Westinghouse Electric Corporation Energy Systems

Nuclear and Advanced Technology Division

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NTD-NRC-95-4477
NTD-NSA-SAI-95-216
July 26, 1995

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

Attention: Mr. R. C. Jones, Jr., Chief, Reactor Systems Branch,
Office of Nuclear Reactor Regulation

Reference: 1) WCAP-10266-P-A Rev. 2, "The 1981 Version of the Westinghouse ECCS Evaluation Model Using the BASH Code", Young, M.Y., et. al., March 1987.

2) WCAP-13451, "Westinghouse Methodology for Implementation of 10 CFR 50.46 Reporting", Ivey, J.S., and Young, M.Y., October 1992.

Subject: Transmittal of Topical Reports WCAP-14404-P and WCAP-14405-NP, "Methodology for Incorporating Hot Leg Nozzle Gaps into BASH"

Dear Mr. Jones:

Westinghouse, in support of the Westinghouse Owners Group (WOG), is currently pursuing a program to eliminate the requirement for post-LOCA hot leg recirculation by taking credit for the gaps that exist between the reactor vessel and core barrel at the hot leg nozzle locations (i.e., hot leg nozzle gaps). As an outgrowth of this effort, Westinghouse has also completed work on a methodology for modelling the hot leg nozzle gaps in Appendix K Large Break LOCA ECCS analyses using the BASH Evaluation Model [EM] (Reference 1). Attached are 10 copies each of WCAP-14404-P and WCAP-14405-NP, which describe the hot leg nozzle gap methodology in BASH and which are being submitted as an EM change in accordance with 10 CFR 50.46.

At this time, Westinghouse is also completing its investigation of the effect of skewed core power distributions on Large Break LOCA. For a small subset of plants with Peak Cladding Temperatures (PCTs) occurring late into the reflood phase of the accident, skewed power distributions may result in a substantial PCT penalty. This penalty may be offset by applying the methodology described in WCAP-14404 transmitted herein. Westinghouse intends to implement this methodology prior to its approval in order to ensure that effected plants continue to maintain compliance with paragraph (b) of 10 CFR 50.46.



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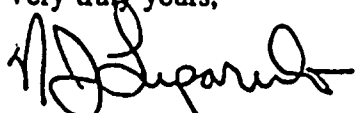
In accordance with the guidance outlined in Reference 2, Westinghouse intends to implement this model prior to specific NRC review and approval. Westinghouse is confident it will be found technically satisfying and in fulfillment of all applicable regulations as it is simply an extension of the basic flow link modeling which was approved in Reference 1 to model an additional flowpath. Furthermore, Westinghouse believes that this method is in full compliance with Appendix K of 10 CFR 50, that the flows through the gap have been calculated to ensure Appendix K conservatism, that adequate bases for the gap's existence and verification calculations have been performed, and that supporting justification exists which demonstrate that the analytical techniques transmitted herein conservatively describe the behavior of the reactor coolant system during a LOCA.

A subsequent WCAP will be submitted for Hot Leg Recirculation Elimination and will incorporate Appendix A of WCAP-14404, which addresses the core barrel structural response during a LOCA.

This submittal contains Proprietary information of Westinghouse Electric Corporation. In conformance with the requirements of 10 CFR Section 2.790, as amended, of the Commission's regulations, we are enclosing with this submittal an application for withholding from public disclosure and an affidavit. The affidavit sets forth the basis on which the information identified as proprietary may be withheld from public disclosure by the Commission.

Additional copies of WCAP-14404-P and/or WCAP-14405-NP can be provided upon request. Correspondence with respect to the Affidavit or Application for Withholding should reference AW-95-835 and should be addressed to N. J. Liparulo, Manager, Nuclear Safety Regulatory and Licensing Activities, Westinghouse Electric Corporation, P.O. Box 355, Pittsburgh, Pennsylvania, 15230-0355. Please contact Mark Kachmar (412) 374-4013 of our technical staff should you have any questions concerning this transmittal.

Very truly yours,



N. J. Liparulo, Manager
Nuclear Safety Regulatory and Licensing

Activities

RRS/ttw

Enclosure(s)

cc: F. Orr, RSB

ATTACHMENT 2 TO AEP:NRC:1118J

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, 3250 MWt Reactor Power

| | | |
|---|---|---|
| A. | ANALYSIS OF RECORD | PCT= 2162°F |
| B. | PRIOR LOCA MODEL ASSESSMENTS - 1989 | ΔPCT= + 0°F |
| C. | PRIOR LOCA MODEL ASSESSMENT - 1990 | ΔPCT= + 0°F |
| D. | PRIOR LOCA MODEL ASSESSMENTS - 1991 | ΔPCT= + 20°F |
| E. | PRIOR LOCA MODEL ASSESSMENTS - 1992 | ΔPCT= -117°F |
| F. | PRIOR LOCA MODEL ASSESSMENTS - 1993 | ΔPCT= -6°F |
| G. | PRIOR LOCA MODEL ASSESSMENTS - 1994 | ΔPCT= 0°F |
| H. | 1995 10CFR50.46 MODEL ASSESSMENTS | |
| | 1. Skewed Power Shape Penalty | ΔPCT= + 253°F |
| | 2. Hot Leg Nozzle Gap Benefit | ΔPCT= -237°F |
| I. | LICENSING BASIS PCT + PERMANENT ASSESSMENTS | PCT= 2075°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- 2181°F |
| B. | PRIOR LOCA MODEL ASSESSMENTS - 1989 | ΔPCT- + 0°F |
| C. | PRIOR LOCA MODEL ASSESSMENTS - 1990 | ΔPCT- + 0°F |
| D. | PRIOR LOCA MODEL ASSESSMENTS - 1991 | ΔPCT- + 30°F |
| E. | PRIOR LOCA MODEL ASSESSMENTS - 1992 | ΔPCT- -25°F |
| F. | PRIOR LOCA MODEL ASSESSMENTS - 1993 | ΔPCT- -6°F |
| G. | PRIOR LOCA MODEL ASSESSMENTS - 1994 | ΔPCT- 0°F |
| H. | 1995 10CFR50.46 MODEL ASSESSMENTS | |
| | 1. Skewed Power Shape Penalty | ΔPCT- + 253°F |
| | 2. Hot Leg Nozzle Gap Benefit | ΔPCT- -237°F |
| I. | OTHER MARGIN ALLOCATIONS (Use of PCT Margin): | |
| | 1. ANALYSIS MARGINS USED: Power Margin | ΔPCT- -94°F |
| J. | LICENSING BASIS PCT + PERMANENT ASSESSMENTS & POWER MARGIN | PCT- 2102°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 $MW_t$ 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 $MW_t$ versus the analysis power level of 3413 $MW_t$.

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 $20°F_{PCT}$/% 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 $MW_t$ to the licensed operating condition of 3250 $MW_t$ (a 4.7% reduction in power):

$$(20°F_{PCT}/\%\ \text{Power})\ (4.7\%\ \text{Power}) = 94°F$$

When this 94°F margin is applied to the Unit 1, 3413 $MW_t$ analysis with RHR cross tie valves open, the 10 CFR 50.46 PCT limit is not exceeded.

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= 2090°F |
| B. | PRIOR LOCA MODEL ASSESSMENTS - 1989 (Analysis of record was completed in January 1990. No prior LOCA Model assessments were made.) | ΔPCT= + NA°F |
| C. | PRIOR LOCA MODEL ASSESSMENTS - 1990 | ΔPCT= + 0°F |
| D. | PRIOR LOCA MODEL ASSESSMENTS - 1991 | ΔPCT= + 30°F |
| E. | PRIOR LOCA MODEL ASSESSMENTS - 1992 | ΔPCT= -25°F |
| F. | PRIOR LOCA MODEL ASSESSMENTS - 1993 | ΔPCT= -6°F |
| G. | PRIOR LOCA MODEL ASSESSMENTS - 1994 | ΔPCT= 0°F |
| H. | 1995 10CFR50.46 MODEL ASSESSMENTS | |
| | 1. Skewed Power Shape Penalty | ΔPCT= + 253°F |
| | 2. Hot Leg Nozzle Gap Benefit | ΔPCT= -237°F |
| I. | LICENSING BASIS PCT + PERMANENT ASSESSMENTS | PCT= 2105°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= 2140°F |
| B. | PRIOR LOCA MODEL ASSESSMENTS - 1989 (Analysis of record was completed in January 1990. No prior LOCA model assessments were made.) | ΔPCT= + NA°F |
| C. | PRIOR LOCA MODEL ASSESSMENTS - 1990 | ΔPCT= + 0°F |
| D. | PRIOR LOCA MODEL ASSESSMENTS - 1991 | ΔPCT= + 30°F |
| E. | PRIOR LOCA MODEL ASSESSMENTS - 1992 | ΔPCT= -25°F |
| F. | PRIOR LOCA MODEL ASSESSMENTS - 1993 | ΔPCT= -6°F |
| G. | PRIOR LOCA MODEL ASSESSMENTS - 1994 | ΔPCT= 0°F |
| H. | 1995 10CFR50.46 MODEL ASSESSMENTS | |
| | 1. Skewed Power Shape Penalty | ΔPCT= + 253°F |
| | 2. Hot Leg Nozzle Gap Benefit | ΔPCT= -237°F |
| I. | OTHER MARGIN ALLOCATIONS | |
| | 1. Power Margin | ΔPCT= -98°F[1] |
| J. | LICENSING BASIS PCT + PERMANENT ASSESSMENTS | PCT= 2057°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.