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Westinghouse Electric Corporation **Energy Systems**

Box 355
Pittsburgh Pennsylvania 15230-0355

June 29, 1994

WAT-D-9751

Ref: 1) ET-NRC-92-3695
2) ET-NRC-92-3699

Mr. R. M. Johnson
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Tennessee Valley Authority
Watts Bar Nuclear Power Plant
I0B-1A, P.O. Box 2000
Spring City, TN 37381

Tennessee Valley Authority
Watts Bar Nuclear Plant Units 1 and 2
Update on Containment and Accumulator Initial
Temperature Assumptions for LB-LOCA Analysis

Dear Mr. Johnson:

References (1) and (2) previously provided the NRC with information concerning the effect on Large Break LOCA calculated Peak Cladding Temperature (PCT) of assumptions in Containment air and Accumulator water initial temperatures. Reference (2) provided a detailed explanation of the effects. At that time, the sensitivity of PCT to accumulator water temperature for a range of water temperature from 90°F to 120°F was an increase of 49°F to 150°F in PCT. The Reference (2) letter was the subject of subsequent NRC telecons regarding the effects. This letter will respond to NRC questions posed during the telecons and provide the current Westinghouse position on this issue.

To assist in the selection of the accumulator water temperature for Watts Bar Units 1 & 2, Westinghouse has reviewed the LB-LOCA analysis, and the current accumulator water temperature assumed in the analysis is 120°F.

Please contact M. E. Nissley (412-374-4303), Manager of Safeguards Analysis I, or C. M. Thompson (412-374-4409), if you have questions on this subject.

Very truly yours,

J. W. Irons, Project Manager
TVA Watts Bar Project
Domestic Customer Projects

Attachment

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cc: R. M. Johnson
R. W. Meadows
T. W. Overlid
S. O. Casteel

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

Attention: Mr. F. Orr, Reactor Systems Branch
Office of Nuclear Reactor Regulation

Accumulator Water Temperature

The change to the Westinghouse Large Break LOCA ECCS Evaluation Model Reported in Reference (3) and approved by the NRC in Reference (4) has had a significant effect on the sensitivity of PCT to accumulator water temperature. The change reported in Reference (3) concerned the fuel assembly spacer grid model used in the BART and BASH versions of the Westinghouse 1981 Large Break LOCA ECCS Evaluation Model (References 5 & 6). A logic error in the calculation of the spacer grid quenching and heat transfer models had sometimes resulted in erratic behavior of spacer grid quenching which could result in large changes to the calculated PCT when small changes were made to input assumptions. New sensitivity studies, using the corrected versions of the Reference (6) Evaluation model have shown a much smaller sensitivity to accumulator water temperature than reported in Reference (2). In all cases the change in PCT is now less than 50°F when the accumulator water temperature is allowed to vary from 90°F to 120°F. Since the sensitivity is now below the 10 CFR 50.46 threshold for determination of a significant change, Westinghouse believes that any change in analysis assumptions can be forward fitted to new analyses. To support this approach, this letter will provide guidance on implementing this change in future analyses.

Accumulator Water Temperature Analysis Assumption

All LOCA analysis performed to satisfy Appendix K to 10CFR50 must meet the criteria of Appendix K part II, "Required Documentation", which states that: "Appropriate sensitivity studies shall be performed for each evaluation model, to evaluate the effect on calculated results of variations in noding, phenomena assumed in the calculation to predominate, including pump operation or locking, and values of parameters over their applicable ranges. For items to which results are shown to be sensitive, the choices made shall be justified." Traditionally, justification of the choice has required that the analysis value and the effect on calculated PCT over the expected range have an effect which is not significant, where significant is currently defined as greater than 50°F. Application of this requirement to the choice of accumulator water temperature would result in a selection for which the effect of variations in water temperature during operation (@100% power) would not result in a significant change in the calculated PCT (<50°F).

If the accumulators are in a location where the water temperature would be expected to trend with containment air temperature, then an acceptable accumulator water temperature to use in Large Break LOCA analyses could be based on, 1) Tech-Spec maximum containment air temperature, 2) maximum fan cooler exhaust temperature, or 3) the estimated annualized average accumulator water temperature (@ 100% power). Since the current sensitivity of PCT to accumulator water temperature is about 1.3°F PCT for a 1°F change in accumulator water temperature, the variation between the accumulator water temperature based on one of these definitions, and that used in the existing analysis should be less than 35°F (50°F/1.3°F PCT per 1°F water temp). As an example, for the case of a plant with a Tech-Spec maximum air temperature of a 120°F and having a LOCA analysis which used 90°F as the minimum air temperature at 100% power, the range in air temperature is less than 35°F. Thus an accumulator water temperature of 90°F or greater would be acceptable and could be justified in the analysis. If the location of the accumulators results in accumulator water temperatures which are either much hotter or colder than the containment average air temperature, then these values should be considered in the selection of the accumulator water temperature, keeping in mind that the uncertainty should be no greater than 35°F.

Since the effect of expected variations in accumulator water temperature have been shown to not have a significant effect on calculated PCT, Westinghouse believes it is not necessary to backfit assumptions for this parameter or provide a justification for continued operation. However, at the next large break LOCA analysis, using an Appendix K model, Westinghouse will request the utility to select a value to be used in the analysis.

Westinghouse Recommendation on Accumulator Water Temperature Selection

Since this issue has previously been reported the NRC and this letter is in response to an NRC request, Westinghouse recommends that each utility review the currently assumed accumulator water temperature against expected temperatures during full power operation. If the variation between the accumulator water temperature based on one of the definitions given above, and that used in the existing analysis is less than 35°F (50°F/1.3°F PCT per 1°F water temp) then no immediate action is necessary. If the current assumption is more than 35°F from one of the definitions given above, then it may be necessary to adjust the plant PCT to address the difference between the analysis assumption and plant operating conditions.

Refueling Water Storage Tank (RWST) Temperature

Due to a question regarding the effect of RWST temperature assumptions on the calculated results of large break LOCA analysis performed with the models of References (5) & (6), Westinghouse has performed sensitivity studies to changes in RWST temperature. RWST temperature affects both the containment spray temperature and pumped Safety Injection temperatures. RWST temperature assumptions of 40°F, 80°F and 120°F were investigated with the result that the maximum PCT occurred when the RWST was at 40°F and the sensitivity seen for increasing RWST temperature was -0.16°F PCT/+1.0°F RWST. The ECCS model of Reference (6) uses the technical specification minimum RWST temperature for containment spray and the nominal RWST temperature for the pumped Safety Injection in the BASH reflood calculation, and this value can be set independently from the containment spray temperature used to calculate the containment pressure. This input methodology applied to analyses performed with the Reference (6) models, results in a slightly conservative PCT calculation by some 2°F to 3°F. This input method has been applied consistently to Reference (6) analyses when it was realized that changes in safety injection temperature could result in either an increase or decrease in the calculated PCT.

Since Westinghouse LOCA analysis performed to satisfy 10 CFR 50.46 and Appendix K to 10 CFR 50 have historically used the minimum RWST temperature in the analysis as one of the features needed to satisfy Appendix K to 10 CFR 50, there is no need to change the current modeling and no need to modify current analysis calculated PCTs.

Containment Air Temperature

Since the issuance of Reference (2) there has been no change in the Large Break LOCA PCT response to this parameter. Therefore, Westinghouse feels that the current modeling assumptions of using the minimum containment air temperature associated with 100% power is acceptable and will not change current practice.

CONCLUSION

The sensitivity to accumulator water temperature reported in Reference (2) has been found to be overly conservative based on new studies using the corrected model of Reference (4). Since the effect of accumulator water temperature on calculated PCT is now less than the significance threshold set by 10 CFR 50.46, Westinghouse believes that this issue can be addressed by a forward fit use of the utility supplied accumulator water temperature at the next analysis. The sensitivity to RWST

temperature has been determined and found to have a negligible effect on calculated PCT. Therefore, Westinghouse will forward fit the utility selected accumulator water temperature to new analyses performed with the models of Reference (5) or (6).

References

1. Letter ET-NRC-92-3695, N. J. Liparulo (W) to U. S. Nuclear Regulatory Commission, "10CFR21 Interim Report: LOCA Containment Initial Temperature Assumption", April 30, 1992.

2. Letter ET-NRC-92-3699, N. J. Liparulo (W) to U. S. Nuclear Regulatory Commission, "Results of Technical Evaluation of Containment Initial Temperature Assumptions for Large Break Loss of Coolant Accident Analysis", June 1, 1992.

3. Letter ET-NRC-92-3787, N. J. Liparulo (W) to U. S. Nuclear Regulatory Commission, "Notification of Changes to the Westinghouse Large Break LOCA ECCS Evaluation Model", December 22, 1992.

4. Letter Ashok C. Thadani (NRC) to N. J. Liparulo (W), "Acceptance for Referencing of Licensing Topical Report, WCAP-10484, Addendum 1, "Space Grid Heat Transfer Effects During Reflood" (TAC M85295), July 07, 1993.

5. WCAP-9561-P-A, w/Addenda (Proprietary) and WCAP-9562-A, w/Addenda (Non-Proprietary), Young, M.Y., "BART-A1: A Computer Code for the Best Estimate Analysis of Reflood Transients", March 1984.

6. WCAP-10266-P-A, Revision 2 (Proprietary), WCAP-10267-A, Revision 2 (Non-Proprietary), Besspiata, J.J., et al, "1981 Version of the Westinghouse ECCS Evaluation Model Using the BASH Code," March 1987.