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Divisions

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November 16, 1979

NS-TMA-2163

Mr. Darrell G. Eisenhut
Director, Division of
Operating Reactors
Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20014

Dear Mr. Eisenhut:

Letter NS-TMA-2147, dated November 2, 1979, responded to NRC concerns related to the fuel rod models used in the Westinghouse LOCA/ECCS evaluation model and potential non-compliance with the requirements of 10CFR Part 50. Table 1 of that letter included information on fuel rod heatup rate prior to burst. That information was based on our initial evaluation of the results of current LOCA analyses for Westinghouse plants with operating licenses. Subsequent to completion and transmittal of that letter, Westinghouse continued investigation of heatup rate calculations. As a result of that investigation, Westinghouse then developed a procedure to determine clad heatup rate prior to burst. That procedure keys on the calculated clad strain during the LOCA transient to establish a starting point, in time, to use in the heatup rate calculation. That procedure was presented to NRC personnel during a meeting on November 13, 1979, in Bethesda, and was accepted on an interim basis, as adequate with respect to Appendix K LOCA analyses. Table A shows the revision to the heatup rates previously given in Table 1 of Letter NS-TMA-2147.

Inspection of Table A shows heatup rates in some cases, less than 250F/sec.

In the current W ECCS Evaluation Model (Feb, '78) used for the above analyses, a fuel rod burst curve which represents burst conditions for heatup rates of 250F/sec and larger was used. From Table A, since some cases have heatup rates less than 250F/sec and burst conditions change for lower heatup rates, Westinghouse recognized that some of those analyses could be non-conservative with respect to the time of rod burst.

Therefore, W performed an evaluation of all operating plants licensed with the W ECCS Evaluation Model with respect to use of a heatup rate dependent burst model. The heatup rate dependent burst model currently used in the W Small Break Evaluation Model (documented in WCAP-8970-P-A "Westinghouse Emergency Core Cooling System Small Break, October 1975 Model" and approved by the NRC) was used in this evaluation.

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The results of that evaluation, the status of each plant evaluated and justification of conclusions reached are as follows:.

PLANT (1)	MODEL	FEB. '78
	FQ	2.31
	PCT	2172

A new analysis was performed using the appropriate heatup rate burst curve and water residing in the accumulator lines (not previously accounted for) was considered. The resulting PCT was 2135°F at an Fq of 2.31.

Therefore, 10CFR50 criteria are satisfied.

PLANT (2)	MODEL	OCT. '75
	FQ	2.17
	PCT	2199

A LOCTA run was made using the Oct. '75 evaluation model with appropriate heatup rate burst curves for Fq = 2.16, PCT = 2127.

Use of Feb. '78 evaluation model, in particular the new accumulator discharge model, will compensate for the ΔFQ , shown above, to maintain 2200°F. (This is a burst node limited plant)

PLANTS (3) (4) (5) (6)

Since the heatup rate for the hot rod is greater than 25°F/second and the PCT does not occur during the steam cooling period, the current analysis for these plants remains valid.

PLANT (8)	MODEL	OCT. '75
	FQ	2.10
	PCT	2188°F

An Oct. '75 model LOCTA run was made using appropriate heatup rate burst curves. Results were: Fq = 2.10, PCT = 2227.

Application of the "Dynamic Steam Cooling" modification of the Feb. '78 evaluation model will result in a 60°F reduction in PCT and the Feb. '78 accumulator discharge model will result in at least a 20°F reduction in PCT. Results of a Feb. '78 model analysis are expected to result in a PCT of approximately 2147°F at an Fq of 2.10.

Therefore, 10CFR50 criteria will be satisfied and there is no safety concern.

PLANT (9)	MODEL	OCT. '75
	Fq	2.25
	PCT	2142

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Based on the results of a calculation for plant #(14), the use of approximate heatup rate burst curves would result in a maximum PCT increase of 68°F. Thus, the estimated (maximum) PCT = 2142 + 68 = 2210°F at an $F_Q = 2.25$.

The benefits associated with the Feb. 78 accumulator discharge model and accounting for paint on containment heat sinks will result in a PCT reduction well in excess of 10°F.

Therefore, no safety problem exists.

PLANT (11)	MODEL	FEB. '78
	F_Q	1.90
	PCT	2124

A LOCTA calculation was performed using appropriate heatup rate burst curves. An F_Q of 1.89 resulted in a PCT of 2161°F.

Therefore, a peaking factor reduction of less than 0.01 is required for this plant to remain in compliance with 10CFR50.

PLANT (12)	MODEL	OCT. '75
	F_Q	2.21
	PCT	2198

Based on analyses performed for plant #(15), a 15°F/second reduction in clad heatup rate impacts hot rod burst to effect PCT by +42°F. Extrapolating, a 17°F/second reduction in heatup rate results in a 48°F PCT increase. Use of the dynamic steam cooling calculation on the accumulator discharge model in the Feb. '78 ECCS evaluation model results in an estimated (60°F + 20°F) 80°F reduction in PCT.

Therefore, a Feb. '78 model analysis would result in a PCT of 2198+48-80=2166°F at F_Q of 2.21 and no safety problem exists.

PLANT (13)	MODEL	FEB. '78
	F_Q	2.05
	PCT	2172

A LOCTA calculation was done using appropriate heatup rate burst curves and the results were:

$$F_Q = 2.05, \text{ PCT} = 2191^\circ\text{F}$$

Therefore, no safety problem exists.

PLANT (14)	MODEL	FEB. '78
	F_Q	2.32
	PCT	2124

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A LOCTA calculation was done using appropriate heatup rate burst curves and the results were:

$$F_Q = 2.32, PCT = 2192^{\circ}F$$

Therefore, no safety problem exists.

PLANT (15)	MODEL	FEB. '78
	F _Q	2.32
	PCT	2158

A LOCTA analysis was done using appropriate heatup rate burst curves and the results were:

$$F_Q = 2.32, PCT = 2200^{\circ}F$$

Therefore, no safety problem exists.

PLANTS (16) and (17)

The latest licensing analyses have been verified to use appropriate heatup rate burst curves and therefore remain valid.

PLANTS (18) and (19)

New LOCTA analyses were performed using appropriate heatup rate burst curves. The PCT was virtually unchanged. Therefore, no safety problem exists.

Based on the detailed information provided above, the Westinghouse Safety Review Committee concluded that two plants were found to require a reduction of 0.01 in allowable core peaking factor to maintain a PCT of 2200°F. Four other plants have current analyses to the October, 1975 version of the Westinghouse model and may require a peaking factor reduction. However, we believe that reanalyses with the most current Westinghouse LOCA/ECCS evaluation model (February, 1978) would show that no changes are necessary. That is, we believe margins available in this model will more than offset any effect associated with the change in the fuel clad burst curve. A copy of the NRC notification letter (NS-TMA-2158) regarding this issue is attached.

The above information was also presented to the NRC Staff at the November 13, 1979 meeting.

Following the November 1, 1979 meeting, Westinghouse has again reviewed the ORNL data quoted as a basis for NRC concern regarding adequacy of the W Appendix K blockage model. Comparison of individual rod burst strains from ORNL data to the corresponding Westinghouse data which has used as a basis for our blockage model indicates the ORNL data is in excellent agreement with the W data. Since the axial distribution of the burst strains in the ORNL multi rod burst test has

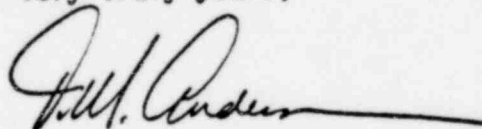
been shown by ORNL to conform to local temperature distributions in the specific heating rods used in the tests, conclusion as to the applicability of the axial distribution of bursts (which is the parameter that relates individual burst strain to flow blockage) cannot validly be made. Nevertheless, the blockages measured from the ORNL tests are similar to those calculated by the Westinghouse model, which has been approved by NRC, when due consideration is made in translating blockages measured in 4X4 bundles to blockages applicable to 15X15 or 17X17 rod fuel assemblies using accepted statistical techniques. Thus, we believe no immediate action is appropriate with respect to reanalysis of plants using the proposed NRC blockage model pending detailed review of the proposed model.

As a result of further investigation and evaluation, the following can be concluded:

- 1) A modification to the W model to account for the heatup rate dependence is necessary for compliance to Appendix K.
- 2) The impact of this modification is relatively small, effecting only two operating plants in terms of requiring peaking factor adjustments to meet the criteria of 10CFR50.46. The affected utilities and the NRC have been adequately informed.
- 3) Comparison of the Westinghouse data and ORNL data shows excellent agreement and the current Westinghouse model, in the range of interest, is still appropriate.

It is therefore concluded that no safety problem for Westinghouse plants has been identified and all plants are in conformance with NRC regulations since the burst temperature modifications (1 and 2 above) are accounted for.

Very truly yours,



T. M. Anderson, Manager
Nuclear Safety Department

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TABLE A

REVISION TO HEATUP RATES TRANSMITTED
IN LETTER NS-TMA-2147

<u>CASE</u>	<u>HEATUP RATE (°F/SEC)</u>	
	<u>HOT ROD</u>	<u>AUG OR ADJ ROD</u>
1)	8.5	10.9
2)	20.3	13.1
3)	25.6	18.0
4)	25.0	15.4
5)	31.5	19.4
6)	27.4	23.8
7)	(Not Westinghouse Fuel)	
8)	19.1	7.4
9)	12.3	12.0
10)	(Not Westinghouse Fuel)	
11)	6.2	11.3
12)	8.0	11.4
13)	18.3	15.1
14)	9.3	14.3
15)	8.2	13.8
16)	39.6	23.7
17)	43.2	26.7
18)	22.7	17.6
19)	26.5	16.7

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