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U. S. Nuclear Regulatory Commission
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ULNRC-04751

Ladies and Gentlemen:

DOCKET NUMBER 50-483
UNION ELECTRIC COMPANY
CALLAWAY PLANT
10CFR50.46 ANNUAL REPORT
ECCS EVALUATION MODEL REVISIONS

Attachment 1 to this letter describes changes to the Westinghouse ECCS Large Break and Small Break Loss of Coolant Accident (LOCA) Evaluation Models for Callaway during the time period from October 2001 to October 2002. Attachment 2 provides an ECCS Evaluation Model Margin Assessment which accounts for all peak cladding temperature (PCT) changes resulting from the resolution of prior issues as they apply to Callaway. There are no PCT changes since the last 10CFR50.46 report. References 1-16, listed on the next page, include prior 10CFR50.46 reports.

The PCT values determined in the Large Break and Small Break LOCA analyses of record, when combined with all PCT margin allocations, remain below the 2200°F regulatory limit. As such, no reanalysis is currently planned.

Should you have any questions regarding this letter, please contact us.

Very truly yours,

David Shafer
for John D. Blosser
Manager-Regulatory Affairs

GGY/jdg

Attachments

A001

References:

1) ULNRC-2141 dated 1-19-90
2) ULNRC-2373 dated 2-28-91
3) ULNRC-2439 dated 7-19-91
4) ULNRC-2664 dated 7-16-92
5) ULNRC-2822 dated 7-15-93
6) ULNRC-2892 dated 10-22-93
7) ULNRC-3087 dated 10-19-94
8) ULNRC-3101 dated 11-23-94
9) ULNRC-3295 dated 11-22-95
10) ULNRC-3499 dated 11-27-96
11) ULNRC-3552 dated 3-21-97
12) ULNRC-3761 dated 3-6-98
13) ULNRC-3975 dated 3-5-99
14) ULNRC-4146 dated 11-4-99
15) ULNRC-4338 dated 11-2-00
16) ULNRC-4551 dated 11-2-01

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ATTACHMENT ONE

CHANGES TO THE WESTINGHOUSE

ECCS EVALUATION MODEL

AND PCT PENALTY ASSESSMENTS

TABLE OF CONTENTS

1. REFILL Hot Wall Delay Model Generic Input Values

2. LOCBART Rod-Average Oxidation Error

3. Inclusion of Required NOTRUMP Version 38.0 Input Variables in SPADES

4. Use of NOTRUMP Subcooled Steam Table Routines in SPADES

5. Accumulator Line Friction Factor in the NOTRUMP Evaluation Model

6. Improved Code I/O and Diagnostics and General Code Maintenance

1. REFILL HOT WALL DELAY MODEL GENERIC INPUT VALUES

Various discrepancies were identified in the generic input values that are used with the REFILL hot wall delay model, which is presently incorporated as a module in BASH. This issue was resolved by replacing the use of generic values with expressions that were derived based on the IMP database and utilize appropriate plant-specific information. These changes were determined to be a closely related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451, "Westinghouse Methodology for Implementation of 10CFR50.46 Reporting," October 1992. In a typical PWR calculation, the hot wall delay period represents a very minor portion of the large break LOCA transient. Replacing the use of generic values with IMP-based expressions was determined to have a negligible effect on results and will be treated as a 0°F PCT effect for 10CFR50.46 reporting purposes.

2. LOCBART ROD-AVERAGE OXIDATION ERROR

An error was discovered in LOCBART whereby the calculation of the rod-average oxidation incorrectly includes elevations below the bottom of the active fuel. As discussed below, it was determined that correcting this error would either have a negligible effect on, or would result in a reduction in, the rod-average oxidation, so LOCBART updates will be deferred to a future code release. When corrected, this error correction will represent a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451. For typical near-BOL calculations, correcting this error would have a negligible effect on the rod-average oxidation. For calculations beyond BOL, correcting this error would result in a reduction in the rod-average oxidation. In either case, existing analysis results remain conservative.

3. INCLUSION OF REQUIRED NOTRUMP VERSION 38.0 INPUT VARIABLES IN SPADES

Following the release of NOTRUMP Version 38.0, which introduced several new input variables to the Evaluation Model, it became necessary to update the SPADES code to reflect these new input variables. These input variables are required to activate the revised model features incorporated into the NOTRUMP Version 38.0 code. This change was determined to be a Discretionary Change in accordance with Section 4.1.1 of WCAP-13451. This change simply introduces the new input parameters required by the release of NOTRUMP Version 38.0 to SPADES. The revised NOTRUMP model PCT effects have previously been assessed, and this change to SPADES does not introduce an additional PCT impact.

4. USE OF NOTRUMP SUBCOOLED STEAM TABLE ROUTINES IN SPADES

A review of SPADES calculation methodology determined that subcooled fluid node properties were being calculated based on steam tables that were inconsistent with those of NOTRUMP. As a result, slight differences in fluid node conditions could be seen between SPADES and NOTRUMP. The SPADES code has been modified to utilize the NOTRUMP subcooled steam table properties. This reduces perturbations incurred during the steady-state simulation period with NOTRUMP resulting from differences in subcooled steam table properties. This revision was determined to be a Discretionary Change in accordance with Section 4.1.1 of WCAP-13451. The nature of this change leads to an estimated PCT impact of 0°F.

5. ACCUMULATOR LINE FRICTION FACTOR IN THE NOTRUMP EVALUATION MODEL

The current input for the NOTRUMP evaluation model uses a dimensionless value of 0.013 for line loss friction factor in the accumulator injection lines. This is based on fully developed, turbulent flow in the general pipe size range for accumulator injection lines applicable to Westinghouse designed NSSSs. However, in small break LOCA during accumulator injection, the flow seldom obtains velocities high enough to support the fully developed, turbulent flow value. Taking this into account yields a friction factor on the order of 0.016. This revision was determined to be a Discretionary Change in accordance with Section 4.1.1 of WCAP-13451. The nature of this change leads to an estimated PCT impact of 0°F.

6. IMPROVED CODE I/O AND DIAGNOSTICS AND GENERAL CODE MAINTENANCE

Various changes in code input and output format have been made to enhance usability and help preclude errors in analyses. This includes both input changes (e.g., more relevant input variables defined and more common input values used as defaults) and input diagnostics designed to preclude unreasonable values from being used, as well as various changes to code output which have no effect on calculated results. In addition, various blocks of coding were rewritten to eliminate inactive coding, optimize the active coding, and improve commenting, both for enhanced usability and to facilitate code debugging when necessary. These changes were determined to be Discretionary Changes in accordance with Section 4.1.1 of WCAP-13451. The nature of these changes leads to an estimated PCT impact of 0°F.

ATTACHMENT TWO

ECCS EVALUATION MODEL

MARGIN ASSESSMENT FOR CALLAWAY

LARGE BREAK LOCA

A.	ANALYSIS OF RECORD (AOR)	PCT = 2014°F
B.	1989 LOCA MODEL ASSESSMENTS (refer to ULNRC-2141 dated 1-19-90)	+ 10°F
C.	1990 LOCA MODEL ASSESSMENTS (refer to ULNRC-2373 dated 2-28-91)	+ 0°F
D.	1991 LOCA MODEL ASSESSMENTS (refer to ULNRC-2439 dated 7-19-91)	+ 10°F
E.	1992 LOCA MODEL ASSESSMENTS, MARGIN ALLOCATIONS, AND SAFETY EVALUATIONS (refer to ULNRC-2664 dated 7-16-92 and ULNRC-2892 dated 10-22-93)	+ 29°F
F.	1993 LOCA MODEL ASSESSMENTS (refer to ULNRC-2822 dated 7-15-93 and ULNRC-2892 dated 10-22-93)	- 65°F
G.	1994 LOCA MODEL ASSESSMENTS (refer to ULNRC-3087 dated 10-19-94 and ULNRC-3101 dated 11-23-94)	- 6°F
H.	1995 LOCA MODEL ASSESSMENTS (refer to ULNRC-3295 dated 11-22-95)	+ 39°F
I.	1996 LOCA MODEL ASSESSMENTS (refer to ULNRC-3499 dated 11-27-96)	+ 0°F
J.	1997 LOCA MODEL ASSESSMENTS (refer to ULNRC-3552 dated 3-21-97)	+ 15°F
K.	1998 LOCA MODEL ASSESSMENTS (refer to ULNRC-3761 dated 3-6-98)	+ 0°F
L.	1999 SAFETY EVALUATIONS (refer to ULNRC-3975 dated 3-5-99)	+ 30°F[5]

LARGE BREAK LOCA (cont.)

M.	1999 LOCA MODEL ASSESSMENTS, MARGIN ALLOCATIONS, AND SAFETY EVALUATIONS	
	1. LOCBART ZIRC-WATER OXIDATION ERROR (This PCT assessment is tracked separately since it will change depending on future margin allocations.)	+197°F
	2. NET CHANGE OF OTHER ALLOCATIONS (refer to ULNRC-4146 dated 11-4-99)	-139°F[8]
N.	2000 LOCA MODEL ASSESSMENTS AND MARGIN ALLOCATIONS (refer to ULNRC-4338 dated 11-2-00)	- 14°F
O.	2001 LOCA MODEL ASSESSMENTS (refer to ULNRC-4551 dated 11-2-01)	- 10°F
P.	CURRENT LOCA MODEL ASSESSMENTS - October 2002	+ 0°F
	LICENSING BASIS PCT + MARGIN ALLOCATIONS	2110°F
	ABSOLUTE MAGNITUDE OF MARGIN ALLOCATIONS SINCE LAST LBLOCA 30-DAY REPORT (ULNRC-4146)	25°F

SMALL BREAK LOCA

A.	ANALYSIS OF RECORD (AOR)	PCT = 1528°F
B.	1989 LOCA MODEL ASSESSMENTS (refer to ULNRC -2141 dated 1-19-90)	+229°F
C.	1990 LOCA MODEL ASSESSMENTS (refer to ULNRC-2373 dated 2-28-91)	+ 0°F
D.	1991 LOCA MODEL ASSESSMENTS (refer to ULNRC-2439 dated 7-19-91)	+ 0°F[1]
E.	1992 LOCA MODEL ASSESSMENTS AND SAFETY EVALUATIONS (refer to ULNRC-2664 dated 7-16-92)	+ 0°F
F.	1993 LOCA MODEL ASSESSMENTS (refer to ULNRC-2892 dated 10-22-93)	- 13°F[2]
G.	1993 SAFETY EVALUATIONS (refer to ULNRC-2822 dated 7-15-93)	+ 0°F[3]
H.	BURST AND BLOCKAGE/TIME IN LIFE (This PCT assessment is tracked separately since it will change depending on future margin allocations.)	+ 0°F[1]
I.	1994 LOCA MODEL ASSESSMENTS (refer to ULNRC-3087 dated 10-19-94 and ULNRC-3101 dated 11-23-94)	-282°F[4]
J.	1995 LOCA MODEL ASSESSMENTS (refer to ULNRC-3295 dated 11-22-95)	+ 0°F

SMALL BREAK LOCA (cont.)

K.	1996 LOCA MODEL ASSESSMENTS - (refer to ULNRC-3499 dated 11-27-96)	+ 30°F[6]
L.	1997 LOCA MODEL ASSESSMENTS - (refer to ULNRC-3552 dated 3-21-97)	+ 0°F
M.	1998 LOCA MODEL ASSESSMENTS - (refer to ULNRC-3761 dated 3-6-98)	+ 0°F
N.	1999 SAFETY EVALUATIONS* (refer to ULNRC-3975 dated 3-5-99)	+120°F[7] + 22°F[6] + 40°F[5]
O.	1999 LOCA MODEL ASSESSMENTS (refer to ULNRC-4146 dated 11-4-99)	+ 0°F
P.	2000 LOCA MODEL ASSESSMENTS - (refer to ULNRC-4338 dated 11-2-00)	+ 13°F
Q.	2001 LOCA MODEL ASSESSMENTS - (refer to ULNRC-4551 dated 11-2-01)	+ 0°F
R.	CURRENT LOCA MODEL ASSESSMENTS - October 2002	+ 0°F

LICENSING BASIS PCT + MARGIN ALLOCATIONS	1687°F
ABSOLUTE MAGNITUDE OF MARGIN ALLOCATIONS SINCE LAST SBLOCA 30-DAY REPORT (ULNRC-3101)	43°F*

* Per Section 3.5 of WCAP-13451, intentional changes to plant input parameters evaluated per 10CFR50.59 (such as the March 1999 safety evaluations) are not tracked against the 10CFR50.46 reporting requirements related to a significant change (i.e., > 50°F).

NOTES:

1. See Attachment 1 to ULNRC-3101. The 1991 assessments have been eliminated as a result of the new SBLOCTA calculation. The Small Break Burst and Blockage penalty is a function of the base PCT plus margin allocations and has been reduced to 0°F since the total PCT has been reduced to a value below that at which burst would occur.

2. Addendum 2 to WCAP-10054 has been submitted to NRC. It references the improved condensation model (COSI) described in WCAP-11767 and provides justification for application of this model to small break LOCA calculations. Union Electric tracks the Peak Cladding Temperature (PCT) change reported in ULNRC-2892 (+150°F/-150°F) as a permanent change to Callaway's calculated PCT. See WCAP-10054, 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," August 1994.

3. +4.0°F Cycle 6 crud deposition penalty has been deleted. A PCT penalty of 0°F has been assessed for 4 mils of crud, provided BOL conditions remain limiting. In the event that the SBLOCA cumulative PCT becomes ≥ 1700°F, this issue must be reassessed.

4. Based on the limiting case clad heatup reanalysis with axial offset reduced from 30% to 20%, as discussed in ULNRC-3101.

5. Based on a safety evaluation for a 5°F reduction in full-power T_{avg} (from 588.4°F to 583.4°F), a +30°F PCT penalty is established for LBLOCA and a +40°F PCT penalty is established for SBLOCA.

6. The 1996 safety evaluation reported a +10°F PCT penalty for a feedwater temperature reduction from 446°F to 410°F. This is replaced by a new safety evaluation. The 1996 assessment is reduced from +40°F to +30°F and a new +22°F PCT penalty is established for SBLOCA associated with a feedwater temperature reduction from 446°F to 390°F.

7. See Amendment No. 128 dated October 2, 1998.

8. Included in this value is an estimated PCT benefit of 100°F associated with reducing the F_Q limit from the AOR value of 2.5 to a value of 2.45 for core average burnups between 0 and 8000 MWd/MTU. After a burnup of 8000 MWd/MTU, the F_Q limit returns to 2.5 with no PCT penalty. This applies for the current operating cycle as well as the next operating cycle.