10CFR50.46

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Refer to: RC-93-0158

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

Gentlemen:

Subject: VIRGIL C. SUMMER NUCLEAR STATION
DOCKET NO. 50/395
OPERATING LICENSE NO. NPF-12
ECCS EVALUATION MODEL REVISIONS REPORT (ANN 2300)

Attached is the annual Emergency Core Cooling System (ECCS) Evaluation Model Revisions Report for the Virgil C. Summer Nuclear Station (VCSNS). This report is pursuant to 10CFR50.46 which requires licensees to notify the NRC on at least an annual basis of errors or changes in the ECCS Evaluation Models. Westinghouse recently revised their program for providing 10CFR50.46 reporting information to licensees to put plants on the same reporting schedule. Therefore, SCE&G is providing this annual report prior to the December 1993 due date.

Tables 2 - 5 in the attachment summarize the changes in peak clad temperature from the previous analysis of record (i.e., the analysis of record from the last 10CFR50.46 report-Vantage + ZIRLO core, 20% Steam Generator tube plugging). None of the model changes is considered significant under 10CFR50.46.

As part of the contingency planning for Steam Generator tube inservice inspection, a new analysis of record was established which incorporated the reported model changes and 25% tube plugging. Tables 6 - 9 summarize the changes in peak clad temperature for the new analysis which is based on an acceptable evaluation model. The results of the analysis remain within the 10CFR50.46 limits. The VCSNS Final Safety Analysis Report will be updated to reflect the new analysis.

I declare that the statements and matters set forth herein are true and correct to the best of my knowledge, information, and belief.

If you have any questions, please call.

Very truly yours,

John L. Skolds

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Attachment

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CHANGES TO THE WESTINGHOUSE ECCS EVALUATION MODELS

INTRODUCTION

Provisions in 10CFR50.46 require the reporting of corrections to or changes in the ECCS Evaluation Model (EM) approved for use in performing safety analyses for the loss of coolant accident (LOCA). This report describes corrections and revisions to the Westinghouse ECCS EM as of April 30, 1993, which are applicable to V. C. Summer Nuclear Station (VCSNS). The current Westinghouse ECCS EMs are listed in Table 1, and consist of several computer codes with specific functions.

Westinghouse has completed the evaluation of several items related to the Westinghouse ECCS Evaluation Models listed in Table 1. Each of these items is discussed in the following sections, which include a description of the item, the assessment which was performed, the resulting change to the Evaluation Model, and the effect of the change on the Peak Clad Temperature (PCT).

TABLE 1
SUMMARY OF WESTINGHOUSE
ECCS EVALUATION MODELS
FOR VCSNS

NAME: 1981 MODEL WITH BASH

APPLICATION: Analysis of Large Break LOCA

CODES USED:	PURPOSE:
SATAN-VI	Blowdown hydraulic transient
BASH	Reflood hydraulic transient
LOCBART	Hot assembly thermohydraulics and fuel rod thermal transient
WREFLOOD/COCO/LOTIC	Containment pressure transient

NAME: 1985 SBLOCA MODEL

APPLICATION: Analysis of Small Break LOCA

CODES USED:	PURPOSE:
NOTRUMP	System Hydraulic transient
SBLOCTA	Fuel rod thermal transient

LOCA Evaluation Model Changes

Auxiliary Feedwater Flow Table Error

Background

The Steam Generator Auxiliary Feedwater (AFW) flowrate is governed by the timing variable TIMESG(I). A minor logic error associated with this variable was discovered which led to a step change in the AFW flowrate once the transient time passed the value of TIMESG(7). Typically, this value is set equal to 11000 seconds and so this error would only affect very long transient calculations. In addition, the nature of the error is to allow the AFW flowrate to immediately revert to the full value of the Main Feedwater flowrate. This enormous step change has led to code aborts in the cases where it has occurred.

This logic was corrected as a Discretionary Change as described in Section 4.1.1 of WCAP-13451. This determination is based on the fact that SBLOCA transients are generally terminated before the logic error can have an effect coupled with the codes lack of capability to handle the step change if it does occur. Therefore, it was reasoned that the logic could not affect LOCA results.

Affected Evaluation Models

1985 Small Break LOCA Evaluation Model

Estimated Effect

This error correction has no effect on any current or prior applications of the Evaluation Model.

Steam Generator Secondary Side Modeling Enhancements

Background

A set of related changes which make steam generator secondary side modeling more convenient for the user were implemented into NOTRUMP. This model improvement involved several facets of feedwater flow modeling. First, the common donor boundary node for the standard Evaluation Model nodalization has been separated into two identical boundary nodes. These donor nodes are used to set the feedwater enthalpy. The common donor node configuration did not allow for loop specific enthalpy changeover times in cases where asymmetric AFW flowrates or purge volumes were being modeled for plant specific sensitivities.

The second improvement is the additional capability to initiate main feedwater isolation on either loss of offsite power coincident with reactor trip (low pressurizer pressure) or alternatively on safety injection signal (low-low pressurizer pressure). The previous model allowed this function only on loss of offsite power coincident with reactor trip. The auxiliary feedwater pumps are still assumed to start after a loss of offsite power with an appropriate delay time to model diesel generator start-up and bus loading times.

The final improvement is in the area of modeling the purging of high enthalpy main feedwater after auxiliary feedwater is calculated to start. This was previously modeled through an approximate time delay necessary to purge the lines of the high enthalpy main feedwater before credit could be taken for the much lower enthalpy auxiliary feedwater reaching the steam generator secondary. This time delay was a function of the plant specific purge volume and the auxiliary feedwater flowrate. The new modeling allows the user to input the purge volume directly. This then is used together with the code calculated integrated feedwater flow to determine the appropriate time at which the feedwater enthalpy can be assumed to change.

These improvements are considered to be a Discretionary Change as described in Section 4.1.1 of WCAP-13451. Since they involve only enhancements to the capabilities and usability of the Evaluation Model, and not changes to results calculated consistently with the previous model, these changes were implemented without prior review as discussed in Section 4.1.1 of WCAP-13451.

Affected Evaluation Models

1985 Small Break LOCA Evaluation Model

Estimated Effect

Because these enhancements only allow greater ease in modeling plant specific steam generator secondary side behavior over the previous model, it is estimated that no effect will be seen in Evaluation Model calculations.

Structural Metal Heat Modeling

Background

A discrepancy was discovered during review of the finite element heat conduction model used in the WREFLOOD-INTERIM code to calculate heat transfer from structural metal in the vessel during the reflood phase. It was noted that the material properties available in the code corresponded to those of stainless steel. While this is correct for the internal structures, it is inappropriate for the vessel wall which consists of carbon steel with a thin stainless internal clad. This was defined as a non-discretionary change per Section 4.1.2 of WCAP-13451, since there was thought to be potential for increased PCT with a more sophisticated composite model. The model was revised by replacing it with a more flexible one that allows detailed specification of structures.

Affected Evaluation Models

1981 ECCS Evaluation Model with BASH

Affected Codes

WREFLOOD-INTERIM

Estimated Effects

The estimated effect of this correction is a 25°F PCT benefit.

Spacer Grid Heat Transfer Error in BART

Background

During investigations into anomolous wetting and dryout behavior demonstrated by the BART grid model a programming logic error was discovered in the grid heat transfer model. The error caused the solution to be performed twice for each timestep. The error was traced back to the original coding used in all of the BART and LOCBART codes. This was defined as a non-discretionary change per Section 4.1.2 of WCAP-13451. The error was corrected, and a complete reverification of the grid model was conducted and transmitted to the NRC (WCAP-10484, Addendum 1).

Affected Evaluation Models

1981 ECCS Evaluation Model with BASH

Affected Codes

BART
LOCBART

Estimated Effects

Calculations performed with the affected code have consistently demonstrated significantly better grid wetting and lower clad temperatures. A conservative estimate of zero degrees PCT penalty has been assigned for this issue.

TABLE 2

Small Break Peak Clad Temperature Margin Utilization

Revision Date: 1/18/93

Plant Name: Virgil C. Summer (CGE) Eval. Model: NOTRUMP Fuel: Vantage +
Utility Name: South Carolina Electric & Gas FQ = 2.45 FΔH = 1.62 SGTP = 20%

		Reference *	Clad Temperature		Notes
A.	ANALYSIS OF RECORD (12/90)	1	PCT=	2007°F	
B.	PRIOR PERMANENT ECCS MODEL ASSESSMENTS	1	ΔPCT=	0°F	
C.	10 CFR 50.59 SAFETY EVALUATIONS	Table 4	ΔPCT=	0°F	
D.	1992 10 CFR 50.46 MODEL ASSESSMENTS (Permanent Assessment of PCT Margin)				
	1. SB-LOCA Steam Generator Secondary Modeling		ΔPCT=	0°F	1
E.	TEMPORARY ECCS MODEL ISSUES				
	1. None		ΔPCT=	0°F	
F.	OTHER MARGIN ALLOCATIONS				
	1. None		ΔPCT=	0°F	
	LICENSING BASIS PCT + MARGIN ALLOCATIONS		PCT=	2007°F	

* References for the Peak Clad Temperature Margin Utilization summary can be found in Table 5.

Notes:

1. Reference 2 assigns a 49°F penalty for this issue. However, it has since been determined that no penalty is associated with the SB-LOCA Steam Generator Secondary Model Issue.

TABLE 3

Large Break Peak Clad Temperature Margin Utilization

Revision Date: 1/18/93

Plant Name: Virgil C. Summer (CGE) Eval. Model: BASH Fuel: Vantage +
Utility Name: South Carolina Electric & Gas FQ = 2.45 FΔH = 1.62 SGTP = 20%

		Reference *	Clad Temperature		Notes
A.	ANALYSIS OF RECORD (12/90)	1	PCT=	2105°F	
B.	PRIOR PERMANENT ECCS MODEL ASSESSMENTS	1	ΔPCT=	11°F	
C.	10 CFR 50.59 SAFETY EVALUATIONS	Table 4	ΔPCT=	0°F	
D.	1992 10 CFR 50.46 MODEL ASSESSMENTS (Permanent Assessment of PCT Margin)				
	1. Structural Metal Heat Modeling		ΔPCT=	-25°F	
E.	TEMPORARY ECCS MODEL ISSUES				
	1. Spacer Grid Heat Transfer Error in BART		ΔPCT=	0°F	
	2. BOL Rod Internal Pressure Uncertainty		ΔPCT=	2°F	
F.	OTHER MARGIN ALLOCATIONS				
	1. None		ΔPCT=	0°F	
	LICENSING BASIS PCT + MARGIN ALLOCATIONS		**PCT=**	**2093°F**	

* References for the Peak Clad Temperature Margin Utilization summaries can be found in Table 5.

TABLE 4 - 10 CFR 50.59 Safety Evaluations

Revision Date: 1/18/93

Plant Name: Virgil C. Summer (CGE)
Utility Name: South Carolina Electric & Gas

	Reference	Clad Temperature		Notes
I. SMALL BREAK ECCS SAFETY EVALUATIONS				
A. None		ΔPCT=	0°F	
TOTAL 10 CFR 50.59 SMALL BREAK ASSESSMENTS		PCT=	0°F	
II. LARGE BREAK ECCS SAFETY EVALUATIONS				
A. None		ΔPCT=	0°F	
TOTAL 10 CFR 50.59 SMALL BREAK ASSESSMENTS		PCT=	0°F	

TABLE 5 - References

1. CGE-92-120, "South Carolina Electric & Gas Company, V. C. Summer, ECCS Evaluation Model Changes," December 1992.

2. CGE-92-078, "South Carolina Electric & Gas, Virgil C. Summer Nuclear Station, 18% Steam Generator Tube Plugging Safety Evaluation," August 1992.

TABLE 6

Small Break Peak Clad Temperature Margin Utilization

Revision Date: 4/30/93

Plant Name: Virgil C. Summer (CGE) Eval. Model: NOTRUMP Fuel: Vantage +
Utility Name: South Carolina Electric & Gas FQ = 2.45 FΔH = 1.62 SGTP = 25%

		Reference *	Clad Temperature		Notes
A.	ANALYSIS OF RECORD (2/93)	1	PCT=	1948°F	
B.	PRIOR PERMANENT ECCS MODEL ASSESSMENTS		ΔPCT=	0°F	
C.	10 CFR 50.59 SAFETY EVALUATIONS	Table 8	ΔPCT=	1°F	
D.	1992 10 CFR 50.46 MODEL ASSESSMENTS (Permanent Assessment of PCT Margin)				
	1. None		ΔPCT=	0°F	
E.	TEMPORARY ECCS MODEL ISSUES				
	1. Small Break LOCA Burst and Blockage/Time in Life		ΔPCT=	144°F	
F.	OTHER MARGIN ALLOCATIONS				
	1. None		ΔPCT=	0°F	
	LICENSING BASIS PCT + MARGIN ALLOCATIONS		PCT=	2093°F	

* References for the Peak Clad Temperature Margin Utilization summary can be found in Table 9.

TABLE 7

Large Break Peak Clad Temperature Margin Utilization

Revision Date: 4/30/93

Plant Name: Virgil C. Summer (CGE) Eval. Model: BASH Fuel: Vantage +
Utility Name: South Carolina Electric & Gas FQ = 2.45 FΔH = 1.62 SGTP = 25%

		Reference *	Clad Temperature		Notes
A.	ANALYSIS OF RECORD (3/93)	1	PCT=	2195°F	
B.	PRIOR PERMANENT ECCS MODEL ASSESSMENTS		ΔPCT=	0°F	
C.	10 CFR 50.59 SAFETY EVALUATIONS	Table 8	ΔPCT=	2°F	
D.	1992 10 CFR 50.46 MODEL ASSESSMENTS (Permanent Assessment of PCT Margin)				
	1. None		ΔPCT=	0°F	
E.	TEMPORARY ECCS MODEL ISSUES				
	1. None		ΔPCT=	0°F	
F.	OTHER MARGIN ALLOCATIONS				
	1. None		ΔPCT=	0°F	
	LICENSING BASIS PCT + MARGIN ALLOCATIONS		**PCT=**	**2197°F**	

* References for the Peak Clad Temperature Margin Utilization summaries can be found in Table 9.

TABLE 8 - 10 CFR 50.59 Safety Evaluations

Revision Date: 4/30/93

Plant Name: Virgil C. Summer (CGE)
Utility Name: South Carolina Electric & Gas

	Reference	Clad Temperature		Notes
I. SMALL BREAK ECCS SAFETY EVALUATIONS				
A. Fuel Reconstitution		ΔPCT=	1°F	
TOTAL 10 CFR 50.59 SMALL BREAK ASSESSMENTS		PCT=	1°F	
II. LARGE BREAK ECCS SAFETY EVALUATIONS				
A. Fuel Reconstitution		ΔPCT=	2°F	
TOTAL 10 CFR 50.59 LARGE BREAK ASSESSMENTS		PCT=	2°F	

TABLE 9 - References

1. CGE-93-0065, "South Carolina Electric & Gas Company, Virgil C. Summer Nuclear Station, Margin Broker Program Results: Large Break & Small Break LOCA Sensitivities for 25% Steam Generator Tube Plugging," March 3, 1993.