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U.S. Nuclear Regulatory Commission
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ULNRC-04146

Gentlemen:

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



Attachment 1 to this letter describes changes to the Westinghouse ECCS Large Break Loss of Coolant Accident (LBLOCA) Evaluation Model which have been implemented for Callaway during the time period from March 1999 to October 1999. In addition, prior PCT penalty assessments have been revised or eliminated. 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. References 1-13, listed below, include prior 10CFR50.46 reports.

The small break LOCA table included in Attachment 2 remains unchanged from that submitted in Reference 13 and is enclosed here for completeness only. Based on the criteria and reporting requirements of 10CFR50.46(a)(3)(ii), as clarified in Section 5.1 of WCAP-13451, "Westinghouse Methodology for Implementation of 10CFR50.46 Reporting," the cumulative changes since the last LBLOCA 30-day report, Reference 11, are significant and require a new 30-day report. The regulation also requires a "proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with Section 50.46 requirements." In lieu of reanalysis, Union Electric has elected to reduce the heat flux hot channel factor (F_q) limit from 2.5 to 2.45, as discussed in the attachments. This is reflected in the Cycle 11 Core Operating Limits Report to be submitted pursuant to Current Technical Specification 6.9.1.9. With this peaking factor reduction, the PCT value determined in the large break LOCA analysis of record, when combined with all PCT margin allocations, remains below the 2200°F regulatory limit. As such, no reanalysis is currently planned by Union Electric. We may restore the F_q limit to 2.5 under 10CFR50.59 if future PCT assessments free up sufficient margin to the 2200°F regulatory limit.

A-001

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

Very truly yours,



Alan C. Passwater
Manager-Corporate Nuclear Services

TEH/DS/GGY/jdg

Attachments

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

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ATTACHMENT ONE

CHANGES TO THE WESTINGHOUSE

LBLOCA ECCS EVALUATION MODEL

AND PCT PENALTY ASSESSMENTS

1. LOCBART ZIRC-WATER OXIDATION ERROR

As discussed in NSD-NRC-99-5845, "Closure of Westinghouse Interim Report No. 98-029," H. A. Sepp, August 27, 1999, a logic error in the LOCBART code caused the Baker-Just metal-water reaction calculations to be performed three times per time step. Correcting the error was found to reduce the total cladding oxidation while increasing the heat deposition in the cladding. This error correction is a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

The PCT penalty assessment was derived using a correlation of PCT changes that were based on sensitivity studies using the corrected code version. The PCT changes were taken from a number of representative PWR Large Break LOCA transient calculations, and suitably grouped into early/late PCT and burst node limited/non-burst node limited behavior. The appropriate correlation branch was then implemented for the existing plant-specific analysis results. A LBLOCA PCT penalty of +197°F was assigned.

2. LOCBART SPACER GRID SINGLE-PHASE HEAT TRANSFER ERROR

As discussed in WCAP-10484-P-A, "Spacer Grid Heat Transfer Effects During Reflood," M. Y. Young, et.al., March 1991, the Yao-Hochreiter-Leech correlation is used in the LOCBART code to compute the single-phase heat transfer enhancement for axial elevations located downstream of spacer grids. The Safety Evaluation Report to WCAP-10484-P-A requires that a length-averaged value be used to specify the heat transfer coefficient for a given fluid cell, since use of a local value corresponding to the forward edge or the rear edge of the cell could be non-conservative. It was determined that the length-averaging in LOCBART was not being done correctly in all cases. This error correction is a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

The PCT penalty assessment was selected to bound the results of nine LOCBART sensitivity calculations for typical PWR Large Break LOCA transients using the corrected code version. A LBLOCA PCT penalty of +15°F was assigned. This is an update to the 0°F penalty assigned in Reference 5.

3. ACCUMULATOR LINE/PRESSURIZER SURGE LINE DATA

An issue was identified where the accumulator line piping schedule installed at a plant was different than the design value. This discovery led to a review of various geometric data related to the accumulator lines and pressurizer surge lines, and these revised data were compared to the LOCA analysis values to determine the effect on existing analysis results. For cases where erroneous data were identified, this issue is a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

A plant-specific evaluation of the analysis-based values compared to utility-provided data shows that Callaway was within the screening criteria established for this issue. As such the estimated impact to the LBLOCA analysis is 0°F.

4. REBASELINE OF LIMITING ANALYSIS-OF-RECORD (AOR) CASE

A previous (5/96) LOCBART reanalysis for ZIRLO™ cladding resulted in a 3°F peak clad temperature benefit. This benefit was never credited on previous PCT rackups but will be credited now. This 3°F benefit appears in the LBLOCA PCT rackup with a title of "Rebaseline of Limiting AOR Case (5/96). "

5. REMOVAL OF FUEL ROD INITIAL CONDITION INCONSISTENCY PENALTY

Since the rebaseline analysis mentioned in Item 4 above used a version of LOCBART that resolves the Fuel Rod Initial Condition Inconsistency issue, and since this issue is considered to have a negligible effect on the SATAN and BASH thermal-hydraulic model calculations, the corresponding +10°F penalty has been removed from the LBLOCA PCT rackup. This penalty was originally reported in ULNRC-2439 dated 7-19-91.

6. REMOVAL OF SG TUBE SEISMIC/LOCA ASSUMPTION PENALTY

This +19°F PCT penalty was originally reported in ULNRC-2664 dated 7-16-92 to account for SG tube crush that would result from a double-ended pump suction break at the steam generator outlet. Originally, the structural integrity analysis results for Callaway showed that 0% tube crush resulted from seismic forces and 6.2% resulted from SSE plus LOCA forces. The current large break LOCA analysis of record for Callaway supports a steam generator tube plugging level of 15%. The maximum predicted tube plugging in any one steam generator for cycle 11 is 1.8%. Therefore, the total tube plugging due to tube collapse from a SSE concurrent with LOCA plus actual tube plugging would be 8% (6.2% + 1.8%). This is well within the tube plugging level modeled in the LOCA analysis. Based on the above discussion, the +19°F PCT penalty for "SG Tube Seismic/LOCA Assumption" will be reduced to 0°F based on an analysis SGTP margin of 8.8% (i.e., 15% - 6.2%).

7. REDUCTION OF CONTAINMENT PURGE EVALUATION ASSESSMENT

This +10°F PCT penalty assessment was originally reported in ULNRC-2664 dated 7-16-92. The magnitude of the penalty was based on an earlier Evaluation Model and a containment mini-purge valve opening time increase from 3 to 5 seconds. The longer valve opening time of 5 seconds was calculated to result in a 0.25 psi decrease in the containment pressure following a postulated large break LOCA. The original PCT penalty of +10°F was based on an Evaluation Model prior to BASH. It was concluded that the original +10°F penalty was conservatively bounding for the BASH Evaluation Model. However, BASH is less sensitive to containment pressure than previous Evaluation Models, with a typical sensitivity on the order of 10°F PCT/1 psi reduction in containment pressure. This sensitivity for the BASH EM will be applied now to reduce this penalty from +10°F to +3°F.

8. REDUCTION OF ACCUMULATOR WATER TEMPERATURE ASSESSMENT

A +39°F penalty was reported in ULNRC-3295 dated 11-22-95 to account for the difference between actual accumulator water temperatures and the accumulator water temperature (90°F) modeled in the large break analysis. Previously, this +39°F penalty was based on an accumulator water temperature of 120°F, taken from the containment air temperature TS limit. Using actual containment air temperature data for Cycles 7 and 8, it has been determined that a maximum value of 108°F can be supported rather than the TS limit of 120°F for containment air temperature. With a PCT sensitivity of +1.3°F PCT per °F of accumulator water temperature increase (108°F - 90°F), a revised PCT penalty of +24°F was calculated.

9. CYCLE 11 F_Q REDUCTION

An F_Q sensitivity has been employed to gain offsetting large break LOCA PCT margin for Cycle 11 operation. Reducing the F_Q limit from the AOR value of 2.5 to 2.45 yields an estimated PCT benefit of 100°F. This F_Q reduction shall be implemented for Cycle 11.

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-03975 dated 3-5-99)	+ 30°F ⁵
M.	CURRENT LOCA MODEL ASSESSMENTS, MARGIN ALLOCATIONS, AND SAFETY EVALUATIONS - OCTOBER 1999	
	1. LOCBART ZIRC-WTER OXIDATION ERROR (refer to Item 1 of Attachment 1)	+197°F

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|--|---------|
| 2. LOCBART SPACER GRID SINGLE-PHASE
HEAT TRANSFER ERROR
(refer to Item 2 of Attachment 1) | + 15°F |
| 3. ACCUMULATOR LINE/PRESSURIZER
SURGE LINE DATA
(refer to Item 3 of Attachment 1) | + 0°F |
| 4. REBASELINE OF LIMITING AOR CASE (5/96)
(refer to Item 4 of Attachment 1) | - 3°F |
| 5. REMOVAL OF FUEL ROD INITIAL CONDITION
INCONSISTENCY PENALTY
(refer to Item 5 of Attachment 1) | - 10°F |
| 6. REMOVAL OF SG TUBE SEISMIC/LOCA
ASSUMPTION PENALTY
(refer to Item 6 of Attachment 1) | - 19°F |
| 7. REDUCTION OF CONTAINMENT PURGE
EVALUATION ASSESSMENT
(refer to Item 7 of Attachment 1) | - 7°F |
| 8. REDUCTION OF ACCUMULATOR WATER
TEMPERATURE ASSESSMENT
(refer to Item 8 of Attachment 1) | - 15°F |
| 9. CYCLE 11 F _Q REDUCTION
(refer to Item 9 of Attachment 1) | - 100°F |

LICENSING BASIS PCT + MARGIN ALLOCATIONS	=	2134°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 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-03975 dated 3-5-99)	+120°F ⁷ + 22°F ⁶ + 40°F ⁵
O.	CURRENT LOCA MODEL ASSESSMENTS - OCTOBER 1999	+ 0°F

LICENSING BASIS PCT + MARGIN ALLOCATIONS = 1674°F

ABSOLUTE MAGNITUDE OF MARGIN ALLOCATIONS = 30°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_{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.