Attachment A

Documentation of Westinghouse - NRC Video Teleconference

Introduction and Background

The purpose of this letter is to document the video teleconference held between Westinghouse and the NRC on September 20, 1985. This teleconference addressed NRC concerns on the Augmented Startup test program and, in particular, concerns expressed during their review of Supplement 3 of WCAP-8575. The NRC has expressed three concerns. The first concern deals with the xenon model. This was the result of comparisons between the Follow Rod and Follow AO methods. Since the Follow Rod method resulted in large discrepancies in AO when compared to actual plant parameters the NRC indicated potential inaccuracies in the calculational model for xenon. Because of the concern with the xenon model, there was a second concern raised over the FQ calculations in the Westinghouse FAC analysis. This further led to the third concern dealing with the W(z) calculations in the Westinghouse FQ Surveillance Technical Specification since some recent Peaking Factor Limit Reports showed some W(z) values in the 1.3 to 1.4 range.

Xenon Model (Follow Rod vs. Follow AO)

Addressing the xenon model concerns first, it is difficult to separate cause and effect when comparing nuclear model simulations to actual plant parameters. There are three reasons for this. First, the basic nuclear model is not exact. Second the basic input to the model, for example cross sections, are not exact. Finally the plant data obtained is neither exact nor continuous. There are certain measurement

uncertainties associated with any plant data. In addition, typical intervals for data collection range from 15 minutes to 1 hour.

To examine the effect of these uncertainties load follow simulations were performed in a 1D nuclear model. The simulations consisted of six days of load follow. The first two days used 100-50-100 load follow swings using the MAX RTP[1] load follow strategy. This was followed by two days of 100-70-100 load follow swings again using the MAX RTP load follow strategy and, finally, this was followed by two days of 100-50-100 power swings using the MINB[1] load follow strategy. This six day simulation was then treated as an augmented startup test. From the simulation, power, AO and rod position versus time were obtained. Sensitivity studies examined [ ] +(a,c)

The results of the Follow Rod sensitivity studies are shown in Figures 1 A through 1 C. These figures present the difference in axial offset between the sensitivity study and the original load follow simulation. These differences are plotted as a function of time for all six days, two days on each figure. As can be seen in these figures, the results of the Follow Rod method diverge quickly. [ ] +(a,c) This is consistent with the

[1] MAX RTP and MINB load follow strategies are described in Westinghouse to NRC (Anderson to Kniel) letter dated January 31, 1980

differences seen in Supplement 3 of WCAP-8575. By the sixth day the differences are as large as [ ] +(a,c) It can also be observed in Figures 1A-1C that the results presented are completely inconsistent with the CAOC concept. These types of differences shown in Figures 1A-1C could never occur in actual plant operation.

Figures 2A through 2C show the results of the Follow AO sensitivity studies. These figures show the change in D Bank position (in percent inserted) as a function of time during the load follow simulations. It can be observed here that the perturbations to the model result in only small changes to the D Bank position. Typical differences are less than [ ] +(a,c) The results of the Follow AO sensitivity studies were also used to calculate FQ. These results are shown in Figure 3. As can be seen in this figure the sensitivity studies had very little impact on FQ. In fact, the worst difference in peak FQ was less than [ ] +(a,c)

To summarize the Follow Rod and Follow AO sensitivity studies, it has been shown that Follow Rod requires essentially perfect models with precise input. [ ] +(a,c) Follow AO on the other hand is much less sensitive to model and input uncertainties, both in terms of differences in rod

position and FQ. In addition Follow AO is consistent with the CAOC operating strategy.

The xenon model is really just a solution to a simple set of differential equations. Therefore, there is no likely error in the xenon model. Using the sensitivity studies to evaluate the variations in the Beaver Valley augmented startup test indicate that these variations could have been caused

+(a,c)

FQ Calculations

Addressing the FQ concerns, Westinghouse has performed an in-house study using RAOC methods on a CAOC plant. The purpose of this study was to examine the completeness of the 18 case FAC analysis. Recall that the RAOC method is not a time dependent analysis. The RAOC method finds the most adverse xenon distribution possible in any given input Delta I Band. The input Delta I Band can be either CAOC or RAOC based. The most adverse xenon is not a function of any time dependence of the xenon model. For example, if the xenon model were changed the most adverse xenon distribution may be found at hour 16 instead of hour 12.

The RAOC methods were used to evaluate FQ on a plant with a ±5 percent Delta I CAOC Band. The results of this analysis were then compared to a

three case subset[2] FAC analysis on the same plant and band. The results of this comparison can be seen in Figure 4. Figure 4 shows the maximum FQ X P versus core height results for both the RAOC and CAOC calculations. The CAOC calculation results include the 3 case subset penalty.[2] The two methods (CAOC and RAOC) yield nearly identical FQ results with [

] +(a,c)

To summarize the FQ calculations, FQ has been calculated with time dependent CAOC and time independent RAOC methods with nearly identical results. These results confirm the applicability of the CAOC concept and the 18 case FAC analysis.

W(z) Calculations

The concern on the W(z) calculations arose because of the combination of large W(z) values seen in recent Peaking Factor Limit Reports of some RAOC plants and the concern expressed over the xenon model. As discussed previously, RAOC is not a time dependent analysis and therefore the FQ values (and hence W(z) values) obtained are not dependent on the xenon model. In addition, the RAOC analysis is conservative in that the analysis assumes instantaneous power level changes along with instantaneous boron concentration and AO changes, without regard to the physical limitations of actual plant operation.

[2] The subset cases and penalty are described in Westinghouse to NRC (Eicheldinger to Stolz) letter dated April 6, 1978.

Summary and Conclusions

Three areas of concern in the Augmented Startup Test Program have been expressed by the NRC. All three concerns have been addressed in this letter. It has been demonstrated that the variations seen in the Augmented Startup load follow test using the Follow Rod method are not indicative of a xenon model inaccuracy. Rather these variations are likely caused +(a,c)

In addition, independent determination of FQ using RAOC methods has confirmed the applicability of the Westinghouse FQ calculations and hence their use in W(z) determination.

FIGURE 1A
FOLLOW ROD SENSITIVITY RESULTS
DAYS 1 AND 2

+(a,c)

DELTA AXIAL OFFSET (PERCENT)

0 6 12 18 24 30 36 42 48

TIME (hours)

FIGURE 1B
FOLLOW ROD SENSITIVITY RESULTS
DAYS 3 AND 4

+(a,c)

DELTA AXIAL OFFSET (PERCENT)

0 6 12 18 24 30 36 42 48

TIME (hours)

+(a,c)

FIGURE 1C
FOLLOW ROD SENSITIVITY RESULTS
DAYS 5 AND 6

DELTA AXIAL OFFSET (PERCENT)

0 6 12 18 24 30 36 42 48

TIME (hours)

FIGURE 2A
FOLLOW AO SENSITIVITY RESULTS
DAYS 1 AND 2

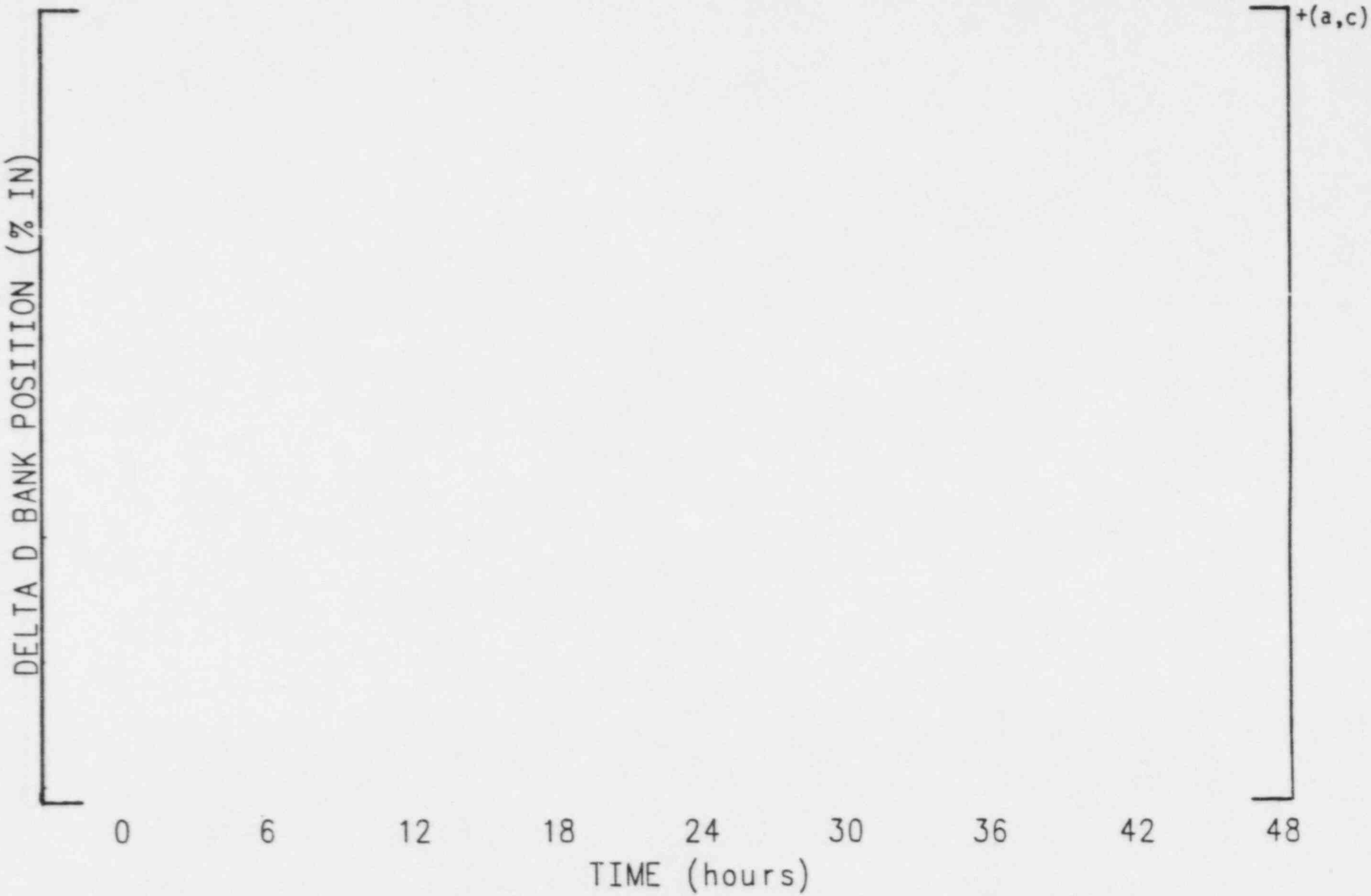

FIGURE 2B
FOLLOW AO SENSITIVITY RESULTS
DAYS 3 AND 4

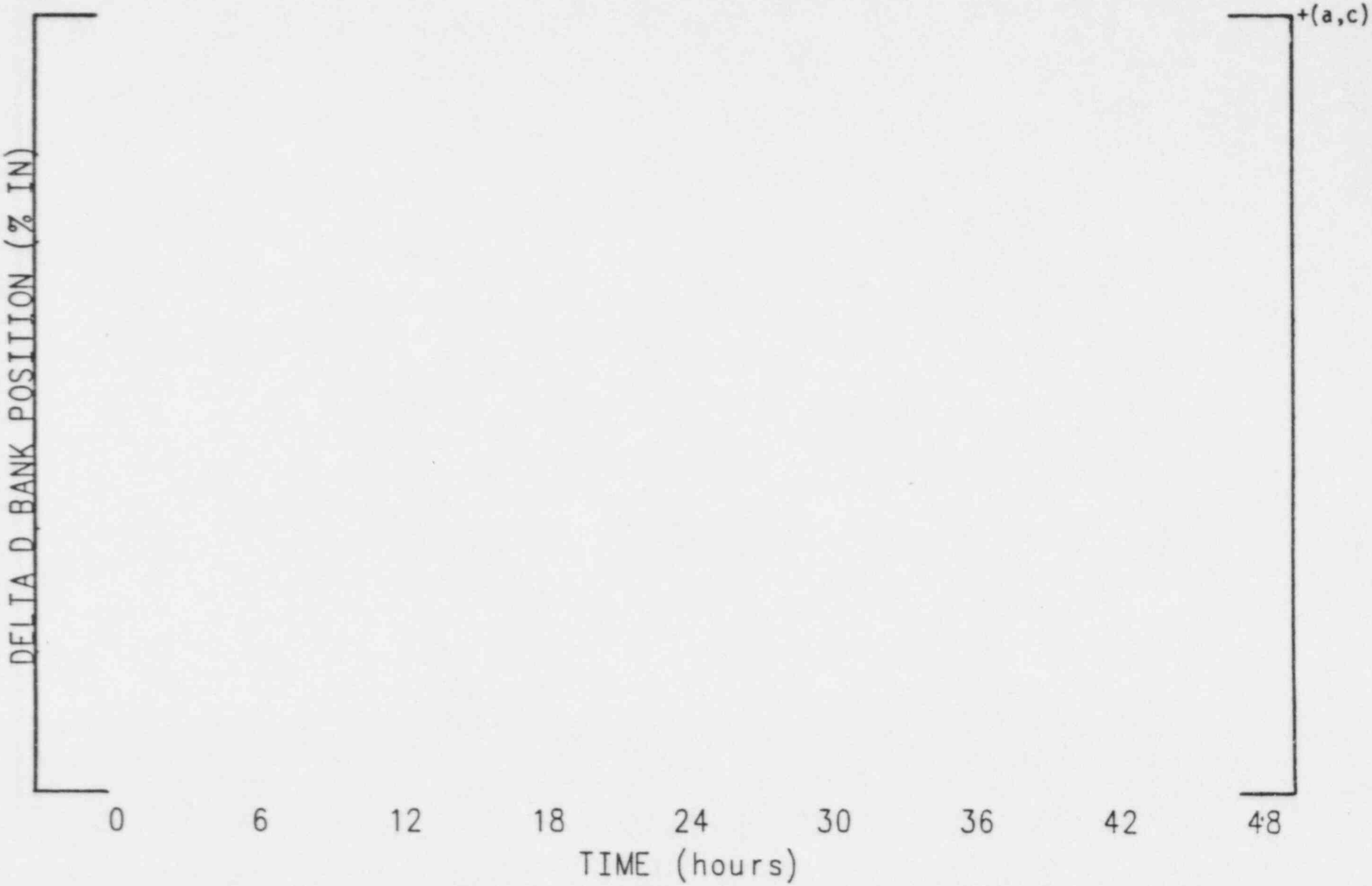

FIGURE 2C
FOLLOW AO SENSITIVITY RESULTS
DAYS 5 AND 6

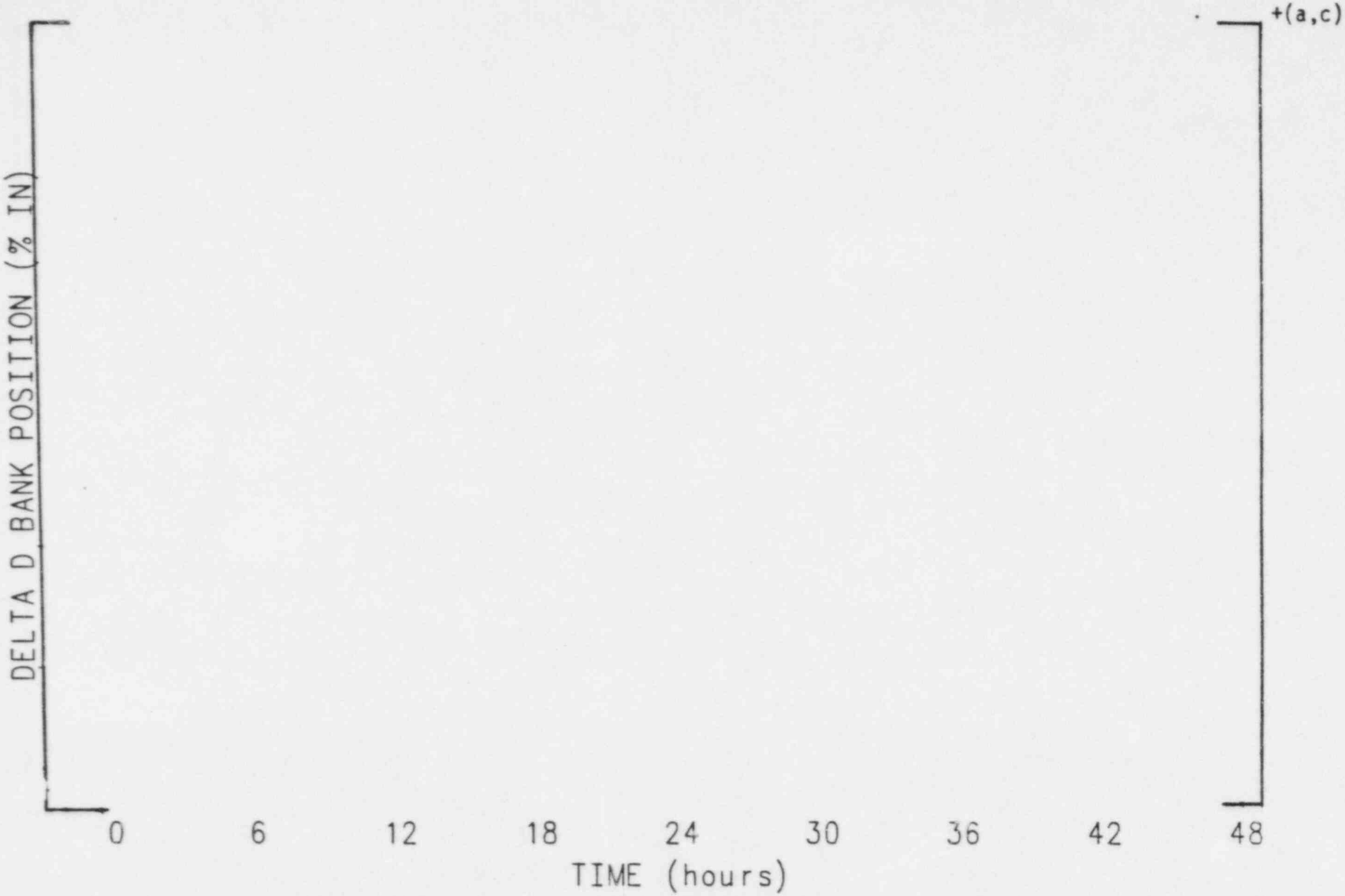

FIGURE 3
FQ x POWER vs HEIGHT
FOLLOW AO SENSITIVITIES

FIGURE 4
MAXIMUM (FQ * POWER) VERSUS AXIAL CORE HEIGHT
DURING NORMAL OPERATION