March 13, 1989

Dockets Nos. 50-277/278

Mr. George A. Hunger, Jr.
Director-Licensing
Philadelphia Electric Company
Correspondence Control Desk
P. O. Box 7520
Philadelphia, Pennsylvania 19101

Dear Mr. Hunger:

SUBJECT: QUESTIONS ON REPORT PECo-FMS-0005 (TAC NOS. 67190/67191)

RE: PEACH BOTTOM ATOMIC POWER STATION, UNIT NOS. 2 AND 3

The staff has developed questions as a result of its review of the report entitled PECo-FMS-0005, "Methods for Performing BWR Steady State Reactor Physics Analyses." These questions, as attached, were developed by our contractor, the Brookhaven National Laboratory.

Please provide us with a firm commitment to a schedule for the submittal of your response so that we may schedule our review.

Sincerely,

/s/

Robert E. Martin, Project Manager
Project Directorate I-2
Division of Reactor Projects I/II
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc w/enclosure:
See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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See next page

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Philadelphia Electric Company

Peach Bottom Atomic Power Station, Units 2 and 3

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Questions Concerning the PECO Steady-State Physics Methods (PECO-FMS-0005)

1. How is the bias in the SIMULATE-E k_{eff} critical data relative to k_{eff} = 1.0 accounted for? What is the standard deviation of the SIMUALTE-E k_{eff} predictions relative to k_{eff} = 1.0?

2. Does the PECO physics methodology require three SIMULATE/measurement normalizations during a burnup cycle (BOC, MOC, EOC)? Since this is not typical industry practice, why are these additional normalizations required? What parameters will be adjusted and will this information be used to update the precalculated cycle safety analyses such as those of Appendices A-D?

3. What is the effect on the PECO calculation uncertainty estimates when only the PECO calculations are included in the benchmark comparisons?

4. Are the KENO-II and CASMO calculations independent? For example, are the nuclear cross sections used in the two calculations different?

5. How do the uncertainties derived from the EPRI and AB Atomenergi Doppler coefficient comparisons account for actual core conditions such as fuel burnup, fuel rod geometrical changes, fuel temperature uncertainty, spectral effects due to the presence of voids, etc.?

6. How is the expression for $(\Delta K/K)_{DOP}$ (p. 4-209) derived? What is the relation between K_{DOP} and the CASMO-1 cross sections?

7. How are the rodded and unrodded void and Doppler reactivity coefficient uncertainties combined to determine the core reactivity coefficient uncertainties?

8. What is the sensitivity of the Doppler and void coefficients to changes in the core flux distribution during a transient? How is this uncertainty accounted for?

9. How do the Peach Bottom-3 Cycle-7 (for example) Doppler and void coefficients and control rod worth, calculated by SIMULATE-E, compare with the fuel vendor values?

10. How is the dependence of the void coefficient on changes in control rod insertion and void fraction during a transient accounted for? What uncertainty is introduced by the treatment of these effects?

11. How is the reduced leakage probability for delayed neutrons calculated?

12. How is the highest worth rod determined in the calculation of core shutdown margin?

13. How are the "projected cold critical eigenvalues" determined from the "data base of cold critical projections" (p. 5-32)? How are the projected eigenvaluves represented by a polynomial?

14. How is the increased uncertainty in the shutdown margin calculation of k_{eff} for the state with the highest worth rod withdrawn accounted for?

15. What are the calculational uncertainties when all measured TIP signals are included in the calculation/measurement comparisons (e.g., MCPR, MAPLHGR, PPLHGR, etc.)?

16. In the analysis of the rod withdrawal event, how is the error-rod yielding the minimum RBM setpoint determined? How is the uncertainty introduced by this procedure accounted for?

17. In the analysis of the rod withdrawal event, how are rods with less than four adjacent LPRM strings treated considering worst-case LPRM failures?

18. How is the misoriented fuel bundle treated?

19. What is the sensitivity of the ΔCPR regression fit of Figure B-1, for the mislocated bundle loading error, to the core operating conditions (power, flow, rod pattern, xenon, etc.)? How is the resulting uncertainty accounted for?

20. In the loss of feedwater heater event, is the feedwater flow increased as a result of the increased power level? If not, how is the resulting increase in power and axial peaking accounted for in the analysis?

21. What is the sensitivity of the loss of feedwater heater event to the core conditions (power, flow, xenon, rod pattern, exposure, pressure, inlet subcooling), and how is the resulting uncertainty accounted for?

22. The PECO loss of feedwater heater analysis assumes a fixed core power shape during the transient. In fact, the axial power distribution becomes more bottom-peaked during the transient, resulting in an additional reduction in CPR margin in the bottom of the core. How is this effect accounted for in the PECO methodology?

23. The 4.1% RMS error in the SIMULATE assembly integral power calculation is based on the elimination of the top and bottom 18 inches of the core from the statistics. What is the effect of this deletion on the calculational uncertainty? Are these regions ever limiting?

24. Describe the fuel loadings of PB-2, Cycles 5 and 6 and PB-3, Cycles 4, 5 and 6 which were included in the benchmarking of SIMULATE. Does PECO intend to use fuel designs and loadings which are not represented in the benchmarking? If so, what are they and how will they affect the qualification of the PECO methods?

25. The hot critical eigenvalue results for PB-2 and PB-3 shown in Figures 3.1.1 through 3.1.9 show a pronounced upward trend with exposure. This trend is clearly seen in the multicycle plot of Figures 3.1.6 and 3.1.7. What is causing this exposure dependent bias, and how is it accounted for in the SIMULATE predictions?

26. Which specific SIMULATE-E normalization parameters are adjusted from one cycle to the next?

27. Explain the systematic underprediction of the core average axial power distribution near the bottom of the core for BF-3 Cycle 6.

28. Describe the procedures used in correcting for temperature and reactor period in the calculation of the critical tests.

29. Have any few-rod criticals been evaluated with SIMULATE-E and, if so, how do these calculations compare with the measurements?

30. Are the system variables such as pressure, feedwater flow, steam flow, etc., assumed constant during the loss of feedwater heater transient? If so, provide the basis for this assumption. Can changes in these variables result in a limiting ΔCPR during the transient, making the final-state ΔCPR calculation not bounding?