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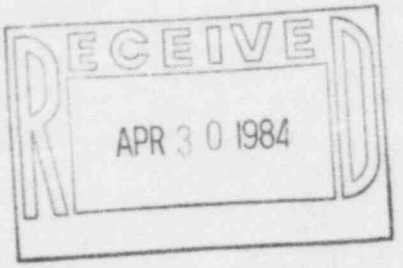

Mr. John T. Collins
Regional Administrator, Region IV
Nuclear Regulatory Commission
611 Ryan Plaza Dr., Suite 1000
Arlington, Texas 76012

Dear Mr. Collins:

South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499
Final Report Concerning the
NSSS Model Used in Seismic Analyses

On July 27, 1983, pursuant to 10CFR50.55(e), Houston Lighting & Power Company (HL&P), notified your office of an item concerning the Nuclear Steam Supply System (NSSS) model used in the seismic analyses for the South Texas Project (STP). On August 26, 1983, our First Interim Report (reference: ST-HL-AE-977) described this deficiency and summarized our plans for evaluation and resolution. On February 17, 1984, our Second Interim Report (reference: ST-HL-AE-1056) provided the partial results of the analyses and evaluations to date, and the near term plans for complete resolution. Attached is our Final Report.

If you should have any questions concerning this item, please contact Mr. Michael E. Powell at (713)993-1328.

Very truly yours,

D S Baker for

G. W. Oprea, Jr.
Executive Vice President

AJS/mg
Attachment: Final Report Concerning the
NSSS Model Used in Seismic Analyses

W2/NRC1/d

IE-27

cc:

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Revised 04/03/84

South Texas Project
Units 1 & 2
Final Report Concerning the
NSSS Model Used in Seismic Analyses

I. Summary

A concern was identified regarding the Nuclear Steam Supply System (NSSS) model used in seismic analyses. The seismic acceleration response spectra developed from a new analysis using an updated model for the STP NSSS system exhibited increased amplification at some locations associated with the NSSS supports. Westinghouse (W) has reviewed the resultant response spectra and concluded that there is no effect on the existing design of the NSSS equipment and the Reactor Coolant Loop (RCL) piping within the W scope of responsibility.

For other points within the Reactor Coolant system (RCS), including the nozzle attachment points for the RCL Class 1 branch piping, Bechtel has computed the resultant new response spectra in order to fully evaluate the effect of the updated W NSSS model on the corresponding seismic design. Comparison of the new spectra with the design spectra used at the RCL nozzle points, which were originally computed by EDS Nuclear, Inc. (hereafter EDS) indicates that the design spectra are higher and envelope the new spectra or have no effect on the seismic design. Therefore, the new spectra do not result in higher seismic response, and thus the W NSSS updated model does not affect the existing seismic design of the RCL Class 1 branch piping.

II. Description of the Deficiency

On July 27, 1983, pursuant to 10CFR50.55(e), Houston Lighting & Power Company (HL&P) notified the NRC Region IV of an item concerning the NSSS model used in the seismic analyses for the South Texas Project. There are differences between the NSSS model submitted by W and that originally developed by EDS during the preliminary STP design activities for seismic analyses. In 1981, HL&P and Brown & Root (B&R) undertook efforts with W to verify the set of NSSS data used by EDS to develop the NSSS model incorporated in the B&R analysis of the seismic response of the Reactor Containment Building (RCB) structure, which was then extended as input for the site-specific seismic analyses of the NSSS equipment by W, and for the decoupled analyses of the RCL by EDS.

These verification reviews established that, although W recommended that a more detailed, representative NSSS model should be used for such analyses, the effect of using the simpler model (as developed by EDS) would be insignificant for the purposes of evaluating the seismic response of the RCB structure and NSSS proper. Accordingly, the prior analyses were judged to be acceptable.

However, it was noted that although the RCB structural response would be unaffected by the more detailed modeling, it was not clear that NSSS associated piping would also be unaffected. Therefore, HL&P identified to Bechtel during its transition as the new architect/engineer, that action should be undertaken to investigate the effect of the W recommended updated NSSS model on the NSSS associated piping.

Accordingly, Bechtel has developed the new seismic response spectra in the RCB structure based on the W updated model utilizing the design-basis analysis by two-step finite element method (FEM) for soil-structure interaction (SSI) and including the effect of SSI by the elastic half-space (EHS) method of analysis. It was determined that, in general, (1) the design-basis spectra at the NSSS structural support points envelope the new spectra except in the low frequency range of less than 4 cps for the horizontal response and in the high frequency range of 15 to 30 cps for the vertical response at elevations of 19 ft. and 37 ft. of the RCB interior structure, and (2) the new response spectra at points corresponding to the interface between the NSSS equipment and the steel intermediate supports with the W scope are significantly amplified.

These new comparative response spectra were submitted to W to confirm the earlier judgment that the effect on the NSSS proper would be insignificant. W has concluded that the limited increases in spectral response restricted to the low frequency range and to the two locations as defined in item (1) above, are of no adverse impact on the NSSS loop or primary equipment, and that the amplified spectra at the interface points, defined in item (2) above, were not used for any site-specific seismic analyses of the NSSS. For the site-specific seismic analyses of the NSSS equipment W used the response spectra at the concrete/support interface and since the W model included the support/NSSS equipment interface, the amplified spectra are inconsequential.

With respect to the increased spectral response in the vertical direction restricted to the high frequency range, as described in item (1) above, Bechtel has established that the increased response is inconsequential because it corresponds to a secondary peak within a narrow frequency band that does not affect the seismic design and/or qualification of other non-NSSS subsystems. The increased spectral response in the low frequency range of less than 4 cps is totally related to the EHS method of analysis for SSI. This is the subject of STP's response to NRC Question 220.08 which was submitted in FSAR Amendments 30 and 34.

It was also recognized that since the updated NSSS model appeared to be slightly more flexible than the previous NSSS model, the seismic spectral response at attachment points of the RCL branch piping could be potentially subject to amplification within the frequency range of the NSSS. The evaluation of the effect of this potentially amplified seismic response, which is used as input for the seismic analysis of RCL Class 1 branch piping by Bechtel, is complete.

The mathematical model of the RCB structure coupled with the W updated NSSS model, as used by Bechtel in the foregoing dynamic analyses, was modified to incorporate a more refined representation of certain portions of the RCS as prepared by W. This approach permitted dynamic analyses through a coupled model that afforded sufficient resolution to obtain seismic acceleration response at the nozzle attachment points for the RCL Class 1 branch piping and at other points within the RCS including the interface with the steel intermediate supports. The resultant response spectra represent the envelope of the two-step FEM and EHS solutions for SSI incorporating the W updated NSSS model (with refined RCS representation). These spectra were compared to the corresponding nozzle point spectra computed by EDS and to the RCS intermediate support spectra computed by B&R. It is noted that the EDS dynamic analyses included amplification factors introduced by EDS as a conservative measure, and the analyses were based on decoupled models of the RCL excited by the time-history responses at the RCS supports obtained from the B&R analyses of the RCB structure and NSSS by two-step FEM for SSI.

The new spectra exhibit two characteristic cases as follows: (1) at the points of interface with the steel intermediate supports the new spectra are generally higher than the prior B&R spectra, and (2) at nozzle attachment points the new spectra are lower and are enveloped by the EDS spectra which were used for design. The higher response of the first case is attributed to the introduction of the updated NSSS model. The favorable enveloping obtained in the second case resulted from the conservative amplification factors introduced by EDS, the over representation of spectral response within the structural frequency range that is inherent in decoupled analyses as performed by EDS, and the enriched frequency intervals used by EDS in the computation of response spectra. These characteristics of the EDS analyses effectively offset any increase in spectral response associated with the updated NSSS model and/or the EHS solution for SSI.

The B&R response spectra at the intermediate support interfaces were not used for any seismic analysis and/or qualification by W, EDS, B&R and Bechtel; therefore, the amplification exhibited by these spectra is not a concern. These spectra, which had been issued as part of the design-basis spectra for the STP, will be replaced by the corresponding new spectra. The EDS response spectra at nozzle points are the basis for the existing seismic analyses of RCL Class 1 branch piping. Therefore, since the EDS spectra envelope the new spectra, the existing piping seismic analyses are adequate and may be preserved, but any future reanalyses or new analyses by Bechtel will be based on the new spectra which will be formally adopted as the STP design-bases response spectra for points within the RCS.

III. Corrective Action

The new seismic response spectra resulting from the incorporation of both the W updated NSSS model and the EHS method for SSI into the dynamic analyses have been computed. W has stated that the new spectra do not result in any change in the existing design of the NSSS. Bechtel has determined that the new spectra does not affect the existing design of the RCL Class 1 branch piping. Therefore, no corrective action is required on any existing design.

The seismic response analysis using the methods described in the Standard Review Plan Section 3.7.2, item II.4.a, as addressed in the second interim report on this deficiency item, is still being performed by Bechtel. However, this analysis is no longer considered as a part of the corrective action for this deficiency item.

The following actions have been taken:

(1) The verification calculations pertaining to the W updated NSSS model and the EHS SSI method for seismic analyses of the RCB structure and NSSS have been incorporated into the STP calculation file.

(2) The STP design-basis seismic response spectra have been revised to incorporate the new spectra at the NSSS intermediate support points and at the nozzle attachment points for RCL Class 1 branch piping.

IV. Safety Analysis and Recurrence Controls

The seismic response spectra resulting from the incorporation of both the W updated NSSS model and the EHS method for SSI into the dynamic analyses have been computed. W has stated that the new spectra do not result in any change in the existing design of the NSSS. Bechtel has determined that the new spectra does not affect the existing design of the RCL Class 1 branch piping. Therefore, there is no safety significance associated with the subject deficiency.

Recurrence control actions are not required.