Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37379

November 18, 1994

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

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - 10 CFR 50.46 UPDATED ANNUAL REPORT

Reference: TVA letter to NRC dated July 6, 1994, "Sequoyah Nuclear Plant (SQN) - 10 CFR 50.46 Annual Report"

10 CFR 50.46 requires that a 30-day report be furnished if a significant change in peak clad temperature is discovered. The purpose of this letter is to provide this notification. Westinghouse Electric Corporation has completed an evaluation of a potential issue concerning the SBLOCTA code that is part of the NOTRUMP and WFLASH small break loss-of-coolant accident (LOCA) emergency core cooling accident (ECCS) evaluation models. The potential issue originally identified was a deficiency in the amount of detail used for the axial nodalization of the fuel rod, as it affected the solution of the channel fluid equations. Further investigation identified several additional related issues associated with nodalization and the overall solution of the fluid conservation equations, which have subsequently been corrected. The enclosed documentation contains these recent changes to SQN's ECCS evaluation model.

As a separate, but related issue, Westinghouse has implemented a revised model for calculating transient fuel rod internal pressure in the SBLOCTA code. Fuel rod pressure is a governing factor in defining the clad creep, burst and blockage behavior for small break LOCA transients. Since the combination of these corrections and improvements can have a significant effect on the predicted peak clad temperature (PCT), the SBLOCTA calculation from the limiting small break LOCA transient has been rerun, with the revised code and methodology, in order to obtain an accurate estimation of the net effect of these changes on the SQN analysis of record. The analysis results did not exceed the PCT limits of 10 CFR 50.46(b)(1).

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Additionally, 10 CFR 50.46 requires, in this situation, a schedule for reanalysis. Since Westinghouse has performed a reanalysis for the small break LOCA, further work is not required and this new analysis is the analysis of record for the small break LOCA.

The large break LOCA ECCS evaluation model remains unchanged from that previously reported in the listed reference. As a matter of information relative to the large break LOCA, Westinghouse has submitted Westinghouse Commercial Atomic Power (WCAP) 12945-P, "Code Qualification Document for Best Estimate LOCA Analysis." This WCAP includes the SQN large break LOCA analysis using best estimate techniques allowed under the 1988 revision to 10 CFR 50, Appendix K rule. Upon NRC approval, TVA will use this methodology for the analysis of record for the large break LOCA.

Additionally, potential issues are under investigation by Westinghouse that may impact the PCT for both large and small break LOCA. The potential issues have had PCT margin temporarily allocated to ensure that the cumulative effects are tracked such that the 10 CFR 50.46 PCT limit of 2200-degrees Fahrenheit is not exceeded. Upon their resolution, these issues will be reported as appropriate.

Please direct questions concerning this issue to W. C. Ludwig at (615) 843-7460.

Sincerely,

R. H. Shell

R. H. Shell
Manger
SQN Site Licensing

Enclosure
cc: See page 3

cc (Enclosure):

Mr. D. E. LaBarge, Project Manager
Nuclear Regulatory Commission
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852-2739

NRC Resident Inspector
Sequoyah Nuclear Plant
2600 Igou Ferry Road
Soddy-Daisy, Tennessee 37379-3624

Regional Administrator
U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323-2711

ENCLOSURE

10 CFR 50.46 UPDATE REPORT

Large Break Loss-of-Coolant Accident (LOCA)

	PCT
Previous Licensing Basis Peak Cladding Temperature (PCT) (July 6, 1994)	2174°F
No Change Identified	0°F
Updated Licensing Basis PCT	2174°F
Net Change	0°F

Small Break LOCA

	PCT	Attachment
Previous Licensing Basis PCT (July 6, 1994)	2004°F	
1. Boiling Heat Transfer Correlation Error	-6°F	1
2. Steam Line Isolation Logic Error	+18°F	2
3. Axial Nodalization, RIP Model Revision and SBLOCTA Error Corrections Analysis	-389°F	3
4. Effect of Item 3 on Prior Assessments	+160°F	4
5. Effect of Items 1 thru 3 on Burst/Blockage Modeling	-71°F	5
Updated Licensing Basis PCT	1716°F	
Net Change	-288°F	

A detailed discussion of each of the following changes outlined above is included in the indicated attachment.

BOILING HEAT TRANSFER CORRELATION ERRORS

Background

This set of errors deals with how the mixture velocity is defined for use in various boiling heat transfer regime correlations. The previous definition for mixture velocity did not properly account for drift and slip effects calculated in NOTRUMP. This error particularly affected NOTRUMP calculations of heat transfer coefficient when using the Westinghouse Transition Boiling Correlation and the Dougall-Rohsenow Saturated Film Boiling Correlation.

This was determined to be a Non-Discretionary Change as described in Section 4.1.2 of WCAP-13451 and was corrected in accordance with Section 4.1.3 of WCAP-13451.

Estimated Effect

Representative plant calculations were performed to establish the net PCT effect of the identified errors. These calculations resulted in a net 6°F PCT reduction for the Sequoyah small break loss-of-coolant accident analysis.

STEAM LINE ISOLATION LOGIC ERRORS

Background

This error involves two specific modeling logic problems. The first problem is generic and applies to all small break loss-of-coolant accident analyses. It was the result of incorrect logic which modeled steam line isolation functions at a slightly later time in the event than when the actual signals are generated. The second problem is applicable only to analyses which assume that main feedwater flow is isolated upon receipt of a safety injection signal. It was the result of incorrect logic which modeled steam line isolation coincident with receipt of a feedwater isolation signal. This logic resulted in steam line isolation upon receipt of a safety injection signal, which is inconsistent with the standard conservative assumption of steam line isolation on loss-of-off-site-power coincident with the earlier reactor trip signal.

This was determined to be a Non-Discretionary Change as described in Section 4.1.2 of WCAP-13451 and was corrected in accordance with Section 4.1.3 of WCAP-13451.

Estimated Effect

Representative plant calculations were performed to establish the net PCT effect of the identified errors. These calculations resulted in a net 18°F PCT increase for the first logic error and a net 12°F PCT increase for the second logic error. Only the first logic error is applicable to the Sequoyah small break loss-of-coolant accident analysis.

SBLOCTA FUEL ROD AXIAL NODALIZATION

Background

The standard fuel rod model (developed in the early 1970's) used in performing SBLOCTA calculations has 19 axial nodes with a finer distribution at the top elevations. Section II.3 of 10CFR50.46, Appendix K requires all nodalization schemes to be verified as conservative based upon the results of developmental sensitivity studies. Upon review, it was found that sensitivity studies which justify the number and distribution of the fuel rod nodes in the Westinghouse standard model were not documented. As a result, a series of calculations were performed using increasingly finer axial nodalizations to confirm the adequacy of the 19 node model. The results indicated that the standard model under-predicted rod PCT. With the finer nodalization, portions of the fuel rod were uncovered sooner in the transient and reached higher temperatures than in the standard model. As a result of additional investigation into the SBLOCTA code, several additional minor issues related to nodalization and the overall solution of fluid conservation equations were also identified.

As a result of this finding, Westinghouse has revised the standard fuel rod model. The revised model requires a fine nodalization (one node every 0.25 ft) for all rod elevations which are predicted to uncover during a small break loss-of-coolant-accident. The additional SBLOCTA code errors were also corrected.

Estimated Effect

Since the improved axial nodalization methodology, when coupled with a revised fuel rod internal pressure model recently developed by Westinghouse, can have a significant effect on calculated peak clad temperature, the SBLOCTA calculation for the limiting Sequoyah small break loss-of-coolant-accident was reanalyzed with the revised code and methodology. During the process of reviewing the analysis of record for Sequoyah, a conservatism in the core power axial offset limit was noted. The current Sequoyah licensing basis limit for axial offset is +6%. The present small break loss-of-coolant-accident analysis assumes an axial offset of 30%. Based upon the existing limit, the revised calculation was performed with a maximum axial offset of 13% rather than 30%. The synergistic effect of the revised fuel rod model, the revised rod internal pressure model and the reduction in assumed axial offset used in the analysis reduced the calculated peak clad temperature for Sequoyah by 389°F.

SBLOCTA FUEL ROD AXIAL NODALIZATION - PRIOR ASSESSMENTS

Background

When the limiting small break loss-of-coolant accident case was reanalyzed to address the issues outlined in Attachment 3, the model used reflected the resolution of the following issues which were previously identified in 10CFR50.46 evaluation model reports.

Issue	Report
NOTRUMP Bessel Function Error	July 28, 1993 Annual Report
Secondary Side Modeling in Small Break/Input Corrections	November 12, 1993 Special Report
NOTRUMP Code Solution Convergence	November 12, 1993 Special Report
Auxiliary Feedwater Flow Reduction	November 12, 1993 Special Report
Hot Assembly Average Rod Burst Effect	July 6, 1994 Annual Report
Revised Burst Strain Limit Model	July 6, 1994 Annual Report

These issues were previously resolved by permanent PCT assessments which were conservatively estimated based upon generic sensitivity analyses. Since the plant-specific reanalysis described in Attachment 3 uses models which have been revised to reflect resolution of these issues, the prior generic assessments have been removed from the calculated PCT (in favor of the plant-specific assessment contained within the result obtained in Attachment 3).

Estimated Effect

Prior reporting of the above issues had established a net 160°F benefit against the calculated small break loss-of-coolant-accident PCT. As the benefit of the resolution of these issues is now reflected in the plant-specific reanalysis which was performed to address the issue in Attachment 3, the prior cumulative assessment of 160°F will be deleted.

SMALL BREAK LOCA ROD BURST AND BLOCKAGE MODEL

Background

Westinghouse has previously completed an evaluation of an issue concerning rod burst/blockage modeling in the Westinghouse small break evaluation model. The issue involved a number of synergistic effects all of which were related to the manner in which the small break model accounts for the swelling and burst of fuel rods and the subsequent flow channel blockage. Detailed review of fuel rod burst during the course of a small break loss-of-coolant-accident analysis found that a significant temperature excursion above the clad temperature transient for a non-burst case was possible. Since the methodology for small break analyses had been to perform the analysis at near beginning of core life (where rod internal pressures are relatively low), most analyses did not result in a fuel rod burst. As such, they may not reflect the most limiting time in core life for a small break loss-of-coolant-accident. To evaluate the effects of this phenomenon, Westinghouse has developed an analytical model which allows the prediction of rod burst PCT effects based upon the existing analysis of record. This model establishes a permanent allocation of PCT margin to address this issue (which can vary with subsequent margin allocations).

Estimated Effect

The effect of the "Boiling Heat Transfer Correlation Error", "Steam Line Isolation Logic Error" and "Fuel Rod Axial Nodalization" issue resolutions have been evaluated against the "Burst and Blockage" margin allocation. Based upon the results of this evaluation, the resolution of the these issues results in a 71°F PCT margin allocation reduction for the "Burst and Blockage" issue.