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November 2, 2001

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

ULNRC-04551

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 which have been implemented for Callaway during the time period from October 2000 to October 2001. Attachment 2 provides an ECCS Evaluation Model Margin Assessment which accounts for the peak cladding temperature (PCT) changes resulting from the resolution of the issues described in Attachment 1 as they apply to Callaway. Only the Large Break LOCA Margin Assessment summary has changed since the last 10CFR50.46 report. References 1-15, listed below, 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 by Union Electric.

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

Very truly yours,

  
for John D. Blosser  
Manager-Regulatory Affairs

Attachments

2001

U.S. Nuclear Regulatory Commission

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

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**ATTACHMENT ONE**

**CHANGES TO THE WESTINGHOUSE**

**ECCS EVALUATION MODEL**

**AND PCT PENALTY ASSESSMENTS**

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9. LOTIC2 Time Step Logic Error
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**\*New PCT Penalty Assessment**

## **1. LOCBART CLADDING EMISSIVITY ERRORS**

Section 2-17 of Reference 1 (see Reference list below), Section 3.2.5 of Reference 2, and Section 3-2 of Reference 3 describe expressions that are used to model radiation heat exchange between the rod, grid, and fluid during the reflood phase of the transient. It was discovered that the cladding surface emissivity values used with Equation 2-93 of Reference 1, Equation 3-47 of Reference 2, and Equation 3-8 of Reference 3 were substantially lower than the values that would be expected to exist during a large break LOCA reflood transient. A review of existing documentation by Westinghouse was inconclusive as to the exact values that were intended for use with the equations, so a constant, representative value of 0.7 was used based on the value used in WCOBRA/TRAC for a similar application (Reference 4). These errors 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.

These error corrections result in a -10°F PCT benefit for Callaway Plant since our analysis reflects a burst-node-limited PCT occurring coincident with the onset of entrainment in reflood. The generic PCT assessment for this issue was derived by Westinghouse from representative plant calculations as the bounding value for early PCT, burst-node-limited plants.

## **2. LOCBART DISPERSED FLOW REGIME WALL EMISSIVITY ERROR**

As discussed in Section 2-18 of Reference 1, the Sun, Gonzalez, and Tien model is used in LOCBART to predict radiant heat exchange between the fuel rod, vapor, and droplets in the dispersed flow regime. An error was discovered in LOCBART whereby the wall emissivity in the dispersed flow regime was substantially lower than the corresponding value identified in Section 2-18 of Reference 1. This error correction was determined to be a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

This error correction generally results in a small PCT benefit for plants such as Callaway with PCTs occurring early in reflood and a small to moderate PCT benefit for plants with PCTs occurring late in reflood. The generic PCT assessments for this issue were derived by Westinghouse from representative plant calculations as the bounding values for each of the two plant/transient categories (i.e., early-reflood-PCT plants and late-reflood-PCT plants) that were defined specifically for this purpose. For Callaway Plant, this error correction is being conservatively treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes.

## **3. BASH ISOTHERM INITIALIZATION ERROR**

As discussed in Section 3-6 of Reference 1, the quench front progression in BART is computed using the isotherm migration method. An error was discovered in BASH whereby a variable was not being initialized for cases where a user entered the initial

isotherm temperatures and elevations into the BASH input file, instead of letting the code calculate the initial isotherms internally. This error existed in BASH Versions 18.0 and 19.0. This error correction was determined to be a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

A survey of BASH-EM analyses under Westinghouse Pittsburgh LBLOCA analysis cognizance found no usage of the erroneous option which is not accessed for standard production applications. As a result, the correction of this error is treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes.

#### **4. BASH IMPLEMENTATION OF LOCBART CORRECTIONS**

Since BART coding is used in both LOCBART and BASH, the following changes have also been implemented into BASH for consistency:

- LOCBART Cladding Emissivity Errors (see item 1 above)
- LOCBART Vapor Film Flow Regime Heat Transfer Error (see item 14 in Attachment 1 to ULNRC-04338 dated 11/2/00)
- LOCBART Dispersed Flow Regime Wall Emissivity Error (see item 2 above)

These changes were determined to be a closely related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451.

Representative plant calculations using the BASH code showed that these error corrections had a relatively minor effect on the core inlet flooding rate during reflow, which in turn would be expected to have a negligible effect on PCT. As a result, these corrections are being treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes.

#### **5. INADEQUATELY DIMENSIONED CORE REFLUX FLOW LINK ERROR IN NOTRUMP**

An error has been discovered which results in the termination of the NOTRUMP code when attempting to model more than 12 active core nodes. The problem results from an inadequately defined maximum number of core reflux flow links in the code externals. The nature of the error is such that code execution can not be performed when attempting to model more than 12 core nodes due to compiler options selected. This problem only exists in the NOTRUMP Version 37.0 code. This error correction was determined to be a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

The nature of this error leads to no PCT impact for all EM applications due to the core modeling assumed in these models (i.e.,  $\leq 12$  core nodes).

## **6. LOCBART ROD-TO-ROD RADIATION ERROR**

An error was discovered in LOCBART whereby a variable was not being defined for the rod-to-rod radiation calculations. This error caused the radiation heat flux for the hot rod to be calculated incorrectly and caused the radiation heat flux for the adjacent rod to be zero. This error is present only in LOCBART Version 20.0. This error correction was determined to be a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Representative plant calculations using the LOCBART code showed that this error correction had a negligible effect on PCT. As a result, this correction is being treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes.

## **7. LOCBART NUREG-0630 CODING ERRORS**

The following errors were discovered in the LOCBART code related to the programming of the NUREG-0630 (Reference 5) burst and blockage models for Zircaloy-4 cladding:

1. In Subroutine FBLOK, the assembly blockage corresponding to a burst temperature of 700°C (1292°F) and a temperature ramp rate of 25°C/sec (45°F/sec) was programmed as 13.6%, instead of the correct value of 13.8% from page 112 of Reference 5.
2. In Subroutine XPAND, the burst temperature corresponding to a burst strain of 48% (for a temperature ramp rate of 10°C/sec or 18°F/sec) or 45% (for a temperature ramp rate of 25°C/sec or 45°F/sec) was programmed as 1675°F, instead of the correct value of 1652°F (900°C) from pages 111 and 112 of Reference 5.

It was determined that correcting these errors would either have no effect on results or would be expected to result in a small PCT benefit, so LOCBART updates will be deferred to a future code release. When corrected, these error corrections will represent Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451.

The error in Subroutine FBLOK affects the calculation of assembly blockage for Zircaloy-4 cladding over the burst temperature range of 1247-1337°F, which is substantially lower than the burst temperatures that are encountered in typical licensing calculations. For a hypothetical case with a burst temperature in the affected range, the difference in assembly blockage is very small and would be expected to have a negligible effect on results.

The error in Subroutine XPAND affects the calculation of burst strain for Zircaloy-4 cladding over the burst temperature range of 1607-1697°F. It was determined that correcting the error would either have no effect on results or would result in a small reduction in burst strain, which would be expected to result in a small decrease in PCT with all other things being equal.



Based on the preceding information, these error corrections will be deferred to a future code release and are treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes.

#### **8. LOTIC2 NITROGEN ADDITION LOGIC ERROR**

LOTIC2 calculates the minimum containment backpressure during a large break LOCA transient for plants with an ice condenser containment design. When the accumulators empty, the nitrogen cover gas is released into the containment. An error was discovered whereby some of the nitrogen was being released to the upper compartment, instead of correctly being released entirely to the lower compartment. The nitrogen addition logic was corrected to force all nitrogen releases into the lower compartment. This error correction was determined to be a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Representative plant calculations using the LOTIC2 code showed that this error correction had a negligible effect on containment pressure, which in turn would have a negligible effect on PCT. As a result, this correction is being treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes. In addition, Callaway Plant has a large, dry containment design, not an ice condenser design.

#### **9. LOTIC2 TIME STEP LOGIC ERROR**

An error was discovered in LOTIC2 whereby the transient time was being adjusted twice in a typical time step, which led to negative time step sizes under certain conditions. The time step logic was modified to force the transient time to change only once per time step, which eliminates the occurrence of negative time step sizes. This error correction was determined to be a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Representative plant calculations using the LOTIC2 code showed that this error correction had a very minor effect on containment pressure, which in turn would have a negligible effect on PCT. As a result, this correction is being treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes. In addition, Callaway Plant has a large, dry containment design, not an ice condenser design.

#### **10. NOTRUMP CORE HEAT TRANSFER ERROR**

An error was discovered in NOTRUMP which results in either a code abort or the use of invalid steam table properties and/or heat transfer correlations in the core region under certain conditions. The problem results from the steam cooling core heat transfer correlation attempting to pass sub-cooled properties to steam property routines. Since the property routines do not perform input validity checking, this can result in erroneous properties being returned/utilized by the correlation. This error can only occur when complete subcooling of the core cladding occurs in conjunction with core uncovering. This error affects all code versions up to and including NOTRUMP Version 37.0. This error

correction was determined to be a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

The nature of this error leads to no PCT impact for all standard EM applications due to the lack of this type of core uncover process.

#### **11. SATAN6 MOMENTUM FLUX LOGIC ERROR**

An error was discovered in the SATAN6 momentum flux logic whereby the sonic velocity limit was being applied incorrectly. In some instances, this caused the break flow to hang near the end of the blowdown transient, instead of allowing the calculation to proceed normally to the end of blowdown. The erroneous logic was corrected to ensure proper application of the sonic velocity limit. This error correction was determined to be a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Representative plant calculations using the SATAN6 code showed that this error correction had a very minor effect on blowdown results for typical cases, which in turn would be expected to have a negligible effect on PCT. Even for a case with a more substantial effect on SATAN6 results, the effect on PCT was found to be small, due mainly to the fact that the core heatup near end-of-blowdown is essentially adiabatic. As a result, this correction is being treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes.

#### **12. SATAN6 REACTOR COOLANT PUMP LOGIC ERROR**

An error was discovered in the SATAN6 reactor coolant pump logic where, during a time step in which the pump critical flow iteration failed to converge, the pump discharge mass flow rate was incorrectly reset to the value corresponding to the last iteration. This problem was resolved by removing the pump critical flow iteration from the code, since the corresponding logic was found to be of little use for standard licensing applications. This change was determined to contain both Discretionary and Non-Discretionary aspects in accordance with Sections 4.1.1 and 4.1.2, respectively, of WCAP-13451.

Representative plant calculations using the SATAN6 code showed that these changes had either no effect or a negligible effect on blowdown results, which would be expected to have either no effect or a negligible effect on PCT. As a result, these changes are being treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes.

#### **13. LARGE BREAK LOCA SINGLE FAILURE ASSUMPTION**

A concern was raised by a licensee whereby a single failure in the Solid State Protection System could cause the loss of an entire train of safety injection pumps, without causing the loss of the corresponding train of containment heat removal equipment. This situation is contrary to Section 3.6 of Reference 6, which defines the limiting single failure for Appendix K LBLOCA and SECY LBLOCA analysis as the loss of a low pressure

injection pump. To address this concern, Westinghouse has modified their analysis guidance to direct the analyst to assume the loss of an entire train of safety injection pumps, unless a less conservative single failure assumption can be justified. This was determined to represent a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Recent LBLOCA analyses have generally assumed the loss of an entire train of safety injection pumps as the limiting single failure, since the additional conservatism introduced by this simplification is typically small. A survey of BART-EM and BASH-EM analyses under Westinghouse Pittsburgh LBLOCA analysis cognizance found no domestic applications in which the analyst assumed the loss of a low pressure injection pump as the limiting single failure. As a result, this change is being treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes.

#### **14. SIMPLIFIED ISOTHERMAL SOLUTION FOR LOCABART SUBROUTINE RATE**

As discussed in Reference 7, LOCABART was revised in 1999 to correct a logic error that caused the Baker-Just metal-water reaction calculations to be performed three times per time step. During the review of the corresponding code logic, it was determined that the complicated solution technique described in Section 3.3.2 of Reference 8 could be replaced with a simplified isothermal solution, with only a minimal effect on results. This replacement has been accomplished and was determined to represent a Discretionary Change, that will be implemented on a forward-fit basis, in accordance with Section 4.1.1 of WCAP-13451.

Representative plant calculations using the LOCABART code confirmed that this change has a negligible effect on results that will be implemented on a forward-fit basis and is being treated as having a 0°F PCT effect for 10CFR50.46 reporting purposes.

#### **15. PAD 4.0 IMPLEMENTATION**

The Westinghouse Performance Analysis and Design (PAD) Model is used to generate fuel-related input data for use in LOCA licensing calculations. As documented in Reference 9, the Safety Evaluation Report for Version 4.0 of the PAD model was issued by the USNRC on April 24, 2000. Use of PAD Version 4.0 is considered to represent a Discretionary Change and will be implemented on a forward-fit basis, in accordance with Section 4.1.1 of WCAP-13451.

The implementation of PAD Version 4.0 with respect to Appendix K Large Break LOCA and Small Break LOCA analyses will be handled on a forward-fit basis and is assigned a PCT estimate of 0°F PCT effect for 10CFR50.46 reporting purposes.

## **16. LOCBART ROD INTERNAL PRESSURE MODEL REVISIONS**

In the original LOCTA-IV model (Reference 8), the gas in the rod plenum was assumed to remain at a constant, steady-state temperature throughout the entire transient. In order to more accurately track the rod internal pressure history during a Large Break LOCA transient, the use of this assumption in LOCBART has been replaced with the temperature-dependent model that was implemented previously in the SBLOCTA code, as described in Reference 10. In addition, other minor changes were made to the LOCBART rod internal pressure model, including an option to specify the volumes corresponding to the upper and lower annular blankets, and a simplified treatment of the crack and dish volumes. These changes were determined to represent a closely related group of Discretionary Changes and will be implemented on a forward-fit basis, in accordance with Section 4.1.1 of WCAP-13451.

These changes will be implemented on a forward-fit basis and are assigned an estimated PCT impact of 0°F PCT for 10CFR50.46 reporting purposes.

## **17. 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.

## References

1. WCAP-9561-P-A, "BART-A1: A Computer Code for the Best Estimate Analysis of Reflood Transients," M. Young, et. al., March 1984.
2. WCAP-7437-L, "LOCTA-R2 Program: Loss of Coolant Transient Analysis," W. A. Bezella, et. al., January 1970.
3. WCAP-10484-P-A, "Spacer Grid Heat Transfer Effects During Reflood," M. Young, et. al., March 1991.
4. WCAP-12945-P-A, Volume I (Revision 2) and Volumes II-V (Revision 1), "Westinghouse Code Qualification for Best Estimate Loss of Coolant Accident Analysis," S. M. Bajorek, et. al., March 1998.
5. NUREG-0630, "Cladding Swelling and Rupture Models for LOCA Analysis," R. O. Meyer and D. A. Powers, April 1980.
6. WCAP-8471-P-A, "The Westinghouse ECCS Evaluation Model: Supplementary Information," F. M. Bordelon, et. al., April 1975.
7. Westinghouse letter NSBU-NRC-00-5970, "1999 Annual Notification of Changes to the Westinghouse Small Break LOCA and Large Break LOCA ECCS Evaluation Models, Pursuant to 10CFR50.46(a)(3)(ii)," H. A. Sepp, May 12, 2000.
8. WCAP-8301, "LOCTA-IV Program: Loss-of-Coolant Transient Analysis," F. M. Bordelon, et. al., June 1974.
9. WCAP-15063-P-A, Revision 1 with Errata, "Westinghouse Improved Performance Analysis and Design Model (PAD 4.0)," J. P. Foster and S. Sidener, July 2000.
10. Westinghouse letter NTD-NRC-94-4253, "Revision to the Rod Internal Pressure Model in Westinghouse SBLOCTA Code (Proprietary)," N. J. Liparulo, August 9, 1994.

**ATTACHMENT TWO**

**ECCS EVALUATION MODEL**

**MARGIN ASSESSMENT FOR CALLAWAY**

## LARGE BREAK LOCA

A.	ANALYSIS OF RECORD	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 <sup>5</sup>

- |    |   |         |
|----|---|---------|
| M. | 1999 LOCA MODEL ASSESSMENTS,<br>MARGIN ALLOCATIONS, AND<br>SAFETY EVALUATIONS   |         |
|    | 1. LOCBART ZIRC-WATER OXIDATION ERROR<br>(This PCT assessment is tracked separately since<br>it will change depending on future margin<br>allocations.) | +197°F  |
|    | 2. NET CHANGE OF OTHER ALLOCATIONS<br>(refer to ULNRC-4146 dated 11-4-99)   | - 139°F |
| N. | 2000 LOCA MODEL ASSESSMENTS AND MARGIN<br>ALLOCATIONS   | - 14°F  |
| O. | CURRENT LOCA MODEL ASSESSMENTS - OCTOBER 2001   |         |
|    | 1. LOCBART Cladding Emissivity Errors<br>(refer to Item 1 of Attachment 1)  | - 10°F  |

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LICENSING BASIS PCT + MARGIN ALLOCATIONS	=	2110°F
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ABSOLUTE MAGNITUDE OF MARGIN ALLOCATIONS SINCE LAST LBLOCA 30-DAY REPORT (ULNRC-4146)		25°F
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## SMALL BREAK LOCA

A.	ANALYSIS OF RECORD	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 <sup>1</sup>
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 <sup>2</sup>
G.	1993 SAFETY EVALUATIONS (refer to ULNRC-2822 dated 7-15-93)	+ 0°F <sup>3</sup>
H.	BURST AND BLOCKAGE/TIME IN LIFE (This PCT assessment is tracked separately since it will change depending on future margin allocations.)	+ 0°F <sup>1</sup>
I.	1994 LOCA MODEL ASSESSMENTS (refer to ULNRC-3087 dated 10-19-94 and ULNRC-3101 dated 11-23-94)	- 282°F <sup>4</sup>
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 <sup>6</sup>
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 <sup>7</sup> + 22°F <sup>6</sup> + 40°F <sup>5</sup>
O.	1999 LOCA MODEL ASSESSMENTS - (refer to ULNRC-4146 dated 11-4-99)	+ 0°F
P.	CURRENT LOCA MODEL ASSESSMENTS - OCTOBER 2000	
	1. NOTRUMP Mixture Level Tracking/Region Depletion Errors (refer to Item 15 of Attachment 1)	+ 13°F

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LICENSING BASIS PCT + MARGIN ALLOCATIONS = 1687°F

ABSOLUTE MAGNITUDE OF MARGIN ALLOCATIONS = 43°F\*  
SINCE LAST SBLOCA 30-DAY REPORT (ULNRC-3101)

\* Per Section 3.5 of WCAP-13451, intentional changes to plant input parameters evaluated per 10 CFR 50.59 (such as the March 1999 safety evaluations) are not tracked against the 10 CFR 50.46 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  $\geq 1700^\circ\text{F}$ , 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  $T_{\text{avg}}$  (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.