April 2, 2002

Mr. Anthony Pietrangelo
Nuclear Energy Institute
1776 I Street, N. W.
Suite 400
Washington, DC 20006-3708

Dear Mr. Pietrangelo:

The Nuclear Regulatory Commission (NRC) has completed its review of the Nuclear Energy Institute Technical Specification Change Traveler, TSTF-371, Revision 1, " NIS Power Range Channel Daily SR TS Change to Address Low Power Decalibration" proposed changes to NUREG-1431, Revision 2, "Standard Technical Specifications Westinghouse Plants." The staff finds the proposed changes acceptable without modification. Accordingly, enclosed is the staff safety evaluation approving TSTF-371, Revision 1 for plant-specific license amendment requests and for incorporation into NUREG-1431, Revision 2, "Standard Technical Specifications Westinghouse Plants."

Please contact me at (301) 415-1161 or e-mail wdb@nrc.gov if you have any questions or need further information on these proposed changes.

Sincerely,

/RA/
William D. Beckner, Program Director
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Enclosure: As stated

cc: J. Arbuckle, BWROG
D. Bice, CEOG
N. Clarkson, BWOG
S. Wideman, WOG
D. Hoffman, EXCEL

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DOCUMENT NAME: G:\RORP\SCHULTEN\TSTF-371.WPD ADAMS ACCESSION #: ML020940096

OFFICE	TSS/DRIP:NRR	SC:PWR/DSSA:NRR	TSS/DRIP:NRR	SC:TSS/DRIP:NRR	PD:RORP:DRIP:NRR
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SAFETY EVALUATION ON
PROPOSED CHANGES TO NUREG-1431,
STANDARD TECHNICAL SPECIFICATIONS WESTINGHOUSE PLANTS

1.0 INTRODUCTION

By letters dated April 5, 2001 and March 5, 2002 the Nuclear Energy Institute (NEI) submitted Technical Specification (TS) Change Traveler, TSTF-371, Revision 1 "NIS Power Range Channel Daily SR TS Change to Address Low Power Decalibration" to NUREG-1431, Revision 2, "Standard Technical Specifications Westinghouse Plants." TSTF-371, Revision 1 revises the requirements for performing a daily surveillance adjustment of the power range channel(s) to address industry concern that compliance with current STS SR 3.3.1.2 may result in a non-conservative channel calibration during reduced power operations.

2.0 BACKGROUND

Currently, standard technical specifications (STS) surveillance requirement (SR) 3.3.1.2 requires adjusting nuclear instrumentation system (NIS) channels when indicated power differs from calorimetric heat balance calculated power by more than 2%. TSTF-371, Revision 1 revises STS requirements for performing a daily surveillance adjustment of the power range channel(s) above 15% rated thermal power (RTP) to include only changes in the increasing direction. TSTF-371, Revision 1 also revises the format of SR 3.3.1.2 and SR 3.3.1.3 to establish a consistent presentation of notation for surveillance requirements. Both SRs contain two notes, the first of which contains the requirement to adjust the NIS channels based on results of a calculation or test, respectfully. The format change moves the contents of the note to the SR to be consistent with the formatting of other STS surveillances. SR 3.3.1.2 applies only to Table 3.3.1-1, "Reactor Trip System Instrumentation," Function 2.b., "Power Range Neutron Flux - High" and SR 3.3.1.3 only applies to Table 3.3.1-1, "Reactor Trip System Instrumentation, Function 6., "Overtemperature ΔT."

3.0 EVALUATION

TSTF-371 is based on the recommendations reported in Westinghouse Technical Bulletin ESBU-TB-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. The NEI TSTF provided the operational and safety analysis considerations information below to support the changes for this traveler. The staff reviewed the justification and determined that it provides an acceptable basis for changing STS surveillance requirements required by Section 50.36 paragraph (c)(3), "Surveillance requirements."

Background

Westinghouse Technical Bulletin ESBU-TB-92-14-R1 identified potential effects of decalibrating the NIS Power Range channels at part power operation. Westinghouse reported that the decalibration may occur due to the increased uncertainty of the

secondary side power calorimetric when performed at part power (less than approximately 70% RTP). The industry concern is that when NIS channel indication is reduced to match calculated power, the decalibration results in a non-conservative bias. The proposed change to the Technical Specifications removes the requirement to adjust the NIS Power Range channels when the indicated power is greater than the calorimetric heat balance calculation by an absolute difference of > 2% RTP.

The primary error contributor to the instrument uncertainty for a secondary side power calorimetric measurement is the feedwater flow measurement, which is typically a DP measurement across a feedwater venturi. While the measurement uncertainty remains constant in DP 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 DP error has not changed. ESBU-TB-92-14-R1 depicted how the potential effects of this error increase at lower power levels. In the example presented, for a 10% error in 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. Typically, this event is the Rod Withdrawal from 10% RTP.

There are six recommendations in the revised bulletin. Recommendation No. 6 suggests that if the NIS Power Range indicates a higher power than the secondary side power calorimetric measurement at power levels below approximately 70%, the Power Range channel(s) should not be adjusted. This recommendation is in conflict with the Standard Technical Specifications Power Range daily Surveillance Requirement, which requires channel adjustment whenever the absolute difference is > 2% above 15% RTP.

Some plants have identified and implemented interim administrative controls to address this conflict with the Technical Specifications. For long-term resolution, the WOG initiated a program (MUHP-3034) to obtain NRC approval to relax the present Technical Specifications requirements to always adjust NIS channels when indicated power differs from calorimetric heat balance calculated power by more than 2%. This TS change was submitted by Southern Nuclear Operating Company (SNC) for Farley Units 1 and 2 on November 6, 1998. The NRC approved the proposed change for Farley in License Amendment No. 144 (Unit 1)/135 (Unit 2), dated October 1, 1999.

Operational and Safety Analysis Considerations

When gain adjustments are performed on a power escalation, the NIS Power Range daily surveillance results in the NIS channel 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 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 trip. Another example is when 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 channel output in the decreasing power direction to more closely match the calorimetric heat balance calculation may result in a closer agreement between the NIS Power Range and Intermediate Range channels, thus decreasing the possibility of an adverse interaction.

To ensure that the Power Range High Neutron Flux High setpoint reactor trip signal will be generated prior to the safety analysis limit of 118% RTP, should operating conditions require that indicated power be decreased to match calorimetric heat balance calculated power based on data obtained below [70]% RTP, plant operating procedures will continue to specify that the Power Range High Neutron Flux High reactor trip setpoint be reduced to $\leq$[85]% RTP on all channels. The proposed ITS Bases change includes this administrative control requirement.

An evaluation of scenarios of extended part power operation concluded that the probability of the need to adjust the NIS Power Range indicated power in the decreasing power direction is quite small. In fact only one scenario clearly requires the adjustment and it involves several atypical conditions be present at the same time. Several plausible extended part power operation scenarios were evaluated and it was determined that adjustment of the NIS Power Range indicated power in the decreasing power direction is not required. For example, on loss of a feedwater heater, the plant could be required to reduce power but if the NIS Power Range indicated power was greater than the calorimetric power, there would be sufficient margin to the full power trip setpoint such that even with a five or ten % differential between the two measurements, there would be no explicit need to adjust the NIS Power Range in the decreasing power direction.

The only scenario that has an explicit need is part power operation in the P-10 power region. Under normal circumstances operation in that power range would be expected as a transitory condition, i.e., startup or controlled shutdown. However, it is possible that for some unforeseen reason, the plant decreases power to approximately 10% RTP as indicated by the secondary side calorimetric measurement and the NIS Intermediate Range channels, but the NIS Power Range channels indicate significantly above 10% RTP. In this set of circumstances, it would be advantageous to adjust the NIS Power Range channels to match the secondary side calorimetric such that P-10 could be reset and the NIS Power Range - Low setpoint and NIS Intermediate Range reactor trips could be enabled. At that low power level, it would be more conservative to rely on the 25 - 35% RTP trip setpoints of these two low power functions rather than the 109% RTP trip setpoint of the NIS Power Range - High function. Under these circumstances, it would be prudent to administratively adjust the NIS Power Range - High trip setpoint to < [85]% RTP to address any decalibrating aspects associated with the adjustment in the decreasing power direction. This would allow the plant to operate in a conservative mode at or below 10% RTP and on the return to power above 10% RTP until the NIS Power Range could be normalized with a calorimetric performed at $\geq$[70]% RTP. As noted, this is envisioned as an infrequent scenario and thus the administrative control of the NIS Power Range - High setpoint is considered prudent and sufficient.

Analysis

The purpose of this analysis is to assess the impact of the proposed NIS Power Range surveillance change on the licensing basis and demonstrate that the change will not adversely affect the subsequent safe operation of the plant.

NIS Power Range Indication and RTS Functions

When operating above 15% RTP, each Power Range channel is normalized (i.e., calibrated) daily 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 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, and the associated power indicators. Therefore, the proposed change to the NIS Power Range daily surveillance potentially impacts the Power Range indications, RTS functions, control system functions, and miscellaneous alarm functions. These functions include: High Flux High Setpoint, High Flux Low Setpoint, High Positive Rate and High Negative Rate Reactor Trips; Permissives P-8, P-9 and P-10; Control Interlock C-2 (i.e., Power Range High Flux Rod Stop); automatic Reactor Control System nuclear power input; and Power Range Channel Deviation, Quadrant Power Tilt Ratio, and [N-16 Leakage Detection System alarms].

Reactor power is monitored by the plant operators to ensure that the unit is operated within the limits of the Facility Operating License and 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 greater than actual power). With regard to the core safety limits, reactor power is one of four operating parameters with uncertainties explicitly used in the [Revised Thermal Design Procedure (RTDP)]. The [RTDP] and safety analyses assume a reactor power uncertainty of [± 2%] RTP. Plant-specific calculations presented in [the plant specific instrument uncertainty calculations or setpoint study] demonstrate that the secondary side power calorimetric measurement uncertainty at full power conditions is less than the [RTDP] assumption. Since the uncertainty calculation is not invalidated by the proposed Power Range surveillance method change, the [RTDP] and safety analyses reactor power 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.

The calculation assumptions associated with the methodology used to calculate the RTS Trip setpoints account for the daily Power Range calibration specified by the Technical Specifications. The setpoint uncertainty calculations demonstrate conservative margin between the associated Technical Specifications nominal trip setpoints and, when applicable, the corresponding safety analysis limits. Since the daily calibration will continue to be performed and the maximum non-conservative error (i.e., when NIS channel output is less than calorimetric heat balance calculated power) will be $\leq$2% RTP, the Power Range setpoint calculations, setpoints, and applicable safety analysis limits are not affected by the surveillance change. With respect to the Power Range

High Positive Rate and High Negative Rate Reactor Trips, these trip functions are generated by time-delay relative-comparison circuits. As such, the NIS Power Range rate trips are not affected by the proposed change. One potential non-conservative impact on the NIS RTS functions is evaluated herein. If the channel indication is greater than the calorimetric heat balance calculated power during a unit shutdown, the proposed change could delay the reset of Permissive P-10. Reset of P-10 (» 8% RTP) is required to enable the Power Range High Neutron Flux Low setpoint and IR High Neutron Flux reactor trips, which afford reactor protection for uncontrolled reactivity excursions from subcritical and low power (i.e., < 10% RTP). It is unlikely that a subcritical condition would be achieved before P-10 would reset. Nevertheless, if NIS 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 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 and Hot Zero Power rod ejection analyses. This evaluation is applicable to any Westinghouse PWR that has plant Technical Specifications requiring all reactor coolant pumps to be in operation in MODES 1 and 2, and the current licensing basis Rod Withdrawal from Subcritical and Hot Zero Power rod ejection analyses bound lower MODES of operation by specifically assuming only one of two RCPs are in operation for a 2-loop plant, two of three RCPs are in operation for a 3-loop plant, and two of four RCPs are in operation for a 4 loop plant. Diverse protection is also afforded by the Power Range High Positive Rate, OTDT and OPDT reactor trips. Therefore, the Power Range RTS functions are not adversely affected by the proposed change.

The Power Range input functions to the Reactor Control System are: Control Interlock C-2 (i.e., Power Range High Flux Rod Stop), which blocks automatic and manual control rod withdrawal; and the nuclear power input signal to the power mismatch circuits associated with automatic reactor coolant system temperature control. These are control system functions that are not required for safety [FSAR Chapter 7.7]. Nevertheless, the proposed Power Range 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 also use input signals from the NIS Power Range channel(s). The functions are: Power Range Channel Deviation; Quadrant Power Tilt Ratio (QPTR); and [N-16 Leakage Detection System]. The Channel Deviation and QPTR alarms are generated by comparison of the Power Range channel output signals. In that these are relative comparisons between channels, these alarm functions are not adversely affected by the proposed daily calibration change.

[The N-16 Leakage Detection System associated with the steam line radiation monitors may be impacted by the proposed change since the proposed calibration change allows NIS channel output to be greater than calorimetric heat balance calculated power. When greater than 20 % power, the N-16 Leakage Detection System provides a continuous trend of the estimated “power-corrected” primary-to-secondary leak rate, and it generates control room alarms if the leak rate increases above three threshold levels

(alert, high, high-high). The nuclear power signal is provided from a NIS Power Range channel. A potential non-conservative impact on the leakage detection system is acceptable based on the following.

1. The N-16 Leakage Detection System is a non-safety-related indication system that is considered to be an operational aid.

2. Other radiation monitors, such as the air ejector and steam generator blowdown monitors, provide diverse continuous primary-to-secondary leakage indication.

3. Reactor Coolant System leakage is periodically monitored by performance of the surveillance tests required by the Technical Specifications.

4. Actual primary-to-secondary leak rates are determined by radiochemistry analysis in accordance with plant procedures.

5. Normally, when operating at or near full power, the NIS Power Range channel will be adjusted on a daily basis to match NIS channel output with calorimetric heat balance calculated power. This plant practice results in the optimum channel calibration.]

LOCA and LOCA-Related Analyses

The following LOCA and LOCA-related analyses are not adversely affected by the proposed modification of 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 modification does not effect the normal plant operating parameters, the safeguards systems actuation or accident mitigation capabilities important to LOCA mitigation, or the assumptions used in the LOCA-related accidents. The surveillance change does not create conditions more limiting than those assumed in these analyses. In addition, the proposed modification 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 Chapter 15 of the FSAR are not adversely affected by the proposed NIS Power Range surveillance modification. This modification does not affect normal plant operating parameters, accident mitigation capabilities, the 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.

Mechanical Components and Systems

The surveillance modification as described does not affect the reactor coolant system component integrity or the ability of the system to perform its intended safety function. The modification as described does not affect the integrity of a plant auxiliary fluid system or the ability of the 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, the proposed NIS Power Range daily surveillance change does not directly or indirectly involve additional 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, PAMS, or plant control electrical equipment. Consideration has been given to seismic and environmental qualification, design and performance criteria per IEEE standards, functional requirements, and plant Technical Specifications.

The proposed change does not affect the plant normal operating design transients, margin to trip analysis, or low temperature overpressure protection system.

An evaluation herein determined that the proposed surveillance modification will ensure the performance of the NIS Power High Neutron Flux High setpoint reactor trip function consistent with the safety analysis assumptions. Deletion of the requirement to adjust the NIS Power Range channel(s) when NIS channel output is greater than calorimetric heat balance calculated power allows the channel(s) to not be adjusted in the non-conservative direction at part power. This allowance prevents the introduction of an error that has not been accounted for in the setpoint uncertainty calculations and the safety analyses associated with the NIS Power Range High Neutron Flux High setpoint reactor trip function. If NIS channel output is decreased to match a part power calorimetric performed below [70]% RTP, plant administrative controls ensure the Power Range High Neutron Flux High setpoint is reduced to $\leq$ [85]% RTP. Thus, the proposed modification does not have a potential for identification of an unreviewed safety question as it would relate to the safety-related function of I&C systems.

RTS and ESFAS Setpoints

With the specific exception of the NIS Power Range indication and reactor trip functions, the proposed modification to the Power Range daily surveillance, does not affect the Reactor Trip System (RTS) or the Engineered Safety Feature Actuation System (ESFAS) setpoints. This proposed modification does not change the current trip setpoints or instrument operability requirements identified in the Technical Specifications. The modification should ensure the operability of the NIS Power Range reactor trip at part power conditions after normalization at 100% RTP conditions consistent with the safety analysis assumptions. Therefore, the proposed modification 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 modification: Containment Integrity Analyses (Short Term/Long Term LOCA Release); Main Steamline Break (MSLB) Mass and Energy Release; Radiological Analyses; Probabilistic Risk Assessment; and Emergency Response Procedures.

The proposed Technical Specifications change modifies the 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 detailed analysis presented herein assessed the potential impact of the proposed daily surveillance change on applicable safety analyses and NIS Power Range indications, RTS functions, and control system functions. The assessments demonstrated that the change will not adversely affect the design basis safety analyses, Power Range functions, or the subsequent safe operation of the plant.

CONCLUSIONS

The NRC finds the proposed change to revise SR 3.3.1.2 for performing a daily surveillance adjustment of the power range channel(s) above 15 percent rated thermal power (RTP) to include only changes in the increasing direction and the revised formats of SR 3.3.1.2 and SR 3.3.1.3 to establish a consistent presentation of notations for surveillance requirements will allow safe operation and meet the intent of 10 CFR Part 50.36. The staff, therefore, concludes that the proposed TSTF-371, Revision 1 changes are acceptable.