Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

MAY 0 8 1995

U.S. Nuclear Regulatory Commission
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Washington, DC 20555

Gentlemen:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

WATTS BAR NUCLEAR PLANT (WBN) - ANNUAL REPORT OF EMERGENCY CORE COOLING SYSTEM (ECCS) EVALUATION MODEL CHANGES

This letter provides notification of recent changes to WBN's ECCS evaluation model. It is intended to satisfy the annual reporting requirement of 10 CFR 50.46. Note that in separate telphone conversations on April 24, 1995, Messrs. Fred Hebdon and Peter Tam of the NRC staff agreed to a two-week extension for submitting this report.

WBN's last annual report of ECCS model changes was submitted in a letter dated April 23, 1994. Since that report was submitted, Westinghouse Electric Corporation has notified TVA of additional ECCS model changes that affected the WBN analyses for both a large-break loss-of-coolant accident (LBLOCA) and a small-break loss-of-coolant accident (SBLOCA). Westinghouse has contractual responsibility for maintaining WBN's ECCS evaluation model. Recent changes to WBN's ECCS evaluation model are described in detail in Enclosure 1. Only changes that resulted in margin allocations to the calculated value of peak cladding temperature (PCT) are included in Enclosure 1. The PCT margin allocations resulting from the changes listed in Enclosure 1 are summarized in Enclosure 2.

Note that Westinghouse performed an updated SBLOCA analysis for WBN in June 1994. This updated analysis incorporated previously reported ECCS model changes related to SBLOCA analysis. TVA submitted the results of the reanalysis for NRC staff review in a letter dated February 16, 1995. The NRC staff approved the SBLOCA reanalysis in a letter dated April 18, 1995. Therefore, the June 1994 analysis is now the SBLOCA analysis of

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MAY 0 8 1995

record for WBN. The PCT margin allocations that are tabulated in Enclosure 2 for SBLOCA analysis are referenced to the PCT value that was calculated in this new SBLOCA analysis of record.

In previous reports of ECCS evaluation model changes, TVA identified cumulative changes that affected WBN's LBLOCA analysis and exceeded the threshold defined in 10 CFR 50.46(a)(3)(i) for a "significant" change of more than 50°F in calculated PCT. As a result, TVA committed in a letter dated July 28, 1993, to perform LBLOCA reanalysis no later than the end of WBN's second refueling outage. TVA has reviewed the schedule for this commitment in consideration of the additional ECCS model changes described in Enclosure 1. The review determined that there is no need to accelerate the schedule for LBLOCA reanalysis.

For ECCS evaluation model changes which affect SBLOCA analysis, Enclosure 2 indicates that the sum of the absolute values of their PCT margin allocations is 51°F. This exceeds the threshold for a "significant" change by 1°F.

For a "significant" change, 10 CFR 50.46(a)(3)(ii) requires "a proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with 10 CFR 50.46 requirements." In this case, TVA does not consider a SBLOCA reanalysis to be warranted. TVA has reviewed the various ECCS evaluation model changes related to SBLOCA analysis and determined that they do not have a significant effect on continued compliance with 10 CFR 50.46 requirements. The calculated value of PCT, including the various margin allocations listed in Enclosure 2, is 1491°F. This is 709°F below the 2200°F limit established in 10 CFR 50.46(b)(1). In addition to the PCT limit, 10 CFR 50.46 requirements include (1) maximum cladding oxidation, (2) maximum hydrogen generation, (3) coolable geometry, and (4) long-term cooling. TVA's review determined that the above 10 CFR 50.46 requirements are satisfied with ample margin. Therefore, a SBLOCA reanalysis is not needed since the unincorporated ECCS model changes that have accumulated to date do not pose a credible reactor safety concern.

If you have any questions about the information provided in this letter, please telephone John Vorees at (615) 365-8819.

Sincerely,

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cc: See page 3

MAY 0 8 1995

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ENCLOSURE 1

DESCRIPTION OF CHANGES WHICH AFFECT WBN'S
EMERGENCY CORE COOLING SYSTEM (ECCS) EVALUATION MODEL
AND ITS CALCULATION OF PEAK CLADDING TEMPERATURE (PCT)

ACCUMULATOR WATER TEMPERATURE

Background

The choice of accumulator water temperature can affect the value of peak cladding temperature (PCT) calculated in large-break loss-of-coolant accident (LBLOCA) analyses. WBN's LBLOCA analysis assumed an accumulator water temperature of 90°F. This assumption was carried over from earlier Westinghouse LBLOCA evaluation models that were based on a conservatively low value of containment air temperature at 100 percent power in fulfillment of the 10 CFR 50 Appendix K requirements associated with the calculation of a low containment backpressure.

Newer LBLOCA evaluation models have demonstrated that a higher containment air temperature, coupled with higher accumulator water temperatures, may result in an even more conservative calculation of PCT, even if containment pressure is slightly higher than calculated with the 90°F assumption. Sensitivity studies performed with these newer evaluation models (such as WBN's current model) have shown a small sensitivity to accumulator water temperature. WBN's accumulator water temperature could be as high as 120°F, which is the normal maximum temperature for the accumulator rooms per environmental drawing 47E235-42, Revision 7. The effect on calculated PCT was a 1.3°F change in PCT for a 1.0°F change in accumulator water temperature over the accumulator temperature range of 90°F to 120°F.

For small-break loss-of-coolant accident (SBLOCA) analysis, a sensitivity study performed by Westinghouse showed that accumulator water temperature has no significant effect on calculated PCT. In addition, the SBLOCA reanalysis that was performed for WBN in June 1994 assumed an accumulator water temperature of 120°F.

Affected Evaluation Model

Westinghouse 1981 LBLOCA evaluation model using the computer code BASH.

Estimated Effect

As stated above, the estimated effect on calculated PCT for a LBLOCA event is 1.3°F for each 1.0°F change in accumulator water temperature. However, accumulator water temperatures are difficult to measure directly and are expected to vary during plant operation. Westinghouse is still evaluating the

generic implications of this issue and has not determined the specific quantitative impact for each affected plant. In the absence of both Westinghouse guidance and operating history data for WBN's accumulators, TVA has chosen to assess a very conservative PCT penalty of 39°F based on the normal maximum accumulator water temperature of 120°F.

RHR HOT LEG INJECTION VALVE BYPASS LINE

Background

TVA's last annual report of ECCS evaluation model changes in a letter dated April 23, 1994, described a change that accounted for double-disk wedge-type valve leakage. The change resulted from modifications to prevent binding of certain double-disk gate valves used as isolation valves between the ECCS and the reactor coolant system (RCS) hot legs. The modifications provided a means for the fluid volume between the valve disks to equalize pressure with the RCS hot legs. Since the modifications increased leakage through the valves (i.e., some ECCS injection flow to the RCS cold legs would be diverted to the hot legs), the calculated PCT for LBLOCA analysis increased.

The specific modifications at WBN involved drilling a small hole in the hot-leg-side disk of each affected valve. Subsequently, TVA recognized that this modification to valve FCV-63-172, which isolates the injection path from the residual heat removal (RHR) system to the RCS hot legs, causes undesirable leakage during shutdown conditions when the RHR system is used for decay heat removal and the RCS is depressurized. Therefore, TVA redesigned the modifiction to this one valve. The hole in the disk was plugged and, in its place, a pressure equalization line was installed from the valve bonnet to the RCS hot legs. There is a valve in the pressure equalization line that can be closed to block leakage flow during shutdown conditions. When in use, however, the pressure equalization line allows a greater leakage flow rate than the previous hole in the valve disk.

In total, for all ECCS double-disk wedge-type valves that have been modified at WBN, leakage flow rate has been recalculated as 42.4 gpm. The double-disk wedge-type valve leakage that was previously reported in the letter dated April 23, 1994, was 34 gpm. Due to the increased leakage flow, there is a larger PCT penalty for LBLOCA analysis.

Affected Evaluation Models

Westinghouse 1981 LBLOCA evaluation model using the computer code BASH.

Estimated Effect

Westinghouse's evaluation of this issue determined that the greater leakage flow increases the PCT penalty for a LBLOCA event by +6°F with respect to the PCT penalty that was previously reported for double-disk wedge-type valve leakage.

DECREASED MINIMUM ECCS FLOW

Background

At TVA's request, Westinghouse evaluated the minimum ECCS pump flow rates that are used as input data for both the LBLOCA and SBLOCA analyses for WBN. TVA and Westinghouse were responding to various system performance issues which were identified during preoperational testing and final design reviews at WBN. The most significant of these issues involved adding an allowance for slight flow imbalances between injection lines. The safety evaluation performed by Westinghouse considered a reduction in the minimum required ECCS flow rates as a means of resolving these performance issues. Westinghouse determined that the criteria of 10 CFR 50.46 were still satisfied for both LBLOCA and SBLOCA analyses with the decrease in minimum ECCS flows.

Affected Evaluation Models

Westinghouse 1981 LBLOCA evaluation model using the computer code BASH.
Westinghouse 1985 SBLOCA evaluation model using the computer code NOTRUMP.

Estimated Effect

Westinghouse's evaluation of this issue assigned penalties to WBN's calculated PCT of +6°F for a LBLOCA event and +23°F for a SBLOCA event.

STEAM GENERATOR TUBE PLUGGING MARGIN BENEFIT

Background

Due to the cumulative estimated effects of ECCS evaluation model changes, a substantial penalty has been imposed on the calculated value of PCT for a LBLOCA event. TVA requested Westinghouse to review WBN's LBLOCA analysis of record to identify conservative assumptions that provide margin which can be used to offset at least part of the accrued PCT penalty. Westinghouse identified several conservative assumptions that provide quantifiable margins in the calculated value of PCT. Of these, the assumption that 10 percent of steam generator (SG) tubes are plugged provides the largest quantifiable margin.

TVA chose to apply some of this available margin by temporarily changing the basis for LBLOCA analysis so that it assumes a SG tube plugging level of 5 percent rather than 10 percent. At this time, WBN's actual SG tube plugging level is much less than 1 percent. It is reasonable to expect that there will be a limited number of tubes which require plugging in the first two fuel cycles. However, the 5 percent allowance for tube plugging is more than adequate for this period of time by the end of which WBN will have completed its scheduled LBLOCA reanalysis.

Affected Evaluation Models

Westinghouse 1981 LBLOCA evaluation model using the computer code BASH.

Estimated Effect

Westinghouse's evaluation of this issue determined that it benefits WBN's calculated PCT for a LBLOCA event by -20°F.

BOILING HEAT TRANSFER CORRELATION ERRORS

Background

Westinghouse identified a closely related set of errors concerning how the mixture velocity is defined for use in various heat transfer regime correlations within the computer code NOTRUMP. The previous definition for mixture velocity did not properly account for drift and slip effects calculated in NOTRUMP. The errors particularly affected NOTRUMP calculations of heat transfer coefficients when using the Westinghouse transition boiling correlation and the Dougall-Rohsenow saturated film boiling correlation.

Affected Evaluation Model

Westinghouse 1985 SBLOCA evaluation model using the computer code NOTRUMP.

Estimated Effect

Representative plant calculations for this issue determined an estimated PCT effect of -6°F for a SBLOCA event.

STEAM LINE ISOLATION LOGIC ERROR

Background

This error consisted of two portions: (1) a possible plant-specific effect that only applied to analyses which assumed main feedwater isolation occurred in response to a safety injection signal and (2) a generic effect that applied to all previous analyses performed by Westinghouse. The plant-specific effect did not apply to WBN. The generic effect was the result of incorrect logic which always led to steam line isolation functions occurring at a slightly later time than when the appropriate signal was generated.

Westinghouse considered this error to be a non-discretionary change as described in Section 4.1.2 of WCAP-13451 and corrected it in accordance with Section 4.1.3 of WCAP-13451.

Affected Evaluation Model

Westinghouse 1985 SBLOCA evaluation model using the computer code NOTRUMP.

Estimated Effect

Representative plant calculations for this issue determined an estimated PCT effect of +18°F for the generic portion. As previously stated, the plant-specific portion did not apply to WBN.

AXIAL NODALIZATION, RIP MODEL REVISION, AND SBLOCTA ERROR CORRECTIONS

Background

The computer code SBLOCTA is part of the SBLOCA evaluation model based on the computer code NOTRUMP. Westinghouse initially identified a deficiency in the amount of detail that SBLOCTA uses for the axial nodalization of the fuel rod and its effect on the solution of the channel fluid equations. Further investigation identified several additional related issues concerning nodalization and the overall solution of the fluid conservation equations. All of the above errors were subsequently corrected. As a separate, but related issue, Westinghouse also implemented a revised model for calculating transient fuel rod internal pressure in the SBLOCTA code.

The NRC was informed of these modeling changes in Westinghouse letter NTD-NRC-94-4343, "Interim Report of an Evaluation of a Deviation or Failure To Comply Pursuant to 10 CFR 21.21(a)(2) - Closeout 94-002," dated November 15, 1994.

Affected Evaluation Model

Westinghouse 1985 SBLOCA evaluation model using the computer code NOTRUMP.

Estimated Effect

Since all of the above issues related to portions of the SBLOCTA code and/or its associated input methodology, they were reported as a single, closely related group of changes. The net effect of these changes for WBN's calculated PCT was determined to be +4°F for a SBLOCA event.

ENCLOSURE 2

SUMMARY OF PEAK CLADDING TEMPERATURE (PCT) MARGIN ALLOCATIONS RESULTING FROM CHANGES TO THE EMERGENCY CORE COOLING SYSTEM (ECCS) EVALUATION MODEL

	PCT (°F)
Large-Break Loss-of-Coolant Accident (LBLOCA):	
A. ANALYSIS OF RECORD (8/87) (Based on BASH evaluation model with F_Q=2.40, $F_{\Delta H}$=1.58, SGTP=10%, and VANTAGE 5H fuel)	2126
B. PRIOR MODEL ASSESSMENTS (Refer to letters dated July 22, 1991, July 13, 1992, March 17, 1993, November 10, 1993, and April 23, 1994.)	+37
C. CURRENT MODEL ASSESSMENTS (5/95) (Permanent assessment of PCT margin)	
1. Accumulator water temperature	+39
2. RHR hot leg injection valve bypass line	+6
3. Decreased minimum ECCS flow	+6
D. OTHER MARGIN ALLOCATIONS (5/95) (Temporary assessment of PCT margin)	
1. Steam generator tube plugging margin benefit	-20
LICENSING BASIS PCT + MARGIN ALLOCATIONS	2194
Small-Break Loss-of-Coolant Accident (SBLOCA):	
A. ANALYSIS OF RECORD (6/94) (Based on NOTRUMP evaluation model with F_Q=2.40, $F_{\Delta H}$=1.58, SGTP=10%, and VANTAGE 5H fuel)	1452
B. PRIOR MODEL ASSESSMENTS	0
C. CURRENT MODEL ASSESSMENTS (5/95) (Permanent assessment of PCT margin)	
1. Decreased minimum ECCS flow	+23
2. Boiling heat transfer correlation errors	-6
3. Steam line isolation logic error	+18
4. Axial nodalization, RIP model revision, and SBLOCTA error corrections	+4
LICENSING BASIS PCT + MARGIN ALLOCATIONS	1491