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

ATTENTION: R. W. BORCHARDT

SUBJECT: INDEPENDENT REVIEW OF AP600 BASEMAT ANALYSES

Dear Mr. Borchardt:

During the closeout of the NRC staff audit of structural calculations the week of July 11, 1994, NRC stated that they had found discrepancies in the design calculations for the basemat. We were unable to schedule the key individuals responsible for this calculation to be present at the audit due to other commitments. However, the Westinghouse and Bechtel personnel present at the audit agreed that there were areas of the analysis that required further investigation. Westinghouse committed during the meeting to perform an independent review of the analyses, to perform simplified analyses as appropriate to confirm the existing results, and to provide the results of this independent review to NRC. In addition the review would address some of the specific concerns raised during the audit. This letter confirms that such an independent review will be performed and identifies the scope of this review.

The design calculations for the basemat include the following three areas:

- Major assumptions utilized in the analyses related to the overall model, soil conditions, and seismic loads. These assumptions were developed jointly by Initec, Bechtel and Westinghouse at the start of the analyses. A number of RAIs have been issued requesting further justification of these assumptions.
- Non-linear finite element analyses of the basemat. These analyses used ANSYS and considered non-linear effects due to lift-off of the basemat as well as of the containment vessel and internal structure. These are complex analyses and difficult for an independent reviewer to assure himself of their validity. Confirmatory "sanity checks" will be performed by simplified calculations. Additional hard copy documentation of the models and output will be developed. (The information is available on electronic files but hard copies were not available for the audit).
- Code evaluation. Post processors were developed to perform evaluations against the code allowables. This is the area where NRC identified concerns. Out of plane shear forces in the basemat will be specifically addressed. ANSYS does not provide this force directly and the assumptions used in developing the post processors were questioned. Further investigation is required for the design of flexural reinforcement.

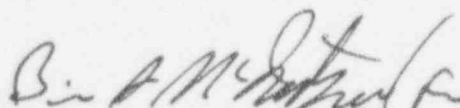
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The basemat design and analysis will continue using existing project personnel. This will include the preparation of additional information from the existing analyses and performance of simplified analyses for comparison against the existing results. It will also include simplified sensitivity analyses to address issues, such as soil springs and seismic loads, raised in the RAIs and during the meeting. In addition an independent review will be conducted by Dr. W. White of Bechtel who has not previously been involved in the basemat design and analysis. This review will cover the existing analyses and any additional work performed to support the existing analyses. The independent review will include the following scope:

- a) Hardcopy documentation on model, and results
- b) A simplified analysis with rigid basemat that compares bearing reactions against the ANSYS results for at least one non-linear case. The case reviewed should be one that results in the largest bearing reactions below the six foot thick portion of the mat.
- c) Local analyses of the basemat spanning between support walls, using the bearing reactions verified in (b), and comparison of moments and forces against those given by ANSYS.
- d) Hand calculations to determine the required reinforcement, using the moments and forces verified in (c), and comparison against reinforcement given by ANSYS post processor.
- e) For the portion of the mat below the containment, review model including use of constraint equations. Review hand calculations to determine the required reinforcement using moments and forces from the ANSYS results and comparison against reinforcement given by ANSYS post processor.

The independent review is being initiated immediately and the evaluation of the existing work will be completed by November 1. Implementation of the resulting recommendations and finalization of the design calculations for the basemat will be completed by July, 1995.


Nicholas J. Liparulo, Manager
Nuclear Safety Regulatory and Licensing Activities

/nja

cc: G. Bagchi NRC/NRR