Omaha Public Power District
1623 Harney Omaha, Nebraska 68102
402/536-4000

March 28, 1984
LIC-84-087

Mr. James R. Miller, Chief
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Branch No. 3
Washington, D.C. 20555

Reference: Docket No. 50-285

Dear Mr. Miller:

Fort Calhoun Station
Cycle 9 Core Reload Submittal

Attached is Omaha Public Power District's response to the seven (7) questions concerning the Fort Calhoun Station's Cycle 9 core reload submittal. This information was requested by your staff to enable them to continue their review of the Cycle 9 reload facility license change application. Questions 1 through 6 were delineated in a letter from your office dated March 12, 1984. Question 7 was received later in a telephone conversation between members of your staff and District personnel.

Sincerely,

W C Jones

W. C. Jones
Division Manager
Production Operations

WCJ/JCB:jmm

Attachment

cc: LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Avenue, N.W.
Washington, D.C. 20036

Mr. E. G. Tourigny, Project Manager
Mr. L. A. Yandell, Senior Resident Inspector

IE26 1/1

NRC Question 1: What are the maximum expected peaking factors (F_R and F_{xy}) during Cycle 9?

Response: The maximum expected untilted values of F_R and F_{xy} for Cycle 9 are:

$$F_R = 1.63$$

$$F_{xy} = 1.68$$

NRC Question 2: Is the BOC, HZP moderator temperature coefficient of +0.86 X 10^{-4} $\Delta\rho$/°F given in Table 5-1 correct? If so, the Technical Specification value for power levels below 80 percent is violated and the values used in the safety analyses are non-conservative.

Response: The value is not correct. The BOC, HZP MTC reported did not include the DIT bias of -0.3 X 10^{-4} $\Delta\rho$/°F. The value which should have been reported is +0.56 X 10^{-4} $\Delta\rho$/°F. Because this value still exceeds the Technical Specification limit of +0.50 X 10^{-4} $\Delta\rho$/°F, the District will use rod insertions to lower the critical boron concentration and thus the MTC, thereby insuring that the Technical Specification limit is not exceeded.

NRC Question 3: Since SCU procedures were used for DNBR and CTM calculations, why was the nominal reactor coolant flow value given in Technical Specification 2.10.4(5) not used as input to the safety analyses? Explain how the value of 208,280 gpm was obtained.

Response: The best estimate RCS flow rate is used as input to the safety analysis of events in which the uncertainties are combined statistically as documented in Part III, Appendix C, of CEN-257(O)-P (Reference 1). The Technical Specification LCO value of 202,500 gpm represents the minimum guaranteed RCS flow rate including uncertainties and not the nominal flow rate. This LCO flow rate less uncertainties is used as input to the safety analysis for events in which the uncertainties are combined deterministically. The best estimate RCS flow rate is the 208,280 gpm value and was determined from a Cycle 3 through Mid-Cycle 8 data base of surveillance test measurements of the RCS flow rate.

NRC Question 4: Please clarify the explanation of the changes made to Technical Specification 2.10.4(5)(a)iii given in Table B-1 (change Number 18).

Response: Change Number 18 reflects a change in the method of application of uncertainties. The Cycle 8 Technical Specification limit on RCS flow rate was 197,000 gpm, which was an actual limit (not including uncertainties). The surveillance test limit used to monitor this LCO included the uncertainties. An RCS flow rate limit of 202,500 gpm was

used in this test. In the proposed Cycle 9 Technical Specifications, the flow measurement uncertainty has been statistically combined with other measurement uncertainties and is not treated independently as was done in previous cycles. Therefore, the allowance for measurement uncertainty on the RCS flow rate should now be included in the Technical Specification LCO. The proposed value of 202,500 gpm is consistent with parameters in Technical Specification 2.10.4(5)(a) because all limits are now indicated values.

NRC Question 5: What is the calculated net available scram worth at full power conditions including stuck CEA allowance, PDIL allowance, and physics uncertainty and bias?

Response: The values of scram worths including the stuck CEA allowance, PDIL, and physics uncertainties are summarized below:

	Reactivity (%Δρ) BOC	EOC
Worth of all CEA's less Worth of Most Reactive CEA Stuck Out	7.85	8.32
PDIL CEA Worth	-0.18	-0.26
Physics Uncertainty Plus Bias	-0.76	-0.80
Moderator Void Collapse Allowance	0.00	-0.10
Thermal Hydraulic Axial Gradient Allowance	-0.20	-0.40
TOTAL	6.71	6.76

NRC Question 6: Please confirm that the analytical methods (e.g., creep collapse) used in the Cycle 9 or reference cycle fuel system design (1) have been reviewed and approved by the staff, (2) have been applied for the range of expected Cycle 9 conditions (e.g., burnup), and (3) consider both (vendor) fuel types in the Cycle 9 core.

Response: The CE fuel was analyzed using the methods used for the Cycle 5 analysis and reviewed and approved in Reference 2. Mechanical design analysis, including creep collapse, has been performed on CE fuel in the Fort Calhoun reactor for an assembly burnup greater than 45,000 MWD/MTU. This analysis adequately bounds the expected EOC 9 exposure for a CE fuel assembly of less than 40,000 MWD/MTU.

The ENC batch H and I fuel was analyzed using the methods discussed in XN-NF-79-70, Reference 3, which was submitted as part of the Cycle 6 analysis and reviewed and approved in Reference 4. The mechanical design analysis contained

in XN-NF-79-70 was performed on ENC Batch H and I fuel in the Fort Calhoun reactor for an assembly burnup up to 40,000 MWD/MTU. This analysis adequately bounds the expected EOC 9 exposure of a Batch H or I fuel assembly of less than 40,000 MWD/MTU.

NRC Question 7: For those events in which a lower (RCS) flow rate results in a more conservative analysis, justify the use of 208,280 gpm rather than the Technical Specification value of 202,500 gpm.

Response: The CEA Drop and Loss of Coolant Flow events analyzed for Cycle 9 are the two events which fall into the category described in the question.

The analysis of the CEA Drop and Loss of Coolant Flow events for Cycle 9 is consistent with the methods described in the Statistical Combination of Uncertainties topical (CEN-257(O)-P). In the topical (Appendix C of Part 3), a ROPM function is derived to account for the difference in ROPM's of the base coolant conditions and the worst coolant conditions. The base coolant conditions are represented by a core power of 100%, an inlet temperature of 545°F, a pressurizer pressure of 2075 psia, an F_R of 1.75, and an RCS flow rate of 208,280 gpm. A sensitivity study was performed on each of the aforementioned parameters for both the CEA Drop and Loss of Flow events by varying the parameter of interest, including RCS flow rate, from the base condition over the uncertainty range. The largest value of ROPM (i.e., conservative) resulting from the sensitivity cases for any one of the parameters was denoted the worst condition for that parameter (The worst condition for RCS flow was a low flow corresponding to the lower bound 95/95 confidence interval). The worst conditions for all of the parameters were combined resulting in the worst coolant conditions. The worst coolant conditions thus maximize the value of the ROPM. The difference in ROPM between the worst coolant conditions case and base coolant conditions case represent the ΔROPM function and accounts for the combination of all parameter uncertainties. The ΔROPM function translates the parameter uncertainties into an equivalent ΔROPM. The ΔROPM function includes an accounting for the flow uncertainty at the 95/95 confidence interval. Since the parameter uncertainties are invariant from fuel cycle to fuel cycle, the Δ ROPM function is applicable to any future cycle after its derivation.

The transient analysis for the SCU program included a comparison between the SCU derived worst coolant condition ROPM and an ROPM derived using the deterministic combination of the uncertainties. The attached Figures 1 and 2 show this comparison and the SCU base coolant conditions ROPM. These figures show that the deterministically calculated ROPMs are always bounded by the SCU worst coolant conditions case. It should also be noted that the SCU base coolant condition ROPMs are often more restrictive (i.e., larger) than the deterministically calculated values.

These Cycle 9 CEA drop and loss of coolant flow transient analyses use the best estimate flow of 208,280 and the flow uncertainty is accounted for by the ΔROPM function. The LCO flow is set such that a deviation from the data base used to calculate the best estimate flow would be detected and that a minimum flow is guaranteed for those events analyzed using a deterministic methodology.

Based on Figures 1 and 2, it can be concluded that use of the 208,280 gpm RCS flow rate, for the CEA Drop and Loss of Coolant Flow events for Cycle 9, in conjunction with the SCU methodology, generates ASI dependent ROPM values which are conservative with respect to those which would be generated through the use of deterministic methods utilizing the RCS flow rate Technical Specification limit of 202,500 gpm. The use of the best estimate flow of 208,280 gpm is justified because the flow uncertainty is accounted for in the ΔROPM function which is added to the ROPM calculation which used the best estimate flow (i.e., base coolant conditions) and because the ROPM for the worst coolant condition case (base coolant condition case plus ΔROPM function) is conservative with respect to the deterministic method case.

rh/J

REFERENCES

1. CEN-257(O)-P, "Statistical Combination of Uncertainties", November, 1983.

2. Letter from R. W. Reid (NRC) to T. E. Short (OPPD) dated December 5, 1978.

3. XN-NF-79-70, "Generic Mechanical Design Report for Exxon Nuclear Fort Calhoun 14 x 14 Reload Fuel Assembly", September, 1979.

4. Letter from Robert A. Clark (NRC) to W. C. Jones (OPPD) dated August 15, 1980.

Figure 1

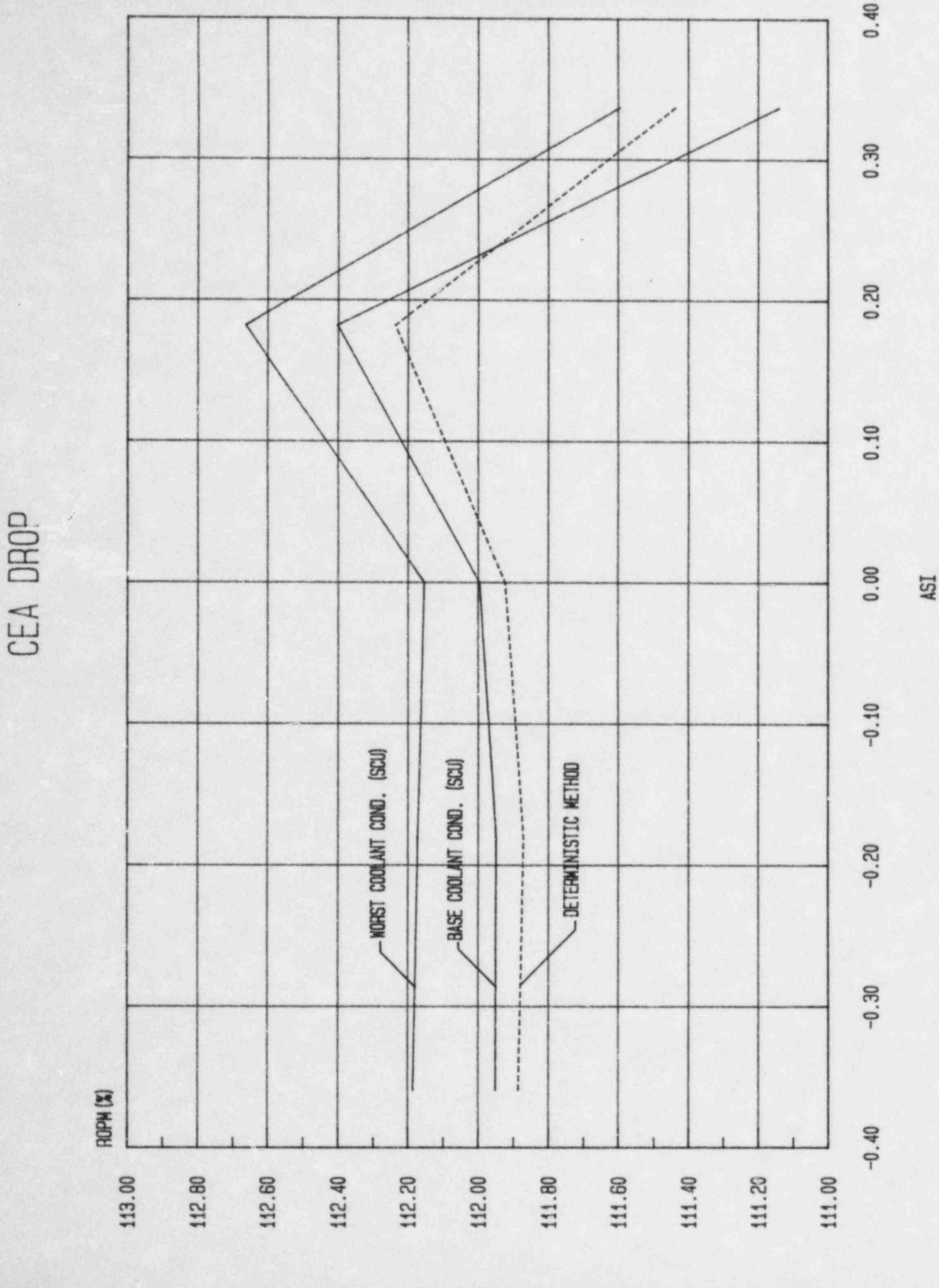
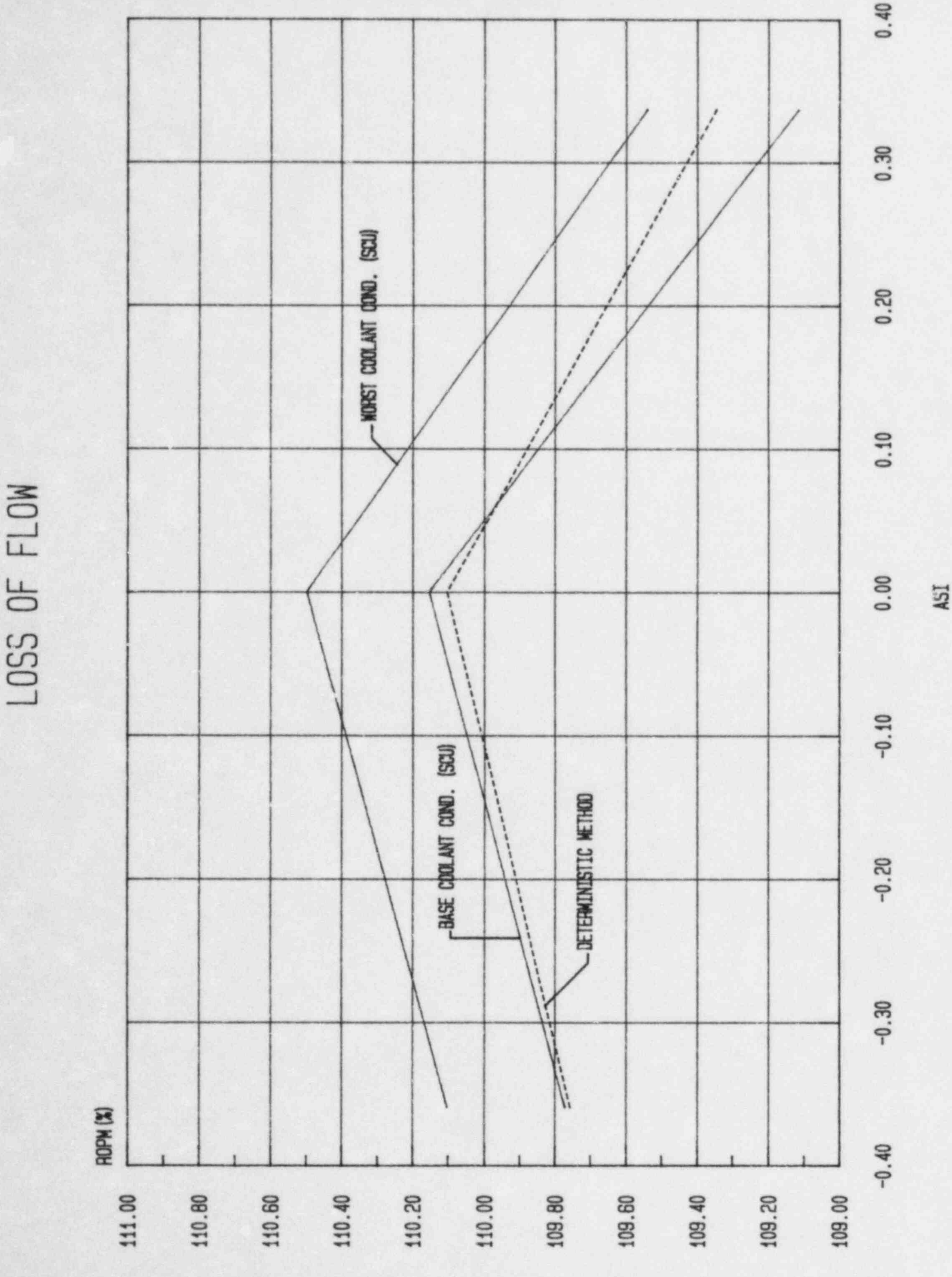

CEA DROP
ROPM (%)
113.00
112.80
112.60
112.40
112.20
112.00
111.80
111.60
111.40
111.20
111.00
-0.40
-0.30
-0.20
-0.10
0.00
0.10
0.20
0.30
0.40
ASI
WORST COOLANT COND. (SCU)
BASE COOLANT COND. (SCU)
DETERMINISTIC METHOD

Figure 2



LOSS OF FLOW
ROPM (%)
ASI
WORST COOLANT COND. (SCU)
BASE COOLANT COND. (SCU)
DETERMINISTIC METHOD
111.00
110.80
110.60
110.40
110.20
110.00
109.80
109.60
109.40
109.20
109.00
-0.40
-0.30
-0.20
-0.10
0.00
0.10
0.20
0.30
0.40