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MIDLAND PROJECT
DOCKET NOS 50-329, 50-330
RESULTS OF SOIL BORING AND TESTING
PROGRAM FOR AUXILIARY BUILDING (PART 1)
FILE 0485.16 SERIAL 13794
REFERENCE: R B PECK, W E HANSON AND T H THORNBURN, FOUNDATION ENGINEERING, JOHN WILEY AND SONS, INC, 2ND EDITION, 1974, FIGURE 18.2
ENCLOSURE: TEST RESULTS, FOUNDATION SOILS, AUXILIARY BUILDING (PART 1), SOIL BORING AND TESTING PROGRAM, MIDLAND PLANT - UNITS 1 AND 2

We are providing thirty (30) copies of the enclosed Woodward-Clyde Consultants (WCC) Report (Part 1) dated August 28, 1981 which documents the soil boring and sampling program and the subsequent laboratory testing program for the foundation soils at the auxiliary building. The results of these programs are presented in the form of logs of borings and in both tabular and graphical data summaries of index property, strength and compressibility testing of the foundation soils. This data is found in the appropriate appendices of the enclosed report.

The subsequent discussion is a summary of the WCC test results and our conclusions. The WCC triaxial strength test results performed on undisturbed foundation soil samples obtained from Borings COE-17 and COE-18 yielded the following values of undrained shear strength:

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UNDRAINED SHEAR STRENGTH, (Su), KSF

	Range	Average
3 Undrained Unconsolidated (UU) Tests from Elev 570 to 560	(5.18 - 7.40)[1]	6.6
3 (UU) Tests from Elev 560 to 540	(7.24 - 9.29)	8.2

For natural soils deposits the undrained shear strength, presented in FSAR Figure 2.5-33, is on the order of 6 ksf down to Elevation 560, and a value of 8 ksf below this elevation. A comparison of average shear strength values presented in the FSAR and the average values obtained in recent WCC tests indicate that the average shear strength values given in the FSAR are conservative.

The allowable bearing capacity commitment in Subsection 2.5.4.10.1 of the FSAR for the foundation design requires a safety factor of 3 against dead load plus sustained live load and a safety factor of 2 for the above loadings plus the seismic load. For the strip footing, which represents the mode of load application for the continuous underpinning piers, the bearing capacity factor (Nc) in ϕ=0 foundation soil ranges between 6 and 7 depending on the depth of embedment in the natural soils (see the above-referenced textbook). Choosing a bearing capacity factor (Nc) of six and the average shear strength (Su) of 6.6 ksf for a typical condition where embedment equals half the width of the underpinning piers an ultimate bearing capacity can be calculated. This ultimate bearing capacity equals Nc x Su which is approximately 40 ksf. The allowable bearing capacity under sustained loads thus equals 40/3 or 13.3 ksf. The ultimate bearing capacity under sustained loads using an undrained shear strength of 6 ksf from FSAR Figure 2.5-33 is 36 ksf resulting in an allowable bearing capacity of 36/3 or 12 ksf. Similarly, the corresponding allowable bearing capacity values for the seismic condition are 20 ksf and 18 ksf using the average shear strength based on WCC tests and the design values presented in FSAR Figure 2.5-33. It is evident from the foregoing discussion that the allowable bearing capacity based on the average shear strength obtained from WCC tests are higher than the conservative values based on FSAR shear strength data.

Note 1: One UU test at elevation 560.3 gave a shear strength of 2.57 ksf and was not considered because the laboratory noted that sample disturbance took place before testing.

Four consolidation tests in the recent WCC report were performed on soil samples obtained in the natural soils to determine a preconsolidation pressure value. The values of preconsolidation pressure from the resulting log compression curve were evaluated using Casagrande's construction. Based on this evaluation, the preconsolidation pressures ranged from 26 ksf to 84 ksf. This range is much higher than the previously estimated range of 15 ksf to 20 ksf given in FSAR Subsection 2.5.4.2.9. This substantiates the heavily preconsolidated nature of the natural deposits in the area of the Auxiliary Building.

We will provide the NRC the index property and strength results for the fill materials and natural soils below elevation 540 in the auxiliary building area by a Part 2 report. The testing of these materials is in progress and the Part 2 report is scheduled for publication the first week in November.

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For James W Cook

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