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May 18, 1995
LIC-95-0107

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, DC 20555

- References:
1. Docket No. 50-285
 2. WCAP-13027-P, "Westinghouse ECCS Evaluation Model for Analysis of CE-NSSS," dated July 1991
 3. WCAP-13451, "Westinghouse Methodology for Implementation of 10 CFR 50.46 Reporting," dated October 1992
 4. WCAP-10054-P, Addendum 2, "Addendum to the Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code: Safety Injection into the Broken Loop and COSI Condensation Model," dated August, 1994
 5. Letter from OPPD (T. L. Patterson) to NRC (Document Control Desk) dated December 2, 1994 (LIC-94-0206)

SUBJECT: Annual Report for 1994 Loss of Coolant Accident (LOCA)/Emergency Core Cooling System (ECCS) Models

In accordance with 10 CFR 50.46(a)(3)(ii), the Omaha Public Power District (OPPD) is submitting the annual 10 CFR 50.46 summary report for 1994. In Reference 5, OPPD provided notification of significant errors (as defined in 10 CFR 50.46(a)(3)(i)) in the ECCS evaluation pursuant to 10 CFR 50.46(a)(3)(ii). This summary report updates all identified changes or errors in the LOCA/ECCS codes and methods used by Westinghouse Electric Corporation (W) to model Fort Calhoun Station (FCS) Unit No. 1. Reference 2 describes the methodology utilized by W to model Combustion Engineering plants, such as FCS.

Beyond the Reference 5 errors previously reported, Westinghouse identified three additional errors and six changes in the ECCS evaluation for 1994. Attachment 1 contains the two errors and two changes identified using the NOTRUMP code for the small break LOCA (SBLOCA) analysis. Attachment 2 includes the one error and four changes identified using the BASH code for the large break LOCA (LBLOCA) analysis.

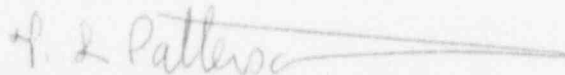
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In conclusion, the cumulative errors/changes identified or implemented through 1994 (by Reference 5 and this notification) result in a net reduction of 34°F peak clad temperature (PCT) for the SBLOCA analysis and no change in PCT for the LBLOCA analysis. The resultant SBLOCA PCT still remains less than the 10 CFR 50.46(b)(1) acceptance criteria of 2200°F. Attachment 3 summarizes the small break LOCA/ECCS PCT margin utilization and the large break LOCA/ECCS PCT margin utilization.

If you should have any questions, please contact me.

Sincerely,



T. L. Patterson
Division Manager
Nuclear Operations

TLP/d11

Attachments

c: Winston & Strawn
L. J. Callan, NRC Regional Administrator, Region IV
T. Y. Liu, NRC Acting Project Manager
W. C. Walker, NRC Senior Resident Inspector

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Attachment 1

**SMALL BREAK LOCA ANALYSIS
(NOTRUMP) CHANGES AND ERRORS**

NOTRUMP Changes and Errors

Pressure Search Convergence Criteria in NOTRUMP

The convergence criteria used during the pressure search in NOTRUMP (the small break LOCA analysis code) were found in some cases to be inadequately restrictive to ensure a sufficiently accurate value for Fluid Node pressure when conditions approach the boundary between subcooled and saturated. The resulting effects on predicted pressure were more pronounced at pressures below those normally seen during standard Evaluation Model calculations. The previous hardwired convergence criteria values were changed to be a user input; appropriate values have been determined and these will be implemented in all future analyses.

This was determined to be a Non-Discretionary Change as described in Section 4.1.2 of WCAP-13451 (Reference 3) and was corrected in accordance with Section 4.1.3 of this report.

Estimated Effect

This error led to an estimated generic PCT effect of 0 °F for existing analyses.

Friction Value Input Corrections

An error was found in the SPADES code which involved the values assigned to some of the friction factor input. The SPADES code is used to generate input decks for the small break analysis code, NOTRUMP. The erroneous values had no impact on transient calculations and were corrected in order to maintain the consistency of the SPADES code with the relevant documentation.

These errors were determined to be discretionary changes as described in Section 4.1.1 of WCAP-13451 (Reference 3) and were corrected in accordance with Section 4.1.3 of this report.

Estimated Effect

Representative plant calculations indicate no effect on PCT analyses.

Automatic Containment Spray Actuation During SBLOCA

Automatic containment spray actuation during a SBLOCA had not previously been addressed in the W SBLOCA evaluation model. The containment pressure transient is not modeled because the small break LOCA PCT is not directly sensitive to this effect. Westinghouse has concluded that containment spray actuation early in the small break transient is possible for a variety of containment types.

Estimated Effect

Plant-specific evaluations of affected plants currently indicate no PCT effect due to safety injection (SI) interruption or reduction following switchover to cold leg recirculation.

Safety Injection in the Broken Loop

Reference 4 presents a change to the W SBLOCA methodology dealing with ECCS flows in the broken loop. It also presents a revised condensation model that will be used on the SI jet in future analyses. This change is being implemented on a forward-fit basis prior to formal approval in accordance with Section 4.1.3 of WCAP-13451 (Reference 3).

Estimated Effect

This change has been shown to typically produce PCT benefits in studies presented in Reference 4. Since it is being implemented on a forward-fit basis, a net PCT impact of 0°F is being assessed against existing analyses.

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Attachment 2

**LARGE BREAK LOCA ANALYSIS
(BASH) CHANGES AND ERRORS**

BASH Changes and Errors

Code Stream Improvement

Revisions were made to the procedures used to interface the various codes that comprise the entire execution stream for performing a large break LOCA (LBLOCA) analysis with the BASH Evaluation Model. This revision was made only as a process improvement for conducting analyses, and involved no changes to the approved physical models or basic solution techniques governing the solutions provided by the individual computer codes.

Estimated Effect

Since this methodology is a process improvement, which is to be implemented on a forward-fit basis, there are no effects on existing analyses; any small effects on results will be implicitly accounted for in future analyses.

BASH: Loop/Core Interface Corrections

Changes were made in the logic for interfacing the loop model and the BART code model. One correction prevents the possibility of an occasional inconsistency in how the core timestep was limited by the loop timestep. Another change corrects the fluid density used in the interface calculation when the inlet flowrate is negative.

Estimated Effect

Sensitivity studies for both corrections demonstrated negligible perturbations in the trends of the system parameters with a relatively minor net effect on peak clad temperature (PCT) predictions. As this is an extremely small effect with no apparent bias, the net effect on existing analyses is estimated to be 0°F for margin tracking purposes. This change has been implemented on a forward-fit basis only and will be incorporated implicitly in future analyses.

Improvements to Flooding Rate Smoothing

Included in the approved methodology for performing LBLOCA analyses with the BASH evaluation model is the requirement that the core inlet flooding rate calculated by the BASH code be linearized in a piece-wise manner to remove oscillations prior to use in the hot channel fuel rod calculation. This operation is known as smoothing, and guidelines are provided to the analysts describing how to linearize the curve by observing inflections in the overall flooding rate. The logic for this operation has been coded into a program called SMUUTH. A new version of the SMUUTH program has been implemented which incorporates improved logic for determining the inflection points; the improvements were gained through experience in utilizing the program for a broad range of plant transients.

Estimated Effect

There are no effects on predicted results from using the new program version.

Accumulator Water Temperature

The choice of accumulator water temperature can affect the calculated PCT associated with LBLOCA analyses. Westinghouse has discovered through sensitivity studies that there is a 1.3°F change in PCT for a 1°F change in accumulator water temperature when the accumulator water temperature varies over a range from 90°F to 120°F. Application of this sensitivity over its applicable range results in a PCT effect which is below the 10 CFR 50.46 threshold for determination of a significant change (i.e., less than 50°F). Therefore, immediate implementation of this new methodology is not required.

Estimated Effect

Since accumulator water temperatures are expected to vary greatly during plant operation and are difficult to measure directly, the plant-specific effect of this new methodology may only be assessed once detailed accumulator water temperature data are available. As such, it is expected that these data will be provided when implementation of the new methodology occurs at the initiation of future plant-specific LBLOCA analyses.

Pellet Power Radial Flux Depression Error

An incorrect sign error was discovered and corrected in a subroutine that calculates radial distribution power factors in the fuel pellet for the LOCBART code.

Estimated Effect

Sensitivity studies found the error correction to result in less than a $\pm 0.1^{\circ}\text{F}$ effect on predicted PCT. Therefore, the net effect on existing analyses is 0°F for margin tracking purposes, and will be implicitly included in future recalculations.

1994 SMALL BREAK PEAK CLAD TEMPERATURE MARGIN UTILIZATION
FORT CALHOUN STATION UNIT NO. 1

	<u>CLAD TEMPERATURE</u>
A. Analysis of Record (8/91)	PCT = 1444°F
B. Prior Permanent ECCS Model Assessments (Includes Reference 5 Assessments)	Δ PCT = -34°F
C. 10 CFR 50.59 Safety Evaluations	Δ PCT = 0°F
D. 10 CFR 50.46 Model Assessments this Update (Permanent Assessment of PCT Margin) - None	Δ PCT = 0°F
E. Temporary ECCS Model Issues - None	Δ PCT = 0°F
F. Other Margin Allocations - None	Δ PCT = 0°F
LICENSING BASIS PCT + MARGIN ALLOCATIONS	PCT = 1410°F

1994 LARGE BREAK PEAK CLAD TEMPERATURE MARGIN UTILIZATION
FORT CALHOUN STATION UNIT NO. 1

	<u>CLAD TEMPERATURE</u>
A. Analysis of Record (8/91)	PCT = 2066°F
B. Prior Permanent ECCS Model Assessments	Δ PCT = -25°F
C. 10 CFR 50.59 Safety Evaluations	Δ PCT = 0°F
D. 1994 10 CFR 50.46 Model Assessments (Permanent Assessment of PCT Margin) - None	Δ PCT = 0°F
E. Temporary ECCS Model Issues - None	Δ PCT = 0°F
F. Other Margin Allocations - None	Δ PCT = 0°F
LICENSING BASIS PCT + MARGIN ALLOCATIONS	PCT = 2041°F