primary error contributor to the instrument uncertainty for a secondary side power calorimetric measurement is the feedwater flow measurement, which is determined by a ΔP measurement across a feedwater venturi. While the measurement uncertainty remains constant in ΔP span as power decreases, when translated into flow the uncertainty increases as a square term. Thus, a 1% flow error at 100% power can approach a 10% flow error at 30% RTP even though the ΔP error has not changed. To assure a reactor trip below the power range high SAL, the power range neutron flux - high trip setpoint is first set at ≤ 85% RTP prior to adjusting the power range channel output in the decreasing power direction whenever the calorimetric power is ≥ 20% RTP and < 40% RTP. To assure a reactor trip below the power range high SAL, the power range neutron flux - high trip setpoint is first set at ≤ 70% RTP prior to adjusting the power range channel output in the decreasing power direction whenever the calorimetric power is ≥ 15% RTP and < 20% RTP. Adjustments in the increasing power direction do not require a prior decrease in the trip setpoint. Following a plant shutdown, it is permissible to reduce the power range neutron flux - high trip setpoint prior to startup. This would anticipate the potential need for a decreasing power direction adjustment, thereby obviating the need to suspend power escalation for the purpose of first reducing the trip setpoint. Before the power range neutron flux - high trip setpoint is re-set to its nominal full power value (≤ 109% RTP), the power range channel calibration must be confirmed based on a calorimetric performed at ≥ 40% RTP.

INSERT 3

The Note to SR 3.3.1.2 clarifies that this Surveillance is required only if reactor power is ≥ 15% RTP and that 24 hours are allowed for performing the first Surveillance after reaching 15% RTP. A power level of 15% RTP is chosen based on plant stability, i.e., automatic rod control capability (manual rod control is normally used at Callaway) and the turbine generator synchronized to the grid.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.2 (continued)

~~calorimetric is > 2% RTP. The second Note clarifies that this Surveillance is required only if reactor power is ≥ 15% RTP and that 24 hours is allowed for performing the first Surveillance after reaching 15% RTP. At lower power levels, calorimetric data are inaccurate.~~ The 24-hour allowance after increasing THERMAL POWER above 15% RTP provides a reasonable time to attain a scheduled power plateau, establish the requisite conditions, perform the required calorimetric measurement, and make any required adjustments in a controlled, orderly manner and without introducing the potential for extended operation at high power levels with instrumentation that has not been verified to be OPERABLE for subsequent use. ~~Reference 10 provides additional, administratively imposed restrictions applicable to this SR.~~

INSERT 4 →

~~The Frequency of every 24 hours is adequate. It is based on unit operating experience, considering instrument reliability and operating history data for instrument drift. Together these factors demonstrate the change in the absolute difference between NIS and heat balance calculated powers rarely exceeds 2% in any 24 hour period.~~

In addition, control room operators periodically monitor redundant indications and alarms to detect deviations in channel outputs.

SR 3.3.1.3

SR 3.3.1.3 compares the incore system to the NIS channel output every 31 EFPD. If the absolute difference is ≥ 2%, the NIS channel is still OPERABLE, but must be readjusted. The purpose of the comparison is to check for differences that result from core power distribution changes that may have occurred since the last required adjustment or incore-excore calibration (SR 3.3.1.6).

If the NIS channel cannot be properly readjusted, the channel is declared inoperable. This Surveillance is performed to verify the f(ΔI) input to the Overtemperature ΔT Function.

~~Two Notes modify SR 3.3.1.3. Note 1 indicates that~~ the excore NIS channel shall be adjusted if the absolute difference between the incore and excore AFD is ≥ 2%. ~~Note 2~~ The Note to SR 3.3.1.3 clarifies that the Surveillance is required only if reactor power is ≥ 50% RTP and that 24 hours is allowed for performing the first Surveillance after reaching 50% RTP. ~~Note 2~~ This allows power ascensions and associated testing to be conducted ~~in a controlled~~ and orderly manner, at conditions that provide acceptable results and

(continued)

INSERT 4

The Frequency of every 24 hours is adequate. It is based on unit operating experience, considering instrument reliability and operating history data for instrument drift. Together these factors demonstrate that a difference between the calorimetric heat balance calculation and the power range channel output of more than + 2% RTP is not expected in any 24 hour period.

BASES

REFERENCES (continued)

8. FSAR Section 16.3, Table 16.3-1.

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

10. ~~RFR-16940A.~~ FSAR Table 15.0-4.

11. WCAP-9226, "Reactor Core Response to Excessive Secondary Steam Releases," Revision 1, January 1978.

12. NRC Generic Letter 85-09 dated May 23, 1985.

13. FSAR Section 15.1.1.

14. RFR - 18637A.

15. WCAP-14036-P-A, Revision 1, "Elimination of Periodic Protection Channel Response Time Tests," October 1998.

APPENDIX A

Purpose:

In response to Reference 1, determine the Callaway-specific power level above which adjustments can be made to the power range neutron flux channels without restriction in order to achieve ±2.0% rated thermal power (RTP) agreement between indicated power and secondary calorimetric power. The margin available in the power range neutron flux high trip setpoint calculation (±2.2% of span) is used to determine the limiting secondary calorimetric power uncertainty term.

Also determine the adequacy of reducing the power range neutron flux high trip setpoint to 85% RTP in order to compensate for the calorimetric uncertainty between 15% RTP and 20% RTP.

Calculation:

From Attachment 3 of Reference 1, the single loop feedwater flow error is:

$$\varepsilon_i = \left(\frac{Fmax}{Fnom}\right)^2 \cdot \left(\frac{\Delta p}{2}\right) \qquad \text{(Eq. 1)}$$

From Reference 2, the total flow error can be taken as:

$$\varepsilon_t = \frac{\varepsilon_i}{\sqrt{n}} = \left(\frac{Fmax}{Fnom}\right)^2 \cdot \left(\frac{\Delta p}{2\sqrt{n}}\right) \qquad \text{(Eq. 2)}$$

where n = 4 is the total number of loops and F_{nom} is the total nominal feedwater flow. Equation 2 can now be rearranged to solve for F_{nom}, the total nominal feedwater flow:

$$F_{nom} = F_{max} \Big/ \sqrt{2(\sqrt{n})\varepsilon_t / \Delta p} \qquad \text{(Eq. 3)}$$

Based on Table 3-16 of Reference 3 for power range-high (Ref. 3 was resubmitted to the NRC with Ref. 4), the maximum allowable calorimetric uncertainty corresponding to setting the available margin to zero in the setpoint calculation is ±6.68% RTP. As discussed in Reference 5, setpoint margin is available for licensee use since the setpoint methodology requires only that the sum of the nominal trip setpoint and the channel statistical allowance equal the safety analysis limit. Reference 6 provided a comprehensive discussion of the setpoint methodology used at Callaway.

Substituting ε_t = 6.68% RTP, Δp error = 2.7% of Δp span (from Table 3 of Appendix B to Reference 2), and F_{max} = 120% flow (from Reference 7) into Equation 3 yields:

$$F_{nom} = \frac{120}{2\sqrt{6.68/2.7}} \quad \text{(Eq. 4)}$$

or

$$F_{nom} = 38.14\ \%\ \text{flow}$$

which also corresponds to 38.14% RTP since total feedwater flow is directly proportional to total calorimetric power.

However, this value does not reflect the addition of other uncertainty components in the secondary calorimetric calculation. These other components are assumed to remain approximately constant since they are not direct functions of power level and are treated as a bias to Equation 4. From Table 5 of Appendix B to Reference 2, the calorimetric uncertainty at 100% RTP, ε_c = 1.14% RTP. Using Equation 2, the calculated uncertainty at 100% RTP is:

$$\varepsilon_{100} = (\frac{120}{100})^2 \cdot \frac{2.7}{2\sqrt{4}} = 0.97 \quad \text{(Eq. 5)}$$

The difference between ε_c and ε_{100} can then be added to F_{nom} to determine the final power level above which sufficient setpoint margin is available to offset the increased calorimetric uncertainty. Thus,

$$\varepsilon_p = F_{nom} + (\varepsilon_c - \varepsilon_{100}) = F_{nom} + \text{Bias}$$

$$= 38.14 + (1.14 - 0.97)$$

$$= 38.31\%\ \text{RTP} \quad \text{(Eq. 6)}$$

This value will be rounded up to 40% RTP for additional conservatism. Thus, power range neutron flux channel adjustments can be performed without restriction provided the secondary calorimetric power level is ≥ 40% RTP.

In addition to the evaluation presented above, the adequacy of decreasing the power range neutron flux high trip setpoint to 85% RTP was checked. This was accomplished by first adding Equation 2 (with $\frac{Fmax}{Fnom}$ set at $\frac{120}{15}$ or $\frac{120}{20}$) to the bias established in Equation 6 (1.14% RTP – 0.97% RTP). This resulted in a calorimetric uncertainty at 15% RTP and 20% RTP. These uncertainties were then input to the process measurement accuracy (PMA) term in the setpoint calculation and the trip setpoint was then determined after setting the margin to zero.

The results of this calculation indicate that a trip setpoint of 92.8% RTP is required to accommodate the calorimetric uncertainty at 20% RTP. This setpoint would have to be furthered lowered to 74.2% RTP in order to compensate for the calorimetric uncertainty at 15% RTP. As a conservative measure, these values have been rounded down to 85% and 70% RTP, respectively.

References:

1. Westinghouse Technical Bulletin ESBU-TB-92-14-R1, "Decalibration Effects of Calorimetric Power Measurements on the NIS High Power Reactor Trip at Power Levels less than 70% RTP," dated February 6, 1996.

2. ULNRC-1227 dated December 13, 1985, Enclosure 1, Attachment A, "ITDP Instrument Uncertainties Calculations," Callaway Amendment No. 15.

3. SLNRC 84-0050 dated March 23, 1984, "Response to NRC Questions on Setpoint Methodology for SNUPPS."

4. ULNRC-03747 dated March 4, 1998, "Response to NRC Questions on the MSSV Setpoint Tolerance Revision," RAI #7 on setpoint methodology, Callaway Amendment No. 128.

5. ULNRC-03717 dated January 20, 1998, "Response to NRC Questions on the MSSV Setpoint Tolerance Revision," RAI #7 on setpoint margin, Callaway Amendment No. 128.

6. ULNRC-03748 dated February 27, 1998, "Response to NRC Questions on RTS and ESFAS Delta-T Functional Units," Callaway Amendment No. 125.

7. FSAR Table 7A-3, Data Sheet 4.4.