0601

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July 30, 1985
ST-HL-AE-1315
File No.: G2.4/B4.1

Mr. Robert D. Martin
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South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499 OL
Supplemental Response/Clarification
to the Response to Notice of Violation
Inspection Report 83-24

Reference: 1) ST-HL-AE-1064 dated March 23, 1984 from G. W. Oprea, Jr. to J. T. Collins

Dear Mr. Martin:

By Reference 1 Houston Lighting & Power Company (HL&P) responded to the Notice of Violation 50-498/83-24, 50-499/83-24 dated January 30, 1984. In our letter, under Section III, "Corrective Steps Which Have Been Taken and Results Achieved," the bases for design as defined in the FSAR and the implications of the failure to meet ASTM D2049-69 were described. Since the submittal of our initial response the locations of backfill relative density tests have been replotted to correct errors in the original plotting. As a result we have determined that one relative density test value of 78.7% is located below the foundation of the Unit 2 Auxiliary Feedwater Storage Tank and 5 relative density test values lower than the 80% specified minimum are located under the truck loading bay of the Unit 2 Mechanical Electrical Auxiliary Building. None of these 5 test locations under the truck loading bay are under its bearing foundation. We have determined that the foregoing errors in the plotting of the location of relative density tests have not introduced any significant technical problems.

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Accordingly items A.1), A.2) and A.3) of our initial response should be revised as indicated in the enclosed revision to the original response. Changes are highlighted by vertical bars in the right hand margin.

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

Very truly yours,

J. H. Goldberg
Group Vice President, Nuclear

MRW/as

Attachment

cc:

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South Texas Project
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I. NRC's Statement of Violation

Failure to Follow Standard Test Method

Bechtel Power Corporation specification for field and laboratory testing of earthwork construction, 2Y060YS044, references ASTM D2049-69, "Relative Density of Cohesionless Soils."

ASTM D2049-69, "Relative Density of Cohesionless Soils," Table 2, requires that a funnel pouring device be used in the minimum density test for soil samples having a maximum size of soil particle of 3/8".

Contrary to the above, backfill having a maximum size of soil particle of 3/8" was tested for minimum density using the scoop method.

This is a Severity Level IV Violation (Supplement IID) (498/8324-02).

II. Reply

Prior to April 6, 1983, minimum density testing of the backfill was performed in conformance with ASTM D2049-69, Table 2, which specifies the use of either a scoop or a funnel pouring device, depending on the maximum soil particle size in the soil sample being tested. On April 6, 1983 by letter to Pittsburgh testing laboratory, Bechtel directed the exclusive use of the scoop pouring device. The directive was based upon a Bechtel evaluation that the scoop method is an acceptable measure of minimum soil density for the backfill specified at STP. Bechtel also concluded that using the scoop method was supported by a previous evaluation by independent outside consultants (Expert Committee) in a report filed on this docket (Reference 2). However, the April 6 letter was in conflict with a commitment to perform minimum density testing in accordance with ASTM D2049-69 which was established in the FSAR. ASTM requires use of the funnel or scoop depending upon maximum soil particle size in individual test samples. The backfill soil specified for STP allows particles greater than 3/8-inch for which the scoop method is used. However, an individual sample may have all particles less than 3/8-inch, in which case, the funnel method should be used. This change was issued in violation of project procedures since there was no corresponding change made in the applicable construction specifications. Furthermore, no FSAR change was generated for HL&P's review.

III. Corrective Steps Which Have Been Taken and Results Achieved

A. Backfill Minimum Density

Pittsburgh Testing Laboratory has been redirected to perform future minimum density testing in strict conformance with ASTM D2049-69. NCR AC-00046 was issued to address the adequacy of the Category I backfill placed subsequent to April 6, 1983. This NCR has received a detailed engineering evaluation and the backfill has been determined to be acceptable.

In evaluating the effect of use of the scoop instead of the funnel, the funnel method results in a more conservative value for relative density measurements that are generally 4% to 6% lower than the scoop method for the range of interest of relative densities. Thus, the scoop method is less conservative. Therefore, this evaluation considers whether lower relative densities in this range have any significant effect on the adequacy of the backfill to provide its safety related functions. The following describes the bases for design as described in the FSAR and the implications of the failure to meet ASTM D2049-69.

1) Structural vs. Yard Backfill

Safety related backfill in the STP is separated into two categories, Category I structural backfill and yard backfill for the ECW pipe trench outside the power block. Structural backfill is generally used to support Seismic Category I buildings and is required by the FSAR to have a minimum relative density of 80% with a running average of 84%. Yard backfill is required by the FSAR to have a minimum of 70% relative density. Relative density measurements are to be in conformance with ASTM D2049-69.

2) Structural Backfill

The relative density test values for all Category I structural backfill (80% minimum criteria) placed between April 6, 1983 and February 3. 1984 have been re-evaluated considering the reduction in relative densities which results from correction for the funnel versus the scoop method. The relative density test values being evaluated have also been corrected for problems with the running average calculations. The results are that 185 out of 1135 test values would be below the 80% minimum relative density criteria, and of these, 4 would be below 70% which is a lower bound based on liquefaction considerations as described under item e. below. However, none of the lower than 70% test values are from locations within

the structural backfill below or adjacent to Category I structures, and of the 70-80% test values, only one is directly below the bearing foundation of a Category I structure. This lower test value is a single relative density value of 78.7% reported at a location below the foundation of the Unit 2 Auxiliary Feedwater Storage Tank (AFST). The single point low test value is acceptable because (1) the AFST is a relatively light structure resting on a 60 ft circular base mat with very low soil bearing pressure, and (2) the in-place density of 120.4 pcf and the percentage compaction of 97% (in-place density divided by maximum density) corresponding to the backfill at the test location both are representative of a relative density of 80%. The 80% relative density criteria is established in order to provide foundation support. For soil directly below buildings, the criteria considers dynamic (shear) modulus and damping characteristics, cyclic strength and liquefaction potential, bearing capacity, and lateral earth pressures (FSAR paragraph 2.5.4.5.6.1). However, the soil not directly under building foundations, the significant considerations are lateral earth pressure, shear modulus and liquefaction potential. The determination that the lower relative density values have no adverse technical significance is based on the following:

a. The lower than specified relative densities are randomly located and of very limited extent within a dense material. Therefore, there is no impact on lateral earth pressures.

b. For points not directly below structures the shear modulus is a design factor to be considered. However, the soil structure interaction analysis assumes a range for shear modulus that corresponds to relative density values as low as 40%. Any relative density value over 40% is acceptable for shear modulus. Additionally, the adjusted values below 70% are all near the surface and/or away from structures and have no significance with respect to the structures.

c. For points not below a structure, liquefaction potential is the other criteria of interest. A conservative, well established factor of safety against liquefaction is a value of 1.5. This value, or below, has been used on at least four recent nuclear power plant dockets. In no case for STP is the factor of safety less than 1.5 at any tested location even when corrected for using the funnel method. All values were above 1.7.

d. The Expert Committee report states that "...there is considerable evidence that the minimum density may actually be somewhat lower than determined by this method" (scoop). Thus"...the actual relative densities would be higher than reported" (Reference 2). Therefore, evidence indicates that the actual relative density achieved is higher than that calculated by test results from either the scoop or the funnel method.

e. In addition, the Expert Committee (Reference 2) has provided the following:

"It is further the judgment of the Committee that a minimum relative density of 70 percent would be sufficient to provide an ample margin of safety against liquefaction of the project backfill soil under the postulated SSE. Thus, if all the structural backfill had been compacted to actual relative densities between, say 70 and 80 percent, we conclude that there would be no risk of liquefaction occurring at this site."

Only 4 corrected relative density test values are below this 70% value. These test values are not located within the structural backfill below or adjacent to Category I structures, and therefore have no adverse technical significance with respect to the safety of STP.

f. Finally, the requirement in the FSAR, paragraph 2.5.4.5.6.1 is to meet an 84% average relative density. This is achieved by requiring running averages of successive relative density tests be above 84% (FSAR paragraph 2.5.4.5.6.2.3). The funnel vs. scoop method corrected values yield relative density running averages characterized as follows:

- Over 92% of the running averages calculated from the 1135 test values satisfy the value of 84% for running average relative density.

- Out of the 1135 test values, 87 running averages are lower than 84% with all above 80% except one which is 78%.

Since there are few running averages between 80% to 84% (with one exception 78%), the resultant running averages of relative density indicate that the in-place density distribution is adequate.

3) Yard Backfill

Safety related backfill in yard areas of STP is specified to have a minimum relative density of 70%. For the adjusted relative density values now established, there were 204 points out of 2351 test values that fall below 70%. The limiting criteria for yard backfill is liquefaction potential. The use of the scoop in calculating relative density has not resulted in any technical concerns with the adequacy of backfill in the yard area because of the extreme conservatism that is inherent in the 70% specified value. The bases for this conclusion are:

a. For simplicity, the construction specification requires a minimum relative density of 70%. However, as stated in the FSAR, paragraph 2.5.4.8.3, a 70% average relative density with consideration of localized areas having lower relative density provides ample margin against liquefaction. Using adjusted values at STP, the average relative density is above 80% and is, therefore, adequate.

b. Even for the lowest adjusted relative density test values at STP, the minimum factor of safety against liquefaction is greater than 1.7. As indicated above, a factor of safety of 1.5 provides an acceptable margin for yard backfill.

c. As for structural backfill, the random nature of the low relative density values provides confidence that the safety related function of yard backfill is provided.

B. Generic Implications

In view of the fact that the testing contractor was directed to modify his test method through a letter which did not result in a change to the Specification, an investigation was initiated to determine whether this practice has occurred elsewhere. A review has been made of interoffice memorandums, requests for engineering action, meeting notes, and other correspondence initiated by Bechtel Home Office Engineering, Site Engineering, Construction, Procurement and others which are maintained in the Bechtel Site Engineering chronological files. These chronological files contained a complete set of the correspondence received by the Bechtel Construction Manager and would include any documents which would provide clarifications, interpretations, and other guidance not normally included in design disclosure documents. The objective was to determine whether any of these documents provided technical direction without evidence of a commitment

to issue a corresponding Specification Change Notice, Drawing Change Notice, Field Change Request, etc. This investigation has been completed. Bechtel Quality Engineering has reviewed a total of approximately 2,000 documents. This review identified 14 memorandums which could have been interpreted as changing specification or drawing requirements. Bechtel Engineering has reviewed these 14 documents in more detail and concluded that either 1) no design disclosure document changes were actually required, or 2) design changes were followed up by formal design change documents. HL&P has reviewed these documents and verified that the Bechtel assessment is correct.

IV. Corrective Action Taken to Avoid Further Violation

Bechtel has taken steps to ensure that cognizant personnel responsible for transmitting information to the field fully understand the design change procedures. These procedures provide for review and approval of proposed design changes against commitments made in licensing documents. Explicit remedial guidance has been given to ensure that informal documentation, which revises formal requirements provided in design disclosure documents without proper procedural controls, is not generated. This action was completed on February 28, 1984.

Furthermore, HL&P has directed Bechtel that in the future, whenever technical clarifications and interpretations to design disclosure documents are provided to constructors and contractors, that such guidance be provided in the form of approved revisions/changes to the actual design disclosure document, not informal means of communications.

To ensure that work in the backfill area is being performed in accordance with project requirements and that there are no other undetected problems, HL&P has initiated a full programmatic audit of backfull related areas, including the review of licensing and criteria documents, specifications, testing procedures, test data results and QC procedures and covering each of the organizations involved in backfill activities (Bechtel, Ebasco, Pittsburgh Testing Laboratories). This audit will be completed by April 2, 1984. A report of the audit findings will be submitted to the NRC by May 23, 1984.

One area already reviewed is the soil density testing being performed by Pittsburgh Testing Laboratory. Certain discrepancies in the calculation method to obtain average minimum and maximum soil density have been identified. As the result, the relative densities for backfill operations performed by Ebasco at STP up to the present time have been recalculated consistent with Bechtel specified requirements. One-hundred and three out of approximately 3800 tests were determined not to meet project specifications. These results were utilized in the aforementioned discussion of measured backfill densities.

Bechtel has strengthened the management of project geotechnical activities by the addition of a senior geotechnical manager to the project team.

V. Date When Full Compliance Will Be Achieved

STP is currently in full compliance with the commitment to conform to ASTM D2049-69 minimum density test requirements.

References

1. Woodward Clyde Consultant Report "Maximum and Minimum Density Laboratory Report," TPNS Y310CR1412AWC, November 28, 1980.

2. Stanley D. Wilson Consultants Report, "Expert Committees Final Report on Adequacy of Category I Structural Backfill, South Texas Project Electric Generating Station", TPNS Y310XR1378ASH, January 30, 1981.

3. Shannon and Wilson Consultants Report, "Review of Structural Backfill Quality Control Testing and Documentation, South Texas Project Electric Generating Station," Letter ST-SH-BR-00046, December 31, 1981.