TVA

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

September 6, 1995

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 12, 1995, "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. Recently, Westinghouse Electric Corporation withdrew its request for NRC approval of the Power Shapes Sensitivity Model (PSSM). PSSM had been developed and submitted to NRC as a statistical methodology to evaluate and assure that the cosine distribution remains the limiting distribution. This methodology was implemented on a forward-fit basis. In order to minimize potential peak clad temperature (PCT) penalties due to the withdrawal of PSSM, Westinghouse developed an alternate axial power shape methodology, Explicit Shape Analysis for PCT Effects. The Explicit Shape Analysis for PCT Effects methodology is based on explicit analysis of a set of skewed axial power shapes. The explicit use of skewed power shapes has previously been approved by NRC as part of the Westinghouse large break loss-of-coolant accident (LOCA) evaluation model. Based upon this replacement, the SQN large break LOCA analysis is impacted in the form of a penalty.

To offset the effect of the skewed power shapes discussed above, it was necessary to model an improvement to the large break LOCA evaluation model for plants with a severe penality. TVA decided to apply this improvement to its large break LOCA evaluation model. This improvement allows for the modeling of flow through the hot-leg nozzle gap as a benefit. This benefit is obtained by including steam flow through the reactor vessel hot-leg nozzle gap (between the core barrel and the reactor vessel) in the calculations.

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An additional benefit is derived by eliminating the penalty that has been assessed against the large break LOCA evaluation model for the Westinghouse standard fuel assembly with Inconel grids. Since Cycle 5, most of the standard fuel assemblies have been replaced with Vantage-5H assemblies with Zircaloy grids. The few standard fuel assemblies that have not been replaced will continue to be located in low power regions. By ensuring the standard fuel assemblies remain in low power region, the relative average power factor for the Vantage-5H fuel assemblies is bounding. The reload safety analysis process will ensure that the remaining standard fuel assemblies will remain in the low power regions for future cycles.

The summation of the PCT impact from the above three items results in a 245 degrees Fahrenheit (°F) decrease in the large break LOCA PCT, which exceeds the threshold discussed in 10 CFR 50.46 (a)(3)(ii). Additionally, the above-identified changes do not result in exceeding the limits of 10 CFR 50.46, and PCT margin allocations will ensure these limitations are not exceeded. Therefore, further reanalysis or actions are not planned at this time.

The attached enclosure provides the benefits and penalty discussed above. The above reference provided SQN's 1995 Annual 10 CFR 50.46 Report. The small break LOCA PCT remains unchanged from that reported in the referenced document.

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

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

Sincerely,

R. H. Shell

R. H. Shell
Manager
SQN Site Licensing

Enclosure
cc: See page 3

cc (Enclosure):

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ENCLOSURE

10 CFR 50.46 REPORT DOCUMENTATION

Large Break Loss-of-Coolant Accident (LOCA)

	PCT	Attachment
Previous Licensing Basis Peak Cladding Temperature (PCT) (July 12, 1995)	2156°F	
Standard Fuel Assembly Relative Average Power Limit Adjustment	-100°F	1
ESHAPE* Power Shape Sensitivity Model	+25°F	2
Hot Leg Nozzle Gap Flow Modeling	-170°F	3
Updated Licensing Basis PCT	1911°F	
Net Change	-245°F	

Small Break LOCA

	PCT
Previous Licensing Basis PCT (July 12,1995)	1716°F
No Change Identified	0°F
Updated Licensing Basis PCT	1716°F
Net Change	0°F

A detailed discussion of the change outlined above is included in the indicated attachment.

*Explicit SHape Analysis for PCT Effects

STANDARD FUEL ASSEMBLY RELATIVE AVERAGE POWER ADJUSTMENT

Background

The current licensing basis large break loss-of-coolant accident for Sequoyah was performed using the 1981 Westinghouse ECCS Evaluation Model (BASH). The analysis was performed to support operation with a peaking factor (F_Q) of 2.40, a hot channel factor ($F_{\Delta H}$) of 1.62 and a relative average power factor (P_{HA}) of 1.44. This analysis was initially performed for the Westinghouse Standard Fuel Assembly with Inconel grids. Beginning with Unit 1, Cycle 5 operation, TVA began using the Westinghouse Vantage-5H Fuel Assembly with Zircaloy grids. The analysis performed to support use of the Vantage-5H fuel found that the original Standard fuel assembly results bounded the Vantage-5H results. As such, no change to the ECCS evaluation model or calculated peak clad temperature was required to support use of the Vantage-5H fuel assemblies.

Since Cycle 5, most of the Standard fuel assemblies at Sequoyah have been replaced with Vantage-5H assemblies. The Standard fuel assemblies which continue to be in operation in the present (and future) cores are located in low power regions (typically on the periphery of the core). As a result, the relative average power of these assemblies is much lower than the 1.44 value assumed in the licensing basis analysis. At the request of TVA, Westinghouse recently performed an evaluation to determine the maximum allowable average power factor for the Standard fuel assemblies which would result in a peak clad temperature less than that previously calculated for Vantage-5H fuel assemblies. The evaluation found that limiting the Standard fuel relative average power factor to 1.28 will ensure that the Vantage-5H results are bounding.

A review of the Standard fuel assemblies presently installed at Sequoyah (and future core designs for Cycle 8 operation) found that they meet the 1.28 relative average power factor limit. As such, TVA has decided to impose a permanent relative average power limit of 1.28 on all Sequoyah Standard fuel assemblies. This limit will be evaluated as part of the reload safety evaluation process for all future cores designed under the present large break loss-of-coolant accident analysis. This limit will allow the Vantage-5H fuel assembly analysis to be adopted as the Sequoyah licensing basis analysis.

Estimated Effect

The calculated peak clad temperature for the Standard fuel assemblies exceeds that calculated for the Vantage-5H fuel assemblies by 100°F for a relative average power factor of 1.44. Limiting the remaining Standard fuel assemblies to a relative average power factor of 1.28 will result in a 100°F reduction in calculated peak clad temperature.

Attachment 2

ESHAPE POWER SHAPE SENSITIVITY MODEL

Background

Large break loss-of-coolant accident analyses generally assume a symmetric, chopped cosine, core axial power distribution. Under certain conditions, there is a potential for top-skewed power distributions to result in peak clad temperatures greater than those calculated with the chopped cosine power distribution. In 1991, Westinghouse developed a statistical methodology to evaluate and assure that the cosine distribution is the limiting power distribution. This methodology is referred to as the power shape sensitivity model (PSSM) and is documented in Topical Report WCAP-12909-P. This methodology has been used to support the Sequoyah core reload safety evaluations for the present fuel cycles (Cycle 7).

Based upon recent NRC concerns regarding the statistical approach and uncertainties used in the PSSM methodology, Westinghouse has indicated that the PSSM methodology has been replaced by an alternate evaluation methodology for the BASH emergency core cooling system evaluation model. This alternate methodology is referred to as ESHAPE (Explicit SHape Analysis for PCT Effects) and has been approved by NRC as part of the Westinghouse large break loss-of-coolant accident evaluation model (Topical Report WCAP-10266-P-A, Addendum 1, Revision 2-P-A). This methodology is based upon explicit analysis of a set of skewed power shapes.

Estimated Effect

Westinghouse has performed an evaluation of the Sequoyah large break loss-of-coolant accident using the ESHAPE methodology. The revised axial power distribution model increased the calculated peak clad temperature by 25°F.

HOT LEG NOZZLE GAP FLOW MODELING

Background

Westinghouse designed pressurized water reactors have a small gap at the interface between the reactor core barrel and the reactor vessel at the hot leg nozzle location. This gap is necessary for installing and removing the core barrel. This gap creates a flow path for core cooling during a large break loss-of-coolant accident from the upper plenum to the cold leg via the downcomer region. No credit is taken for this flow path in the present Sequoyah large break loss-of-cooling accident analysis.

Westinghouse has recently developed a methodology for modeling these gaps in the BASH emergency core cooling system evaluation model. This methodology is documented in Topical Report WCAP-14404-P. This modification extends the basic flow link modeling of the existing evaluation model to the additional flowpath created by the hot leg gaps. This modeling enhancement has recently been applied to the Sequoyah large break loss-of-coolant accident analysis.

Estimated Effect

Application of the hot leg nozzle gap flow modeling to the Sequoyah large break loss-of-coolant accident analysis reduces the calculated peak clad temperature by 170°F.