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SUBJECT: Provides annual rept of LOCA evaluation model changes, per  
 10CFR50.46(a)(3)(ii).

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March 24, 1995

AEP:NRC:1118I

Docket Nos.: 50-315  
50-316

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

Gentlemen:

Donald C. Cook Nuclear Plant Units 1 and 2  
ANNUAL REPORT OF LOCA EVALUATION MODEL CHANGES

Pursuant to the requirements of 10 CFR 50.46(a)(3)(ii), this letter provides our annual submittal of LOCA model changes.

Attachment 1, which was provided to us by Westinghouse Electric Corporation (Westinghouse), describes LOCA model changes which have been permanently implemented and provides a discussion in general terms of the impact of these changes on calculated peak clad temperatures (PCT's).

Attachment 2 contains the peak clad temperatures calculated specifically for Donald C. Cook Nuclear Plant Units 1 and 2. The calculated SBLOCA PCT's are identical to those contained in our previous submittal (AEP:NRC:1118H, dated December 16, 1994).

The Unit 1 calculated LBLOCA PCT's have not changed since our previous 10CFR50.46 annual report (AEP:NRC:1118E, dated March 25, 1994). A 50°F penalty that was being carried for the Unit 2 LBLOCA PCT's has been removed, since the entire core is now Westinghouse Vantage 5 fuel. Previously, Unit 2 contained fuel manufactured by both Siemen's Power Corporation and Westinghouse. The 50°F penalty had been assessed to account for this mixture of fuel types.

In all cases, the calculated peak clad temperatures remain within the 10 CFR 50.46 limit of 2200°F.

The plan for revising the Unit 1 cross-ties open SBLOCA run, discussed in our letter designated AEP:NRC:1118G, has been delayed several months to ensure that the calculation was made with the most recent code revision. This calculation has been completed and is being reviewed. Current plans also include both LBLOCA and SBLOCA reanalyses in conjunction with evaluations and analyses to support an increase in allowable steam generator tube plugging (SGTP) for Unit 1. The accumulator temperature for these analyses was revised as

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discussed in Attachment 1. This work is tentatively planned to be complete and submitted to the staff by June 1995.

New LBLOCA and SBLOCA analyses of record for Unit 2 will be included as part of a planned uprating effort. A revised accumulator temperature is also planned for Unit 2 in the uprating analyses. The submission of the results of these new Unit 2 analyses is planned for 1996.

Sincerely,

*for*   
E. E. Fitzpatrick  
Vice President

slc

Attachments

cc: A. A. Blind  
G. Charnoff  
J. B. Martin  
NFEM Section Chief  
NRC Resident Inspector - Bridgman  
J. R. Padgett

ATTACHMENT 1 TO AEP:NRC:1118I

WESTINGHOUSE ELECTRIC CORPORATION

DESCRIPTION OF LOCA MODEL CHANGES

## **PRESSURE SEARCH CONVERGENCE CRITERIA IN NOTRUMP**

### **Background**

The convergence criteria used during the pressure search in NOTRUMP have been found to not be adequately restrictive to ensure a sufficiently accurate value for Fluid Node pressure when conditions approach the boundary between subcooled and saturated in some cases. The resulting effects on predicted pressure were more pronounced at pressures below those normally seen during standard Evaluation Model calculations. The previously hardwired convergence criteria values have been made 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 and was corrected in accordance with Section 4.1.3 of WCAP-13451.

### **Affected Evaluation Model**

1985 SBLOCA Evaluation Model (NOTRUMP)

### **Estimated Effect**

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



## PELLET POWER RADIAL FLUX DEPRESSION ERROR

### Background

A coding error (an incorrect sign) was discovered and corrected in a subroutine that calculates radial distribution power factors in the fuel pellet for the LOCBART code.

### Affected Evaluation Models

1981 ECCS LBLOCA Evaluation Model with BASH

### Estimated Effect

Sensitivity studies found the error correction to result in less than a  $\pm 0.1^{\circ}\text{F}$  effect on predicted peak clad temperature. The net effect on existing analyses is therefore zero degrees for margin tracking purposes, and will be implicitly included in future recalculations.





## ACCUMULATOR WATER TEMPERATURE

### Background

The choice of accumulator water temperature can affect the calculated Peak Cladding Temperature (PCT) associated with large break LOCA analyses. Early Westinghouse Evaluation Models had assumed a generic value of 90°F for the accumulator water temperature based on a conservatively low value of containment air temperature at 100% power in fulfillment of the Appendix K requirements associated with the calculation of a low containment back-pressure. These containment initial temperature and pressure assumptions in a plant's LBLOCA analysis have been consistently reported to the NRC in the Final Safety Analysis Report. The NRC had previously reviewed and approved this aspect of the LBLOCA Evaluation Model via plant specific Safety Evaluation Reports. Using these assumptions, and with the early Westinghouse models, 90°F was conservative with respect to the overall effect on large break LOCA PCT.

Newer evaluation models have demonstrated that a higher containment air temperature, coupled with higher accumulator water temperatures, may result in an even more conservative calculation for PCT, even if containment pressure is slightly higher than calculated with the 90°F assumption. Sensitivity studies performed with these newer evaluation models (identified below) have shown a small sensitivity to accumulator water temperature. The effect on PCT was 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., <50°F). It is therefore Westinghouse's position that immediate implementation of this new methodology is not required. As such, application of the new plant specific methodology and associated change in analysis assumptions can be forward-fit to new large break LOCA analyses. This position was previously communicated to utilities in July, 1994 (NSAL Reference 3).

In support of future analyses, Westinghouse has developed a set of criteria for selection of the accumulator water temperature for use in large break LOCA analyses which use either the 1981 Evaluation Model with BART or the 1981 Evaluation Model with BASH. These criteria will be provided to the plant licensees at the time a new large break LOCA analysis is performed.

### Affected Evaluation Models

Westinghouse 1981 Large Break Evaluation Model using BART  
Westinghouse 1981 Large Break Evaluation Model using BASH

### Estimated Effect

As stated above, the estimated effect of a change in the accumulator water temperature methodology over a range from 90°F to 120°F is a 1.3°F change in PCT for a 1°F change in accumulator water temperature. As 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.

ATTACHMENT 2 TO AEP:NRG:11181

WESTINGHOUSE ELECTRIC CORPORATION

DETERMINATION OF EFFECT OF LOCA MODEL CHANGES ON

COOK NUCLEAR PLANT LOCA ANALYSES

## LARGE BREAK LOCA

PLANT NAME: Donald C. Cook Unit 1

Comments: Evaluation Model: BASH, FQT=2.15, FdH=1.55, SGTP=15%,  
Other: RHR Cross Tie Valve Closed, 3250MWt Reactor Power

A.	ANALYSIS OF RECORD	PCT= <u>2162</u> °F
B.	PRIOR LOCA MODEL ASSESSMENTS - 1989	$\Delta$ PCT= <u>+</u> <u>0</u> °F
C.	PRIOR LOCA MODEL ASSESSMENT - 1990	$\Delta$ PCT= <u>+</u> <u>0</u> °F
D.	PRIOR LOCA MODEL ASSESSMENTS - 1991	$\Delta$ PCT= <u>+</u> <u>20</u> °F
E.	PRIOR LOCA MODEL ASSESSMENTS - 1992	$\Delta$ PCT= <u>-117</u> °F
F.	PRIOR LOCA MODEL ASSESSMENTS - 1993	$\Delta$ PCT= <u>-6</u> °F
G.	1994 10CFR50.46 MODEL ASSESSMENTS	$\Delta$ PCT= <u>0</u> °F
H.	LICENSING BASIS PCT + PERMANENT ASSESSMENTS	PCT= <u>2059</u> °F

## LARGE BREAK LOCA

PLANT NAME: DONALD C. COOK UNIT 1

Comments: Evaluation Model: BASH, FQT=2.15, FdH=1.55, SGTP=15%,  
Other: RHR Cross Tie Valve Open, 3413 MWt Reactor Power

A.	ANALYSIS OF RECORD	PCT= <u>2181</u> °F
B.	PRIOR LOCA MODEL ASSESSMENTS - 1989	ΔPCT= <u>+</u> <u>0</u> °F
C.	PRIOR LOCA MODEL ASSESSMENTS - 1990	ΔPCT= <u>+</u> <u>0</u> °F
D.	PRIOR LOCA MODEL ASSESSMENTS - 1991	ΔPCT= <u>+</u> <u>30</u> °F
E.	PRIOR LOCA MODEL ASSESSMENTS - 1992	ΔPCT= <u>-25</u> °F
F.	PRIOR LOCA MODEL ASSESSMENTS - 1993	ΔPCT= <u>-6</u> °F
G.	1994 10CFR50.46 MODEL ASSESSMENTS	ΔPCT= <u>0</u> °F
H.	OTHER MARGIN ALLOCATIONS (Use of PCT Margin):	
1.	ANALYSIS MARGINS USED: Power Margin	ΔPCT= <u>-94</u> °F
I.	LICENSING BASIS PCT + PERMANENT ASSESSMENTS & POWER MARGIN	PCT= <u>2086</u> °F

JUSTIFICATION FOR USE OF POWER MARGIN  
IN DONALD C. COOK NUCLEAR PLANT UNIT 1 LARGE BREAK PCT RACK UP

The analysis peak clad temperature (PCT) for Donald C. Cook Unit 1 at 3413 MW<sub>t</sub> with the RHR cross tie valve open is 2181°F. When the 1991 LOCA model assessment of 30°F was added, the resulting PCT exceeded 2200°F. The following calculation shows that power margin exists for Cook Nuclear Plant Unit 1 since the core is currently licensed at 3250 MW<sub>t</sub> versus the analysis power level of 3413 MW<sub>t</sub>.

A sensitivity to power was previously determined for the Donald C. Cook Nuclear Plant Unit 2 large break analysis. It was conservatively demonstrated that a reduction of 20°F<sub>PCT</sub>/ % Power could be applied for reduced power. This sensitivity is conservative since it only accounts for the assumed power reduction in the LOCBART run. A similar reduction in the assumed power for the SATAN run produces an added benefit to PCT during the blowdown portion of the transient. A reduction in power in the blowdown portion of the transient (i.e., SATAN) would be an added benefit which was not accounted for in this sensitivity. Since both Cook Nuclear Plant Unit 1 and Unit 2 are 4 loop ice condenser plants, this sensitivity will be applied to the reduction in power from the Unit 1 analysis power of 3413 MW<sub>t</sub> to the licensed operating condition of 3250 MW<sub>t</sub> (a 4.7% reduction in power):

$$(20^{\circ}\text{F}_{\text{PCT}}/\% \text{ Power}) (4.7\% \text{ Power}) = 94^{\circ}\text{F}$$

When this 94°F margin is applied to the Unit 1, 3413 MW<sub>t</sub> analysis with RHR cross tie valves open, the 10 CFR 50.46 PCT limit is not exceeded.

## SMALL BREAK LOCA

PLANT NAME: DONALD C. COOK NUCLEAR PLANT UNIT 1

Comments: Evaluation Model: <u>NOTRUMP</u> , FQ= <u>2.32</u> , F&H= <u>1.55</u> , SGTP= <u>15%</u> Other: HHSI Cross Tie Valve <u>Closed</u> , <u>3250</u> MWt Reactor Power
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A.	ANALYSIS OF RECORD	PCT= <u>1951</u> °F
B.	PRIOR LOCA MODEL ASSESSMENTS - 1992	ΔPCT= + <u>3</u> °F <sup>1</sup>
C.	PRIOR LOCA MODEL ASSESSMENTS - March 1994	ΔPCT= <u>-16</u> °F
D.	PRIOR LOCA MODEL ASSESSMENTS - December 1994	ΔPCT= <u>-223</u> °F
E.	Burst and Blockage/Time in Life	ΔPCT= + <u>15</u> °F <sup>2</sup>
E.	LICENSING BASIS PCT + PERMANENT ASSESSMENTS	PCT= <u>1730</u> °F

1. The 1992 assessment for 15x15 hydraulic test results was not included in the new analysis of record. However, the drift flux flow regime error was incorporated.
2. It should be noted that the burst and blockage assessment is subject to change as other model assessments are made because the magnitude of the burst and blockage assessments depends on the PCT without burst and blockage.

## SMALL BREAK LOCA

PLANT NAME: DONALD C. COOK NUCLEAR PLANT UNIT 1

Comments: Evaluation Model: <u>NOTRUMP</u> , FQ= <u>2.32</u> , FΔH= <u>1.55</u> , SGTP= <u>15</u> % Other: HHSI Cross Tie Valve <u>Open</u> , <u>3588</u> MWt Reactor Power
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A.	ANALYSIS OF RECORD	PCT= <u>1570</u> °F
B.	PRIOR LOCA MODEL ASSESSMENTS - October 1993	ΔPCT= <u>-13</u> °F
C.	PRIOR LOCA MODEL ASSESSMENTS - January 1994	ΔPCT= <u>+ 97</u> °F
D.	PRIOR LOCA MODEL ASSESSMENTS - March 1994	ΔPCT= <u>-16</u> °F
E.	PRIOR LOCA MODEL ASSESSMENTS - December 1994	ΔPCT= <u>-86</u> °F
F.	LICENSING BASIS PCT + PERMANENT ASSESSMENTS	PCT= <u>1552</u> °F



## LARGE BREAK LOCA

PLANT NAME: DONALD C. COOK NUCLEAR PLANT UNIT 2

Comments: Evaluation Model: BASH, FQT=2.335, FdH=1.644, SGTP=15%,  
Other: RHR Cross Tie Valve Closed, 3413 MWt Reactor Power

A.	ANALYSIS OF RECORD	PCT= <u>2090</u> °F
B.	PRIOR LOCA MODEL ASSESSMENTS - 1989 (Analysis of record was completed in January 1990. No prior LOCA Model assessments were made.)	ΔPCT= <u>+</u> <u>NA</u> °F
C.	PRIOR LOCA MODEL ASSESSMENTS - 1990	ΔPCT= <u>+</u> <u>0</u> °F
D.	PRIOR LOCA MODEL ASSESSMENTS - 1991	ΔPCT= <u>+</u> <u>30</u> °F
E.	PRIOR LOCA MODEL ASSESSMENTS - 1992	ΔPCT= <u>-25</u> °F
F.	PRIOR LOCA MODEL ASSESSMENTS - 1993	ΔPCT= <u>-6</u> °F
G.	1994 10CFR50.46 MODEL ASSESSMENTS	ΔPCT= <u>0</u> °F
H.	LICENSING BASIS PCT + PERMANENT ASSESSMENTS	PCT= <u>2089</u> °F



## LARGE BREAK LOCA

PLANT NAME: DONALD C. COOK NUCLEAR PLANT UNIT 2

Comments: Evaluation Model: BASH, FQT=2.22, FdH=1.62, SGTP=15%,  
Other: RHR Cross Tie Valve Open, 3588 MWt Reactor Power

A. ANALYSIS OF RECORD	PCT= <u>2140</u> °F
B. PRIOR LOCA MODEL ASSESSMENTS - 1989 (Analysis of record was completed in January 1990. No prior LOCA model assessments were made.)	ΔPCT= <u>+</u> <u>NA</u> °F
C. PRIOR LOCA MODEL ASSESSMENTS - 1990	ΔPCT= <u>+</u> <u>0</u> °F
D. PRIOR LOCA MODEL ASSESSMENTS - 1991	ΔPCT= <u>+</u> <u>30</u> °F
E. PRIOR LOCA MODEL ASSESSMENTS - 1992	ΔPCT= <u>-25</u> °F
F. PRIOR LOCA MODEL ASSESSMENTS - 1993	ΔPCT= <u>-6</u> °F
G. 1994 10CFR50.46 MODEL ASSESSMENTS	ΔPCT= <u>0</u> °F
H. OTHER MARGIN ALLOCATIONS	
1. Power Margin	ΔPCT= <u>-98</u> °F <sup>1</sup>
I. LICENSING BASIS PCT + PERMANENT ASSESSMENTS	PCT= <u>2041</u> °F

1. This value was obtained by temporarily allocating 4.9% of power margin using a sensitivity of 20°F/% power. See the Unit 1 justification for the use of power margin in the Donald C. Cook Nuclear Plant Unit 1 Large Break PCT Rack up on page 3 of this attachment.



## SMALL BREAK LOCA

PLANT NAME: DONALD C. COOK NUCLEAR PLANT UNIT 2

Comments: Evaluation Model: <u>NOTRUMP</u> , FQ= <u>2.45</u> , FdH= <u>1.666</u> , SGTP= <u>15%</u> Other: HHSI Cross Tie Valve <u>Closed</u> , <u>3250</u> MWt Reactor Power
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- |    |  |                                  |
|----|--|----------------------------------|
| A. | ANALYSIS OF RECORD                           | PCT= <u>1956</u> °F              |
| B. | PRIOR LOCA MODEL ASSESSMENTS - October 1993  | ΔPCT= <u>-13</u> °F              |
| C. | PRIOR LOCA MODEL ASSESSMENTS - March 1994    | ΔPCT= <u>-16</u> °F              |
| D. | PRIOR LOCA MODEL ASSESSMENTS - December 1994 | ΔPCT= <u>+ 69</u> °F             |
| E  | Burst and Blockage/Time in Life              | ΔPCT= <u>+ 0</u> °F <sup>1</sup> |
| E. | LICENSING BASIS PCT + PERMANENT ASSESSMENTS  | PCT= <u>1996</u> °F              |

1. It should be noted that the burst and blockage assessment is subject to change as other model assessments are made because the magnitude of the burst and blockage assessments depends on the PCT without burst and blockage.

## SMALL BREAK LOCA

PLANT NAME: DONALD C. COOK NUCLEAR PLANT UNIT 2

Comments: Evaluation Model: <u>NOTRUMP</u> , FQ=2.44, FΔH=1.644, SGTP=15% Other: HHSI Cross Tie Valve <u>Closed</u> , 3413 MWt Reactor Power
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A.	ANALYSIS OF RECORD	PCT=_____1947°F
B.	PRIOR LOCA MODEL ASSESSMENTS - October 1993	ΔPCT=_____ -13°F
C.	PRIOR LOCA MODEL ASSESSMENTS - March 1994	ΔPCT=_____ -16°F
D.	PRIOR LOCA MODEL ASSESSMENTS - December 1994	ΔPCT=_____ -33°F
E.	Burst and Blockage/Time in Life	ΔPCT=+_____ 58°F <sup>1</sup>
F.	LICENSING BASIS PCT + PERMANENT ASSESSMENTS	PCT=_____1943°F

1. It should be noted that the burst and blockage assessment is subject to change as other model assessments are made because the magnitude of the burst and blockage assessments depends on the PCT without burst and blockage.

## SMALL BREAK LOCA

PLANT NAME: DONALD C. COOK NUCLEAR PLANT UNIT 2

Comments: Evaluation Model: NOTRUMP, FQ=2.32, FAH=1.62, SGTP=15%,  
Other: HHSI Cross Tie Valve Open, 3588 MWt Reactor Power

A.	ANALYSIS OF RECORD	PCT= <u>1531</u> °F
B.	PRIOR LOCA MODEL ASSESSMENTS - October 1993	ΔPCT= <u>-13</u> °F
C.	PRIOR LOCA MODEL ASSESSMENTS - March 1994	ΔPCT= <u>-16</u> °F
D.	PRIOR LOCA MODEL ASSESSMENTS - December 1994	ΔPCT= <u>+ 35</u> °F
E.	LICENSING BASIS PCT + PERMANENT ASSESSMENTS	PCT= <u>1537</u> °F