QUESTION 230.1

The response to Question 221.9 is unacceptable. The applicant should commit to submit a report describing the computer program used for core thermal-hydraulic analysis prior to issuance of an operating license for Susquehanna. The report should provide the code description, the calculational methods and empirical correlations used, a sample application and code verification through comparison with experimental data.

RESPONSE:

The computer program cited in Subsection 4.4.4.5 is named ISCOR. Various versions of this code have been used by the General Electric Company for over a decade to perform detailed core, steady-state, thermal-hydraulic analysis.

The ISCOR computer program is used as the basis for the steady state thermal-hydraulic module in the GEBS/PANAC three-dimensional BWR core simulator. The models and non-proprietary correlations are described in Chapter 4 of the BWR Core Simulator Licensing Topical Report (NEDO-20953, May, 1976).

QUESTION 230.2

The response to Question 221.2 is unacceptable. Question 2 requested assumptions used for amount of crud used in design calculations and the sensitivity of CPR and core pressure drop to variations in the amount of crud present. Merely stating that "a conservative amount of crud is deposited on the fuel rods and fuel rod spacers" does not begin to answer this question. The question also asked for a discussion of how crud buildup in the core would be detected; no discussion is provided.

RESPONSE:

In general, the CPR is not affected as crud accumulates on fuel rods (References 1 and 2). Therefore, no modifications to GEXL are made to account for crud deposition. For pressure drop considerations, the amount of crud assumed to be deposited on the fuel rods and fuel rod spacers is greater than is actually expected at any point in the fuel lifetime. This crud deposition is reflected in a decreased flow area, increased friction factors, and increased spacer loss coefficients, the effect of which is to increase the core pressure drop by approximately 1.7 psi, an amount which is large enough to be detected in monitoring of core pressure drop. It should be noted that assumptions made with respect to crud deposition in core thermal hydraulic analyses are consistent with established water chemistry requirements. More detailed discussion of crud (service-induced variations) and its uncertainty is found in Section III of Reference 3.

References:

1. McBeth, R. V., R. Trenberth, and R. W. Wood, "An Investigation Into the Effects of Crud Deposits on Surface Temperature, Dryout, and Pressure Drop, with Forced Convection Boiling of Water at 69 Bar in an Annuler Test Section," AEEW-R-705, 1971.

2. Green, S. J., B. W. LeTourneau, A. C. Peterson, "Thermal and Hydraulic Effects of Crud Deposited on Electrically Heated Rod Bundles," WAPD-TM-918, September, 1970.

3. "General Electric Thermal Analysis Basis (GETAB): Data, Correlation, and Design Application," General Electric Company, January, 1977, (NEDO-10958A).

QUESTION 230.3

Your response to question 221.13 is incomplete. Since the operational design guidelines are exceeded for some operating conditions, Figure 4.4-6 should be revised to show decay ratios as a function of rod position, recirculation flow and power. Figure 4.4-6 as currently presented is not sufficiently detailed for use in inferring operational boundaries.

RESPONSE:

The operational design guideline is not intended for use in defining operational boundaries. It is used to determine the range of optional operation in the automatic flow control mode. Current guideline is the decay ratio 0.5. It is clear from Figure 4.4-6 that most of the operating domain meet the guideline. It should be noted, however, that power/flow condition which has a decay ratio greater than the guideline can always be operated in the manual flow control mode.

Although GE does utilize design stability guides to optimize BWR operation and performance from an availability considerations, application of these guidelines is not considered to be a necessary requirement to demonstrate an acceptable and licensable configuration.

The criterion used with respect to safety is that the calculated decay ratio be less than 1.0 over the expected range of operation. This has been demonstrated for Susquehanna unit. Operational guides have been deleted from Figure 4.4-6.

QUESTION 230.4

Your response to Question 221.15 is unacceptable. You reference NEDO-10958-A for a discussion of the uncertainties and their bases. The staff evaluation of NEDO-10958 states "The estimated value of the uncertainties and the basis for the value depend on the specific design and equipment of each reactor and will be evaluated for each reactor at the time Technical Specifications are issued." Information to support the uncertainty values for Susquehanna must be submitted prior to issuance of a safety evaluation report for Susquehanna.

RESPONSE:

A general discussion of the bounding statistical analysis uncertainty shown in Table 4.4-6 is given in the GETAB Licensing topical report (Reference 1). Of these uncertainties, all except that of critical power are unaffected by the two water-rod assembly design. The GEXL critical power predictability for the 8 x 8 two water-rod design has been shown to be similar to the standard one water-rod design (see the response to Question 221.3); the value for this uncertainty cited in Reference 1 (1 = 3.6%) is conservative with respect to both one water-rod and two water-rod designs.

Additional information concerning the remaining uncertainties in Table 4.4-6 and the bases used in the derivation of those uncertainties is contained in the Licensing topical report "Process Computer Performance Evaluation Accuracy" (References 2, 3 and 4). As stated therein, "the analysis was performed ... for measurements systems typical of (or conservative with respect to) the BWR4-6," and is therefore directly applicable to Susquehanna.

References:

1. "General Electric Thermal Analysis Basis (GETAB): Data, Correlation, and Design Application," General Electric Company, January, 1977 (NEDO-10958A).

2. J. F. Carew, "Process Computer Performance Evaluation Accuracy," General Electric Company, June, 1974 (NEDO-20340).

3. J. F. Carew, "Process Computer Performance Evaluation Accuracy Amendment 1," General Electric Company, December, 1974 (NEDO-20340).

4. J. F. Carew, "Process Computer Performance Evaluation Accuracy Amendment 2," General Electric Company, September, 1975 (NEDO-20340-2).

QUESTION 230.5:

The staff is performing a generic study of the hydrodynamic stability characteristics of LRWs under normal operation, anticipated transients, and accident conditions. The results of this study will be applied to the staff review and acceptance of stability analyses and analytical methods now in use by the reactor vendors. In the interim, the staff concludes that past operating experience, stability tests, and the inherent thermal-hydraulic characteristics of LWRs provide a basis for accepting the Susquehanna stability evaluation for normal operation and anticipated transient events. However, in order to provide additional margin to stability limits, natural circulation operation of Susquehanna will be prohibited until the staff review of these conditions is complete. Any action resulting from the staff study will be applied to Susquehanna.

RESPONSE:

PP&L does not plan to operate the Susquehanna units in the natural circulation mode. The plant technical specifications are consistent with your position, and require that appropriate actions be taken if no recirculation loops are in operation

QUESTION 230.6:

Because the Susquehanna stability analysis is for the first cycle only, a new analysis must be reviewed and approved by the staff prior to second cycle operation.

RESPONSE:

PP&L will perform a stability analysis for the second cycle of operation.

QUESTION 230.7:

No analysis has been presented for MCPR limits or stability characteristics for one long loop operation. One-loop operation will not be permitted until supporting analyses are provided and are approved by the staff.

RESPONSE:

PP&L does not plan to operate the Susquehanna units with only one recirculation loop in operation; therefore, no additional analysis is required. The plant technical specifications are consistent with your position, and require that appropriate actions be taken with one recirculation loop not in operation.

NOTE: Since the original response to this question, supporting analyses have been provided and approved by the staff, and the Susquehanna units are now licensed for single-loop operation (SLO).

QUESTION 230.8:

The steady-state operating limit for the Minimum Critical Power Ratio (MCPR) is 1.25. This value is calculated based on REDY model described in NEDO-10802. The results of three turbine trip tests performed at the Peach Bottom-2 have revealed that in certain cases the results predicted by REDY model are non-conservative. The General Electric Company's new ODYN for use in transient analyses has been approved. Accordingly, the applicant is required to reanalyze prior to criticality the following transients with ODYN: (1) generator load rejection/turbine trip, (2) feedwater controller failure-maximum demand, and (3) main steam isolation valve closure with position switch scram failure. If another event should be more limiting than those listed above, the other event should be reanalyzed with ODYN. The reanalyses should include CPR calculation and demonstrate that the operating limit for MCPR is not less than 1.25.

RESPONSE:

The Susquehanna SES ODYN submittal is scheduled for the second quarter of 1981.