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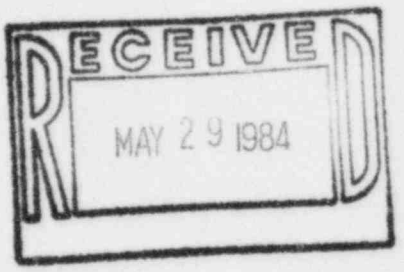

Mr. John T. Collins
Regional Administrator, Region IV
Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76012

Dear Mr. Collins:

South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499
Final Report Concerning the Design
Basis Flood for the South Texas Project

On August 30, 1983, pursuant to 10CFR50.55(e), Houston Lighting & Power Company (HL&P) notified your office of an item concerning the Design Basis Flood (DBF) for the South Texas Project (STP). Attached is the final report concerning this item.

If you should have any questions concerning this item, please contact Mr. Michael E. Powell at (713) 993-1382.

Very truly yours,

G. W. Oprea, Jr.
Executive Vice President

MEP/mpg
Attachment - Final Report Concerning the Design Basis Flood
for the South Texas Project

W2/NRC2/d

IE-27
1/1

cc:

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Revised 04/03/84

Final Report Concerning the Design Basis Flood for the South Texas Project

I. Summary

The Design Basis Flood (DBF) evaluation for STP, as documented in the FSAR, was completed in accordance with Regulatory Guide (RG) 1.59, Rev. 0. This Regulatory Guide does not require consideration of the effects of erosion and scour resulting from the DBF event. Subsequently, RG 1.59, Rev. 2, was issued and includes an endorsement of ANSI N170-1976 which requires consideration of the effects of erosion and scour. HL&P is committed to meet the intent of RG 1.59, Rev. 2.

II. Description of the Deficiency

On August 30, 1983, pursuant to 10CFR50.55(e), HL&P notified the NRC Region IV of an item concerning the DBF for STP. Prior to the project transition phase, the previous architect engineer, Brown & Root, Inc. (B&R), initiated Engineering Design Deficiency (EDD) Report No. 81-0698 identifying a concern relative to the potential for erosion of Category I structural backfill due to a postulated non-mechanistic breach of the MCR embankment. B&R made a preliminary judgment that structures would not be significantly affected. However, the evaluation was not completed prior to the termination of B&R activities on STP. DBF events other than the MCR embankment breach were also considered, but were judged to have insufficient velocities to cause problems.

Evaluation of potential erosion effects of a postulated embankment breach was neither a licensing requirement nor the subject of NRC review at the Construction Permit stage. As a result, this consideration was not included in the design criteria for the STP. As required by RG 1.59, Rev. 0, the FSAR addresses only the hydrostatic and hydrodynamic effects due to an assumed non-mechanistic embankment breach. Subsequently ANSI-N170 was issued and referenced in Revision 2 of RG 1.59, dated August 1977, requiring the evaluation of scour and erosion effects associated with DBF events.

Bechtel performed a preliminary evaluation of the postulated, i.e., non-mechanistic embankment breach and the potential scour and erosion effects on safety-related structures and systems as part of the disposition of the B&R EDD. The results of the preliminary evaluation indicated that it could not be conclusively demonstrated that certain safety-related structures (i.e., those on the near side of the power block to the MCR) would be unaffected by the scour and erosion effects of the postulated breach.

III. Evaluation of the Deficiency

In order to fully clarify the NRC licensing position for STP, HL&P has been in contact with the Hydrology and Geotechnical Branch of NRR. Included in these discussions was the question of the appropriate design basis for flooding effects to be used by NRC in their continuing review of STP. As a result of these preliminary discussions (Reference 1), NRC has indicated that no detailed analysis of the degree of erosion and scour associated with the postulated non-mechanistic MCR embankment failure would be required if it could be demonstrated that the MCR embankment would not fail from any credible event. The NRC staff further indicated that the risk of catastrophic failure of the MCR embankment could be shown to be acceptably low by demonstrating that:

1) The MCR embankment would not be overtopped during a Probable Maximum Flood event (PMF).

2) The MCR embankment facing the STP Category I structures is resistant to seepage and internal soils erosion and that an appropriate monitoring system is in place as well as a means to draw down the reservoir level.

3) The MCR embankment facing the STP Category I structures would not fail in a Safe Shutdown Earthquake (SSE) in combination with a 25-year recurrent MCR water level.

As part of the overall review of the adequacy of the as-built MCR embankment, Bechtel, with the assistance of Harza Engineering Company, has evaluated the three identified credible failure modes to determine the impact on embankment stability. The results of this evaluation are summarized below:

1) Embankment Overtopping During a PMF Event

The as-built MCR embankment crest corrected for settlement ranges from El. 65.00 feet to El. 66.25 feet. The normal maximum operating water level in the reservoir is at El. 49.00 feet. Thus the as-built embankment provides a minimum freeboard of 16.00 feet above the normal maximum operating water level in the reservoir.

The estimated total rise in water level above the normal maximum operating level due to a PMF event, in combination with a conservatively calculated wind setup and wave runup, is approximately 12.74 feet. The embankment height provided above the PMF event water level is approximately 3.26 feet, which is more than adequate to prevent embankment overtopping. In addition, the wind setup and wave runup associated with a Probable Maximum Hurricane (PMH) event was considered. This evaluation showed that, even under a PMH event, the embankment height provided above the PMH event water level is approximately 1.4 feet, which is adequate to prevent embankment overtopping.

2) Potential for Internal Soil Erosion in the Embankment Facing the Power Block

The circulating water (CW) system intake and discharge pipes penetrate the embankment section adjoining the power block. During the review of the MCR transition package, Bechtel identified a concern relative to potential joint leakage and fill erosion. In order to eliminate the erosion concern, remedial work will be done for the pipe and structure penetrations in the embankment. Planned remedial actions will consist of exposing pipes by using a concrete chute at the embankment crest and rerouting new concrete pipes over the embankment slopes on an erosion resistant slab. The existing pipes in the major embankment slopes will be abandoned.

Remedial work will be completed prior to fuel load of Unit 1.

With the addition of concrete chutes in way of penetrations through the embankment, the potential for soils erosion will be eliminated. Piezometers will be installed in the toe berm which will serve to monitor embankment performance. Monitoring instrumentation already in place consists of underseepage piezometers and settlement plates as described in FSAR Section 2.5.6.8.

The MCR flood level will be controlled by the spillway located in the southeast corner of the MCR. The spillway is designed to pass all flood flows up to and including the PMF, which results from rainfall directly into the MCR. For greater detail see FSAR Section 2.5.6.1.1.

3) Embankment Stability Under Seismic Loading

The embankment stability under seismic loading was evaluated with the assistance of Harza Engineering Company.

The embankment section adjoining the power block (from Station 640+00 to Station 0+00 and from Station 0+00 to Station 40+00) was analyzed for a SSE of 0.1 g in combination with a 25-year recurrent MCR water level which was conservatively taken as El. 50.00 feet. The use of the SSE acceleration of 0.1 g is conservative since the maximum vibratory ground acceleration determined for the STP site is 0.07 g, as described in FSAR Section 2.5.2.6.

An analysis using an open search routine was first performed to obtain the critical failure surface following an iterative procedure based on the work by Spencer (Reference 2). Various seismic coefficients were used to determine the yield acceleration for the critical surface. The yield acceleration was then compared with the SSE acceleration of k_{max}, where k_{max} is the maximum average acceleration acting on a potential sliding mass. Where applicable, permanent deformation of the embankment was estimated using a combination of procedures developed by Ambraseys and Sarma (Reference 3) and Makdisi and Seed (Reference 4).

The results of the stability analysis show that the embankment section in the vicinity of the power block and the essential cooling pond can withstand SSE accelerations with at worst negligible permanent deformation. These results are conservative because the analysis was based on drained strength parameters for over-consolidated clays in the foundation and the highest possible phreatic surface within the embankment. The results of this seismic analysis were also reviewed in relation to the behavior of similar dams which have been subjected to earthquake motions in the past, based on case history evaluation. It is concluded that clay embankments on clay or dense silty sand foundations have successfully withstood earthquake accelerations much higher than the SSE acceleration for the STP with no significant effects (Seed, Makdisi, De Alba [Reference 5]).

The seismic stability analysis results, coupled with the case history evaluation of the seismic behavior of similar dams, lead to the conclusion that the section of embankment facing the STP Category I structures, from Station 640+00 to Station 660+00 and Station 0+00 to Station 40+00, will safely withstand SSE accelerations of 0.1 g with little or no permanent deformation. The existing embankment has a minimum freeboard of 15 feet above the 25-year recurrent MCR water level which is more than adequate to accommodate any minor seismically induced slumping of the embankment crest.

IV. Corrective Action

The CW piping will be modified by exposing it in a concrete chute at the embankment crest and by rerouting it over the MCR embankment slopes on an erosion resistant slab. Other minor penetrations through the embankment will be excavated and modified to eliminate the erosion concerns. The existing CW pipes will be filled with concrete and abandoned.

V. Recurrence Control

No recurrence control actions are required.

VI. Safety Analysis

Because the MCR embankment will remain stable under credible failure mechanisms, no safety hazard exists.

References

1. NRC Summary of Discussion with HL&P on the Design Basis Flood (DBF) for STP, Docket Nos. 498/499, dated 21 February 1984.

2. Wright, S. G., "SSTAB1 - A General Computer Program for Slope Stability Analyses," Department of Civil Engineering, The University of Texas at Austin, 1972.

3. Ambraseys, N. N. and S. K. Sarma, "The Response of Earth Dams to Strong Earthquakes," Geotechnique, Vol. 17, September 1978, pp. 181-213.

4 Makdisi, F. I. and H. B. Seed, "Simplified Procedure for Estimating Dam and Embankment Earthquake-Induced Deformations," Journal of the Geotechnical Engineering Division, ASCE, Vol. 104, No. GT7, July 1978, pp. 849-867.

5. Seed, H. B., F. I. Makdisi, and P. De Alba, "Performance of Earth Dams During Earthquakes," Journal of the Geotechnical Engineering Division, ASCE, Vol. 104, No. GT7, July 1978, pp. 967-994.