WOLF CREEK
NUCLEAR OPERATING CORPORATION

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U. S. Nuclear Regulatory Commission
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Subject: Docket No. 50-482: 10 CFR 50.46 Thirty Day Report of ECCS Model Revisions

Gentlemen:

This letter describes significant revisions to the Emergency Core Cooling System (ECCS) Evaluation Models and the estimated effect on the limiting ECCS analysis for Wolf Creek Generating Station (WCGS). This letter is being submitted in accordance with the criteria and reporting requirements of 10 CFR 50.46(a)(3)(i) and (ii), as clarified in Section 5.1 of WCAP-13541, "Westinghouse Methodology for Implementation of 10 CFR 50.46 Reporting." The changes in calculated Peak Clad Temperature (PCT) due to the revisions of Westinghouse ECCS Evaluation Models are reportable per 10 CFR 50.46 guidelines as follows:

1. For Large Break LOCA, the net PCT effect due to Evaluation Model revisions is +16 degrees Fahrenheit (°F), for a net PCT of 1971.2°F, which remains less than the 10 CFR 50.46 limit of 2200°F.

2. For Small Break LOCA, the net PCT effect due to Evaluation Model revisions is 0°F, for a net PCT of 1570.6°F, which remains less than the 10 CFR 50.46 limit of 2200°F.

Attachment I describes the resolution of ECCS Evaluation Model issues and the impact of the ECCS Evaluation Model changes. Attachment II contains the calculated Large Break LOCA and Small Break LOCA PCT margin allocations resulting from the permanent changes to Evaluation Models. Since the PCT values determined in the Large Break and Small Break LOCA analysis of record, when combined with all PCT margin allocations, remain well below the 2200°F regulatory limit, no reanalysis will be performed.

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If you have any questions concerning this matter, please contact me at (316) 364-8831, extension 4553, or Mr. Richard Flannigan, at extension 4500.

Very truly yours,

Robert C. Hagan

RCH/jra

Attachments

cc: L. J. Callan (NRC), w/a
D. F. Kirsch (NRC), w/a
J. F. Ringwald (NRC), w/a
J. C. Stone (NRC), w/a

ATTACHMENT I

SIGNIFICANT CHANGES TO THE WESTINGHOUSE EMERGENCY CORE COOLING SYSTEM EVALUATION MODELS

Significant Changes to the Westinghouse Emergency Core Cooling System Evaluation Models

Background/Issue Description

Large Break LOCA analyses have been traditionally performed using a symmetric, chopped cosine, core axial power distribution. Under certain conditions, calculations have shown that there is a potential for top-skewed power distributions to result in Peak Cladding Temperatures (PCTs) greater than those calculated with chopped cosine axial power distributions. In 1991 Westinghouse developed a statistical methodology to evaluate and assure that the cosine distribution remains the limiting distribution. This methodology, Power Shape Sensitivity Model (PSSM), was submitted to the NRC for review and approval via Reference 1. This methodology has since been implemented on a forward-fit basis as part of the Large Break LOCA evaluation model in conducting new and reload safety evaluations.

In March 1993 and in November 1994, the NRC requested Westinghouse to provide information on the statistical approach and the treatment of uncertainty in PSSM. After the NRC's second request for information and subsequent discussion with the NRC, it became clear that PSSM would not be approved by the NRC without significant modifications. These modifications could have included adding a +100 degrees Fahrenheit (°F) PCT penalty to all Large Break LOCA analyses to account for model uncertainty and a revision to the PSSM database. As a result, Westinghouse determined that the potential penalties associated with these modifications out-weighed the benefits derived from PSSM. Although Westinghouse believed that PSSM was conservative without additional modifications, Westinghouse decided not to continue pursuing licensing of PSSM.

In March 1995, Westinghouse met with the NRC to discuss the Large Break LOCA axial power shape methodology issue. The intent of the meeting was two-fold: 1) to present the basis for safe continued operation for those plants currently using PSSM as part of their licensing basis and 2) to present an alternative axial power shape methodology which was based on explicit analysis with a set of skewed axial power shapes. The use of skewed power shapes in BASH had already been approved by the NRC as part of Westinghouse's Large Break LOCA Evaluation Model.

At the NRC meeting Westinghouse demonstrated to the NRC's satisfaction, using a previously licensed approach to determine bounding axial power shapes, that past plant operation which was based on PSSM met 10 CFR 50.46 criteria (i.e., PCT ≤ 2200°F). The NRC also concurred with Westinghouse that the alternative approach was similar to the approach defined in Westinghouse's approved Large Break LOCA Evaluation Model and therefore may not warrant consideration as an Evaluation Model change subject to NRC review and approval. Given the NRC's recognition of this alternative approach and the preliminary results, which demonstrated that most plants would not be subject to a PCT penalty, Westinghouse decided to continue development of the alternate methodology to replace PSSM.

Technical Evaluation

Development of an alternate axial power shape methodology, ESHAPE (Explicit Shape Analysis for PCT Effects), was completed in June 1995. The ESHAPE methodology is based on explicit analysis of the Large Break LOCA transient with a set of skewed axial power shapes to supplement the standard analysis done with the chopped cosine. Results of multiple plant calculations have shown that the limiting core axial power distribution is related to the time of PCT and that plants with long PCT times (> 100 seconds) are potentially limited by power shapes that are skewed to the top of the core. Based on on-going discussions and meetings with the NRC, Westinghouse considers the ESHAPE methodology to be an updated application of the approved methodology described in Reference 2. Submittal of ESHAPE for explicit NRC review and approval is therefore not anticipated.

On August 7, 1995, Westinghouse issued a letter to the NRC requesting that the PSSM be withdrawn and the ESHAPE Methodology be considered the standard for the Large Break LOCA 1981 BASH Evaluation Model (Reference 3). Westinghouse has requested the NRC to consider October 30, 1995 as the official withdrawal date for PSSM. This will provide a sufficient transition period to accommodate those plant licensees that are currently performing reload safety evaluations. During this transition period, plant licensees may use either PSSM or ESHAPE. After October 30, 1995, Westinghouse will no longer apply PSSM to future reload safety evaluations.

Using the ESHAPE methodology, Westinghouse has determined that plants with early PCT times (< 100 seconds) remain cosine shape limited and are not impacted by the change from PSSM to ESHAPE. For these plants, the current Large Break LOCA analyses of record remains valid and the Large Break LOCA PCT is unaffected as a result of this change. However, Westinghouse has determined that plants (including Wolf Creek Generating Station) with late PCT times (> 100 seconds) are impacted by the change from PSSM to ESHAPE. For these plants, a PCT penalty needs to be assessed as a result of the model change from PSSM to ESHAPE.

To reduce or eliminate the PCT penalty associated with the change from PSSM to ESHAPE, Westinghouse identified a "compensatory benefit," hot leg nozzle gap, that can be used to offset the effect of skewed power shapes. This benefit is obtained by taking credit for the gaps that exist between the reactor vessel and core barrel at the hot leg nozzle locations in the calculations. This hot leg gap model allows steam flow to the break in the latter phases of the Large Break LOCA transient making it effective for offsetting skewed power shape effects which occur in the same time period.

Investigation of this hot leg nozzle gap Evaluation Model feature has recently been undertaken as part of a Westinghouse Owners Group program on Hot Leg Switchover Elimination. As an off-shoot to this program, Westinghouse prepared and submitted Topical Report WCAP-14404, "Methodology for Incorporating Hot Leg Nozzle Gaps into BASH", dated June 1995, to the NRC for review and approval (Reference 4). Westinghouse informed the NRC that use of the hot leg nozzle gap flow is considered to be a permanent Evaluation Model change and will be incorporated on a forward-fit basis for future Large Break LOCA evaluations. Although use of the hot leg nozzle gap flow has not yet been approved by the NRC, Westinghouse believes that the NRC should ultimately approve use of the hot leg nozzle gap flow since it is a relatively straight forward and simple change to the approved Westinghouse Large Break LOCA Evaluation Model. In addition, Westinghouse is maintaining substantial conservatism in this methodology by modeling only single phase flow through the gap. As documented in WCAP-14404, Westinghouse has determined that single phase flow through the gap is conservative compared to two phase flow through the gap which is a more realistic assumption. Based on discussion with the NRC, no concerns have been expressed regarding the implementation of the hot leg nozzle gap model change for use on a forward-fit basis in conjunction with the approved Westinghouse Large Break LOCA Evaluation Model.

Affected Evaluation Model

1981 ECCS Large Break LOCA Evaluation Model with BASH

Estimated Effect

For Wolf Creek Generating Station, a plant specific assessment indicates that a PCT penalty of 152°F needs to be assessed as a result of the model change from PSSM to ESHAPE and a PCT benefit of 136°F can be gained by incorporating the hot leg nozzle gap model. For PCT margin tracking purposes, a net PCT change of +16°F has been assigned to these changes. Wolf Creek Generating Station continues to meet 10 CFR 50.46 requirements (i.e., PCT $\leq$ 2200°F) even without taking credit for hot leg nozzle gap flow.

References

1. WCAP-12909, "Westinghouse ECCS Evaluation Model: Revised Large Break LOCA Power Distribution Methodology," May 1991.

2. WCAP 10266-P-A, "The 1981 Version of the Westinghouse ECCS Evaluation Model Using the BASH Code," December 1987.

3. Westinghouse letter to the NRC, "Withdrawal of WCAP-12909-P on Power Shape Sensitivity Model (PSSM)," dated August 7, 1995.

4. Westinghouse letter NTD-NRC-95-4477, Transmittal of Topical Reports WCAP-14404-P and WCAP-14405-NP, "Methodology for Incorporating Hot Leg Nozzle Gaps into BASH," dated July 26, 1995.

ATTACHMENT II

ECCS EVALUATION MODEL
PEAK CLAD TEMPERATURE MARGIN ASSESSMENTS

***** Large Break LOCA PCT Margin Rack-Up Summary *****

A. ANALYSIS OF RECORD[1]

Evaluation Model:	1981 Evaluation Model with BASH
Peaking Factor:	F_{QT}=2.50, F_{DH}=1.65
SG Tube Plugging:	10 percent
Power Level/Fuel:	3565MW_t/17x17 V5H w/IFM, non-IFBA
Limiting transient:	C_D=0.4, Min. Safeguards, Reduced T_{avg}
Peak Cladding Temperature:	1916°F

B. PRIOR PERMANENT ECCS MODEL ASSESSMENTS	ΔPCT = -31°F
C. 10 CFR 50.59 EVALUATION	
1. RCS Loose Parts	ΔPCT = +20.2°F
D. 1995 10 CFR 50.46 MODEL ASSESSMENTS (Permanent Assessment of PCT Margin)	
1. Skewed Power Shape Penalty	ΔPCT = +152°F
2. Hot Leg Nozzle Gap Benefit	ΔPCT = -136°F
E. TEMPORARY USE OF PCT MARGIN	ΔPCT = 0°F
F. OTHER MARGIN ALLOCATIONS	
1. Transition Core (STD/V5H)	ΔPCT = +50°F[2]
2. Cold Leg Streaming Temperature Gradient	ΔPCT = 0°F[3]
NET PCT Result	**1971.2°F**

Notes:

1. Based on the reanalysis that was performed to support Wolf Creek Generating Station Rerate program. The results of the reanalysis have been reviewed and approved by the NRC.

2. Transition core penalty applies on a cycle-specific basis for reloads utilizing both V5H (with IFMs) and STD fuel until a full core of V5H is achieved.

3. A PCT benefit of < 2.5°F was assessed. For the purposes of tracking PCT, benefit of 0 degrees F has been assigned to this change.

***** Small Break LOCA PCT Margin Rack-Up Summary *****

A. ANALYSIS OF RECORD[1]

Evaluation Model:	1985 Evaluation Model with NOTRUMP
Peaking Factor:	FQT=2.50, F_{DH}=1.65
SG Tube Plugging:	10 percent
Power Level/Fuel:	3565MW_t/17x17 V5H w/IFM
Limiting transient:	3-inch Break

Peak Cladding Temperature:		1510°F
B. PRIOR PERMANENT ECCS MODEL ASSESSMENTS	ΔPCT =	-29°F
C. 10 CFR 50.59 EVALUATION		
1. RCS Loose Parts	ΔPCT =	+44.6°F
D. 1994 10 CFR 50.46 MODEL ASSESSMENTS (Permanent Assessment of PCT Margin)		
1. Boiling Heat Transfer Correction Error	ΔPCT =	-6°F
2. Steam Line Isolation Logic Error	ΔPCT =	+18°F
3. Axial Nodalization, RIP Model Revision and SBLOCTA Error Correction Analysis	ΔPCT =	+26°F[2]
E. TEMPORARY USE OF PCT MARGIN	ΔPCT =	0°F
F. OTHER MARGIN ALLOCATIONS		
2. Cold Leg Streaming Temperature Gradient	ΔPCT =	+7°F
NET PCT Result		**1570.6°F**

Notes:

1. Based on the reanalysis that was performed to support Wolf Creek Generating Station Rerate program. The results of the reanalysis have been reviewed and approved by the NRC.

2. Based on limiting case reanalysis with an axial offset limit of 20 percent.