UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges
Charles Bechoefer, Chairman
Dr. Frederick P. Cowan
Dr. Jerry Harbour

In the Matter of	ASLBP Nos. 78-389-03 OL 80-429-02 SP
CONSUMERS POWER COMPANY	Docket Nos. 50-329 OL 50-330 OL
(Midland Plant, Units 1 and 2)	Docket Nos. 50-329 OM 50-330 OM

SECOND SUPPLEMENTAL MEMORANDUM IN SUPPORT OF INTERVENOR BARBARA STAMIRIS' MOTION TO LITIGATE DOW ISSUES

On September 23, 1983, this Atomic Safety and Licensing Board ("Licensing Board") granted intervenor Barbara Stamiris leave to file a supplemental memorandum demonstrating how the Dow documents and the Dow complaints filed in the Dow Chemical Company's suit against Consumers Power Company ("Consumers") support two issues she wishes to litigate in these OM hearings.

Intervenor hereby submits this supplemental memorandum in support of the following issues:

(1) Consumers used and relied on U.S. Testing test results to fulfill Nuclear Regulatory Commission ("NRC") requirements when it knew the test results were invalid, and

(2) Consumers knowingly misrepresented to the NRC that a single test boring taken near the diesel generator building indicated that unmixed cohesive fill had been used, or alternatively, did not disclose to the NRC that the single test boring demonstrated the use of random, improperly compacted fill in the area and constituted evidence of site-wide problems.

I. BACKGROUND.

Intervenor believes that the allegations of the certified Dow complaints, standing alone, are sufficient to support litigation of these two issues as management attitude issues. In the alternative, she has argued that these allegations support the admission of new contentions in these reopened OM hearings.[1/]

Moreover, as will be argued below, certain Dow documents examined in conjunction with documents already admitted in this record, make out a prima facie case that Consumers knew of the invalidity of U.S. Testing results at a much earlier time than they informed the NRC and that Consumers relied on these test results during this time.

In addition, it is apparent from the allegations of the original and the first amended Dow complaints that Dow has had experts evaluate certain documents already admitted before this Licensing Board, including the Bechtel Report on the "Administration Building Foundation Settlements," December 1977, and the test boring taken near the diesel generator building. Apparently Dow experts believe these documents indicate site-wide soils problems, contrary to Consumers' professed evaluation of these same documents. Thus Dow alleges Consumers fraudulently concealed this information about site-wide soils settlements problems from the use of random, cohesionless fill during negotiation of the Dow-Consumers 1978 General Agreements. Similarly, the allegations make out the case that Consumers concealed this information from the NRC as well during this critical period of time, late 1977 and early 1978.

1/ The Board has set out the standard for admission of new contentions in its Memorandum and Order Denying Admission of Mrs. Stamiris' containment Crack Contention (August 17, 1983).

II. CONSUMERS AND BECHTEL CONTINUED TO RELY ON U.S. TESTING RESULTS EVEN THOUGH THEY KNEW AS EARLY AS 1977 THAT THESE RESULTS WERE INVALID.

It is useful to list the formal and informal reports which either Bechtel or Consumers reviewed regarding the validity of U.S. Testing test results, beginning in 1977. First, in a QA audit of soils work conducted from October 3 - 7, 1977, Consumers' auditors found serious deficiencies in U.S. Testing results, including failing tests which were never cleared and tests which were passed using incorrect data. See Audit Report No. F-77-32, attached and incorporated herein as Attachment 1; Board Exhibit 3. A cursory review of this Audit indicates large variations in test results for percent compaction in the same or adjacent areas. Clearly these large variations should have signaled to Consumers and Bechtel that the test results were not reliable. Id. at 5-6. Mr. Howell testified in the last set of hearings that since he was on distribution for the audit report, in the usual course of business he would have received it. Therefore, it appears Consumers and Bechtel were notified of serious deficiencies in U.S. Testing results as early as October 1977.

Second, the December 1977 Bechtel Report on the Administration Building Foundation Settlements ("1977 Bechtel Report") documents deficient test results such as failing tests which were never cleared. See 1977 Bechtel Report, attached and incorporated herein as Attachment 2. In addition, the Report's conclusion that backfilled soil above the elevation of the footings is adequate, id. at 5, is not substantiated by the U.S. Testing results. For example, according to Table 2 accompanying the Report, borings at 597.5 and 588.0 foot elevations show strain and insufficient bearing capacity. Therefore, the Bechtel Report's conclusions were not supported by the underlying data.

Third, Bechtel notified U.S. Testing in a letter of February 1, 1978, that "a careful review" of U.S. Testing's data shows the company "erroneously reported the fill below the Administration Building to be in conformance with Bechtel Specification(s)." Bechtel further determined the cause to be U.S. Testing's "repeated erroneous selection of compaction standards ...." Under these circumstances Bechtel knew that U.S. Testing was using the same erroneous compaction standards over the entire site and yet continued to rely on U.S. Testing. See Bechtel February 1, 1978 Letter, attached and incorporated herein as Attachment 3.

Finally, the U.S. Testing Bechtel correspondence conducted in the Fall, 1979 (recently released as Dow documents) show that Bechtel was directing many U.S. Testing activities on site, including choosing the locations for tests; dispositioning or clearing failing tests; reviewing and checking all test results; and determining the method of calculating percent compaction. See September 4, 1979 Bechtel Letter and Bechtel Report, and October 1, 1979 U.S. Testing Response, attached and incorporated herein as Attachments 4 and 5, respectively. In fact, U.S. Testing claims that Bechtel's normal practice during this period was to disposition failing tests by scanning reports to look for passing results in the same general area (emphasis added). See Attachment 5 at 3. It is clear that one of the major faults in U.S. Testing data is that those tests which clear failing tests are too distant from the location of the failing tests.

Given Bechtel's intimate involvement in conducting and reviewing the tests, it is obvious Bechtel knew that many of U.S. Testing results were invalid. Bechtel's knowledge must necessarily be imputed to Consumers.

One draws the conclusion from these documents and Dow's expert evaluation of the 1977 Bechtel Report, as stated in the Dow Complaints, that Bechtel and Consumers knew that U.S. Testing results were invalid as early as 1977 and yet continued to rely on them.

Clearly, Consumers did nothing to inform the NRC of the serious failings in U.S. Testing results. In fact, from a presentation Consumers made to the NRC Staff on July 18, 1979, one concludes that Consumers actively concealed not only the gravity of the problem but all specifics of the invalid test results and testing procedures from the NRC. See Portions of Consumers' Presentation to NRC Staff made on July 18, 1979, attached and incorporated herein as Attachment 6. The five major faults documented in the 1979 Bechtel Report are completely omitted.[2/] Consumers states only that an audit of U.S. Testing found an "administrative problem". See Attachment 6 at 8.

Thus, the newly-released correspondence between U.S. Testing and Bechtel and Dow's evaluation of the 1977 Bechtel Report highlight what was suggested earlier in these hearings: Bechtel and Consumers knew that U.S. Testing results were invalid and relied on them to fulfill NRC requirements.

2/ Bechtel outlined in its 1979 Report the following five major faults with U.S. Testing reports:

1. Erroneous field density test data;
2. Incorrect soil identification;
3. Incorrect (or questionable) laboratory test data;
4. Calculation errors; and
5. Improper or incomplete clearing of failed tests.

III. CONSUMERS FAILED TO DISCLOSE TO THE NRC THAT THE TEST BORING NEAR THE DIESEL GENERATOR BUILDING INDICATED IMPROPERLY COMPACTED RANDOM FILL AND POTENTIAL SITE-WIDE PROBLEMS.

On September 29, 1977, Consumers took a soil boring near the diesel generator building. This boring indicated that improperly compacted, random fill had been used in that area in violation of FSAR requirements. Considered together with the other information available to Consumers, this boring showed site-wide problems, or at least problems outside the Administration Building area. Consumers failed to report to the NRC that the test boring revealed uncompacted, random fill or site-wide problems. In fact, Consumers reported the opposite -- that this and other test borings showed fill was adequate in locations other than the Administration Building.

The log for the diesel generator building boring indicates that random, uncohesive fill was used in the area. The "Description and Classification" column of the boring log lists sand, clay and gravel, clearly random fill. See Boring Log, attached and incorporated herein as Attachment 7; Stamiris Exhibit 19.

In addition, it cannot be denied that placement of random, cohesionless fill in this area was in violation of FSAR requirements. Contrary to Consumers' statement in its Response to Intervenors' Motions with Respect to Dow Lawsuit at 13, the job requirements did not call for random fill. Both the PSAR and the FSAR required cohesive fill. In 1975 Bechtel Specification C-211 required "cohesionless" material. At that time Consumers QA Department issued a nonconformance report QF-66 requiring Bechtel to conform to FSAR

requirements. (Bechtel in turn issued an SAR Change Notice No. 0097 which stated Bechtel would in the future comply with requirements in the FSAR.) The FSAR required cohesive material for this area. However, the NRC determined in its Inspection Report No. 050-329/78-20; 050-330/78-20, Settlement of the Diesel Generator Building (March 22, 1979, "NRC Report 78-20"), that Bechtel continued to use construction drawings permitting random fill in violation of the FSAR. See NRC Report 78-20, at 6-8, attached and incorporated herein as Attachment 8. Therefore, Consumers has known since at least 1975 that construction requirements called for cohesive, not random, cohesionless, fill in this area.

Moreover, Dow alleged in its first amended complaint that the Administration Building Report "confirmed that the serious deficiencies in the fill were not localized and instead were present throughout the site ...." Dow First Amendment Complaint, ¶ 12.

It appears that Dow's experts have determined that the 1977 Bechtel Report shows site-wide problems. Among the deficiencies in the report, as argued in Part II, supra, is its failure to support the conclusion that fill above elevation 618 is competent soil.

If one accepts Dow's expert evaluation of the DGB soil boring and the Bechtel 1977 Report it is clear Consumers knew about site-wide soils problems in 1977. Not only did Consumers fail to notify the NRC but Consumers adamantly insisted that the DGB soil boring and the 1977 Bechtel Report indicated adequately compacted soil in other areas of the site.

Don Horn testified before this Licensing Board that the test borings, including the one taken near the diesel generator building, showed no soils compaction problems. Tr. at 7960. Similarly, Mr. Horn stated during a deposition taken on October 22, 1980, that although some Bechtel personnel believed the problems at the Administration Building demonstrated the soils settlement problems were site-wide, the borings indicated to the contrary that the fill in the areas of the borings was adequate. See Horn Deposition at 219-23, 227, attached and incorporated herein as Attachment 9. Apparently Dow's experts disagree.

In fact Consumers even today argues that the DGB boring log shows competent soil. Applicant's Response at 10. Consumers states that the NRC Staff agrees that the blow counts included in the DGB boring log demonstrate acceptable soil. Yet applicant's own chief expert witness, Dr. Peck, has stated in his soils textbook that blow counts are unreliable indicators of the competence of soil when one is testing clay. See Peck, Hanson, and Thornburn, Foundation Engineering (2d ed. 1974) at 114-15. Thus Dow's evaluation of the DGB boring log accords with Dr. Peck's, at least as Dr. Peck and his colleagues evaluate soils testing procedures in clay. Dow's expert evaluation of this boring log and other technical reports may well be critical to this Licensing Board's evaluation of Consumers' honesty and candor in reporting to the NRC Midland's soils settlement problems.

IV. THE DOW COMPLAINT AS A WHOLE RAISES DOUBTS ABOUT CONSUMERS' FULL DISCLOSURE OF SOILS SETTLEMENT PROBLEMS TO THE NRC.

Dow and its experts certainly reviewed the documents before this Licensing Board and additional documents concerning soils settlement problems at the Midland site prior to filing suit against

Consumers. Dow seems to have reached completely contrary expert opinions about several technical reports in evidence before this Licensing Board. These evaluations go to the heart of the question whether Consumers reported to the NRC the serious and site-wide nature of the soils settlement problems as soon as it knew of it.

Dow alleges that the DGB soil boring and the 1977 Bechtel Report indicated as early as 1977 site-wide soils settlement problems and use of random fill beyond the Administration Building. (Dow is concerned with Consumers state of knowledge about the soils settlement problems during the negotiation of their 1978 General Agreement.) In effect, if Consumers knew that these problems were site-wide in 1977 and concealed this information from the NRC it made material false statements through such omissions. Such material false statements are certainly more serious than any so far admitted to exist in the FSAR.

Other documents already omitted in these hearings show that in 1977 Consumers had more knowledge than it acknowledged of site-wide soils problems and improper fill in areas beyond the Administration Building. For example, Mr. Horn testified that at least three soil borings outside the area of the Administration Building were taken. Tr. at 7976. Yet nowhere in the record have the results of that third soil boring been disclosed. Further, it appears certain pages are missing from the 1977 Bechtel Report if one assumes the numbers are numbered consecutively with Bates' numbers. Pages numbered SB 13770-71 are omitted from the Report with no explanation.

Nowhere in the record of these OM hearings has Consumers represented to this Board or the NRC Staff that it did no other internal reviews of the soils settlement problems on site after the failure of the administration building grade beam. Given the seriousness of the problem it seems improbable that Consumers did nothing more than take three test borings, and then lost or mislaid the results of one of them. Therefore, it may be that Dow has obtained through discovery or other channels other technical reports supporting its allegations that Consumers knew in 1977 that the soils settlement problems were site-wide.

Further, it appears that even in July 1979, after Bechtel had written a comprehensive report on the failure of U.S. Testing, Consumers did not give this information to the NRC but instead down-played the significance of U.S. Testing problems. Consumers failed in 1979 to disclose fully the problems it uncovered, after the NRC had indicated its overriding interest in soils settlement issues. It is certainly possible, as the Dow documents and Complaints suggest, that Consumers did the same in 1977 when it had a greater economic incentive to conceal such problems.

V. CONCLUSION.

For the foregoing reasons, intervenor Barbara Stamiris submits that the Dow documents and Dow complaints support litigation of all three issues raised in her original motion.

Respectfully submitted,

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DATED: October 5, 1983

WRBird
SHHowell
JMKlacking
BWMarguglio
JFNewgen
GLRichardson
QA SUBJ FILE

Consumers Power Company

QUALITY ASSURANCE PROGRAM

REPORT NO F-77-32

DATE October 3-7, 1977

PLANT: Midland UNIT 1 & 2

SUBJECT OF AUDIT: Soil Placement Records

I. AUDIT SCOPE

ATTACHMENT 1

The purpose of this record review audit is to verify the documentation associated with the placement of Structural Backfill, North Plant Dike. West Plant Dike, and Plant Area Fill conforms to the specifications and to expedite dike turnover.

II. AUDITORS

***D. A. Blumenthal, CPCo QAE (IE&TV) - Team Member
**D. E. Horn, CPCo QAE Civil Supervisor - Team Leader

III. PERSONNEL CONTACTED

**Ben Cheek, Bechtel Lead Civil Quality Control Engineer
*Keith Berk, Bechtel QCE (QC Vault)
*Pat Guiette, Bechtel QCE (QC Vault)
*Mary Kerridge, Bechtel QC Documentation Clerk
*Jim Miller, Bechtel QC Documentation Lead
*Tom Lieb, Bechtel QCE (Civil)
****Daryl Osborn, Bechtel Assistant Lead Civil QCE
*John Speltz, U.S. Testing Lab Chief

IV. SUMMARY OF AUDIT

A. A Pre-Audit Conference was held on August 31, 1977 in Ben Cheek's office with those in attendance as noted in Sections II and III above. The audit scope was the only item discussed. The audit scope originally was to observe soil placement, however, due to heavy rains and no soil placement in "Q" areas, the audit scope was changed to that given in Section I.

B. The audit was performed on soil reports North Plant Dike MD 72 (5-23-74) through MD 514 (9-21-74), West Plant Dike MD 25 (9-12-74) through MD 307 (9-27-76), Structural Backfill MDR 611 (10-7-76) through MDR 1121 (8-11-77), Plant Area Fill MD 1122 (10-7-76) through MD 1854 (8-12-77) and gradation reports for structural backfill material received February 4, 1977 through August 31, 1977 to assure failing tests have been cleared by passing tests; correct optimum moisture contents, maximum and minimum dry lab densities have been used; the test results were properly evaluated for acceptance; and test reports could be located in the Quality Control Documentation Vault using the attached checklist.

C. The findings associated with this audit are noted in Section V.

*Contacted during Audit
**Attended Pre-Audit Conference and Post-Audit Conference
***Attended Post-Audit Conference
****Contacted during Audit and attended Post-Audit Conference

BY Donald E. Horn DATE 11-4-77 SHEET 1 OF 12
Donald A. Blumenthal 11/4/77 Reviewed by

FILE: 18.4.3.4 & 18.4.3.6
DATE: October 3-7, 1977
PLANT: Midland UNIT 1 & 2
SUBJECT OF AUDIT: Soil Placement Records

AUDIT REPORT NO F-77-32

IV. SUMMARY OF AUDIT (Contd)

D. Future audits will be run the same, when scheduled.

E. A Post-Audit Conference was held on October 11, 1977 in Ben Cheek's office with those in attendance as noted in Sections II and III above. The audit findings were presented to those in attendance by D. A. Blumenthal and D. E. Horn. Bechtel QC understood and agreed with the findings and recommended corrective action.

V. CLOSED OUT FINDINGS

Finding 1

West Plant Dike

MD-276 and 277 (sampled 9-15-76), 278 (sampled 9-16-76), and 285 (sampled 9-17-76) have NA in the optimum moisture content column.

North Plant Dike

MD-92 (sampled 5-25-74) shows maximum dry lab density 110.6. It should have been 103.4.

MD-93 (sampled 5-25-74) shows maximum dry lab desnity 110.6. It should have been 103.4.

MD-109 (sampled 5-28-74) shows maximum dry lab density 103.4. It should have been 115.1.

MD-119 (sampled 5-28-74) shows maximum dry lab density 127.2. It should have been 128.0.

MD-155 (sampled 6-4-74) shows optimum moisture content 18.8. It should have been 18.4.

MD-195 (sampled 6-24-74) shows optimum moisture content 11.0. It should have been 11.6.

MD-223 (sampled 6-25-74) shows optimum moisture content 10.3. It should have been 11.6.

MD-224 (sampled 6-25-74) shows optimum moisture content 13.5. It should have been 13.0.

MD-257 (sampled 7-11-74) shows optimum moisture content 9.8. It should have been 10.4. This also shows maximum dry lab density 126.8. It should have been 127.4.

DATE: October 3-7, 1977
PLANT: Midland UNIT 1 & 2
SUBJECT OF AUDIT: Soil Placement Records

AUDIT REPORT NO F-77-32

V. CLOSED OUT FINDINGS

Finding 1

North Plant Dike (Contd)

MD-269 (sampled 7-12-74) shows maximum dry lab density 116.2. It should have been 116.3.

MD-290 (sampled 7-16-74) shows maximum dry lab density 125.2. It should have been 128.3.

MD-318 (sampled 7-19-74) shows optimum moisture content 13.0. It should have been 13.3.

MD-336 (sampled 7-20-74) shows optimum moisture content 20.5. It should have been 20.0.

MD-341 (sampled 7-25-74) shows optimum moisture content 17.0. It should have been 15.5.

MD-377 (sampled 8-6-74) shows maximum lab dry density 109. It should have been 112.9.

MD-476 (sampled 8-19-74) shows optimum moisture content 17.0. It should have been 17.1.

MD-512 (sampled 8-28-74) shows maximum lab dry density 109.4. This should have been 109.0.

Structural Backfill Area

MDR-919 (sampled 5-25-77) shows maximum dry lab density of 109.3. It should have been 125.3. It also shows minimum dry lab density as 90.3. It should have been 109.3.

Plant Area Fill

MD-1262 (sampled 4-8-77) gives maximum dry lab density of 117.0. It should have been 117.1.

MD-1300 (sampled 5-2-77) gives optimum moisture content of 11.1. It should have been 10.4.

MD-1385 (sampled 6-2-77) gives optimum moisture content of 13.5. It should have been 13.4.

AUDIT REPORT NO F-77-32

V. CLOSED OUT FINDINGS

Finding 1

Plant Area Fill (Contd)

MD-1420 (sampled 6-8-77) gives optimum moisture content of 9.8. It should have been 8.6. It also gives maximum dry lab density of 127.3. It should have been 132.9.

MD-1521 (sampled 6-17-77) gives maximum dry lab density of 117.0. It should have been 117.1.

Corrective Action Requested: Recalculate the test results using the proper values and determine the acceptability of the corrected test results.

Corrective Action Taken: The test results were recalculated and corrections made. The above errors did not change the acceptance of these tests even though they did change the test results.

Corrective action verified October 25-26, 1977.

For further corrective action see Section VI "Open Findings" Finding 1.

Finding 2

Specification C-210, Revision 5 Section 12.6.1 states in part, "The water content during compaction shall not be more than 2 percentage points below optimum moisture content and shall not be more than 2 percentage points above optimum moisture content..."

Specification C-210, Revision 5 Section 13.7.1 states, "All cohesive backfill in the plant area and the berm shall be compacted to not less than 95 percent of maximum density as determined by ASTM D 1557, Method D".

Specification C-210, Revision 5 Section 13.7.2 states in part, "All cohesionless backfill in the plant area and the berm shall be compacted to not less than 80 percent of relative density as determined by ASTM D 2049..."

Contrary to these requirements, the following tests had failing results and did not indicate being cleared by passing tests.

V. CLOSED OUT FINDINGS

Finding 2 (Contd)

Plant Area Fill

Test No.	Date Sampled	Compaction	Moisture Actual	Moisture Optimum
MD 1153	10-21-76	61.6% of Relative Density		
1155	10-21-76	73.5% of Relative Density		
1191	11-03-76	74.6% of Relative Density		
1194	11-02-76	75.4% of Relative Density		
1317	5-09-77		18.0%	15.2%
1318	5-09-77		11.5%	15.2%
1319	5-09-77		11.7%	15.2%
1320	5-09-77		12.2%	15.2%
1321	5-09-77	94.0% of Maximum Density		
1337	5-17-77		12.4%	15.2%
1388	6-02-77		9.8%	15.2%
1393	6-03-77		11.1%	13.4%
1398	6-03-77		11.2%	13.4%
1404	6-03-77		10.2%	13.4%
1415	6-07-77		9.9%	13.4%
1498	6-15-77		14.5%	10.0%
1509	6-16-77	88.2% of Maximum Density	12.9%	15.2%

North Plant Dike

MD 418	8-14-74		17.2%	20.0%

Structural Backfill

MDR 620	10-13-76	72.3% of Relative Density
625	10-12-76	51.5% of Relative Density
629	10-20-76	79.2% of Relative Density
632	10-20-76	73.5% of Relative Density
637	10-21-76	76.3% of Relative Density
663	11-11-76	53.0% of Relative Density
664	11-11-76	72.3% of Relative Density
667	11-11-76	67.5% of Relative Density
673	11-23-76	33.9% of Relative Density
679	11-23-76	71.8% of Relative Density
680	11-23-76	60.0% of Relative Density
682	11-24-76	70.6% of Relative Density
688	11-24-76	77.1% of Relative Density
700	1-13-77	75.0% of Relative Density
701	1-13-77	68.1% of Relative Density
721	3-14-77	60.0% of Relative Density

FILE: .4.3.4 & 18.4.3.6
DATE: October 3-7, 1977
PLANT: Midland UNIT 1 & 2
SUBJECT OF AUDIT: Soil Placement Records

AUDIT REPORT NO F-77-32

V. CLOSED OUT FINDINGS

Finding 2

Structural Backfill (Contd)

Test No.	Date Sampled	Compaction	Moisture Actual	Moisture Optimum
MDR 734	3-17-77	34.0% of Relative Density		
736	3-18-77	79.0% of Relative Density		
737	3-18-77	41.9% of Relative Density		
738	3-18-77	72.4% of Relative Density		
739	3-18-77	70.6% of Relative Density		
740	3-18-77	69.3% of Relative Density		
741	3-21-77	77.8% of Relative Density		
744	3-21-77	56.2% of Relative Density		
746	3-21-77	54.9% of Relative Density		
757	3-23-77	68.7% of Relative Density		
767	3-29-77	54.3% of Relative Density		
768	3-30-77	66.9% of Relative Density		
770	3-30-77	65.0% of Relative Density		
785	4-07-77	69.3% of Relative Density		
799	4-12-77	78.8% of Relative Density		
826	4-19-77	70.4% of Relative Density		
843	4-28-77	66.8% of Relative Density		
845	4-29-77	70.4% of Relative Density		
854	5-09-77	67.4% of Relative Density		
861	5-10-77	76.3% of Relative Density		
862	5-10-77	74.0% of Relative Density		
889	5-13-77	56.5% of Relative Density		
914	5-24-77		9.0%	11.8%
922	5-26-77	75.7% of Relative Density		
925	5-27-77		11.4%	15.2%
938	6-08-77	56.5% of Relative Density		
940	6-08-77	78.6% of Relative Density		
993	6-25-77	60.2% of Relative Density		
998	6-25-77	77.4% of Relative Density		

Corrective Action Requested: Determine if there are passing tests in the same area to clear these failing tests. ✓

Corrective Action Taken: Test reports Plant Area Fill MD 1317-1320; North Plant Dike MD 418; and Structural Backfill MDR 620, 629, 632, 637, 673, 679, 700, 701, 757, 767, 768 and 770 have been cleared by passing tests and Structural Backfill represented by MDR 854, 861 and 862 was removed.

Corrective Action Verified October 26, 1977.

AUDIT REPORT NO F-77-32

V. CLOSED OUT FINDINGS

Finding 2 (Contd)

Corrective Action Taken: Test reports Plant Area Fill MD 1153, 1155, 1191, 1194, 1321, 1337, 1388, 1393, 1398, 1404, 1415, 1498, 1509 and Structural Backfill MDR 625, 663, 664, 667, 680, 682, 688, 721, 734, 736-741, 744, 746, 757, 768, 770, 785, 799, 826, 843, 845, 889, 914, 922, 925, 938, 940, 993 and 998 are in a "Non-Q" area and have been given to CPCo Project Management Organization (Field) for resolution in letter 186FQA77.

For further corrective action see Section VI "Open Findings" Finding 2.

Finding 3

Relative Density Reports 59 and 61 were missing from the QC Vault.

Corrective Action Requested: Obtain copies of these reports and place them in the QC Vault.

Corrective Action Taken: Copies have been obtained and placed in the QC Document Vault.

Corrective action verified October 26, 1977.

VI. OPEN FINDINGS

Finding 1

Specification C-210, Revision 5 Section 12.6.1 states in part, "The water content during compaction shall not be more than 2 percentage points below optimum moisture content and shall not be more than 2 percentage points above moisture content..."

Specification C-210, Revision 5 Section 13.7.1 states, "All cohesive backfill in the plant area and the berm shall be compacted to not less than 95 percent of maximum density as determined by ASTM D 1557, Method D".

Specification C-210, Revision 5 Section 13.7.2 states in part, "All cohesionless backfill in the plant area and the berm shall be compacted to not less than 80 percent of relative density as determined by ASTM D 2049..."

Contrary to these requirements, the following tests had been passed using incorrect testing data. Using the correct testing data, the tests fail.

DATE: October 3-7, 1977
PLANT: Midland UNIT 1 & 2
SUBJECT OF AUDIT: Soil Placement Records

AUDIT REPORT NO F-77-32

VI. OPEN FINDINGS

Finding 1 (Contd)

North Plant Dike

MD 290 (sampled 7-16-74) shows optimum moisture content 11.6. It should be 9.5. Using the correct optimum moisture content of 9.5%, the actual moisture content is 2.2% above optimum moisture content.

MD 360 (sampled 7-31-74) shows optimum moisture content as 21.4. It should be 15.2. This also shows maximum lab dry density as 103.2. It should be 115.1. Using the correct optimum moisture content of 15.2%, the actual moisture content is 5.4% above optimum moisture content. Also using the correct maximum lab dry density of 115.1, the correct percent of maximum density is 86.4%.

MD 377 (sampled 8-6-74) shows optimum moisture content as 18.0. It should be 15.2. Using the correct optimum moisture content of 15.2%, the actual moisture content is 4.5% above optimum moisture content.

Structural Backfill

MDR 621 (sampled 10-14-76) shows minimum dry lab density as 94.2. It should be 112.2. Using the correct minimum dry lab density of 112.2, the correct percent of relative density is 41.5.

Corrective Action Requested:

(1) Determine if there are passing tests in the same area to clear these failing tests.

(2) If these failing tests cannot be cleared by passing tests in the same area, present these findings to Bechtel Project Engineering so Project Engineering can determine what additional tests, reviews, etc. are needed to justify the material these tests represent. Have Project Engineering justify the material these failing tests represent.

(3) Determine the underlying cause(s) and take corrective action to preclude repetition.

Corrective Action Taken:

(1) North Plant Dike MD 290 and MD 377 have been identified on Bechtel NCR 1005. North Plant Dike MD 360 and Structural Backfill MDR 621 density problems have been identified on Bechtel NCR 1004.

Corrective action verified October 26, 1977.

North Plant Dike MD 360 moisture problem has been identified on revised NCR 1005.

Corrective action verified October 28, 1977.

AUDIT REPORT NO F-77-32

VI. OPEN FINDINGS

Finding 1 (Contd)

NCR QF-199 has been written to resolve the corrective action still open.

Finding 2

Specification C-210, Revision 5 Section 12.6.1 states in part, "The water content during compaction shall not be more than 2 percentage points below optimum moisture content and shall not be more than 2 percentage points above optimum moisture content..."

Specification C-210, Revision 5 Section 13.7.1 states, "All cohesive backfill in the plant area and the berm shall be compacted to not less than 95 percent of maximum density as determined by ASTM D 1557, Method D".

Specification C-210, Revision 5 Section 13.7.2 states in part, "All cohesionless backfill in the plant area and the berm shall be compacted to not less than 80 percent of relative density as determined by ASTM D 2049".

Contrary to these requirements, the following tests had failing results and did not indicate being cleared by passing tests or had been marked passing.

North Plant Dike

MD 142 (sampled 5-30-74) shows optimum moisture content 8.0, moisture content 10.3. This test failed but it is shown as passing.

MD 143 (sampled 5-30-74) shows optimum moisture content 13.8, moisture content 11.4. This failed but it is shown as passing.

West Plant Dike

MD 227 (sampled 10-6-75) failed moisture but has not been cleared.

Plant Area Fill

Test No.	Date Sampled	Compaction	Moisture Actual	Moisture Optimum
MD 1311	5-03-77	61.6% of Relative Density		
1326	5-10-77		18.5%	15.2%
1328	5-10-77		12.2%	15.2%
1412	6-07-77		10.4%	15.2%

AUDIT REPORT NO F-77-32

VI. OPEN FINDINGS

Finding 2 (Contd)

Structural Backfill

Test No.	Date Sampled	Compaction	Moisture Actual	Moisture Optimum
MDR 621	10-14-76	78.0% of Relative Density		
671	11-12-76	74.8% of Relative Density		
672	11-23-76	75.4% of Relative Density		
685	11-24-76	56.2% of Relative Density		
686	11-24-76	70.9% of Relative Density		
691	11-24-76	62.0% of Relative Density		

Corrective Action Requested:

(1) Determine if there are passing tests in the same area to clear these failing tests.

(2) If these failing tests cannot be cleared by passing tests in the same area, present these findings to Bechtel Project Engineering so Project Engineering can determine what additional tests, reviews, etc. are needed to justify the material these tests represent. Have Project Engineering justify the material these failing tests represent.

(3) Determine the underlying cause(s) and take corrective action to preclude repetition.

Corrective Action Taken:

(1) Bechtel QC has determined that none of the above have passing tests in the same area to clear the failing tests.

(2) North Plant Dike MD 142 and MD 143, West Plant Dike MD 227 and Plant Area Fill MD 1326, 1328 and 1412 have been identified on Bechtel NCR 1005. Structural Backfill MDR 621, 671, 672, 685, and 686 have been identified on Bechtel NCR 1004.

(3) Corrective action has been taken as of the last of July, 1977 by Bechtel QC and U.S. Testing to more adequately clear failing tests. Therefore, the corrective action to preclude repetition for not clearing failing tests need not be addressed.

Corrective action verified October 26, 1977

Plant Area Fill MD 1311 has been identified on revised NCR 1004.

Corrective action verified November 1, 1977.

NCR QF-199 has been written to resolve the corrective action still open.

AUDIT REPORT NO F-77-32

VI. OPEN FINDINGS (Contd)

Finding 3

Specification C-211 Revision 3 Section 5.6.2 states in part, "Material delivered to the jobsite for use as structural backfill shall be visually inspected, and tested in accordance with ASTM C-136..."

ASTM C136-71 Section 4.2 states in part, "In no case, however, shall the fraction retained on any sieve at the completion of the sieving operation weigh more than $4g/in.^2$ of sieving surface.

Note 2 - This amounts to 200g for the usual 8 in. (203-mm) diameter sieve".

To preclude repetition to NCR QF-152 (the same deficiency as this), U.S. Testing developed a new gradation form that has check points that include documenting that the 200 gram material limit on any individual 8 inch sieve has not been exceeded. In addition, a training session was held on February 21, 1977.

Project Quality Control Instruction No. SC-1.05 "Material Testing Services and Concrete Production" Rev. 3 Section 2.7.2 Reports, Item A states, "Perform a daily review of the subcontractor's jobsite inspection and test reports for acceptability, completeness, and the laboratory chief's signature for concrete, steel, and soils. Sign and date on the report verifying the acceptable status".

Contrary to these requirements:

Structural Backfill Log Number	Date Sampled	Amount Retained
G- 270	1-13-77	#40 Sieve - 225.2g
0364	4-27-77	#10 Sieve - 217.1g
0417	5-11-77	#10 Sieve - 221.4g
0431	5-16-77	#10 Sieve - 260.1g
0451	5-18-77	#10 Sieve - 211.7g
0505	6-02-77	#200 Sieve - 228.0g
0704	7-18-77	#10 Sieve - 249.5g

Corrective Action Requested:

(1) Present these findings to Bechtel Project Engineering and obtain engineering rationale from Bechtel Project Engineering as to the acceptability of the material these tests represent.

(2) Evidently the corrective action taken in NCR QF-152 was not adequate. Determine the underlying cause(s) and take further corrective action to preclude repetition.

ATTACHMENT 2

BECHTEL ASSOCIATES PROFESSIONAL CORPORATION

MIDLAND PLANT UNITS 1 & 2

JOB 7220

ADMINISTRATION BUILDING

FOUNDATION SETTLEMENTS

ALONG COLUMN LINE 0.4

SB 13752

SB 158296 - 318

SB 158134 - 142

Prepared by: GEOTECHNICAL SERVICES

SB 15822 -

December, 1977.

INTRODUCTION

Early in September, 1977, we were requested by project engineering to assist in reviewing conditions surrounding footing settlements during construction of the Midland Project Administration Building. The foundation location plan for this building is shown in Figure 1. The affected foundations are those along Column Line 0.4.

The following data are presented to enable construction and engineering in evaluating the settlement of these footings.

BACKGROUND

The original ground at the Midland site was at approximately Elevation 608 in the vicinity of the administration building. After ground surface preparation, plant area fill was placed to approximately Elevation 634. An excavation was later made to about Elevation 610 to accommodate construction of the steam tunnel. Figure 2 shows a cross-section of the tunnel and the approximate excavation scheme. After construction of the tunnel, the west side of the tunnel excavation was backfilled to approximate Elevation 620 to construct the foundations along Column Line 0.4 of the administration building. After foundation construction, the remainder of the excavation was backfilled with sand to grade as shown in Figure 2.

During the early part of September, Geotech was made aware of settlements along the Column Line 0.4. The settlement data are given in Table 1.

FIELD OBSERVATIONS

During the week of September 19-23, 1977, several site reviews were made by engineering, construction, and Geotech personnel. These took place before

and after the removal of the subject footings.

Upon removal of Column PA 0.4, it was noted that the soil under and adjacent to it was soft. This was confirmed by pushing a 3/4"ϕ steel bar with little effort approximately two feet into the ground, by walking on the soil and noting its spongy characteristics, and by pushing of a shovel with little effort.

Tests taken at that time in and adjacent to PA 0.4 included moisture content, density, and unconfined compression. These tests also were taken at Column LN 0.4.

After these field observations, it was decided that two borings should be taken to further evaluate the conditions along Column Line 0.4.

At that time, Bechtel Construction's decision was that all affected footings be removed.

BORINGS

On September 27 and 28, 1977, two test borings were completed at footings LN 0.4 and HT 0.4. At footing LN 0.4, standard penetration tests (SPT) and shelby tubes (ST) were taken. At footing HT 0.4, standard penetration tests were taken.

Borings included visual inspection and description of soils, Qp tests (compressive strength [illegible] by the pocket penetrometer method) and any visual observations of water conditions (loss or gain).

Samples for proctor testing were also taken as shown in log of holes, LUA, LNB, and ETA.

The boring logs are shown on Figures 3 through 7.

TESTING PROGRAM

Shelby tubes taken from Boring LN were submitted to U. S. Testing Laboratory for unconfined compressive tests.

Samples taken at foundations PA 0.4 and LN 0.4 were also taken by U. S. Testing personnel and unconfined compression tests were made. Results of testing are given in Table 2.

It was also decided to run Proctor tests on the samples taken directly under and adjacent to footings in order to determine the standard to be used in calculating the in situ percent compaction. These results are found in Figures 8, 9, and 10.

The Proctor curve in Figure 8 was used to calculate the in situ percent compaction using the in situ dry density data reported by the Field. This information is compared in Figure 8 with the percent compaction previously reported. This comparison shows that the percent compaction was in all cases lower than that previously determined.

In order to illustrate the effect of a reduced percent compaction on the strength of soil, the data of California Bearing Ratio (CBR) tests previously made on three identical samples of the Midland soils are presented in Figure 11. The samples were compacted at three levels of compaction effort, which

resulted in compactive energies of 56,000 ft-lb/ft^3, 20,000 ft-lb/ft^3, and 12,400 ft-lb/ft^3, respectively. It is seen that the pressure values for a penetration of 0.1" at the maximum dry density reduced from 94.5 psi to 5 psi by reducing the compactive energy from 56,000 ft-lb/ft^3 to 12,400 ft-lb/ft^3.

CONCLUSION

Based on available data the material under and adjacent to the subject footings, (Elevation 618-622) had insufficient bearing capacity to support the foundations.

The backfilled other than the soil in question (below 618) appears adequate and this conclusion is supported by SPT borings and compression tests.

Administration Building
Anchor Bolts for Col. Line 0.4
Top Bolt Elev. 634' - 2-1/2"
Per Dwg. 981, Rev. 1, Sec. D

The Columns and Grade Beam
For Column Line 0.4 Shows
Settlement Per As Built
Elevations Taken 8-23-77

Column	Elevation	Δ Settlement (ft)
Pa	634.10	0.11
N_k	634.03	0.17
M_p	634.01	0.20
L_N	634.05	0.16
K_p	634.02	0.19
K_B	633.93	0.28
J_F	633.93	0.28
H_T	633.92	0.29

SB 13757

MIDLAND UNITS 1 & 2

ADMINISTRATION BUILDING EXCAVATION

UNCONFINED COMPRESSION TESTS

Sample No.	Sample Location	Sample Elevation	*Unconfined Compression Strength Lbs Per Sq Ft	**Allowable Bearing Value Lbs Per Sq Ft	Percent Strain	Remarks
1	PA - .04	622.0	730	625	20.0	
2	PA - .04	621.0	487	420	20.0	
A	PA - .04	612.0	1984	1709	6.7	
B	PA - .04	611.0	633	546	20.0	
3	LN - .04	622.0	9.4	788	12.0	
4	LN - .04	621.0	2081	1792	5.0	
ST-1	Boring LN	617.5	4241	3653	10.3	
ST-2	Boring LN	615.5	2145	1849	20.0	
ST-3	Boring LN	603.0	5945	5123	9.1	
ST-4	Boring LN	597.5	3137	2704	20.0	
ST-5	Boring LN	588.0	2837	2428	20.0	

SB 13758

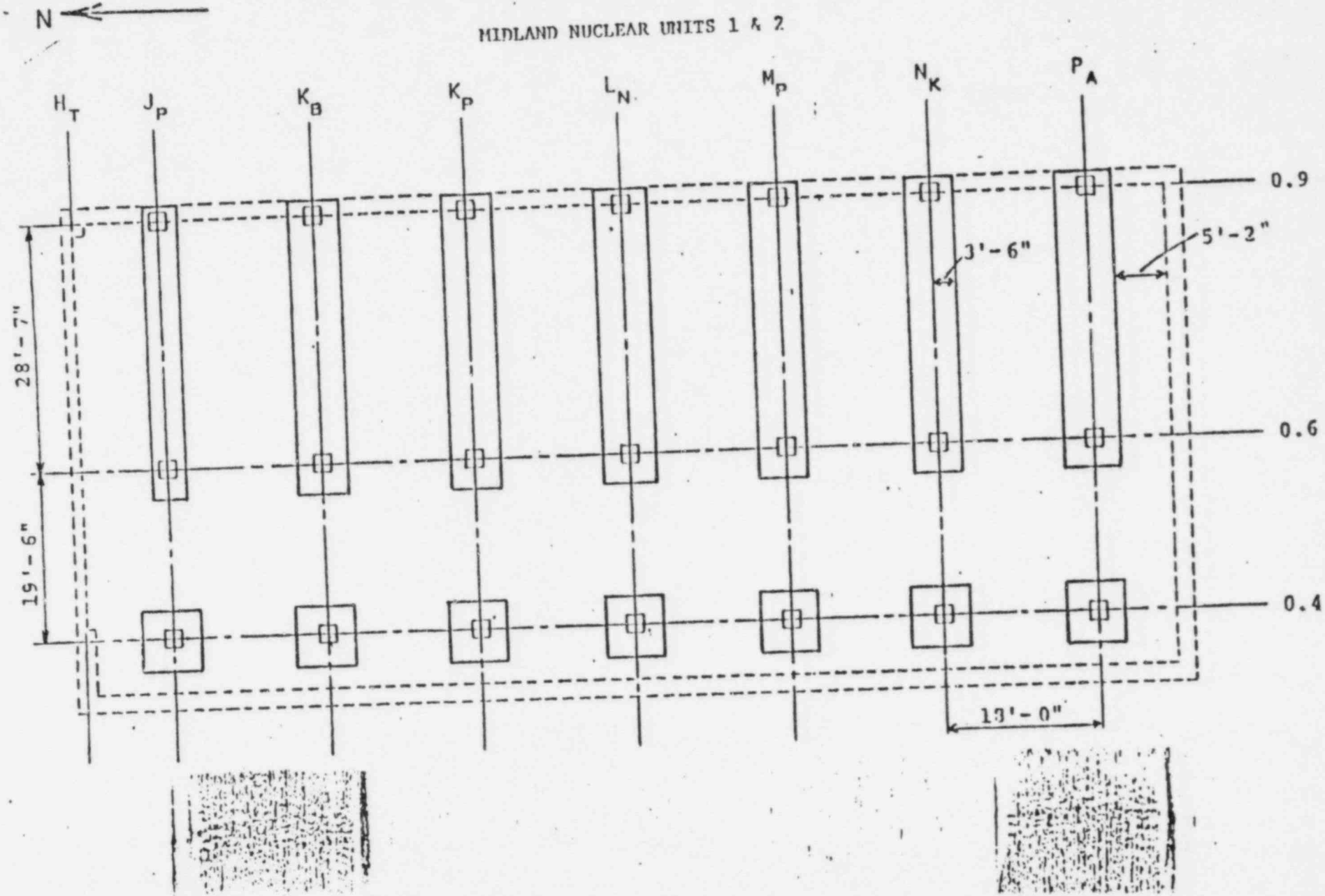
* ANSI/ASTM D 2166-66(72) **1/3 x 5.14 x 1/2 x Unconfined Comp Strength

Figure 1

FOUNDATION LOCATION PLAN

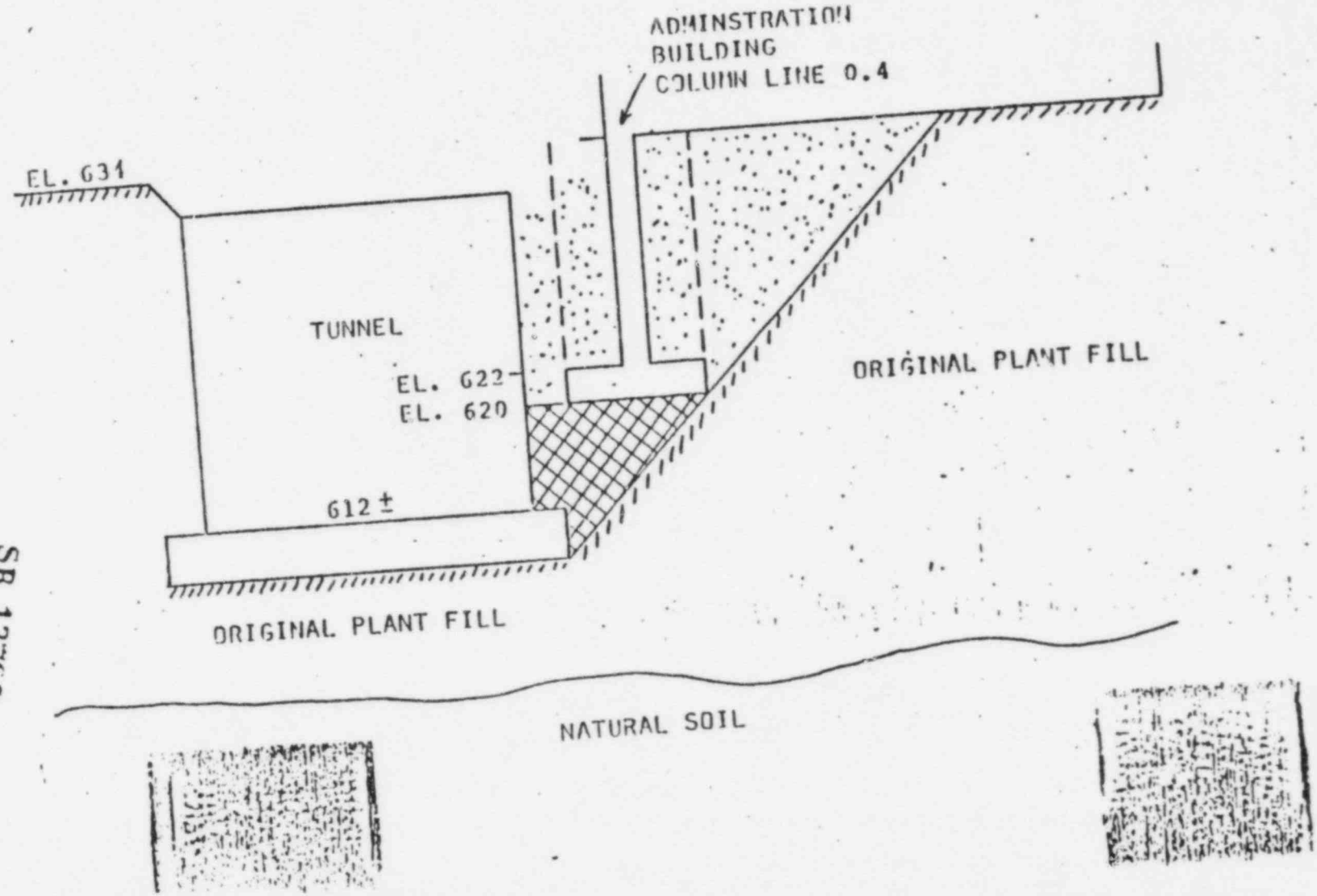
ADMINISTRATION BUILDING

MIDLAND NUCLEAR UNITS 1 & 2



SB 13259

Figure 2



SB 13700

BORING LOG

PROJECT: MIDLAND NUCLEAR PLANT | JOB NO.: 7220 | SHEET NO.: 1 of 1 | HOLE NO.: LN

SITE: ADMINISTRAATION BLDG. | COORDINATES: APPROX. 2' E OF FOOTING & 0.4-LN | ANGLE FROM HORIZ.: 90° | BEARING: —

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
9/27/77	9/28/77	SINGLETON (ABEL DRIL.)	CME-550	5"	—	—	43.5'

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
—	—	18	—	622.0	(SEE NOTES COL.)	—

SAMPLE HAMMER WEIGHT/FALL: 140#/18" | CASING LEFT IN HOLE: DIA./LENGTH: NONE | LOGGED BY: JERRY B. GIVENS

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE	LENGTH CORE RUN	SAMPLE RECOVERY	CORE RECOVERY	CORE SIZE	PERCENT CORE RECOVERY	PENETRATION BLOWS 1ST 6"	2ND 6"	3RD 6"	ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
										622					
										620				0'-2' SILTY SAND, TAN, LOOSE (BACKFILL) (SP/SM)	5" AUGER TO 8.5'; SET 5" CASING; DRILLED W. 4" TRI-CONE ROLLER BIT AND RE-CIRCULATING WATER BELOW 8.5'
2'ST	2'	1.5'	—	—	—	—				619.5	2.5		1	2'-2.5' GREY GRAVELLY CLAY (CL)	
2'ST	2'	0.9'	—	—	—	—					5		2	2.5'-27.5' SANDY CLAY, GREY W. TRACE TO LITTLE GRAVEL, LOW TO MEDIUM PLASTICITY, HARD (CL)	
2'SS	1.5'	1.0'	35	11	13	22					7.5		3	7'-25.5' BROWNISH GRAY (FILL)	
2'SS	1.5'	1.2'	37	13	17	20					10		4		SLIGHT WATER SEEPAGE AT 2.5'
2'ST	2'	0'	—	—	—	—					12		5	13' LARGE COBBLE (? BENT TUBE)	
2'SS	1.5'	0.5'	25	10	14	14					14.5		6	14.5' INCREASE IN SAND CONTENT	USED DEWITTS GLAZING COMPOUND AND MASKING TAPE TO SEAL TUBES
2'ST	2'	1.0'	—	—	—	—					17		7	15.5' 1" STONE	
2'SS	1.5'	0.9'	31	17	16	15					19		8		SAVED AS SAMPLES IN JARS
2'ST	2'	1.7'	—	—	—	—					20		9	22' STONE	#1 Qp = 4.5+ TSF
2'SS	1.5'	0.5'	13	6	9	10					22.5		10	22'-27.5' STIFF TO MEDIUM STIFF	#2 Qp = 4.5+ TSF
										594.5	27.5		11	22.5' DECREASE IN SAND CONTENT	#3 Qp = 4.5+ TSF
2'ST	2'	0'	—	—	—	—					28			25.5'-27.5' MEDIUM PLASTICITY	#4 Qp = 4.5+ TSF
2'SS	1.5'	0.2'	10	4	5	5				591.0	30			27.5'-31' SAND SEAM ? LOOSE? (POOR RECOVERY AREA - TUBE PUSHED EASILY) (FILL)	#5 NO Qp - TUBE BENT BADLY
2'ST	2'	1.3'	—	—	—	—				589.0	32			31'-33' SANDY CLAY, GREY, STIFF TO MEDIUM STIFF (CL) (FILL)	#6 Qp = 2.25 TSF
2'SS	1.5'	0.2'	20	8	9	11					33			33'-37' SILTY SAND, TAN W LITTLE RUST BROWN COLOR, FINE TO MEDIUM GRAINED, MEDIUM DENSE (SP/SM) (FILL)	#7 NO Qp - TIP OF TUBE BENT
2'SS	2'	0.8'	100+	24	100/3"	=				585.0	37			37'-43.5' SILTY SAND, GREY, FINE TO MEDIUM GRAINED, VERY DENSE, MOIST (SP/SM)	#8 Qp = 4.5 TSF
2'SS	2'	0.8'	100+	71	100/3"	=					40			38.5'-43.5' FINE GRAINED	#9 Qp = 2.75, 4.5 TSF
2'SS	2'	0.8'	100+	6	100/2.5"	=					43				#10 Qp = 1.1 TSF
2'SS	2.5'	0.2'	100+	100	=	=				578.5				TOTAL DEPTH = 43.5' EL. BOTTOM = 578.5	#11 NO Qp - TUBE PUSHED EASILY
															#12 NO Qp - NOT ENOUGH RECOVERY (ABOUT 2 TSF
															#13 - #18 NO QP (SAND)
															WATER LEVEL 5.5' AFTER CASING PULLED
															HOLE BACKFILLED WITH SOIL AT COMPLETION

9/27/77

9/28/77

FILL

SB 13761

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: ADMINISTRATION BLDG. | HOLE NO.: LN

10078-1

Figure 4

BORING LOG

PROJECT: MIDLAND NUCLEAR PLANT	JOB NO.: 7220	SHEET NO.: 1 of 1	HOLE NO.: LNA	
SITE: ADMINISTRATION BLDG.	COORDINATES: 2' NORTH OF LN	ANGLE FROM HORIZ.: 90°	BEARING: —	
DRILLED: 9/28/77	COMPLETED: 9/29/77	DRILLER: SINGLETON (ABELDRIL.)	DRILL MAKE AND MODEL: CME-550	HOLE SIZE: 5"
OVERBURDEN (FT.): —	ROCK (FT.): —	TOTAL DEPTH: 5'		
CORE RECOVERY (FT./%): —	CORE BOXES: —	SAMPLES: 1	EL. TOP OF CASING: —	GROUND EL.: 622
DEPTH/EL. GROUND WATER: (SEE HOLE "LN")	DEPTH/EL. TOP OF ROCK: —			
SAMPLE NUMBER: WEIGHT/FALL: N/A	CASING LEFT IN HOLE: DIA./LENGTH: NONE	LOGGED BY: JERRY B. GIVENS		

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE	LENGTH CORE RUN	SAMPLE RECOVERY	CORE RECOVERY	SAMPLE NUMBER	PENETRATION BLOWS 1ST 6"	PENETRATION BLOWS 2ND 6"	PENETRATION BLOWS 3RD 6"	ELEVATION	DEPTH	GRAPHIC LOG	SAMPLES	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
									622					5" AUGER TO 5'; TOOK BULK SAMPLE FOR COMPACTION TEST FROM 2.5'-5' AND COMBINED IT WITH BULK SAMPLE FROM HOLE LNB
									619.5	2.5			0'-2.5' SAND BACKFILL	
B_{LR}	2.5'	2.5'	—	—	—	—	—	—					2.5'-5' COMPACTED CLAY	
									617	5			TOTAL DEPTH = 5' EL. BOTTOM = 617	HOLE BACKFILLED WITH SOIL AFTER COMPLETION
														REFER TO BORING LOG "LN" FOR MORE INFO. CONCERNING SOIL PROFILE

SB = SPLIT SPOON; ST = SHELBY TUBE; B = BARREL; P = PITCHER; O = OTHER

SITE: ADMINISTRATION BLDG.

HOLE NO.: LNA

SB 13762

10073-1

Figure 5

BECHTEL

BORING LOG

PROJECT: MIDLAND NUCLEAR PLANT	JOB NO.: 7220	SHEET NO.: 1 of 1	HOLE NO.: LNB	
SITE: ADMINISTRATION BLDG.	COORDINATES: 2' WEST OF LNA	ANGLE FROM HORIZ.: 90°	BEARING: —	
BEGUN: 9/28/77	COMPLETED: 9/29/77	DRILLER: SINGLETON (AYELARA)	DRILL MAKE AND MODEL: CME-550	HOLE SIZE: 5"
OVERBURDEN (FT.): —	ROCK (FT.): —	TOTAL DEPTH: 5'		
CORE RECOVERY (FT./%): —	CORE BOXES: —	SAMPLES: 1	EL. TOP OF CASING: —	GROUND EL.: 622
DEPTH/EL. GROUND WATER: (SEE HOLE "LN")	DEPTH/EL. TOP OF ROCK: —			
SAMPLE HAMMER WEIGHT/FALL: N/A	CASING LEFT IN HOLE: DIA./LENGTH: NONE	LOGGED BY: JERRY B. GIVENS		

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE	LENGTH CORE RUN	SAMPLE RECOVERY	CORE RECOVERY	SAMPLE BLOWS	PERCENT CORE RECOVERY	PENETRATION BLOWS 1ST 6"	PENETRATION BLOWS 2ND 6"	PENETRATION BLOWS 3RD 6"	ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
										622					5" AUGER TO 5'; TOOK BULK SAMPLE FOR COMPACTION TEST FROM 2.5'-5' AND COMBINED IT WITH BULK SAMPLE FROM HOLE LNA
														0'-2.5' SAND BACKFILL	
										619.5					
BULK	2.5'	2.5'	—	—	—	—	—	—	—		2.5/5			2.5'-5' COMPACTED CLAY	
										617				TOTAL DEPTH = 5' EL. BOTTOM = 617	HOLE BACKFILLED WITH SOIL AFTER COMPLETION
															REFER TO BORING LOG "LN" FOR MORE INFO. CONCERNING SOIL PROFILE

SB 13763

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: ADMINISTRATION BLDG.

HOLE NO.: LNB

BORING LOG

PROJECT: MIDLAND NUCLEAR PLANT	JOB NO.: 7220	SHEET NO.: 1 of 1	HOLE NO.: HT		
SITE: ADMINISTRATION BLDG.	COORDINATES: AT ℄ OF FOOTING, 0.4-HT	ANGLE FROM VERT.: 90°	BEARING: —		
BEGUN: 9/28	COMPLETED: 9/28	DRILLER: SINGLETON (ABEL DRIL)	DRILL MAKE AND MODEL: CME 550	HOLE SIZE: 5"	OVERBURDEN (FT.): —
ROCK (FT.): —	TOTAL DEPTH: 50'				
CORE RECOVERY (FT./%): —	CORE BOXES: —	SAMPLES: 10	EL. TOP OF CASING: —	GROUND EL.: 631	DEPTH/EL. GROUND WATER: (SEE NOTES COL.)
DEPTH/EL. TOP OF ROCK: —					
SAMPLE HAMMER WEIGHT/FALL: 140#/18"	CASING LEFT IN HOLE: NONE	DIA./LBS./FOOTS:	LOGGED BY: JERRY B. GIVENS		

SAMPLED TYPE AND DIAMETER	SAMPLER ADVANCE	SAMPLER RECOVERY	LENGTH CORE RUN	CORE RECOVERY	SAMPLE BLOWS PER 6"	PERCENT CORE RECOVERY	PENETRATION BLOWS 1ST 6"	PENETRATION BLOWS 2ND 6"	PENETRATION BLOWS 3RD 6"	ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
										631					
														0'-11.5' SILTY SAND, TAN (BACKFILL) (SP/SM)	5" AUGER TO 8.5' SET CASING DRILLED W 4" TRI-CONE ROLLER BIT USING RE-CIRCULATING H2O
										619.5					
2"SS	1.5'	0.7'	8		2	3	5						1	11.5'-16' SANDY CLAY, GREYISH BROWN, GRAVEL TO 1½", SOFT TO MEDIUM STIFF, MEDIUM PLASTICITY, MOIST (CL)	#1 Qp = 1.5 TSF
2"SS	1.5	0.9'	5		1	2	3						2		#2 Qp = 0.8 TSF
										615					
2"SS	1.5	0.9'	25		7	12	13						3	16'-28.5' SILTY CLAY, BROWNISH GREY, LITTLE GRAVEL, VERY STIFF TO HARD, MEDIUM PLASTICITY, MOIST (CL)	#3 Qp = 4.5+ TSF
2"SS	1.5'	1.0'	20		8	9	11					FILL	4		#4 Qp = 4.5+ TSF
														23.2 INCREASE IN SAND CONTENT	#5 Qp = 3 TSF
2"SS	1.5'	0.5'	18		16	12	6						5		
										602.5					
2"SS	1.5'	0.9'	22		8	10	12						6	28.5'-47' SANDY CLAY, TANNISH BROWN, VERY STIFF, MEDIUM PLASTICITY MOIST (CL) PIECE OF COAL STREAKING THROUGH	#6 Qp = 3.25 TSF (CLAY)
														28.8'-33.5' SEAM OF GREY SILTY FINE TO MEDIUM SAND	
2"SS	1.5'	1.0'	30		10	15	15						7	33.5-38.5 GREYISH BROWN, SEAMS OF SAND	#7 Qp (NONE, TOO SANDY)
														35.5-47 STIFF	#8 Qp = 1.75 TSF (BREAKING UP, SANDY)
2"SS	1.5'	1.0'	10		2	5	5						8		
															#9 No Qp (TOO LITTLE REC.)
2"SS	1.5	0.2'	15		5	6	9						9		
										584				47-50' FINE SILTY SAND, GREY, VERY DENSE, TRACE ORGANICS, CLAYEY SILT LENSES, SLIGHT MOISTURE (SM)	#10 No Qp (SAN
2"SS	1.5	1.5'	111		18	40	71			581			10		
														TOTAL DEPTH = 50'. EL. BOTTOM = 581'	WATER LEVEL AT 8' WHILE DRILLING, WENT TO 7.1' AFTER DRILLING COMPLETED AND CASING REMOVED. HOLE BACKFILLED W SOIL AFTER COMPLETION

SB 13764

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: ADMINISTRATION BLDG.

HOLE NO.: HT

10070-1

BORING LOG

PROJECT: MIDLAND NUCLEAR PLANT | JOB NO.: 7220 | SHEET NO.: 1 of 1 | HOLE NO.: HTA

SITE: ADMINISTRATION BLDG. | COORDINATES: 1.0' NORTH OF HOLE "HT" | ANGLE FROM HORIZ.: 90° | BEARING: —

BEGUN: 9/28/77 | COMPLETED: 9/29/77 | DRILLER: SINGLETON/ABELDRILL | DRILL MAKE AND MODEL: CME-550 | HOLE SIZE: 5" | OVERBURDEN (FT.): — | ROCK (FT.): — | TOTAL DEPTH: 14.5'

CORE RECOVERY (FT/%): — | CORE BOXES: — | SAMPLES: 1 | EL. TOP OF CASING: — | GROUND EL.: 631 | DEPTH/EL. GROUND WATER: (SEE HOLE "HT") | DEPTH/EL. TOP OF ROCK: —

SAMPLE HAMMER WEIGHT/FALL: N/A | CASING LEFT IN HOLE: DIA./LENGTH: NONE | LOGGED BY: JERRY B. GIVENS

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE	LENGTH CORE RUN	SAMPLER RECOVERY	CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY (RECOVERY)	PENETRATION BLOWS 1ST 6"	2ND 6"	3RD 6"	ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
										631					
														0'-11.5' SAND BACKFILL	5" AUGER TO 14.5'; TOOK BULK SAMPLE FOR COMPACTION TEST FROM 11.5'-14.5'
										619.5	11.5 / 14.5			11.5'-14.5' COMPACTED CLAY	HOLE BACKFILLED WITH SOIL AFTER COMPLETE
SU	3'	3'	—	—	—	—				616.5				TOTAL DEPTH = 14.5' EL. BOTTOM = 616.5	REFER TO BORING LOG "HT" FOR MORE INFO. CONCERNING SOIL PROFILE

SB 13765

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENISON; P = PITCHER; O = OTHER

SITE: ADMINISTRATION BLDG. | HOLE NO.: HTA

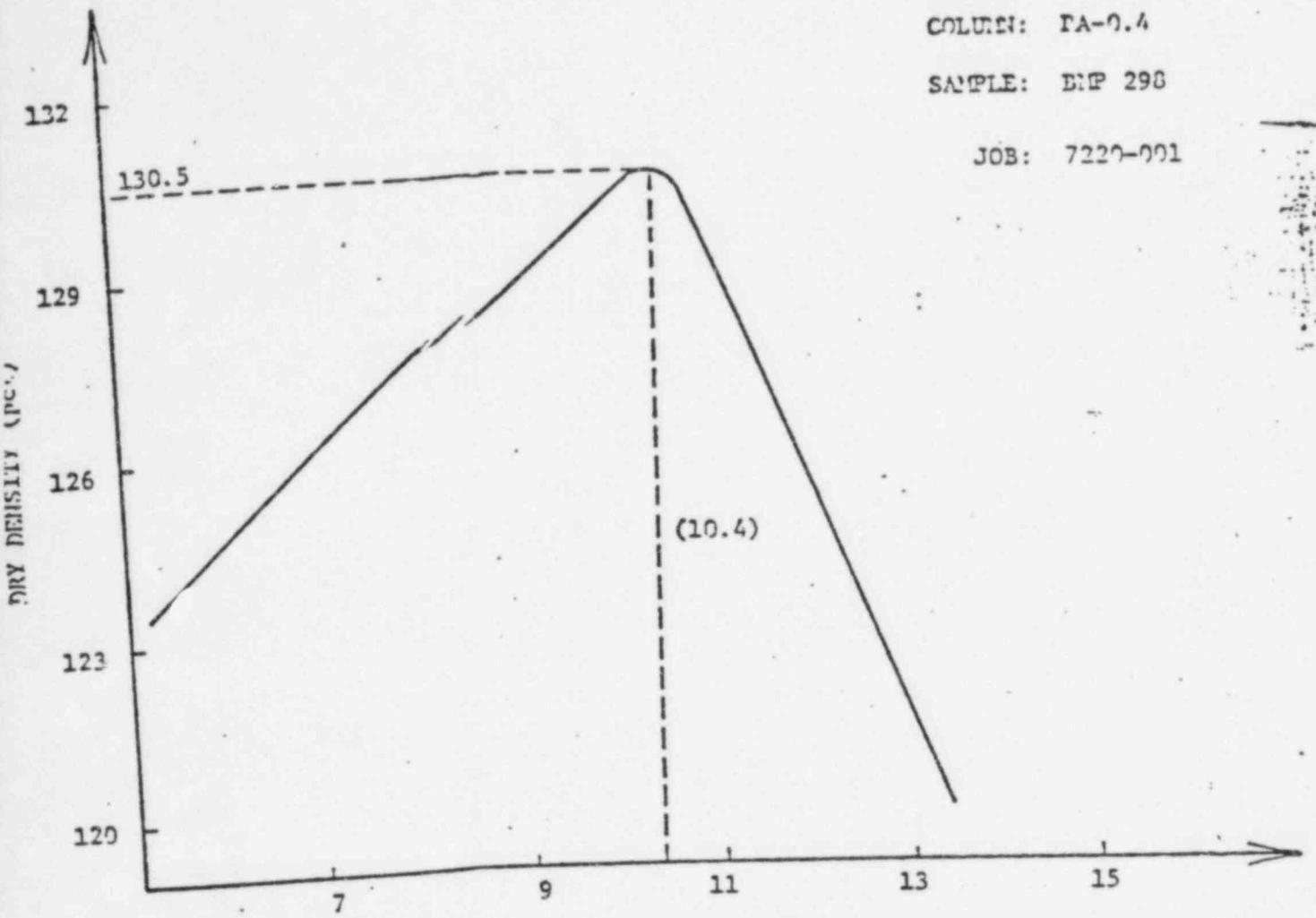
10070-1

LOCATION: Administration Building

COLUMN: FA-0.4

SAMPLE: BMP 298

JOB: 7220-001



Std. Compaction Data Used			Field Data		Original Calculated % Compaction	From Above Data % Compaction
Name	$\gamma_{d(max)}$	Wo	$\gamma_{d(f)}$	Wof		
BMP 262	123.9	11.8	117.5	17.5	94.0	90.9
			120.5	13.8	97.0	92.3
BMP 269	127.3	10.0	127.5	13.3	101.6	97.7
BMP 270	124.6	11.1	118.7	16.7	95.7	91.9
BMP 273	117.0	15.2	108.5	19.5	92.7	83.1

$\gamma_{d(max)}$ = Maximum dry density as determined for a particular compaction test

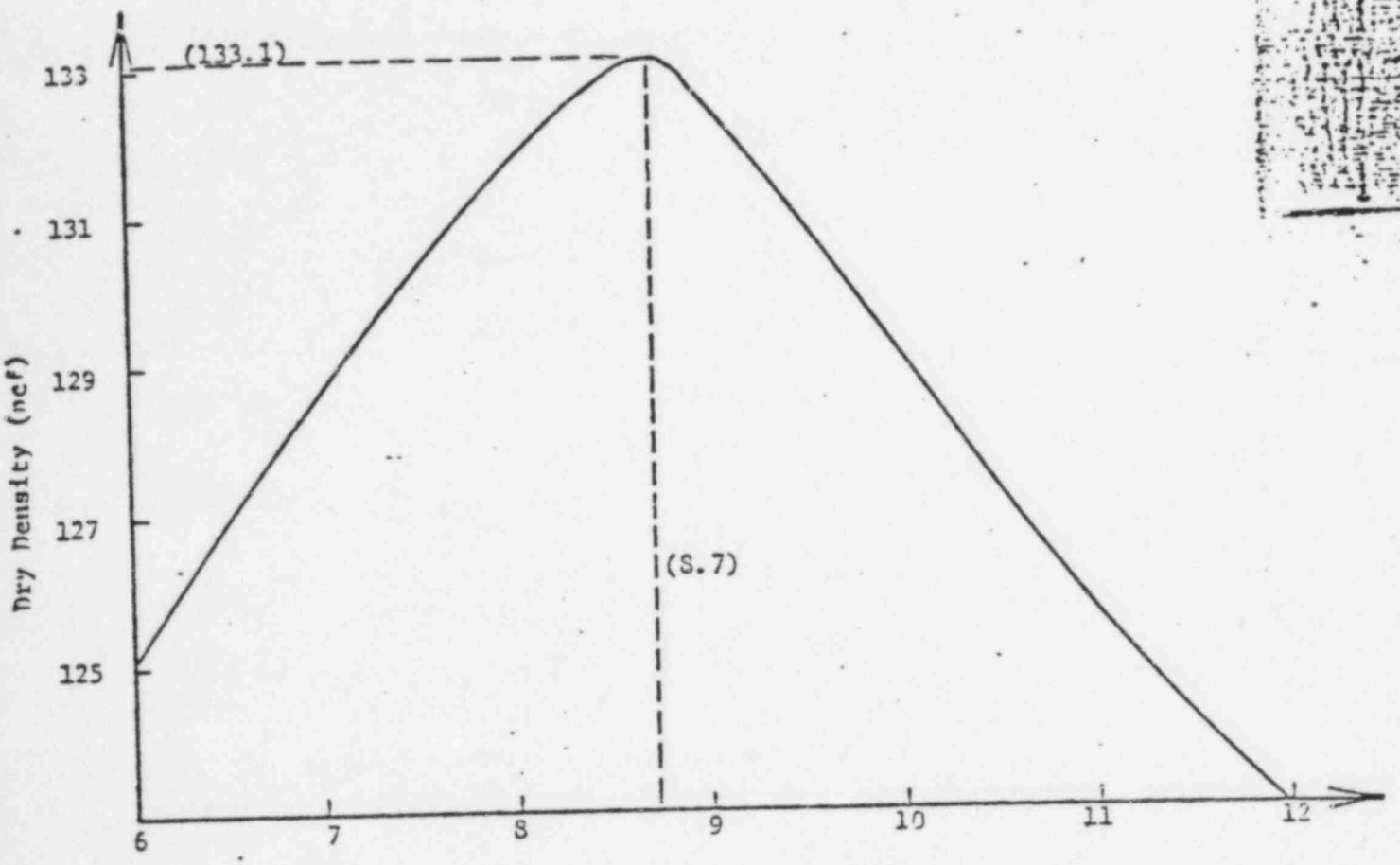
Wo = Corresponding optimum water content

$\gamma_{d(f)}$ = Field dry density

Wof = Corresponding field moisture content

SB 13766

Figure 9



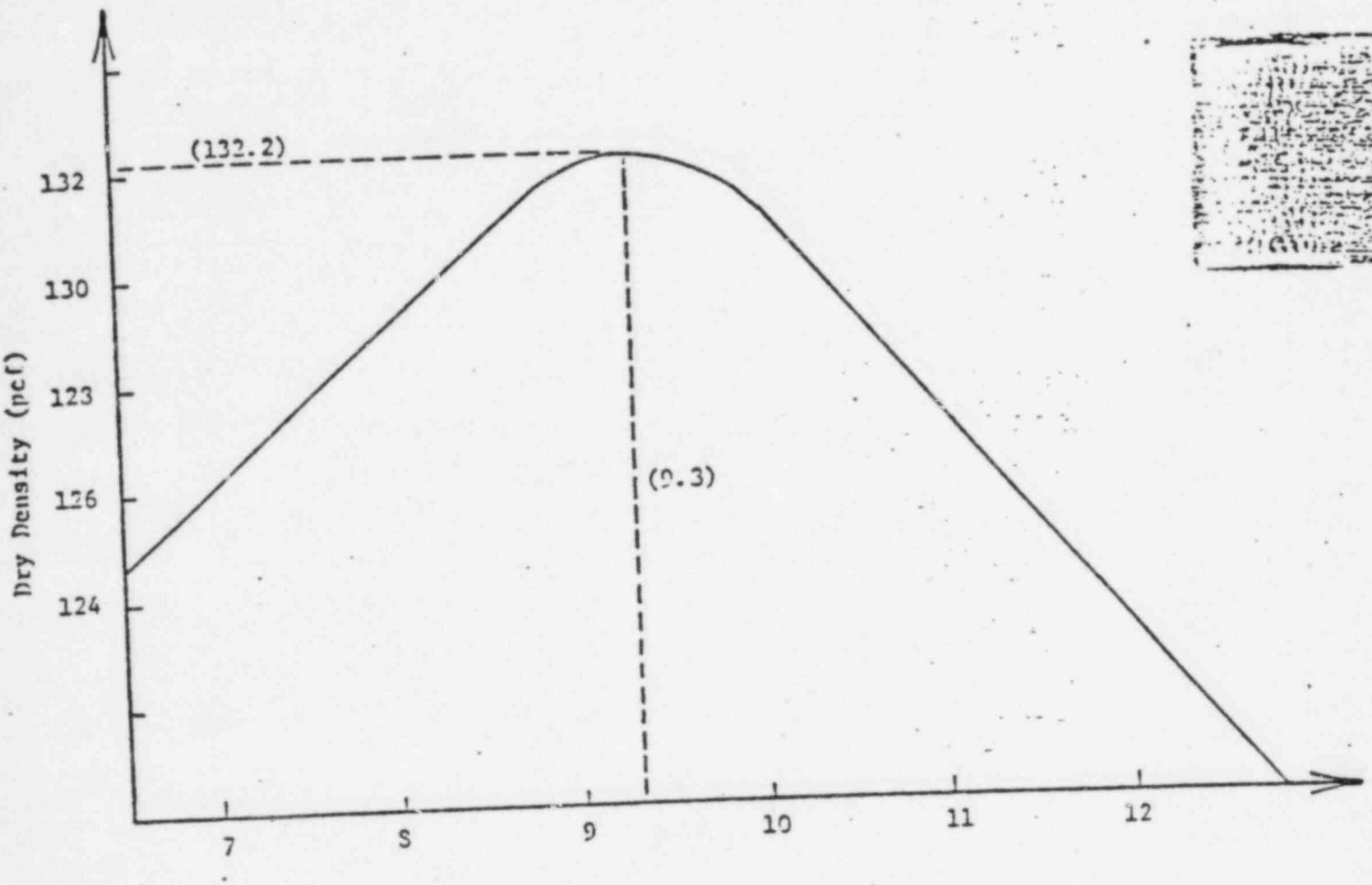
LOCATION: Administration Building

COLUMN: LN-0.4

SAMPLE: BMP-299

JOB: 7220-001

SB 13767



MOISTURE CONTENT %

LOCATION: ADMINISTRATION BUILDING

COLUMN: HT-0.4

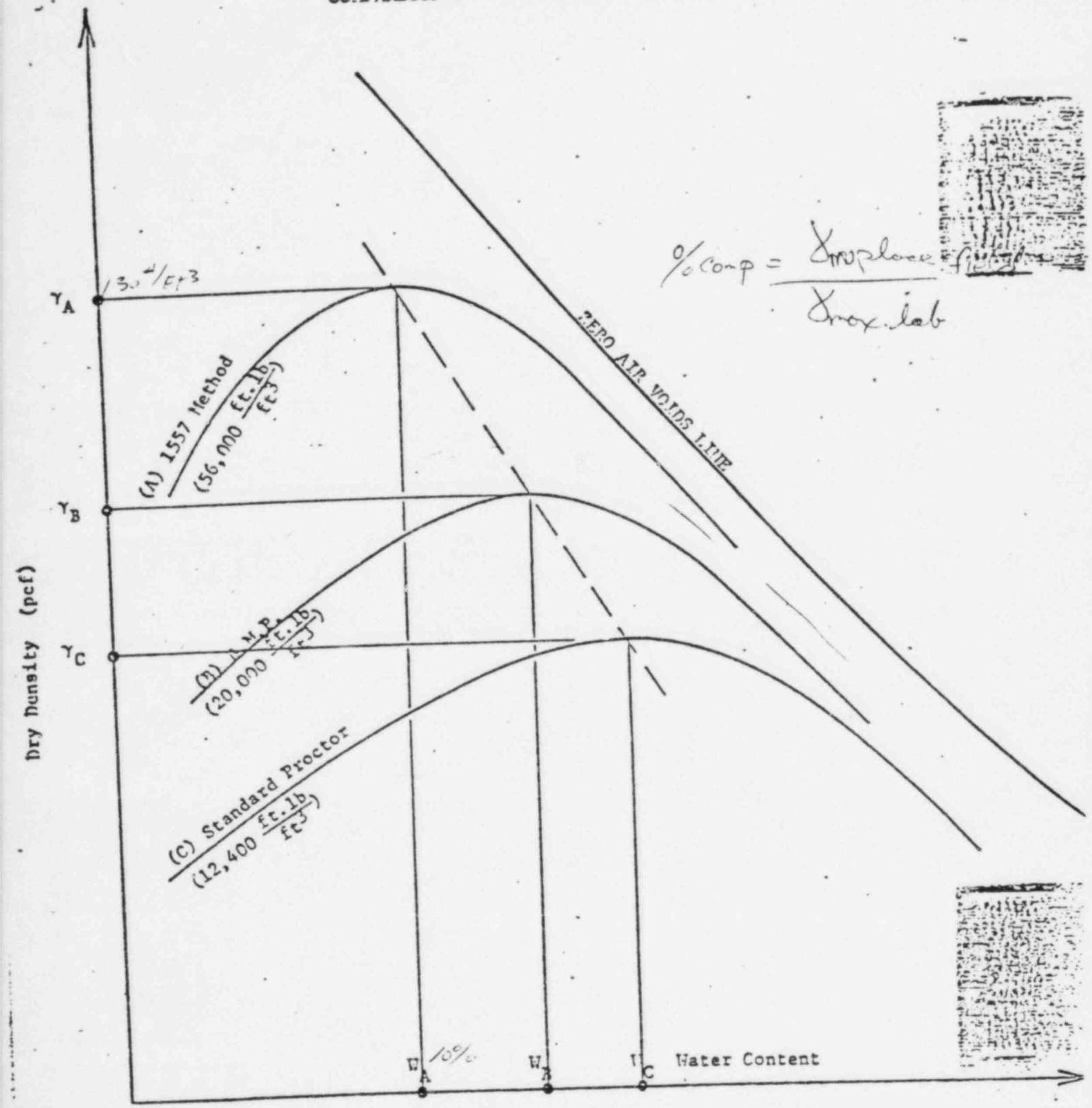
SAMPLE: BMP-300

JOB: 7220-001

SB 13768

EXHIBIT OF MIDLAND SOILS

COMPARISON OF 3 DIFFERENT STANDARDS



$$\%\,comp = \frac{\gamma_{in\,place}}{\gamma_{max.\,lab}}$$

	Optimum Water Content	Maximum Dry Density	Load at 0.1" Penetration
A	12.7(%)	124.5(pcf)	94.5 (psi)
B	14.0(%)	117.0(pcf)	57.2 (psi)
C	15.0(%)	112.0(pcf)	5 (psi)

SB 13769

SITY TESTS - NUCLEAR METHOD

MIDLAND POWER PLANT 7220 DATE: 9/22/77

Quality Control — Construction Supervisor Investigations

DENSITY			MOISTURE	
COUNT ONE			COUNT ONE	
COUNT TWO			COUNT TWO	
COUNT THREE			COUNT THREE	
COUNT FOUR			COUNT FOUR	
TOTAL			TOTAL	
AVERAGE COUNT	426		AVERAGE COUNT	403

AREA: S ADMEN. BLVD.

TEST NUMBER					
DATE OF TEST	9/22/77	9/22/77			
STATION OR LOCATION	0.4 P_A	0.4 P_A			
OFFSET FROM CENTERLINE	E. EDGE OF FOOTING	W. EDGE OF FOOTING			
ELEVATION	613	613.0			
DEPTH OF TEST	6"	6"	6"	6"	6"
ZONE NUMBER	1	1			
DENSITY COUNT	460	433			
COUNT RATIO (DENSITY)	1080	.993			
WET DENSITY #/Ft³	138.5	144.5			
TOTAL DENSITY DRY #/Ft³	118.7	127.5			
MOISTURE COUNT	336	290			
COUNT RATIO (MOISTURE)	.819	.720			
MOISTURE FROM MANUAL CHART#/Ft³	19.2	17.6			
MOISTURE %	16.1	13.3			
PROCTOR CURVE NUMBER	B&P -270	B&P -269			
MAXIMUM DENSITY #/Ft³	124.6	127.3			
OPTIMUM MOISTURE %	11.1	10.0			
% DENSITY REQUIRED	95%	95%	95%	95%	95%
MOISTURE TOLERANCE REQUIRED					
% FIELD DENSITY	95.7	101.6			
P= PASS F=FAILURE	P-M	P-M			
RETEST	NO	NO			
AREA OF TEST	PLANT	PLANT			

RKS: INFO ONLY CAUGE NO. 2932

JERRY MORRIS NOTIFIED OF RESULTS 9/22/77 @ 10:00 By R.S.

CHECKED BY:

TESTED BY

APPROVED BY SB 13772

RM MET-203 4/18/77

DENSITY TESTS - NUCLEAR METHOD

JECT: MIDLAND POWER PLANT 7220 DATE: 9/19/77

Quality Control Construction Supervisor

DENSITY			MOISTURE	
COUNT ONE	432	COUNT ONE	430	
COUNT TWO	431	COUNT TWO	428	
COUNT THREE	434	COUNT THREE	442	
COUNT FOUR	429	COUNT FOUR	431	
TOTAL	1726	TOTAL	1731	
AVERAGE COUNT	432	AVERAGE COUNT	433	

AREA:

TEST NUMBER					
DATE OF TEST	9/19/77				
STATION OR LOCATION	2'E.OF E. SIDE OF FOOTING L'S.OF N. SIDE	N_K 0.4	M_P 0.4	P_A 0.4	
OFFSET FROM CENTERLINE	S. END OF ADMIN BLDG. BEAM	ADMIN. BLD.			
ELEVATION	622	622	622	622	
DEPTH OF TEST	6"	6"	6"	6"	6"
ZONE NUMBER	1	1	1	1	
DENSITY COUNT	529	464	478	447	
COUNT RATIO (DENSITY)	1.225	1.074	1.106	1.035	
WET DENSITY #/Ft³	130.0	139.0	137.0	141.5	
TOTAL DENSITY DRY #/Ft³	108.5	119.2	117.5	121.7	
MOISTURE COUNT	381	338	350	353	
COUNT RATIO (MOISTURE)	.880	.781	.809	.815	
MOISTURE FROM MANUAL CHART #/Ft³	21.5	18.8	19.5	19.8	
MOISTURE %	19.5	15.7	16.6	16.2	
PROCTOR CURVE NUMBER	BMP-218	BMP-270	BMP-262	BMP-262	
MAXIMUM DENSITY #/Ft³	117.0 ✓	124.6	123.9	123.9	
OPTIMUM MOISTURE %	15.2	11.1	11.8	11.8	
% DENSITY REQUIRED	95%	95%	95%	95%	95%
MOISTURE TOLERANCE REQUIRED	± 2%	± 2%	± 2%	± 2%	
% FIELD DENSITY	92.7	95.7	94.8	98.2	
P= PASS F=FAILURE	F-MD	F-M	F-MD	F-M	
RETEST	NO	NO	NO	NO	
AREA OF TEST	PLANT	PLANT	PLANT	PLANT	

RKS: GAUGE NO. 2932 SB 13773

INFO ONLY

SOIL REMOVED

R. Smith

TESTED BY

APPROVED BY

CHECKED BY:

ORM MET-303 4/18/77

ATTACHMENT "2"
(TO BE REVISED TO ADD 60% OVERHEAD CHARGE.)

PROJECT & TITLE 7220 MIDLAND I&Z

CLIENT CPCo

LOCATION

TAKEOFF BR/DH APPROVED

PRICED BR/DH DATE 1-6-78

CHECKED SHEET 1 OF 1

ITEM AND DESCRIPTION	QUANTITY	UNIT	UNIT COST MAT'L	UNIT COST S/C	MAN-HOURS UNIT	MAN-HOURS TOTAL	$/MH	TOTAL COST MATERIAL	TOTAL COST LABOR	TOTAL COST SUB CONT.	TOTAL COST TOTAL
ADMIN BLDG FOOTING & GRADE BEAM REPAIR											
FORMWORK	3,100	SF	1.93			1,250	12.65	5980	15810		
REBAR - FABRICATION						190	18.50		3520		
INSTALLATION	14	T	340			600	17.60	4760	10560		
EMBED METAL - FABRICATION						10	19.70		200		
- INSTALLATION	380	LB	0.80			30	13.80	300	410		
STRUCTURAL CONCRETE	165	CY	36.00			450	11.55	5940	5200		
BACKFILL CONCRETE	585	CY	33.00			1210	12.30	19310	2580		
BACKFILL SAND	610	CY	2.10			510	11.30	1280	5760		
S/T DIRECT						3,250		37570	44040		81610
[illegible] (Est @ 25%)									14210		
DISTRIBUTABLES S/T FIELD								87			
MANUAL LABOR @ 30% DIRECT LABOR						980	14.50		14210		
NON MANUAL @ 35% [illegible]						1,140	11.50		13110		
MATERIAL @ 20% DIR. LABOR $ TOTAL BECHTEL								8810			
S/TOTAL DISTR								8810	27320		36130
S/T 1											130770
S/C SOIL TEST BORINGS											
INVOICE DATED 30 SEP 77 RAYMOND INTL										2460	
TESTS ON FILL CONC	1	LOT				8	20.00			160	
COMPACTION TESTS ON ABOVE SAND FILL	25			50.00						1250	
TOTAL										3870	3870
ROUND OFF											(-10)
											134660

SB 13414

TABLE NO. 1

Summary of Compacted Fill Density Test Data

for

Administration Building Original Fill

(Tests Grouped by General Area and Date of Test)

DATE TAKEN	TESTED BY	LOCATION	ELEV.	IN-PLACE DRY DENS.	MAX. LAB. DRY DENS.	% COMP.	REMARKS
5-23-77	SM	2' N. of N. Steam Tunnel Wall - 25' W. of Turb. #1	614.5	133.1	132.9	100.2	Pass
5-24-77	SM	2' N. of Steam Tunnel Wall - 50' W. of Turb. #1	614.6	125.7	123.9	101.5	Fail - Moisture (Too Dry - 9%)
6- 3-77	RS	4' N. of N. Wall Steam Tunnel - 15' W. of 1.0	621.5	111.0	116.0	95.7	Pass
6- 3-77	RS	5' N. of N. Wall Steam Tunnel - 24' W. of 1.0	623.0	115.7	121.0	95.6	Fail - Moisture (Too Dry - 10.2%)
5-27-77	SM	10' N. of Steam Tunnel - 4' E. of E. Side	615.5	114.2	117.0	97.6	Pass
6- 8-77	BS BT	8' E. of E. Steam Tunnel - 24' N. of N. Steam Tunnel	622.0	117.7	123.9	95.0	Pass
6-13-77	BG	8' S. H_k line - 4' E. of E. Steam Tunnel Wall	617.0	115.2	127.3	90.5	Fail - Comp.
6-15-77	RS	8' S. of H_k line 4' E. of E. Steam Tunnel Wall	617.0	118.2	117.0	101.0	Pass - Retest Clears 1469, 1488
6-15-77	RS	8' S. of H_k line 8' E. of E. Steam Wall	617.0	112.2	127.3	88.2	Fail - Comp.
6-15-77	BT	8' E. of E. Steam Tunnel Wall - 46' N. of N. Steam Tunnel Wall	618.0	113.0	127.3	88.3	Fail - Comp.
6-16-77	BT	5' E. of E. Steam Tunnel Wall - 60' N. of N. Wall	620.0	119.7	123.9	96.6	Pass
6-16-77	BT	8' E. of E. Steam Tunnel Wall - 48' N. of N. Wall	618.0	124.0	127.3	97.4	Pass - Retest Clears 1491
6-15-77	BT	38' W. of 1.0 - 5' N. of N. Steam Tunnel Wall	626.0	116.2	127.3	91.3	Fail - Comp.
6-16-77	BT	38' W. of 1.0 - 5' N. of N. Wall	626.0	122.7	127.3	96.4	Fail - Moisture
6-16-77	BT	38' W. of 1.0 - 5' N. of N. Wall	626.0	122.7	127.3	96.4	Pass - Retest Clears 1492, 1518

SB 13775

TABLE NO. 2

Summary of Test Data and Results

for

Fill Below Original Beam at 0.4 Line

Administration Building (All Tests by U. S. Testing)

DESCRIPTION OF TEST	ELEVATION OF TEST	TEST RESULTS AT COLUMN H_T	TEST RESULTS AT COLUMN L_N	TEST RESULTS AT COLUMN P_A	NOTE CODE
Initial Compacted Fill Density Test	617' ±	In-Place Dry Density = 118 lb./ft.^{3} Test No. .494	In-Place Dry Density = 119.7 lb./ft.^{3} Test No. 1517	In-Place Dry Density = 114.2 lb./ft.^{3} Test No. 1362	A
Proctor Selected by U.S.T. Technician for Item No. 1 Tests	617' ±	BMP - 278 Max. Lab. Dry Density = 117 lb./ft.^{3}	BMP - 262 Max. Lab. Dry Density = 123.9 lb./ft.3	BMP - 278 Max. Lab. Dry Density = 117 lb./ft.^{3}	
In-Place Proctor After Beam Removal	617' ±	BMP - 300 Max. Lab. Dry Density = 132.2 lb./ft.^{3}	BMP - 299 Max. Lab. Dry Density = 133.1 lb./ft.^{3}	BMP - 298 Max. Lab. Dry Density = 130.5 lb./ft.^{3}	
Reported % Compaction	617' ±	101%	96%	97.6%	B
% Compaction Using In-Place Proctor	617' ±	89.3%	89.9%	87.5%	C
Compacted Fill Density Tested After Beam Removal	617' ±	*Dry Density = 119.7 lb./ft.^{3}	Mp & 0.4 Dry Density = 117.5 lb./ft.^{3}	Dry Density = 108.5 lb./ft.^{3}	D
% Compaction Using In-Place Proctor & Dry Density Taken After Beam Removal	617' ±	90.5%	88.3%	83.1%	

erage of Three Tests at This Location

SB 13776

e Code:

A. Test Results do not include failing tests which were cleared by retest

B. Reported % Compaction during initial fill compaction

C. Actual % Compaction calculated using Item No. 1 tests divided by Item No. 3 proctor information

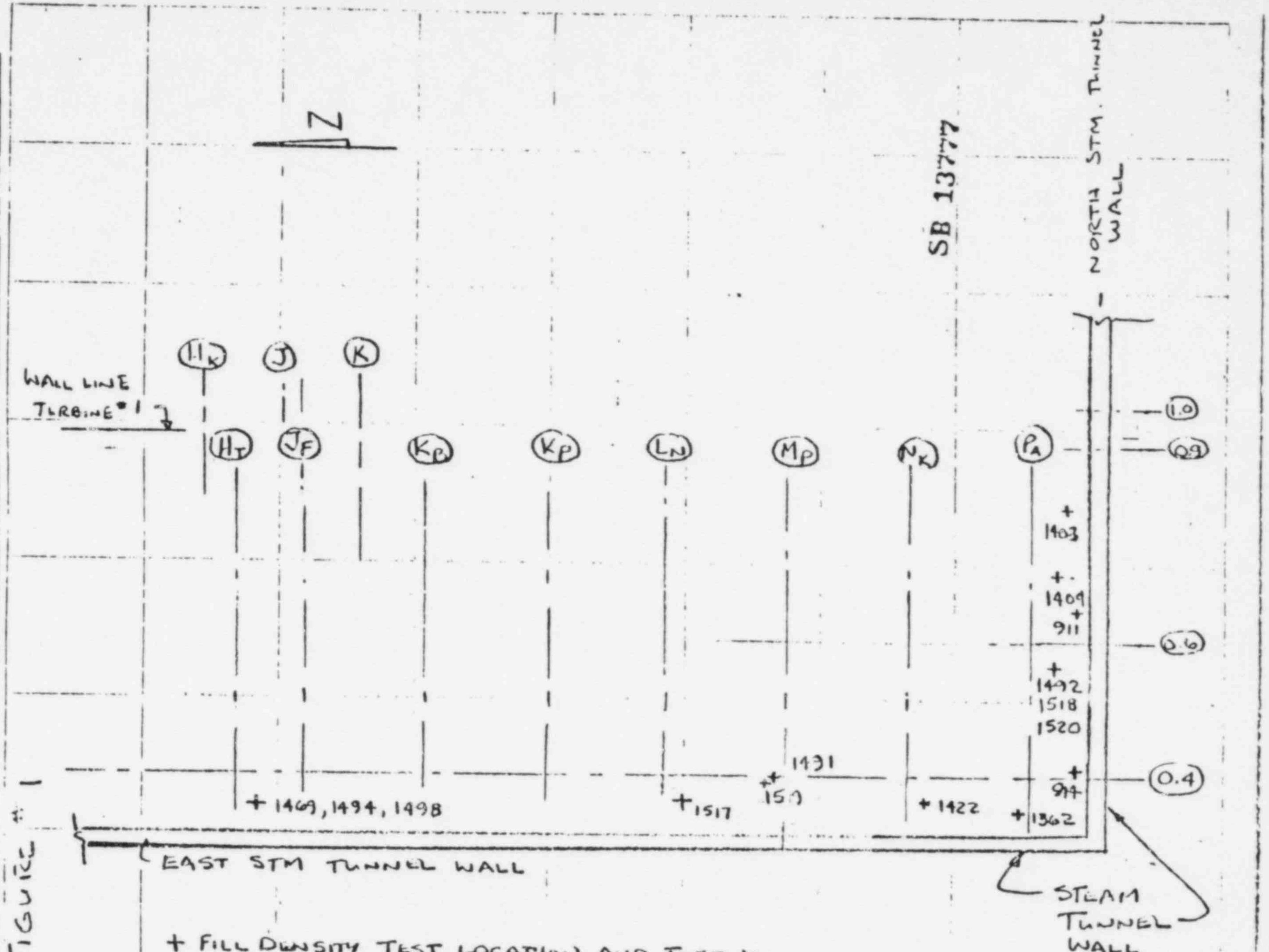
D. Tests taken after footing removal were not numbered by U.S.T., and were submitted for information only to Bechtel. Copies of reports are included as Attachment No. 1

CALCULATION SHEET

DESIGN BY F. G. TEAGUE DATE 1/10/77 CHECKED BY ______ DATE ______ SHEET NO. ______

PROJECT MIDLAND · 7220 JOB NO. 7220

SUBJECT ADMINISTRATION BLDG CALCULATION NO. ______ FILE NO. ______



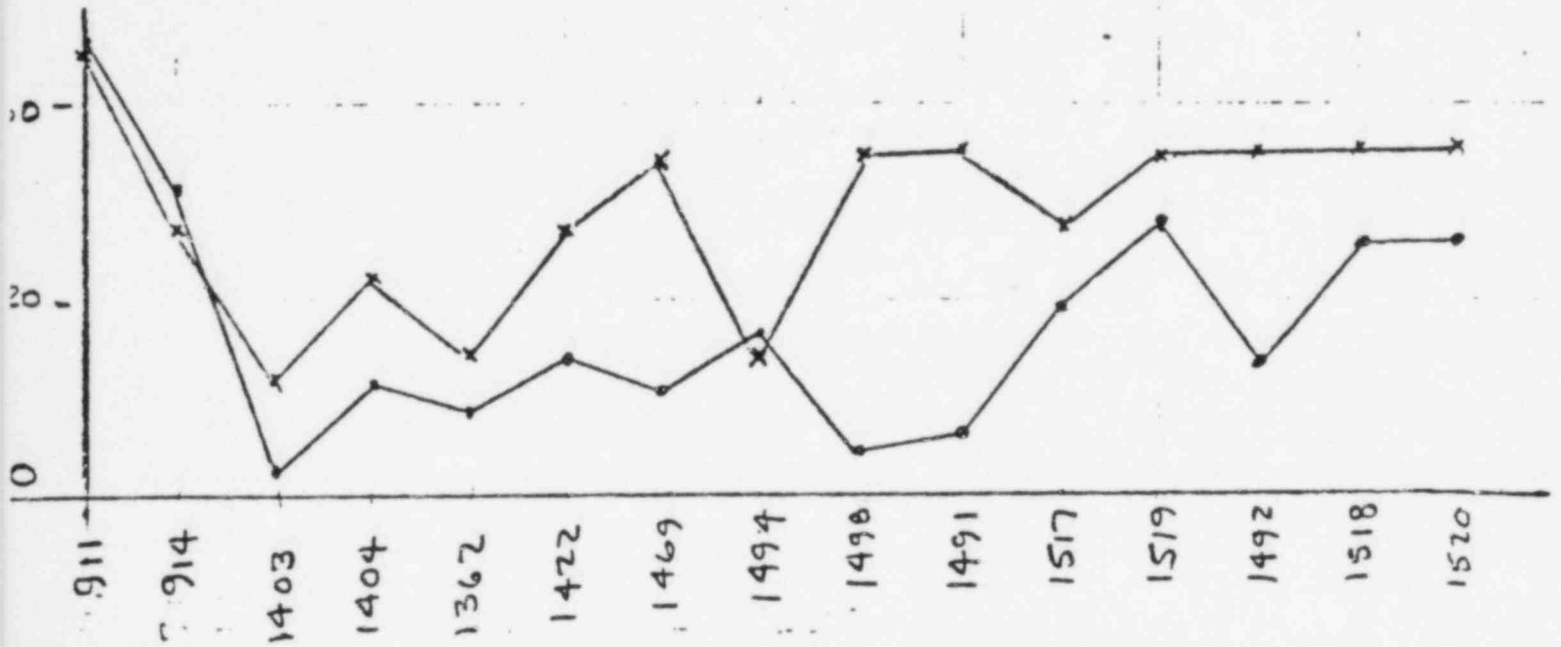
PLAN: 1" = 20' FILL TEST LOCATIONS @ ADMIN BLDG. FOR TESTS DURING ORIGINAL FILL.

DESIGN BY F G TETAGUE DATE 1/10/72 CHECKED BY _____ DATE _____ SHEET NO. _____

PROJECT _____ JOB NO. _____

SUBJECT ADMINISTRATION BLDG CALCULATION NO. _____ FILE NO. _____

FIGURE "Z"



COMPACTED FILL TEST NUMBER

x——x MAX. LAB. (PROCTOR) DRY DENSITY SELECTED BY THE U.S. TESTING TECHNICIAN DURING ORIGINAL TESTING OF COMPACTED FILL

o——o IN PLACE DRY DENSITY TAKEN DURING COMPACTION OF ORIGINAL FILL

SB 13778

Bechtel Associates Professional Corporation

Inter-office Memorandum

To S. S. Afifi

Subject Midland Units 1 & 2-Job 7220-001
Trip Report

Copies to S. L. Blue
H. H. Burke/W. R. Ferris
R. L. Castleberry
J. Newgen
[redacted]
G. Tuveson
1310, 3120

Date 15 November 1977

From J. O. Wanzeck

Of Geotechnical Services

At Ann Arbor 10(D)5

This memo transmits my trip report to the above site on November 8, 1977.

J. O. Wanzeck

JOW/lag
Attachment

Midland Units 1 & 2
Bechtel Job 7220-001

TRIP REPORT

DATE: November 8, 1977

LOCATION: Midland Project
Midland, Michigan

SUBJECT: Observe Administration Building Foundation Load Test at PA-09 and PA-06.

ATTENDEES:	Field Engineers	Bechtel
	Jim Kelleher	J. O. Wanzeck, Geotech-Soils
	Dave Billings	

OBSERVATIONS:

Load set-up was adequate for the test being conducted. Testing procedure followed ASTM recommendations. Very little settlement noted as final load was applied. I requested the field to transmit final data to the Ann Arbor office for evaluation.

JOW/lag

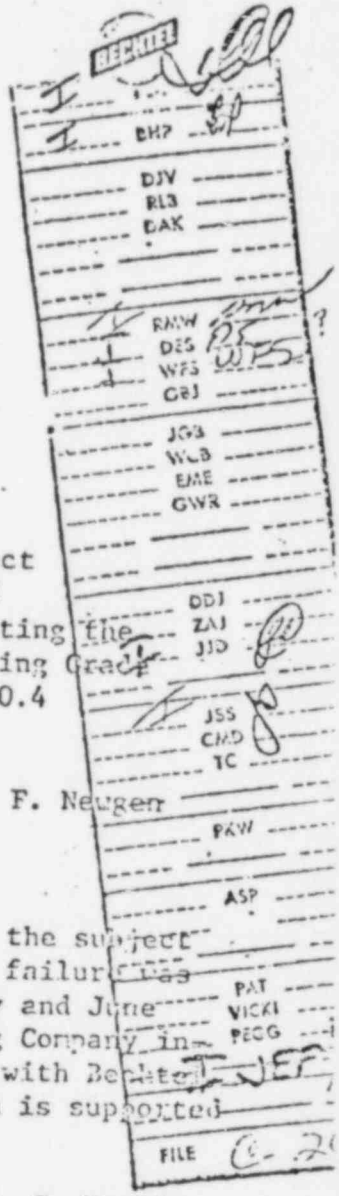
SB 13780

T. C. Cooke

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

February 1, 1978



NRC Dep Ex 3 Fnld Form (10-22-80)

U. S. Testing Company, Inc.
1415 Park Avenue
Hoboken, New Jersey 07030

Attention: Mr. D. Edley

ATTACHMENT 3

Job 7220 Midland Project
Subcontract 7220-C-208
Failure of Fill Supporting the Administration Building Grade Beam at Column Line 0.4
C-208-B-286

Reference: Telex Number C-208-B-283 Dated December 30, 1977 From J. F. Neugen

Dear Mr. Edley:

Pursuant to the referenced Telex, we have conducted an evaluation of the subject failure condition. Our engineering analysis has determined that the failure was caused by insufficient compaction of the fill which was placed in May and June of 1977. A careful review of the test data provided by U. S. Testing Company indicates that this fill was erroneously reported to be in conformance with Bechtel Specification requirements by U. S. Testing Company. This conclusion is supported by the following facts.

1. A summary of fifteen (15) compacted fill density tests taken by U. S. Testing to evaluate the subject fill as it was compacted is provided in Table #1. The location of each test is plotted in Figure #1. Although several initial tests indicate test failure due to insufficient compaction, each failure is properly cleared by a passing test at or near the location of the failure.

2. Maximum laboratory dry density values (from Bechtel Modified Proctor Tests) used as the standards for evaluating acceptability of fill compaction were selected by U. S. Testing Lab Technicians. In a Jobsite meeting with F. Teague and B. Check of Bechtel, J. Speltz of U. S. Testing stated that the testing technician uses a visual comparison between soil characteristics (primarily color) of the in-place sample and bottled samples of material with known maximum laboratory dry density, to select the appropriate standard. Visual examination by Bechtel soils engineers of the subject fill during the subsequent grade beam removal indicated the material was uniform in appearance with minimal variation in soil characteristics (color and plasticity) over the full extent of the fill placement.

3. The value of maximum laboratory dry density selected for comparison of the in-place dry densities in the subject fill varies between 132.9 lb./ft.^{3} and 116.0 lb./ft.^{3}. This variation includes most of the full range of maximum laboratory density standards which represent significantly differing soil characteristics of the clay soils in use on this project. A graph of the maximum laboratory dry density plotted with the corresponding in-place dry density for each test is given in Figure #2. Note that for three compacted fill density tests (1469, 1494 and 1493) taken within a few feet of each other and at the same elevation, two significantly different maximum laboratory densities were used as the compaction standard by the same U. S. Testing technician.

4. Testing during removal of the subject fill was conducted by U. S. Testing in accordance with Bechtel direction and Specification 7220-C-203 requirements. A summary of test data and results is given in Table #2. The results of compacted fill density tests taken during subject fill removal confirm dry density values taken during initial fill. Bechtel modified proctor tests taken during fill removal in three locations (one at the north and south edges of the fill and one approximately in the center) confirm that the maximum laboratory dry density was uniform as the appearance of the material indicated. In addition, the subsequent testing indicates the value of maximum laboratory dry density was between 130.5 lb./ft.^{3} and 133.1 lb./ft.^{3}. From these test results it is apparent that the lower maximum laboratory dry density standards selected during the original fill testing were not appropriate. As shown in Table #2, this error resulted in actual compaction in the range of 83.1% to 90.5% of optimum for three areas of the subject fill, a substantial deviation from the 95% of optimum compaction required by Specification 7220-C-203.

In conclusion, the U. S. Testing Company failure to report deviations from specified compaction requirements which was the result of repeated erroneous selection of compaction standards by U. S. Testing Company employees represents a violation of the Specification 7220-C-203, Section II, requirements and U. S. Testing Company is therefore liable for costs associated with the subsequent failure of the fill. Such costs include but are not limited to the cost of removal and investigation of the original beam and its supporting fill in addition to all replacement costs which amounts to a total of $134,600.00. An outline itemizing these costs is provided as Attachment #2 of this letter.

We trust U. S. Testing Company, Inc. will fulfill its contractual obligations with respect to this matter in a timely manner.

Very truly yours,

J. F. Meyer

JFN/CNC/JB/djg
Attachments
cc: P. A. Bechtel
T. C. Cooke
R. Hermeston
P. A. Martinez
J. Speltz

Summary of Compacted Fill Density Test Data

for

Administration Building Original Fill

(Tests Grouped by General Area and Date of Test)

TEST NO.	DATE TAKEN	TESTED BY	LOCATION	ELEV.	IN-PLACE DRY DENS.	MAX. LAB. DRY DENS.	% COMP.	REMARKS
911	5-23-77	SM	2' N. of N. Steam Tunnel Wall - 25' W. of Turb. #1	614.5	133.1	132.9	100.2	Pass
914	5-24-77	SM	2' N. of Steam Tunnel Wall - 50' W. of Turb. #1	614.6	125.7	123.9	101.5	Fail - Moisture (Too Dry - 9%)
1403	6- 3-77	RS	4' N. of N. Wall Steam Tunnel - 15' W. of 1.0	621.5	111.0	116.0	95.7	Pass
1404	6- 3-77	RS	5' N. of N. Wall Steam Tunnel - 24' W. of 1.0	623.0	115.7	121.0	95.6	Fail - Moisture (Too Dry - 10.2
1362	5-27-77	SM	10' N. of Steam Tunnel - 4' E. of E. Side	615.5	114.2	117.0	97.6	Pass
1422	6- 8-77	BS BT	8' E. of E. Steam Tunnel - 24' N. of N. Steam Tunnel	622.0	117.7	123.9	95.0	Pass
1469	6-13-77	EG	8' S. Hk line - 4' E. of E. Steam Tunnel Wall	617.0	115.2	127.3	90.5	Fail - Comp.
1494	6-15-77	RS	8' S. of Hk line 4' E. of E. Steam Tunnel Wall	617.0	118.2	117.0	101.0	Pass - Retest Clears 1469, 149
1498	6-15-77	RS	8' S. of Hk line 8' E. of E. Steam Wall	617.0	112.2	127.3	88.2	Fail - Comp.
1491	6-15-77	BT	8' E. of E. Steam Tunnel Wall - 46' N. of N. Steam Tunnel Wall	618.0	113.0	127.3	88.3	Fail - Comp.
1517	6-16-77	BT	5' E. of E. Steam Tunnel Wall - 60' N. of N. Wall	620.0	119.7	123.9	96.6	Pass
1519	6-16-77	BT	8' E. of E. Steam Tunnel Wall - 48' N. of N. Wall	618.0	124.0	127.3	97.4	Pass - Retest Clears 1491
1492	6-15-77	BT	38' W. of 1.0 - 5' N. of N. Steam Tunnel Wall	626.0	116.2	127.3	91.3	Fail - Comp.
1518	6-16-77	BT	38' W. of 1.0 - 5' N. of N. Wall	626.0	122.7	127.3	96.4	Fail - Moisture
1520	6-16-77	BT	38' W. of 1.0 - 5' N. of N. Wall	626.0	122.7	127.3	96.4	Pass - Retest Clears 1492, 151

TABLE NO. 2

Summary of Test Data and Results

for

Fill Below Original Beam at 0.4 Line

Administration Building (All Tests by U. S. Testing)

	DESCRIPTION OF TEST	ELEVATION OF TEST	TEST RESULTS AT COLUMN M_T	TEST RESULTS AT COLUMN L_N	TEST RESULTS AT COLUMN P_A	NO CO
1.	Initial Compacted Fill Density Test	617' ±	In-Place Dry Density = 118 lb./ft.^{3} Test No. .494	In-Place Dry Density = 119.7 lb./ft.^{3} Test No. 1517	In-Place Dry Density = 114.2 lb./ft.^{3} Test No. 1362	
2.	Proctor Selected by U.S.T. Technician for Item No. 1 Tests	617' ±	BMP - 278 Max. Lab. Dry Density = 117 lb./ft.^{3}	BMP - 262 Max. Lab. Dry Density = 123.9 lb./ft.3	BMP - 278 Max. Lab. Dry Density = 117 lb./ft.^{3}	
3.	In-Place Proctor After Beam Removal	617' ±	BMP - 300 Max. Lab. Dry Density = 132.2 lb./ft.^{3}	BMP - 299 Max. Lab. Dry Density = 133.1 lb./ft.^{3}	BMP - 298 Max. Lab. Dry Density = 130.5 lb./ft.^{3}	
4.	Reported % Compaction	617' ±	101%	96%	97.6%	B
5.	% Compaction Using In-Place Proctor	617' ±	89.3%	89.9%	87.5%	C
6.	Compacted Fill Density Tested After Beam Removal	617' ±	*Dry Density = 119.7 lb./ft.^{3}	Mp & 0.4 Dry Density = 117.5 lb./ft.^{3}	Dry Density = 108.5 lb./ft.^{3}	D
7.	% Compaction Using In-Place Proctor & Dry Density Taken After Beam Removal	617' ±	90.5%	88.3%	83.1%	

*Average of Three Tests at This Location

Note Code:

A. Test Results do not include failing tests which were cleared by retest

B. Reported % Compaction during initial fill compaction

C. Actual % Compaction calculated using Item No. 1 tests divided by Item No. 3 proctor information

D. Tests taken after footing removal were not numbered by U.S.T., and were submitted for information only to Bechtel. Copies of reports are included as Attachment No. 1

Bechtel Power Corporation

0004191

ATTACHMENT 4

Post Office Box 2167
Midland, Michigan 48640

September 4, 1979

U. S. Testing Company, Inc.
1415 Park Avenue
Hoboken, NJ 07030

Attention: M. Anselmo

Job 7220 Midland Project
Subcontract 7220-C-208
Geotech Review of U. S.
Testing Field and Laboratory
Tests on Soils
C-208-B-405

Dear Mr. Anselmo:

Attached we are transmitting a copy of a Bechtel report, "Review of U. S. Testing Field and Laboratory Tests on Soils" dated July, 1979 for your review and comments.

We are requesting that U. S. Testing respond to the findings; namely those summarized in Section 8.

Your response and comments are requested by September 24, 1979.

Very truly yours,

J. F. Newgen
Site Manager

JFN/JWL/DLP/km

Attachments

SR165296

MIDLAND UNITS 1 & 2
JOB NO. 7220

REVIEW OF U.S. TESTING FIELD AND LABORATORY CONSTRUCTION TEST DATA ON SOILS USED AS FILL

BECHTEL ASSOCIATES PROFESSIONAL CORPORATION
July 1979

PAGE

This review of the quality control tests of the earth fill at the Midland Sit was made as a result of settlement of the fill supported diesel generator building in excess of that predicted. Soil samples obtained in borings indic that soil conditions beneath the plant structures are not compatible with the quality of fill that could be expected based on the results of the control te made by U. S. Testing Company. All fill was accepted as it was being placed based on the results of the field tests performed by U. S. Testing Company.

The review showed many discrepancies in the test results as outlined in the following paragraphs. Review comments are based on the requirements of the technical specifications for fill placement and to subcontract entered into by U. S. Testing Company.

1. Use of Laboratory Test Compaction Curves

Table 9-1 of specification 7220-C-208, Page 14B required one field densit and moisture content test be taken for each 500 cubic yards of fill place It also required one compaction, grain size, and specific gravity for eac 10,000 cubic yards of material. This gives a ratio of 20 field density tests to 1 laboratory compaction test. Although 20:1 is not a strict upp limit, it is a guideline; should density tests be taken more frequently than one per 500 cubic yards of fill the ratio could be higher. The actual ratio is shown in Table A attached. In fact, some of the laborato compaction tests were used to determine percent compaction for several hundred field density tests taken over a period exceeding two years. Eve though no time requirements for the period of use of laboratory tests are specified, it is unlikely that any borrow source in this area would be of such uniform character that such extended use of a compaction curve, trul representative of a large quantity of material, would be applicable. Lis below are selected laboratory test data results indicating the wide range soil properties that were reported. Such a wide range is typical for soil of the kind used in the fill, making prediction of maximum density, based on visual inspection, extremely difficult if not impossible without testin

TEST	MIN. DENSITY (lbs/Ft^3)	MAX. DENSITY (lbs/ft^3)	OPT. MOISTURE (percent)
*BMP269		127.3	10
*BMP278		117.0	15.2
*BMP279		140.8	5.7
**RD24	100.9	119.2	
**RD55	90.2	109.7	
**RD61	109.3	125.3	

*BMP refers to proctor type test.
**RD refers to relative density test run by dry method.

2. Questionable Retests

A field density test that fails to meet requirements of the specification should have been reported to Bechtel who then would have requ reworking of the area and retesting.

Of the 668 "failing" tests which were marked "cleared" by another te in over 10% (72 tests) of the results, the clearing of the "failed" density test was apparently resolved by merely using another laborat compaction curve with either lower maximum density, which resulted i in the percent compaction being increased sufficiently, or different optimum moisture content which caused the fill to meet the requireme of the specification. The possibility exists that soil was removed after a "failing" test and replaced by different material, but the records do not indicate this and it is not possible from the record to determine if a new density test was made. In other cases, tests labeled "failed" were incorrectly cleared though the same laboratory standard was referenced. For example, in some cases retests to clea a "failed" test were not taken in the same area or at the approximat same elevation. More than 40 retests were over 20 feet from the "fa test location (as recorded in the test reports) and some were over 2 feet from the original test location. In general, if after a "faili test the whole area is reworked, the density test location is not to critical assuming that the correct laboratory compaction curve is us for comparison. However, in the plant fill,work areas were relative small, and soil characteristics showed considerable variation necess ting retesting in the immediate vicinity of the "failing" test. Ret should be taken in the lift or soil layer that has been reworked. A most 50 retests were taken at different elevations, some up to 10 ft from the "failed" test. It should be noted that Bechtel field persc gave the locations for retesting. This was not a U. S. Testing resp sibility. Two retests were dated prior to the time the original tes "failed". Over 130 "failing" tests were marked as ("non Q") and nev recorded cleared, as they were outside the saftey related area.

Table B is a compilation of notes relative to questionable clearing failed tests.

3. Theoretically Impossible Test Results

Soils cannot be more than 100 percent saturated; therefore, all fiel density test data points, when plotted as dry density versus moistur content, must be below the zero air voids curve as defined by the sp gravity of the material. Specifications do not require examination the zero air voids curve, but it is considered common practice relat to compaction plots. There are numerous cases in the U. S. Testing Company data where points plot above the zero air voids curve. Figu attached shows a typical laboratory compaction test curve with field test results plotted on it. Many of the field test results are to determine percent compaction plot above the zero air voids curve. Provided the specific gravity is correct this is not possible so tha all such points must represent erroneous data.

The fact that a large number of test results plot above the zero air v curve tends to make all test results questionable.

Also, referring to Figure 1 it would appear that soil density varied widely. Specifications called for compactive effort results as define by ASTM D 1557 which is 56,255 ft-lb/ft^3 energy. This was modified to laboratory test compactive effort of about 20,000 ft-lbs/ft^3 energy, o referred to as Bechtel Modified Proctor (BMP). Laboratory compaction test curves should be related to the same effort as that called for in the field for use in comparing with field density tests to determine percent compaction. According to plots of field data shown on Figure density varied from about 108 lb/ft^3 to about 130 lb/ft^3. It is doubt that the soil classification or other properties would be similar for a wide variation in density. It is noted that 100 percent of modified Proctor (ASTM D 1557) which is difficult to obtain, is rated at 56,255 ft-lb/ft^3 energy. The curve plotted on Figure 1 is at about 20,000 ft- energy. For comparative purposes it was determined by U. S. Testing i that 100 percent of specified effort (20,000 ft-lb/ft^3) is approximate equal to 95 percent of the maximum density as determined by ASTM D 155 ft-lb/ft^3) Reference Figure 8.

4. Repeated use of Questionable Laboratory Test Data

Some laboratory compaction test data were used repeatedly even though continued to show suspect field test results. This could be indicati of questionable laboratory data or the fact that soil was not being pl or compacted according to specifications. Either case is a cause for concern.

Several specific gravity calculations are in error, such as for BMP 27 and 274. In the case of BMP 273, the zero air voids curve passes thro the laboratory compaction curve. In another example, BMP 297, the lab compaction curve is invalid due to calculation errors, yet was referen by field density tests 22 times.

Table C is a compilation of notes relative to questionable test data.

5. Limits of Accuracy and Acceptability for Test Data

Figures 1 through 7 attached will be referenced in discussing limits o accuracy or acceptability for field test results as compared to labora test data. The figures show plots of compaction data for BMP 278 whic are typical of all test results.

Specified laboratory compactive effort was 20,000 ft-lbs/ft^3 and field compaction effort was originally specified at 56,255 ft-lbs/ft^3 but wa changed by Revision 5, dated 7/8/75, specification 7220-C-210, Section 13.7, Page 57 to also be equal to about 20,000 ft-lbs/ft^3.

The specified 20,000 ft-lbs/ft^3 effort establishes a compaction curve relating moisture and density for a specific soil. Moisture was specifi for field placed fill to be within ± 2 percent of optimum moisture as determined by this effort. Density was specified to be greater than 95 percent of the maximum density. As compactive effort is increased in the laboratory test, maximum density will be increased and optimum moisture content will decrease. This change can only occur in the field to the extent that the field moisture content will permit it. Once fiel compaction is such that the fill density is significantly higher than about 105 percent of maximum, the specified tolerance from optimum moisture content in the laboratory compaction test may no longer be applicable for field control. A + 2 percent numerical value of moisture content acceptable at the specified compactive effort would be too wet at a higher effort since the zero air voids curve defines the absolute maximum that can be achieved, indicating that higher densities for that soil are impossible. Therefore, if the record shows high densities for such material, the data are in error. This was apparently overlooked.

Plots of field data for compaction test EMP 278 are shown on Figures 1 through 6. The title of each figure gives the assumptions made in plotting data for the figure. In comparing figures 3 and 4 it is seen that a majority of field tests were made using the nuclear device. The two test results shown on Figure 4 for the sand cone method indicates on test result on each side of the zero air voids curve. The one falling above the zero air voids curve (shown on Figure 4) is designated by U. S. Testing Company as the only passing sand cone test (shown on Figur

For a field test result to be valid as well as "Passing" it must fall wi in a well defined area on the plot containing the laboratory compaction curve. This area or window of acceptability is shown for a hypothetical compaction curve on Figure 7a that would meet requirements of Specificat 7220-C-210. It is defined by horizontal lines at 95 percent and 105 per of specified density, vertical lines through ± 2 percent of optimum moisture content, and a line parallel to the zero voids line indicating saturation about half way between the compaction curve and 100 percent saturation (zero air voids curve). The practical upper limit of 105 percent of specified density is not defined in the specifications. It was arbitrarily chosen as numbers greater than this give increasingly invalid comparisons between field test results and the specified laborat compaction test curve. Therefore, if all data points fall within the defined window there would be no reason to assume that they are wrong. However, when many data points fall outside the designated area there is something wrong with the information and then all data points become sus A review of all data indicates that about 25 percent of the cohesive soi test results fall within this area.

Figure 7B shows an area where field test results would be acceptable, in theory even though not in strict accordance with the specifications. Figure 7B was arrived at by expanding Figure 7a to include test results up to a compactive effort related to ASTM D 1557 (56,255 ft-lb/ft^3) whic is considered to be a practical upper limit. About 40 percent of all cohesive soil test results would plot in this area.

6. Accuracy of Test Equipment

Almost all (over 95%) field density tests on cohesive soils were mad using the Nuclear Density device. Specification 7220-C-210 section 12.4.2 page 42 indicates this to be acceptable for moisture content determination provided that the results are compatible with those obtained by ASTM D 2216. Similarly, section 12.4.4 says density det mined by the nuclear device is acceptable when results are compatibl with density as determined by ASTM D 1556.

In a letter from U. S. Testing to Bechtel (dated May 30, 1974), the average deviation of the nuclear device from oven-dry moistures was +.12% for a set of 30 tests. However, the standard error of estimat 1.8% for the data with the range of differences being from - 3.2% to +3.9%. Thus, accuracy of the nuclear device is questionable, and co translate into errors of about ± 4 pcf in the dry density calculatio (It should be noted that errors in the moisture content tend to shif the position of test results on a moisture density plot approximatel parallel to the zero air voids curve, assuming the in-place wet dens is correct, and thus do not explain the large number of points which plot outside the zero air voids. Compare Figures 1 and 9).

No reliable correlation between sand cone and nuclear density tests were carried out therefore there is no basis for determining if U. S Testing would have performed better using the sand cone procedure.

However, it is clear that a large number of the nuclear density tests are wrong. This can be explained by considering the wet unit weight may have been wrong or both the moisture content and unit weight may have been wrong. A reliable correlation with properly conducted san cone tests should have revealed this, but it was not apparently done.

7. Relative Density Tests

Cases were noted where densities in material classified on the data sheet as zone 3 (sand) were compared to the maximum densities in pro type tests and other cases where densities in clay soils were compar the maximum density in relative density tests. An error must exist the record in such cases either in the classification of the soil on data sheet or in comparing field test results to inappropriate labor test data. In general, it appears that relative density tests were in controlling density of sand fill. There were a significant numbe arithmetic errors on calculation sheets even though there are signat on the sheets indicating they had been checked. Over 100 errors wer found in calculations, of relative density from 8/15/79 through 12/7 (not all of these errors change the acceptability of the test result

ASTM D 2049 section 7.1.2 Wet Method states: "Note 2 - While the dry method is preferred from the standpoint of securing results in a shorter period of time, the highest maximum density is obtained for some soils in a saturated state. At the beginning of a laboratory test program, or when a radical change of materials occurs, the maximum density test should be performed on both wet and dry soil to determine which method results in the higher maximum density. If the wet method produces higher maximum densities (in excess of one percent) it shall be followed in succeeding tests." An example of wet and dry relative density is shown on Figure 10. U. S. Testing Company apparently did not do this frequently enough, or on a broad enough range of non-cohesive soil types. As a consequence many field density test results exceed 100 percent of maximum dry laboratory relative density. As an example, for laboratory test RD55 a total of 566 field tests were made. Of this total, 364 tests were greater than 100 percent compaction. The highest relative density found was 142.2 percent with the majority of tests over 100 percent falling in the range of 100 percent to about 130 percent. Since the difference in maximum density between wet and dry methods is about 4 to 5 lbs/c. ft. (based on recent data) any test result greater than about 115 percent (based on the dry method) is suspect.

Even if the wet laboratory test method data were available for all sands, it appears an unacceptably high number of field test results would greatly exceed 105 percent relative density even based on the wet maximum

8. Summary

In summary, there are five major faults contained in the Midland Compacte Fill Density Test Reports as follows:

1. erroneous field density test data.
2. incorrect soil identification
3. incorrect (or questionable) laboratory test data.
4. calculation errors
5. improper or incomplete clearing of "failed" tests.

Items 4 and 5 represent existing faults in the data which could be corrected. However, as a result of items 1 through 3, there is no rational means of determining which test results are valid and which are not. Since more than one half of the test results for relative densi and percent compaction fall outside the possible theoretical comparison limits, it must be concluded that these test results are suspect and should not be used alone for acceptance of plant area fill. Therefore, other means of testing have been established and employed to determine if the fill in any given area is acceptable.

Also in item 4 it should be noted that on many occassions the inplace density was divided by the maximum density from the relative density test to get percent compaction, these tests were also used to clear other pricing tests.

TABLE A

Listing of All Classifications Referenced in Plant Area Fill Soil Test Records Which were Used for 20 or More Field Density Tests

Classification	No. of Tests
B200	90
B251	31
B252	22
B254	42
B255	57
B260	68
B261	36
B262	165
B269	227
B270	226
B271	141
B274	37
B276	21
B277	158
B278	82
B297	22
R015	20
R016	61
R024	248
R030	54
R035	59
R038	39
R039	28
R040	35
R041	69
R042	103
R043	48
R044	71
R045	43
R049	63
R054	118
R055	566
R059	65
R061	589
R063	42
R065	59

Note: Spec. 7220-C-208 gives a ratio of approximately 20 field tests to each laboratory test.

TABLE B

0004201

Notes on Questionable Clearing of Failed Tests

1. Test number MD 245 fails due to high moisture. Cleared by MD which references a proctor with higher optimum moisture content (OMC) such that the ±2% of optimum requirement is met.

2. MD 205 fails with moisture content 6% above the OMC. Cleared b MD 215, which references a relative density lab standard, and i itself still 6% away from the OMC of the proctor referenced by M

3. MD 223 fails because of high moisture. Cleared by MD 228 whic has actually a higher moisture content and lower density, but re a different proctor; the retest passes and clears the failure.

4. Both MD 844 and 886 fail because of high moisture and low densi They are cleared by MD 888 which references a new proctor with lower maximum density and higher OMC than the first.

5. MD 251 fails due to moisture being too high. Cleared by MD 25 which uses a higher OMC proctor.

6. MD 668 clears MDR 634, but the two tests show no correspondence location, moisture, density, or lab standard.

7. MD 771 failed, being too dry. Cleared by MD 782, which has a identical moisture content and dry density but uses a new BMP w lower optimum moisture.

8. MD 2384 clears MD 2342, referencing a different proctor with a OMC which fits the in-situ conditions. However, the dry densit of MD 2384 is way too high to fit the original soil classifica and in addition, it falls outside of the zero air voids curve f the classification which it has been changed to.

9. MD 556 clears MD 554 by using a BMP with lower moisture requi The field densities differ by 24 pcf and would seem to be diffe material.

10. MD 558 clears MD 555 but has too high a density to be the sam as MD 555. It also uses a different proctor.

11. MD 566 and 568, classified as BMP 262 cohesive soils, are clea by MD 569 which is classified as RD 33 and has totally differe soil properties than the two failures.

12. MD 1317, 18, 19 and 20 fail and are all cleared by MD 1477 ta over 5 weeks later. There is poor correspondence in the soil p and the proctor is different from failing to passing test.

13. MD 2965 clears MD 2963 with a different proctor through the t results would have been passing with the original BMP.

14. MD 1388, classified as BMP 278, is cleared by MD 1461, classi as RD 55.

15. MD 170, classified as RD 24 is cleared by MD 173, classified as BMP 234.

16. MDR 287 fails with a relative density of 77%. Cleared by MDR 291 which has .1 pcf lower density but arbitrarily rounds up the rela density to 80%; it passes and clears the failure.

17. In all of the following field density tests on sand, the passing test has approximately the same or lower density than the failure but references a lower maximum density RD lab standard:

MDR 343	clears	MDR 339
MDR 514	clears	MDR 507
MDR 513	clears	MDR 508
MDR 515	clears	MDR 509
MDR 516	clears	MDR 510
MDR 522A	clears	MDR 521
MDR 558	clears	MDR 556, 557
MDR 480	clears	MDR 473
MDR 555	clears	MDR 525, 527, 534
MDR 533	clears	MDR 526, 530, 531

18. MD 2384 clears MD 2342, but is at 7' lower elevation.

19. MD 123 clears MD 122, but is at 10.5' lower elevation.

20. MD 149 clears MD 142, but is at 10' higher elevation.

21. MD 1694 clears MD 1693 but is 43' away from the site of the fir test.

22. MD 3114 clears MD 3102, but the two tests are 68' apart.

23. MD 186 clears MD 183 though it is 110' away.

24. MD 1209 clears MD 1207 and MD 1205, yet is 183 ft. away from t failures.

25. MD 1097, dated August 4, 1977, cleared by MD 1048 dated July 16

Note: This table gives typical observations and is not meant to be a inclusive.

TABLE C

Notes on Questionable Test Data

1. The first field density test to reference RD 24 (5/75) has a rel density of 170.6%. The standard continued to be used, however, relative densities greater than 100% occuring repeatedly.

2. Similarly for RD 30, the first two tests (9/75) have 114% and 12 relative densities, yet the standard was used for 10 months, 54 tests, with 52% of the results over 100%.

3. During the first two weeks of use (7/76), RD 41 was referenced 2 times with 12 tests over 100% relative density (6 tests over 110 and 3 over 120%). The standard was used for 5 months, however, over 40% of the results over 100%.

4. The first test using RD 55 (8/76) has a relative density of 119%, with the field test being made the same day as the standard and, thus, assumedly the same material. These results would throw doubt on the lab standard, yet it was used for two full years an 566 tests, with 64% of the results over 100% relative density.

5. Even high density structural backfill standards such as RD 61 (maximum density of 125.3 pcf), used 593 times, show over 25% of the tests having greater than 100% relative density.

6. The first seven tests referencing BMP 269 (scattered over a two period around 7/76) <u>all</u> fall outside the zero air voids curve. classification was used for 1 1/2 years, referenced 227 times.

7. The first two tests referencing BMP 270 (7/76) fall 6 pcf above zero air voids curve. Continued use of this proctor for over 2 resulted in 226 tests with 82 outside the theoretical maximum.

8. For the first month (4/77) all BMP 278 tests fell on or outside zero air voids curve. For the next month, over half the tests d the same, or have greater than 105% compaction. The standard wa used over half a year, with 43 out of a total of 82 tests outsid the zero air voids curve.

Note: This table gives typical observations and is not meant to be inclusive.

SR15308

MØISTURE-DENSITY FØR BMP 278

SPECIFIC GRAVITY = 2.65
ALL TESTS

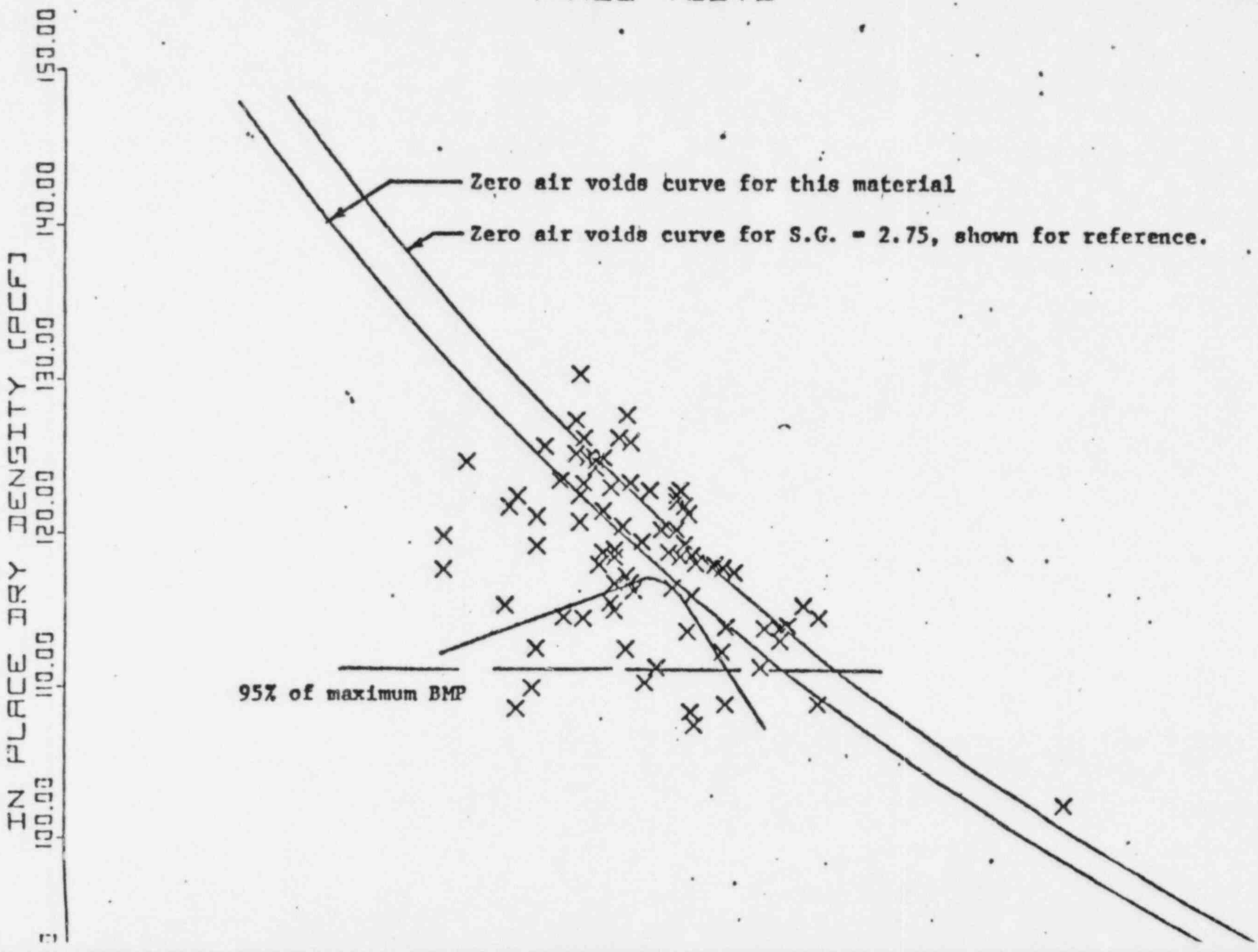


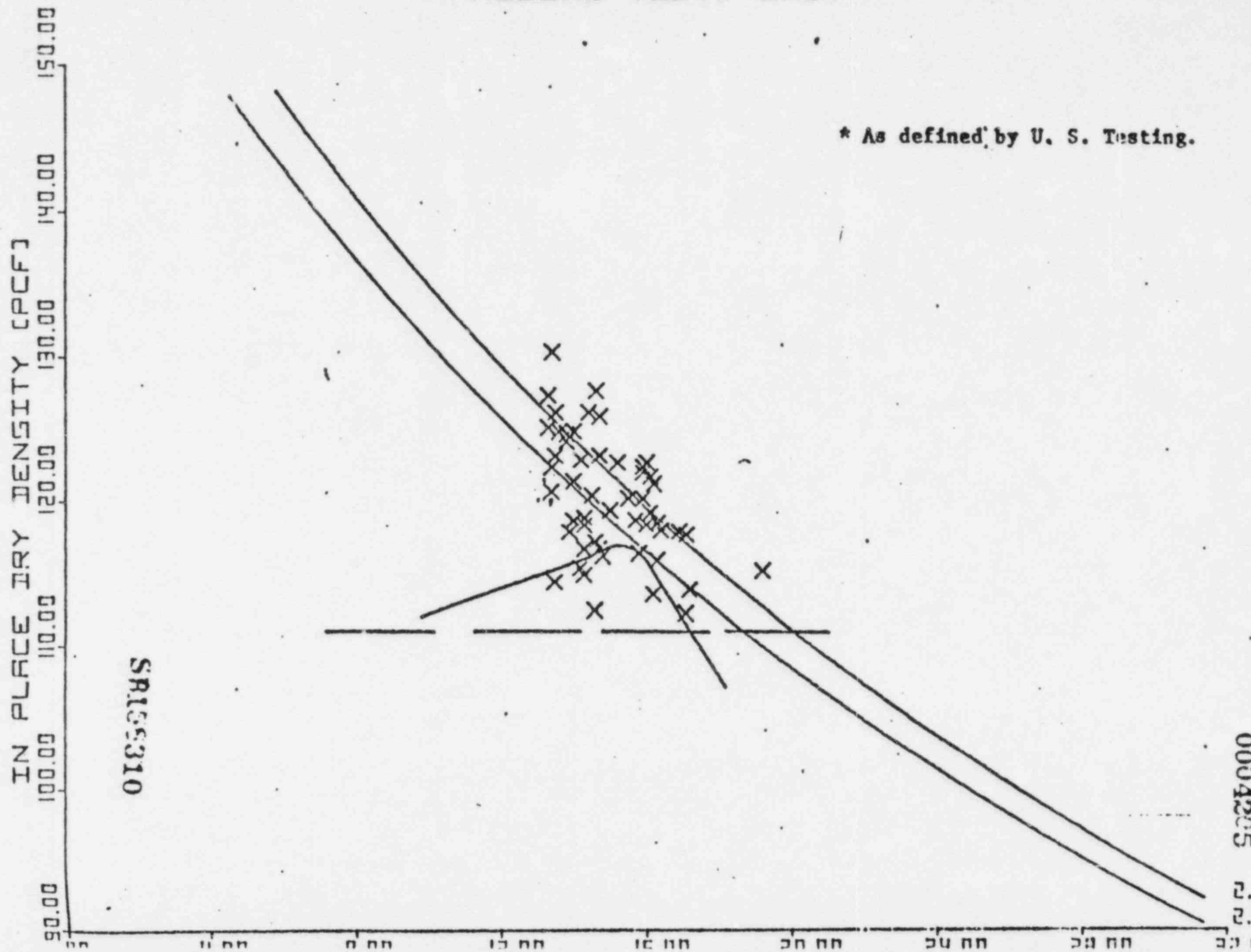
FIGURE 1

SR155309

0004204

MOISTURE-DENSITY FOR BMP 278

SPECIFIC GRAVITY = 2.65
PASSING TESTS ONLY*



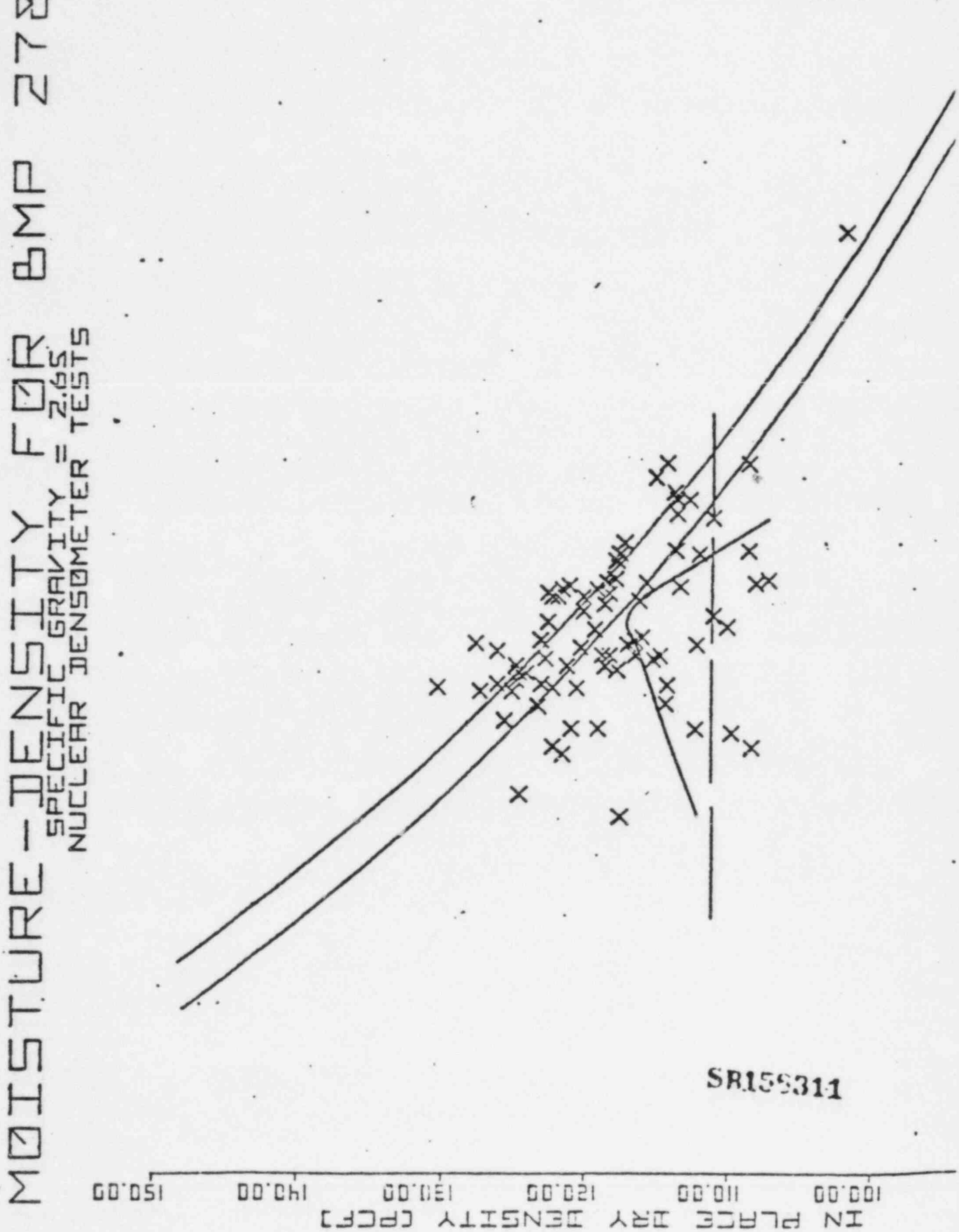
* As defined by U. S. Testing.

FIGURE 2

SR155310

0004205

0004208

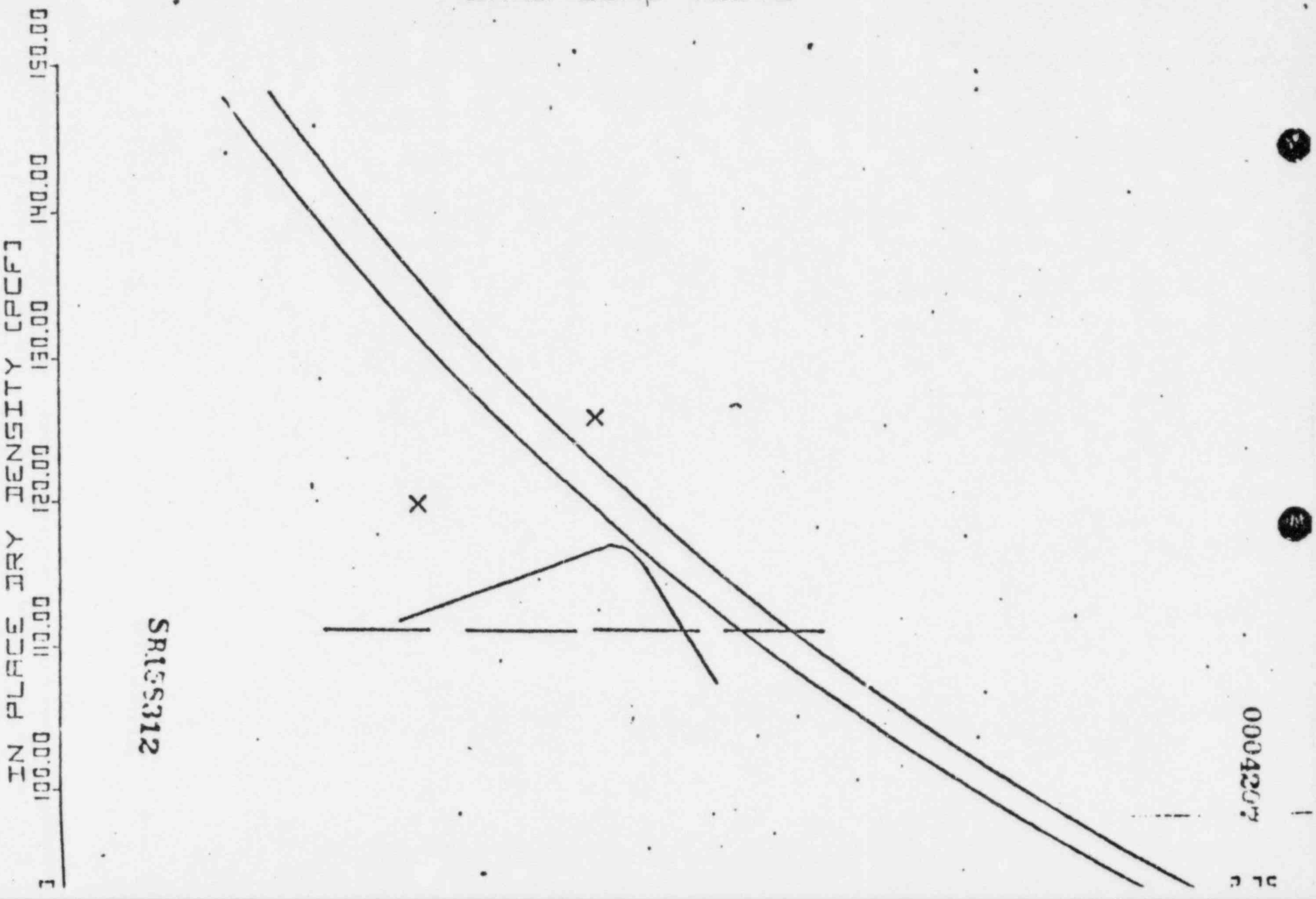


SB155314

FIGURE 3

MØISTURE-DENSITY FØR BMP 278

SPECIFIC GRAVITY = 2.65
SAND-CØNE TESTS

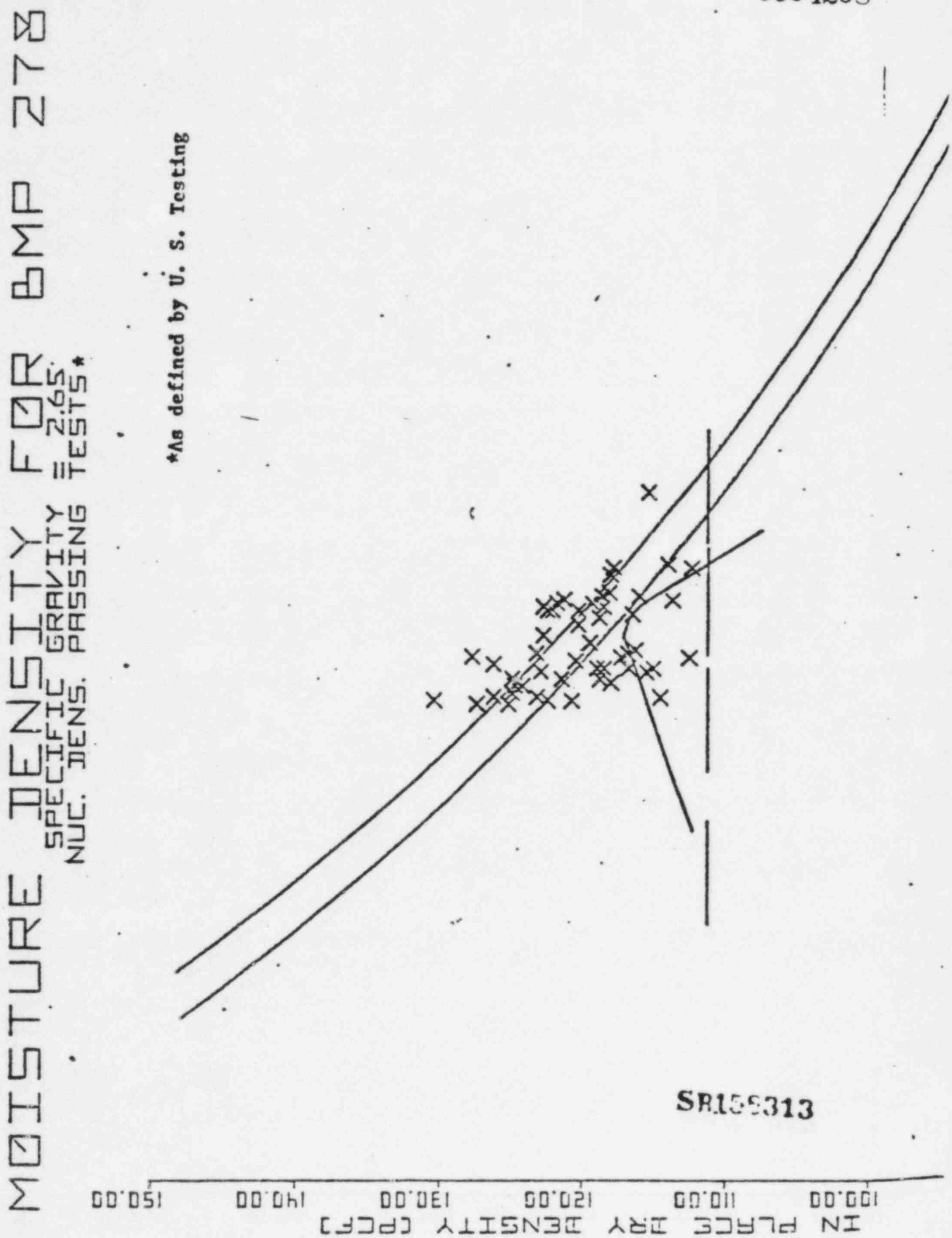


SR155312

0004207

FIGURE 4

0004208



SR158313

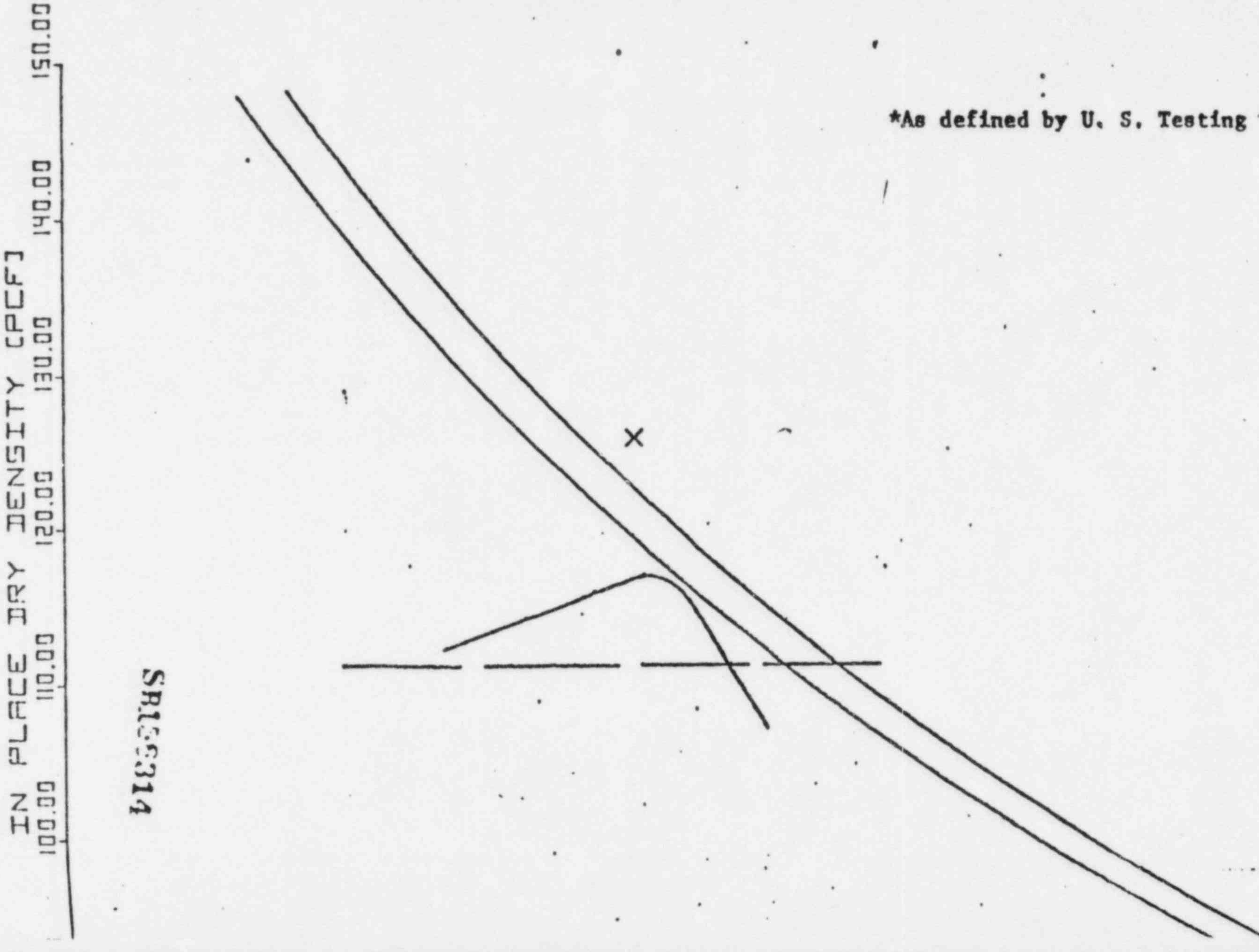
FIGURE 5

0004209

MØISTURE-DENSITY FØR BMP 278

SPECIFIC GRAVITY = 2.65
SAND-CØNE PASSING TESTS*

*As defined by U. S. Testing



SB1[illegible]314

FIGURE 6

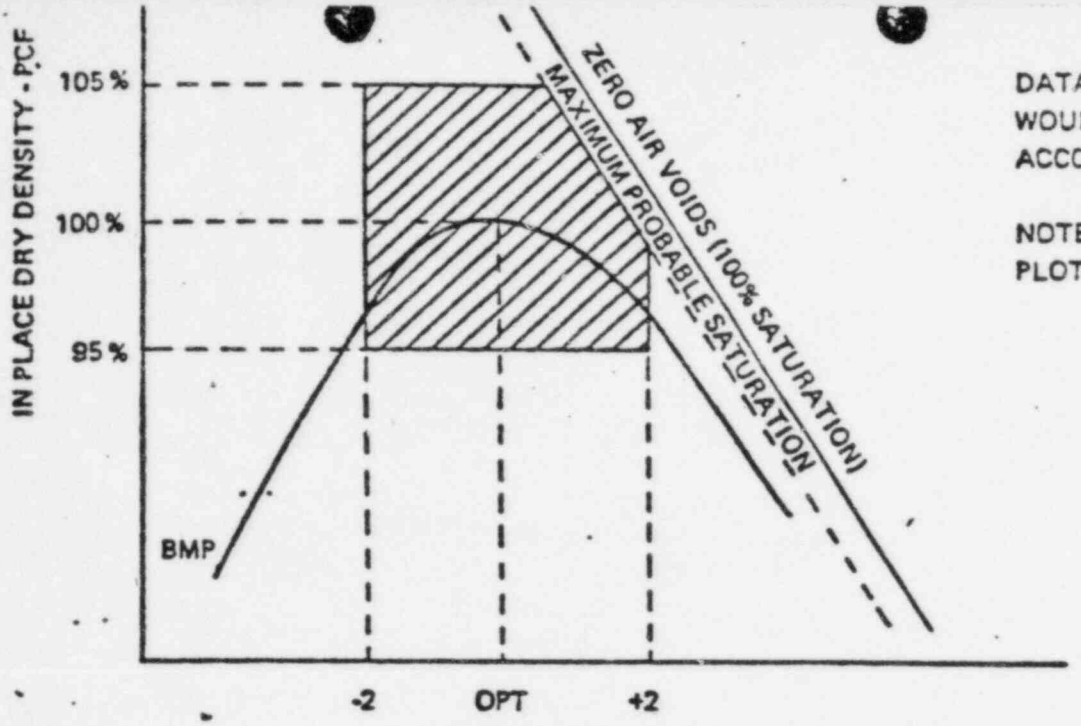


FIGURE 7-A-

DATA POINTS THAT PLOT IN SHA
WOULD BE GENERALLY ACCEPT
ACCORDING TO SPECIFICATIONS

NOTE: ABOUT 25% OF ALL FI
PLOTS IN THE SHADED AREA

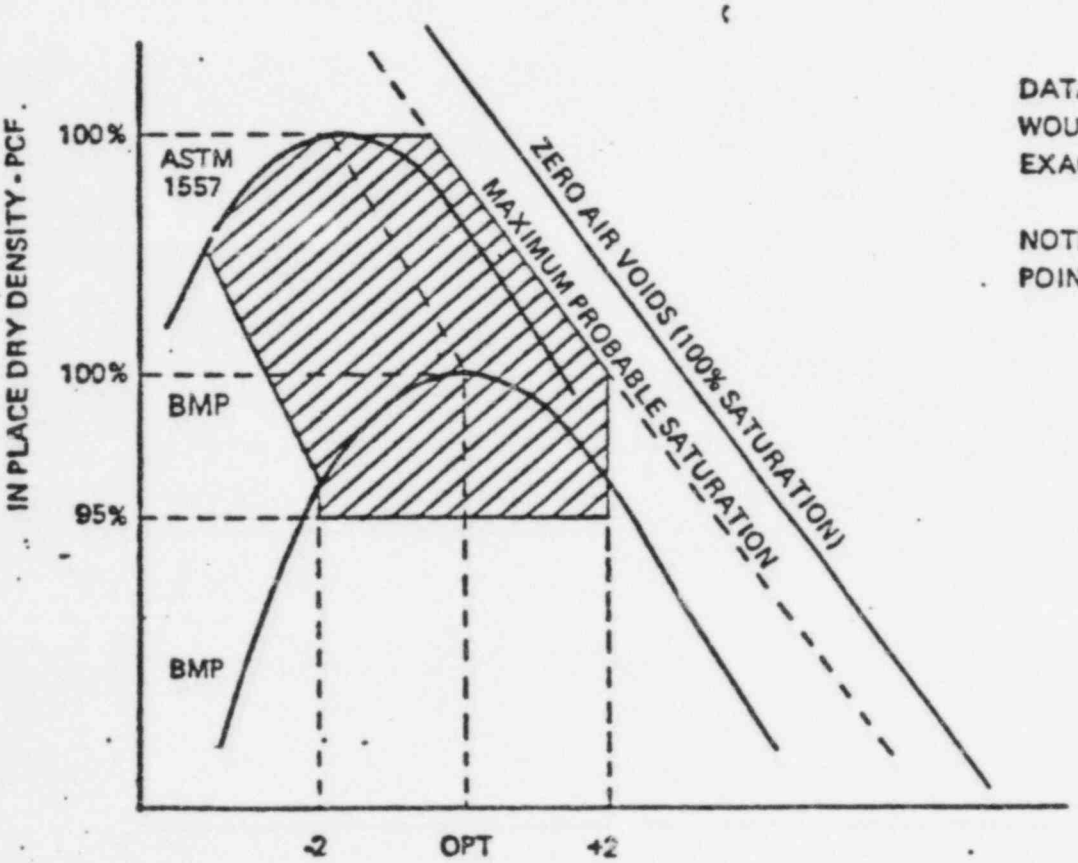


FIGURE 7-B-

DATA POINTS THAT PLOT IN SH
WOULD BE ACCEPTABLE REGAR
EXACT SPECIFICATION WORDIN

NOTE: ABOUT 40% OF ALL F
POINTS PLOT IN THE SHADED A

SR158315

FIGURE 7: WINDOWS OF ACCEPTABILITY (A) BASED ON BMP SPECIFICATION (B) REGARDLESS OF EXACT WORDING OF SPECIFICATION

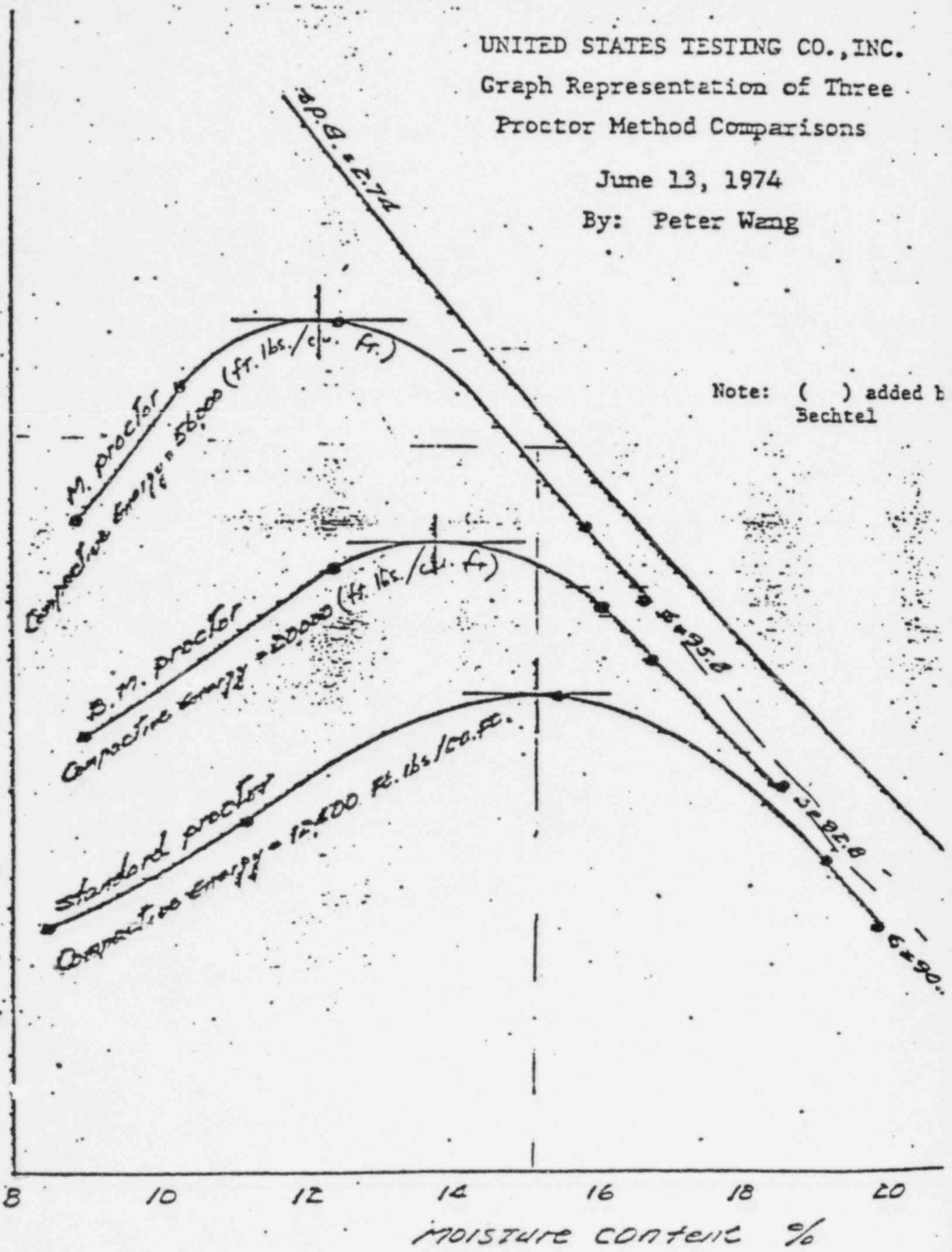
0004211

UNITED STATES TESTING CO., INC.

Graph Representation of Three Proctor Method Comparisons

June 13, 1974

By: Peter Wang



Note: ( ) added b Bechtel

FIGURE 8

SB158316

MOISTURE-DENSITY FOR BMP 27A

SPECIFIC GRAVITY = 2.65

ALL TESTS

3.5% Subtracted from Moisture Content, Dry Density Recalculated

NOTE: Not only does a 3.5% shift in moisture content fail to bring tests inside the zero-air-voids-curve, it results in impossibly high dry densities.

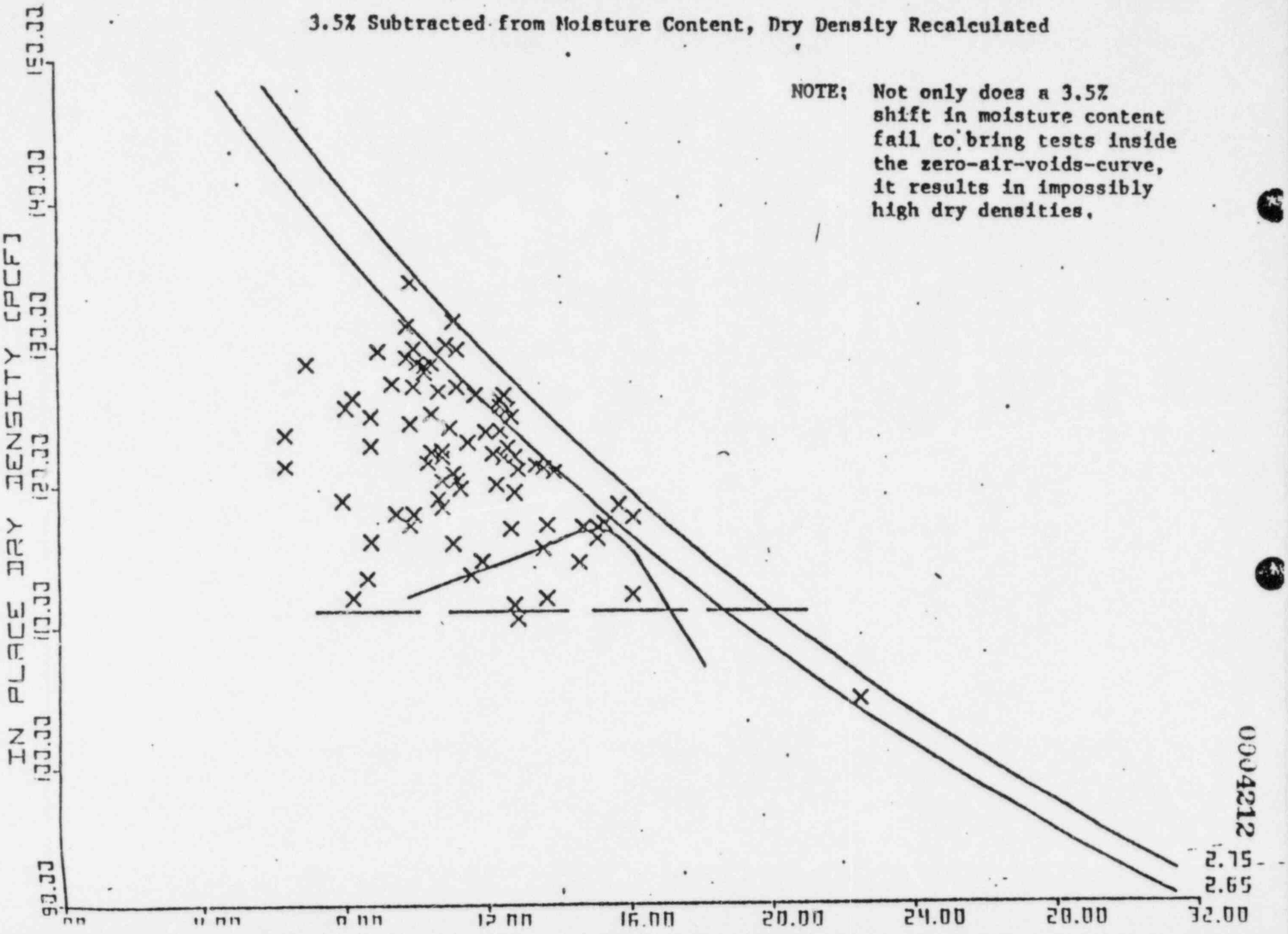
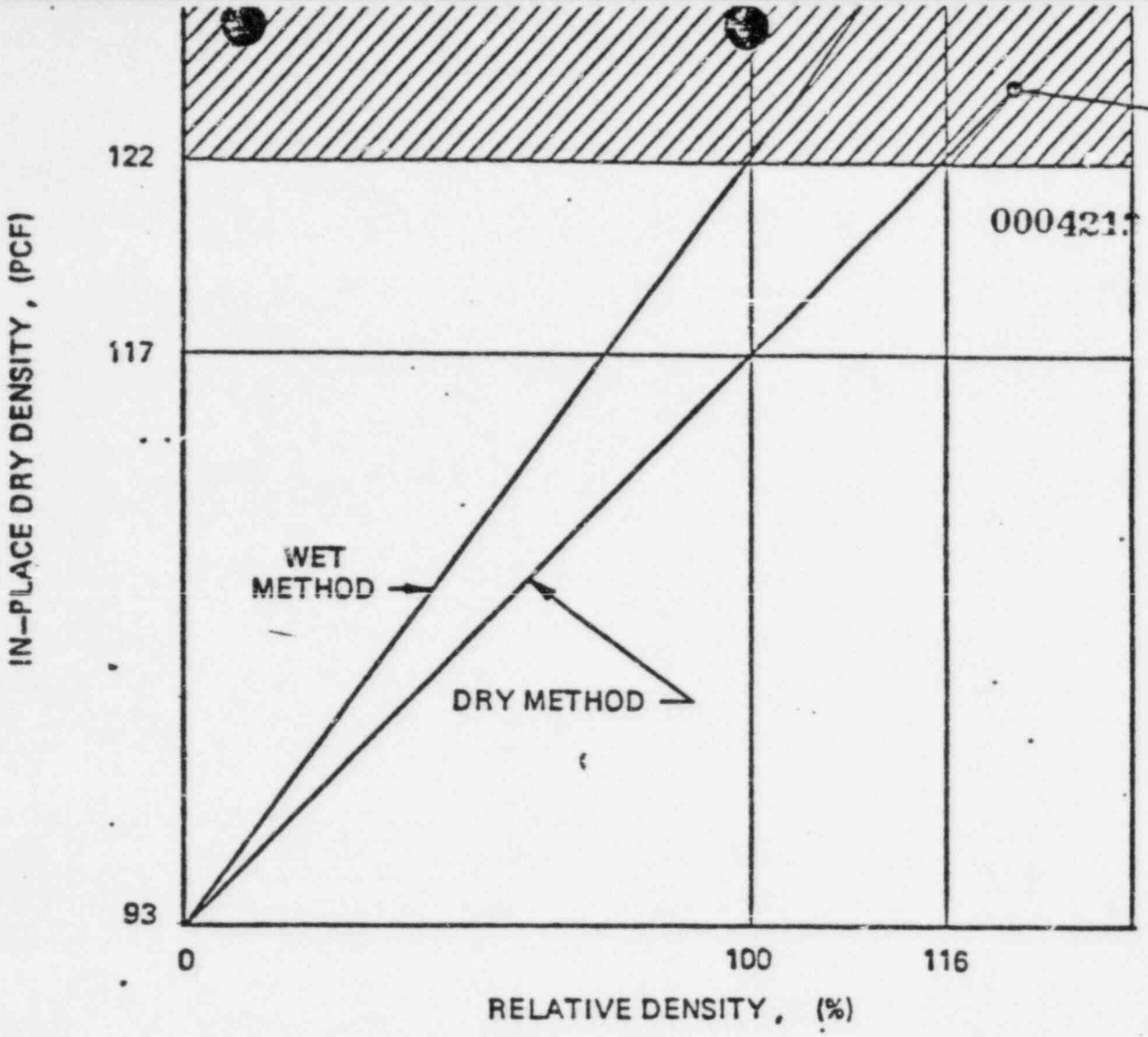


FIGURE 9

SR1S317

0004212



NOTE: VALUES FOR DRY DENSITY ARE TYPICAL OF A RANDOM FILL SAND. ANY TESTS SHOWING MORE THAN 117% RELATIVE DENSITY WOULD BE SUSPECT IN THIS EXAMPLE. STRUCTURAL SANDS TEND TO SHOW ONLY 2 OR 3 PCF INCREASE IN MAXIMUM DENSITY AND THUS RESULTS AT MUCH LOWER RELATIVE DENSITY WOULD BE SUSPECT, SAY 105 – 110 PERCENT

FIGURE 10
CHANGE IN RELATIVE DENSITY SCALE FROM DRY TO WET METHODS OF OBTAINING MAXIMUM DENSITY, BASED ON RECENT LAB RESULTS

United States Testing Company, Inc.
Power Generation Services Division
1415 PARK AVENUE
HOBOKEN, NEW JERSEY 07030 (201) 792-2400 (212) 943-0488

0004214

File: C-208-222/1015.900
October 1, 1979

ATTACHMENT 5

Bechtel Power Corporation
P. O. Box 2167
Midland, Michigan 48640

Attention: Mr. J. F. Newgen

Subject: Midland Project Job 7220
Subcontract 7220-C-208
U.S. Testing's Response to "Geotech Review of U.S. Testing Field and Laboratory Tests on Soils

Dear Mr. Newgen:

Please find attached United States Testing's response to the Bechtel report "Review of U. S. Testing Field and Laboratory Tests on Soils" dated July 1979.

You requested that we respond solely to the summary contained in Section 8, however, we feel it is necessary to respond to all the sections, which in itself details Section 8.

Our response appendices the Bechtel report in so far that it closely follows its logic, answering questions or making statements on each particular point. This U. S. Testing report is not meant to point fingers in any direction but only to indicate, to Bechtel, some of the problems and concerns we faced.

If you have any questions, do not hesitate to contact me.

Very truly yours,

UNITED STATES TESTING COMPANY, INC.

M. Anselmo
Project Engineer

SB155134

MA:hg
Attachments

UNITED STATES TESTING COMPANY'S

Response to the Bechtel Report

"Review of U. S. Testing Field
and Laboratory Construction
Test Data on Soils Uses as Fill"

Midland Units 1 & 2
Job No. 7220

Note: This U. S. Testing report must be read in connection with the Bechtel report in so far that it will provide clarification and rebut statements contained therein.

1. Use of Laboratory Test Compaction Curves

This section of the Bechtel report is concerned with the implied ratio of Field Density Tests to Laboratory Compaction Tests (Ratio 20:1) given in Table 9-1 of Specification 7220-C-208 and the period of time lapse between Laboratory Tests vs. Field Tests.

It is the position of U. S. Testing that Bechtel was then and is now responsible for the monitoring, determining and communicating with U. S. Testing on the fill yardage for use in performing Lab Density Tests. In fact, there were more Lab Density Tests performed by U. S. Testing Technicians (who were double checking results) than directed by Bechtel. It should also be noted that, in most cases, our only Bechtel interface in the field was a labor foreman.

The testing of soil will yield the same densities no matter what time lapse has expired between original testing and subsequent re-tests as long as the material re-tested is representative of the original tests and the test method has not changed. The actual volume of soil that may be represented by any one compaction curve has not been nor can it now be determined. In addition, Bechtel did not control excavated material as required by their specifications and drawings (documented in report on Admin. Bldg.) and it would be likely that any given cubic yard of soil was not only placed several times but tested several times, i.e., the same proctor values would be employed each time a yard of that particular soil was placed.

Visual proctor selection was many times backed-up by pounding a new proctor, in fact, most proctors on the job were generated in this manner as opposed to Bechtel maintaining a frequency list.

During the original submittal of U. S. Testing QA Manual, Bechtel (Project Engineering & Subcontracts) removed the provisions for performing one-point proctor tests for each Field Density Test.

2. Questionable Retests

The statement "A Field Density Test that fails to meet requirements of the specification should have been reported to Bechtel..." is incorrect. All failing test results were reported to either Q.C. or our field interface. However, it has become apparent that our field interface may not have been responsible for making these decisions. Any test U. S. Testing dispositioned as "clearing" was done so at the direction of Bechtel. The clearing of failing tests still is a Bechtel responsibility and on the occasions where U. S. Testing noted clearing tests, the report was a mode of conveying information from our interface. The Bechtel Report mentions three (3) cases where failing tests were cleared, one was "apparently resolved by merely using another Laboratory Compaction Curve...", another "tests labeled 'failed' were incorrectly cleared though the same laboratory standard was referenced.", and the third "two retests were dated prior to the time the original test failure." In fact,

these 'clearings' were the action of Bechtel employees who were also in the habit of marking up U. S. Testing reports. It appears that the standard Bechtel procedure for the dispositioning of failures was to scan reports looking for passing results in the same general area. The direction of U. S. Testing to a test area and provisions for test locations is the responsibility of Bechtel, on those occasions where the Bechtel interface could not relate specific locations the suggestion may have been made by U. S. Testing personnel.

We agree with the Bechtel assumption that it was possible to encounter different soils in the same location, however, it is more likely that the different soils were encountered as a result of the non-control of excavated materials as opposed to the removal and replacement subsequent to a test failure.

U. S. Testing responsibility on this project is to perform testing not control its placement, and in fact, U. S. Testing was excluded from being involved in placement control.

3. Theoretically Impossible Test Results

Any given soil has individual components that cover a broad spectrum of specific gravity values. The major factor contributing to specific gravity values determined by the test method Bechtel requested (ASTM-D854) results from a 25 gram sample and thus the specific gravity values resulting there from should be interpreted with that in mind. The application of the likely

band of specific gravity values represented in the Bechtel report figure 1 results in a 49 percent reduction of theoretically impossible results. The remainder of these test points falling above zero-voids line will be discussed in Section 6. However, specific gravity values from 2.57 to 2.82 for soil fractions are documented for material on this project.

The comment regarding the doubtfullness of the variation of soil properties is likely to be discounted by an examination of the data of the current soils evaluation program.

4. Repeated use of Questionable Laboratory Test Data

Although"...the fact that soil was not being placed or compacted according to specifications" was a major cause for concern. It is evident that another area of concern existed. Errors in calculations went unnoticed thru a good checking system. It is unfortunate that Bechtel's checking system simultaneously experienced difficulty.

5. Limits of Accuracy and Acceptability for Test Data

Although Bechtel statements conclude that only 25 to 40 percent of all clay tests represent compliance to specification, it should not be construed to represent the percentage of valid test data. The envelop of reasonably encountered test values would encompass the vast majority of test data. It has been demonstrated that the nominal scattering of data that may not have been anticipated was well within the statical variance that would be applied to this data.

6. Accuracy of Test Equipment

The average deviation of the nuclear device from oven-dry moistures was +.12 % for a set of 30 tests. The range of differences was approximately from -3 % to + 4 %. It was the assumption of U. S. Testing that Bechtel Engineering was appropriately applying this data to placement tests.

Contrary to the assumption regarding figure 9 with its "impossibly high dry densities" current test data closely resembles this graphical representation.

The use of the nuclear device was employed at the consent of Bechtel to facilitate production.

7. Relative Density Tests

Some of the specification 7220-C-210 zone numbers are an area of concern because of the overlapping soil classifications, i.e., clay could be either zone 1 or 2. The inherent nomenclatural difficulties that plagued the Bechtel Organization in providing data was not addressed in the limited potential problem areas. A re-evaluation of test data, with this third concern in mind, would probably change Bechtel conclusions.

Regarding calculation errors of relative densities and assuming the validity of these errors, it is again unfortunate that our checking systems broke-down.

The re-evaluation of maximum density by the wet method was in response to a relatively recent innovation of Bechtel assigning a geotechnical engineer to oversee the soils operation, here-to-fore there have been no "radical changes" or Bechtel material controls that would serve to flag the need for maximum density method re-determinations. Subsequent to this, the comparison of maximum density methods have been done routinely by U. S. Testing in response to material changes that were identifiable by newly instituted material controls and routine communication with assigned geotechnical representatives. These current comparisons have yielded maximum density variations that result in relative density changes from minimal to 20 %. The acceptability of high relative density results should have been evaluated as part of Bechtel process control that did not exist.

Summary

The Bechtel request that U. S. Testing respond to items 1 thru 5 has been detailed in this report.

The closing remarks of the Bechtel report makes the statement that"...on many occasions the inplace density was divided by the maximum density from the relative density test to get percent compaction..." is true. However, the report fails to mention that this method of calculation was a specific Bechtel directive.

In conclusion, the problems and concerns attributed to U. S. Testing results from a lack of proper soil identification and material quantities normally covered in inspection and placement responsibilities, none of which are contractually the responsibility of the U. S. Testings scope of operations. We are the testing arm of Bechtel. Our function is the reporting of data not its evaluation.

SB15S142

Consumers Power Company

[redacted]

[redacted]

August 10, 1979
Howe-218-79

ATTACHMENT 6

Mr J G Keppler, Regional Director
Office of Inspection & Enforcement
US Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

MIDLAND NUCLEAR PLANT -
UNIT NO 1, DOCKET NO 50-329
UNIT NO 2, DOCKET NO 50-330
SETTLEMENT OF DIESEL GENERATOR
FOUNDATIONS AND BUILDING -
FILE 0485.16 SERIAL 7395

References: 1. S M Howell letters to J G Keppler; Midland Nuclear Plant; Unit No 1, Docket No 50-329; Unit No 2, Docket No 50-330; Settlement of Diesel Generator Foundations and Building:

a. Serial Howe-183-78; dated September 29, 1978
b. Serial Howe-230-78; dated November 7, 1978
c. Serial Howe-267-78; dated December 21, 1978
d. Serial Howe-1-79; dated January 5, 1979
e. Serial Howe-58-79; dated February 23, 1979
f. Serial Howe-132-79; dated April 3, 1979
g. Serial Howe-174-79; dated June 25, 1979

2. G S Keeley letter to J G Keppler; Midland Project Docket [illegible]-329 and 50-330; Response to 10 CFR 50.54 - Request on Plant Fill; Serial 6925; dated April 24, 1979

3. S M Howell letters to H R Denton; Midland Project; Docket No 50-329 and 50-330; Response to 10 CFR 50.54 - Request on Plant Fill:

a. Serial Howe-162-79; Rev 1, dated May 31, 1979 with copies to J G Keppler
b. Serial Howe-199-79; Rev 2, dated July 9, 1979 with copies to J G Keppler

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This letter, as were References 1.a. through g., is an Interim 50.55(e) report on the settlement of the diesel generator foundations and building.

The enclosure documents the presentation made to members of the Staff and Inspection and Enforcement on July 18, 1979 in Bethesda, Maryland. The presentation provided an update of the status of the actions previously discussed in References 1, 2 and 3; the remedial work in progress or planned; the schedule of activities; the results of the cause investigation; the QA/QC aspects; and the licensing activities and changes to the FSAR.

Future 50.55(e) reports will discuss the following in more detail:

a. Results of further investigation of the leaking air line in the tank farm area, and settlement criteria for the borated water storage tanks and the lines into the auxiliary building.

b. Design bases to comply with the intent of the draft Standard Review Plan on Dewatering.

c. A Quality Assurance Plan for implementing the permanent site dewatering system.

Another interim report will be sent on or before September 7, 1979

Bill Mayer for S H Howell

SHH/BAM/GSK

Enclosure: Presentation Made at July 18, 1979 Meeting With NRC at Bethesda.

CC: Director, Office of Inspection & Enforcement
Att: Mr Victor Stello, USNRC (15)

Director, Office of Management
Information and Program Control, USNRC (1)

Director of Nuclear Reactor Regulation
Att Mr Domenic Vassallo, Acting Director
Division of Project Management, US NRC
Washington, DC 20555

POSSIBLE CAUSES (Cont.)

Distinction or Change	Possible Cause	Comments
4. SPECIFICATIONS	NO	
5. SOILS TESTING	YES	Investigation in Process
Methods		
Equipment		
Results/Reports		
Retests		
Reviews/Evaluations		
Personnel		
6. TEST FREQUENCY FOR SMALL AREAS	NO	Problem not Confined to Small Areas
7. DIFFERENT CONTRACTORS		
Personnel Qualifications	NO	See #16
Different Inspection Methods	YES	See #15
Placement Methods	YES	See #2

7.0 CAUSE INVESTIGATION

The investigation into the cause of insufficient compaction of plant area fill was made by Bechtel using a problem analysis technique known as the Kepler-Tregoe (K-T) method. This approach involved the following steps and is shown on Figures 61 through 71.

(1) Identify deviation, in this case insufficiently compacted plant area fill.

(2) Develop criteria for determining in which plant area fill the deviation exists.

(3) Identify distinctions and changes which might have caused the deviation considering the subject of the deviation, where it occurred, time factors, and the extent.

(4) Develop list of possible causes using all distinctions and changes.

(5) Test possible causes for most probable causes.

It should be noted that although all areas were included in the investigation where deviations were identified by the soils investigation, some deviations were thought to be insufficient to require corrective actions. Two examples of such areas are the borated water tank area and the auxiliary building railroad bay. In these areas the compacted fill is adequate despite some indications of localized insufficiently compacted material.

Seventeen distinctions or changes were found to have occurred which could have been possible causes and these have all been evaluated. Specifications, first identified as a possible cause, were not included in the most probable cause list because it was felt upon evaluation that variances from the PSAR and FSAR and the various relatively minor inconsistencies could not have been a cause of the problem under investigation. The investigation is still under way into soils testing methods, equipment, results, retests, reviews, and

evaluations, since those were found to have contributed to the cause.

The five most probable causes remaining after evaluating the possible causes are, not necessarily in order of importance:

(1) Lift thickness/compactive effort. Recent tests have shown that lift thicknesses in some cases exceeded the capability of equipment being used, verifying that equipment was not adequately qualified in all cases.

(2) Compaction equipment/qualification. Same comments as for (1) apply.

(3) Test procedures and results. This included representativeness of tests, procedures for comparison with standard proctor specimens, procedures for taking soil tests within a lift, calculation of relative density, and use of nuclear densimeter.

(4) Inspection procedures. This included the use of a surveillance type program in the power block area for at least part of the time.

(5) Reliance on test results. This included construction's reliance on test results for qualification of equipment during the work and for acceptance of the work by Construction and Quality Control personnel.

Personnel were not included as a most probable cause because a review of qualifications and experience of both Bechtel and U. S. Testing personnel had shown presence of sufficient education, experience, and training to carry out the tasks assigned.

Item No	Possible Causes Per K-T Analysis	Corrective Action
1.	Lift Thickness/Compactive Effort and	Onsite geotechnical soils engineer at the site. Also, geotechnical soils engineer from the Geo-Tech Dept in home office to give technical direction.
2.	Compaction Equipment/Qualification	Specification C-211 has been revised such that the uncompacted lift thickness of the backfill material shall be determined by the onsite geotechnical soils engineer after evaluation of the proposed compaction equipment. However, in no case shall the uncompacted lift thickness exceed 8" for heavy self-propelled equipment and 4" for hand operated equipment. This specification has also been revised to read, "The onsite geotechnical soils engineer shall verify that the equipment used for compacting the backfill materials be capable of obtaining the desired results and obtaining the same acceptable compaction effort achieved in the test pad area." This verification shall include, but not be limited to, the following: number of passes, speed, revolutions per minute (frequency), overlap per pass, lift thickness requirements and uniformity.
		Specification C-211 states, "Selection and approval of all the proposed compaction equipment shall be on the basis of demonstrated ability to accomplish adequate compaction without damage to, or overstressing of, the adjacent structural members".
3.	Testing Procedures & Results	
	a. Methods	Specification C-211 is revised such that Proctors are made with every field density test.
	b. Equipment	The nuclear densometer will not be used.
	c. Results/Reports	The onsite geotechnical soils engineer will review and approve each soil test report. This will include, but not be limited to, gradation, moisture and density tests. QS Testing will be checking all field density tests for cohesive material against a zero-air-voids curve. Any field test result which plots on or to the right of the zero-air-voids curve shall be regarded as suspect and cause for retest. The onsite geotechnical soils engineer shall determine all density test locations.

Item No	Possible Causes Per K-T Analysis	Corrective Action
3.	d. Retests	All material represented by failing tests is to be re-worked until the specified density and/or moisture is obtained. No material will be placed on any known failing material until satisfactory tests are obtained.
	e. Review/Evaluations	See Item c above.
	f. Personnel	An onsite geotechnical soils engineer and a part-time Geo-Tech soils engineer have been added at the site. The onsite geotechnical soils engineer coordinates with craft superintendents and notifies QC of selected areas to be backfilled, monitors subgrade quality and preparation, calling for testing as required. He evaluates size of fill area to determine testing frequency, monitors material and lift thickness placement. Calls for tests in borrow areas for cohesive fill. Monitors compaction process including moisture control for clay. Calls for tests at proper frequency and designates location. Works with craft superintendents and QC to obtain effective remedial action on failing tests. The geotechnical soils engineer provides overview and inputs technical assistance as required.
4. 5.	Inspection Procedures and Reliance on Test Results	
	a. Different Inspection Methods	The Project Quality Control Instruction has been revised to include a daily soil placement report which is used for each area where soils work is being performed. This report includes sketch showing areas of soil placement, identification of equipment being used, identification of supporting personnel, recording lift thickness measurements which are representative of the fill being placed, compactive effort used, location by grid coordinates and elevation of all tests taken and testing frequencies, types of material placed (cohesive/cohesionless). A Quality Control Engineer will be assigned 100% of his time to soil placement. Consumers Power Company will perform over-inspection on a sampling basis of the soil placements. Also see Item 2.f. above.
	b. Placement Methods	See Item 1 above.

7/18/79

Item No	Deficiency Description (Items of Concern)	Corrective Action 50.54(f) Discussion Items Located on Page No (Item)	Action Status
10.	Incorrect soil test results.	I - 17-20 C & D (3), D (5)	a. The Project Quality Control Instruction C-1.02 has been revised from surveillance to inspection of the testing operation. b. The in-depth review of soil test results is still in process. c. Generic Corrective Action - The in-depth audit of US Testing has been completed. Two findings were a result of this audit. One, administrative problem by US Testing, the other by Bechtel Sub-contracts. These audit findings will be closed prior to soil placement. d. Generic Corrective Action - PQCI's have been reviewed for adequacy of documentation callouts and are being resolved. e. Consumers Power Company will implement an over-inspection of US Testing activities in the soils area. f. Bechtel has directed US Testing to check all field density tests for cohesive material against a zero-air-voids curve. Any field test results which plots on or to the right of the zero-air-voids curve shall be regarded as suspect and cause for re-test. g. Bechtel Geo-Tech has re-emphasized to US Testing the importance of taking accurate tests.
11.	Inadequate subcontractor test procedures.	I - 17-20 C & D (4), D (5)	a. Generic Corrective Action - An in-depth audit of US Testing has been completed with no problems found in the area of the test procedures.
12.	Inadequate corrective action for repetitive conditions.	I - 22 C & D (1)	a. An in-depth review of the Bechtel Trend Program Data has been performed by Bechtel QA Management with no items indicating trends found.

Stearns Eng

BORING NO. [illegible]

PULLMAN KELLER

DIESEL GENERATOR BLDG S. 5136 E. 305

ATTACHMENT 7

DRILLER COMPLETED DRILLER

5-23-77 5-24-77 SINGLETON (FIELDFIL) CME-550

CASING ELEVATION (FT. MSL) CASING DEPTH GROUND EL. DEPTH EL. FIRST WATER DEPTH EL. TOP OF ROCK

12 625.4 (SEE NOTES COL.)

SAMPLE HAMMER: WEIGHT FALL CASING LEFT IN HOLE: DIA. LENGTH LOGGED BY

140 #/12" NONE JERRY R. GIVENS

SAMPLE TYPE AND NUMBER	SAMPLE ADVANCE (LENGTH OF CORE RUN)	SAMPLE RECOVERY (LENGTH OF CORE RECOVERED)	SAMPLE BLOWS	PERCENT CORE RECOVERY	PENETRATION BLOWS 1ST 6"	2ND 6"	3RD 6"	ELEVATION	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								625.4			5" AUGER TO 20.5', SET CASING, BEGAN DRILLING WITH 4" TRI-CONE ROLLER BIT AND RECIRCULATING WATER
SS	1.5'	0.9'	21	17	10	11		624.9		0'-2.5' SILTY TO SANDY CLAY GREY, SLIGHT TO LOW PLASTICITY (CL)	Qp #1 = 4 TSF
SS	1.5'	1.2'	34	10	10	24		622		2.5'-7.4' SAND, TAN, MEDIUM DENSE, SLIGHTLY MOIST (BACKFILL) (SP)	Qp #2 = (SAND)
SS	1.5'	0.8'	16	5	5	11		621.4		CONCRETE RUBBLE	Qp #3 = SAMPLE CRUMBLES UP AT 3.5 TSF
SS	1.5'	0.5'	31	16	17	14				7.4'-25.5' SILTY TO SANDY CLAY, GREY, LITTLE GRAVEL, LOW MOIST., LOW PLASTICITY, VERY STIFF TO HARD (CL)	Qp #4 = 4.5+ TSF
SS	1.5'	0.6'	26	10	16	16					Qp #5 = SAMPLE CRUMBLES, LOW MOISTURE
SS	1.5'	0.9'	47	10	22	25					
SS	1.5'	1.2'	65	15	29	36					
SS	1.5'	1.0'	57	16	25	32					
SS	1.5'	1.0'	55	20	33	22				23'-24.2' SEAM OF CLAYEY SAND W. TRACE ORGANICS, GREYISH BRN.	
SS	1.5'	1.0'	107	30	42	65		603.9		24.2' TAN MEDIUM SAND SEAM LOW MOIST.	Qp #6 = 4.5 TSF
SS	1.5'	0.6'	113	35	49	64				25.5'-31.5' SILTY SAND, BROWN, MEDIUM GRAINED, WET, VERY DENSE (SM)	Qp #7 = 4.5 TSF
SS	1.5'	1.0'	102+	42	102	=		597.9			Qp #8 = 4.5+ TSF
										TOTAL DEPTH = 31.5' EL. BOTTOM = 597.9	Qp #9 (TIP) = 4.5+ TSF
											Qp #10 (SAND)
											Qp #11 (SAND)
											HOLE CAVING IN @ 23' SO USED 3/4 BAG QUIK-GEL
											WATER LEVEL AT 10.4 AFTER DRILLING
											HOLE BACKFILLED WITH SOIL AFTER COMPLETION

SS = SPLIT SPOON; ST = SHELBY TUBE; C = CRUMMOND; P = PITCHER; O = OTHER

SITE: DIESEL GENERATOR BLDG

HOLE NO. D

NRC Report 78-20

ATTACHMENT 8

with the issuance of the noncomformance report, No. 1482, on August 18, 1978, CPCo was also informed of this condition. On or about August 21, 1978, the NRC Resident Inspector was orally informed of the matter by CPCo. It was indicated at that time that although CPCo regarded the matter as serious, they did not consider it to be reportable under 10 CFR 50.55(e).

Construction on the DGB was placed on hold on August 23, 1978 and a test boring program was initiated on August 25, 1978. After preliminary evaluation of soil boring data, a Management Corrective Action Report (MCAR), No. 24, was issued by Bechtel on September 7, 1978. The MCAR stated that based on a preliminary evaluation of the data, the matter was reportable under 10 CFR 50.55(e), 1, iii and Region III was so notified by telephone on that date.

The telephone notification was subsequently followed up by a letter dated September 29, 1978, from CPCo enclosing a copy of MCAR 24 and Interim Report 1 prepared by Bechtel.

On the basis of the above, it is concluded that in this instance the licensee complied with the reporting requirements of 10 CFR 50.55(e).

Review of PSAR/FSAR Commitments on Compacted Fill Material

In a previous NRC Inspection Report, No. 329/78-12; 330 78-12, an apparent inconsistency was identified between FSAR Table 2.5-14 (Summary of Foundations Supporting Seismic Category I and II Structures), Table 2.5-9 (Minimum Compaction Criteria) and the site construction drawing C-45 (Class I Fill Material Areas) regarding the type of foundation material to be used for plant area fill. Table 2.5-14 identifies the supporting soil materials for the Auxiliary Building D, E, F, and G, Radwaste Building, Diesel Generator Building and Borated Water Storage Tanks to be "controlled compacted cohesive fill." Table 2.5-9 also indicates the soil type for "support of structures" to be clay. Contrary to these FSAR commitments, drawing C-45 indicates Zone 2 (random fill) material, defined in Table 2.5-10 as "any material free of humus, organic or other deleterious material," is to be used with "no restrictions on gradation." Boring samples substantiated that Zone 2 (random fill) material was in fact used.

During this investigation a review of documentation showed that the commitment to use cohesive soils was also made in response to PSAR question 5.1.11 and submitted in PSAR Amendment 6, dated December 12, 1969, which states, "Soils above Elevation 605 will be cohesive soils in an engineered backfill." This response also indicated that certain class 1 components such as, emergency diesel generators, borated water storage tanks and associated piping and electrical conduit would be founded on this material.

CPCo cuality assurance issued a nonconformance report QF-66, dated October 10, 1975, which stated that contrary to the PSAR statement (quoted above) Specification C-211 being implemented at the site required cohesionless (sand) material to be used within 3 feet of the walls of the plant area structures. The corrective action taken was for Bechtel to issue SAR Change Notice No. 0097 which stated, "The FSAR will clarify the use of cohesive and cohesionless soils for support of Class 1 structures." As noted above, the FSAR tables 2.5-14 and 2.5-9 once again stated that cohesive (clay) material was used for support of structures while the construction drawing continued to permit the use of random fill material.

This investigation included efforts to ascertain whether procedures were established and implemented for the preparation, control and review of the technical criteria set forth in the safety analysis report (SAR). This included the role of both Bechtel and CPCo in the review of the SAR. Bechtel had established control of the SAR in procedure MED 4.22 (Preparation and Control of Safety Analysis Report Revision 1, dated June 20, 1974). The SAR preparation and review flow chart requires the Engineering Group Supervisor (EGS) to review the originator's draft for technical accuracy and compliance with the standard format guide. Records indicated that Section 2.5.4 was originated by the Bechtel Geotech group on January 3, 1977. It was reviewed and approved for technical accuracy by an engineer in the civil project group on April 29, 1977. No technical inaccuracies were noted in the documentation. The Civil EGS advised that he did not personally review Section 2.5.4.

The designated engineer stated that in his review of the section he was primarily concerned with the Auxiliary Building not the Diesel Generator Building. He said the review of FSAR material was performed by members of a group set up for this purpose. Not all of the content was checked since they relied to some extent on the originator. The author of Section 2.5.4 said he was not aware that changes regarding fill material had occurred since the preparation of the PSAR. It was ascertained that Field Engineering did not review the FSAR prior to its submittal.

A partial review of the FSAR revealed that although Figure 2.5-48 indicates anticipated settlement of the Diesel Generator Building during the life of the plant to be on the order of 3 inches. Section 3.8.5.5 (Structural Acceptance Criteria) contains the following statement: "Settlements on shallow spread footings founded on compacted fills are estimated to be on the order of 1/2" or less."

Section 3.8 was prepared by Project Engineering. Geotech, who prepared Section 2.5, said they were unaware of the presence of the statement regarding 1/2" settlement in Section 3.8. The originator of Section 3.8

said that the above statement was taken from the Dames and Moore report submitted as part of the PSAR. Since the PSAR did not show any change in this regard, he assumed the statement was valid for inclusion in the FSAR. He said there was no other basis to support this statement.

CPCo also has an established procedure for the review and final approval of the SAR by procedure MPPM-13 dated June 23, 1976. Section 5.6 states that "CPCo shall approve all final draft sections of the FSAR prior to final printing." Discussion with the responsible licensee representatives for review of Section 2.5.4 indicated that a limited amount of cross-reference verification of technical content of the FSAR is performed by CPCo.

The CPCo Project Engineer in Jackson stated that the review of drawings and specifications was an owner's preference kind of thing. No attempt was made to review all drawings and specifications since they did not have the manpower or expertise for that type of review. The staff engineers of the various disciplines were asked to indicate the drawings and specifications they wanted to review.

Regarding the review of the FSAR, he said that he had prepared a memorandum to the staff engineers stating the procedure that would be followed in performing the review. An examination of this memo, dated July 28, 1976, showed that prime reviewers would perform a technical review, resolve comments made by other reviewers and perform the CPCo licensing review to assure compliance with required FSAR format and content.

As portions of the FSAR were received from Bechtel, CPCo sent comments to Bechtel. Following this review, meetings between Bechtel and CPCo were held to clearup any unresolved matters before each section was released for printing. A review of the files at CPCo relating to Section 2.5 and 3.8 showed that no comments were made concerning the above inconsistent and incorrect content. The apparent inconsistent and incorrect statements were not identified during the review of the FSAR prior to submittal and the review procedures did not provide any mechanism to identify apparent inconsistencies between sections of the FSAR.

Based on the above, measures did not assure that design basis included in design drawings and specifications were translated into the license application which resulted as an inconsistency between the design drawings and the FSAR. This is considered an item of noncompliance with 10 CFR 50, Appendix B, Criterion III as identified in Appendix A. (329/78-20-01; 330/78-20-01)

Q What was it?

A Based on that document, it was the selection of proctors.

MR. ZAMARIN: That document is referring to Exhibit 3.

BY MR. PATON: (Resuming)

Q The selection of erroneous proctors.

A Yes.

Q By U.S. Testing?

A Yes.

Q And someone at Bechtel thought that this problem was more widespread than just at the administration building?

A Yes.

Q Who was that?

A I don't recall. I know Bechtel took action on that. I don't know who within Bechtel took the action.

Q What action did Bechtel take?

A They took borings in other locations.

Q What was the purpose of that?

A To determine if there was a problem with insufficient compaction of material.

Q Did they get a result?

A Yes.

Q What was that result?

A Adequate results.

Q Adequate results. What does that mean?

A That there wasn't a problem with insufficient compaction of backfill in those areas where they took borings.

Q Where did they take borings?

A They took some around the administration building. They took one south of the diesel generator building, and I believe they took one by the chlorination building.

Q So, other than around the administration building, they took two borings.

A To the best of my recollection, that is correct.

Q You say one is south of the diesel generator building.

A Yes.

Q How far south?

A Approximately 20 feet.

Q The other one, where was the other boring taken?

A The chlorination building.

Q Do you in your professional judgment believe the taking of those two borings there, would that have satisfied you as to whether this problem was an isolated problem?

MR. ZAMARIN: You mean his QA as opposed to a geotechnical engineer, which he is not?

MR. PATON: In his expertise. Do you want to go

back? We have spent a lot of time on what his expertise is.

MR. ZAMARIN: You are asking him what appears to call for the expertise of an geotechnical engineer, which he is not.

MR. PATON: We spent a lot of time on his expertise. We will do it again. Do you want to do it again?

MR. ZAMARIN: I don't know whether you are asking him for a lay opinion or --

MR. PATON: I am asking him for an opinion by his expertise.

MR. ZAMARIN: I object to the form of the question.

MR. PATON: Do you want me to go back and ask him what his expertise is again?

MR. ZAMARIN: No. I know what it is.

MR. PATON: What is the objection, then?

MR. ZAMARIN: The question that you asked would appear to go toward geotechnical engineering expertise.

MR. PATON: I didn't ask him that. I said within your expertise. He is either an expert in some area or he is not. I asked him within your expertise. I assume he knows his own expertise.

MR. ZAMARIN: He can answer it. I have an objection to the form of the question.

MR. PATON: I have no idea what the question is at this point.

Would you please reread the question?

(The pending question was read by the reporter.)

MR. ZAMARIN: You can answer subject to the objection, if you can.

THE WITNESS: I am not a geotechnical soils engineer. I rely on their expertise and project engineers' expertise in that area. I can't answer that question.

BY MR. PATON: (Resuming)

Q Did you ever hear anyone at Consumers discuss, to your knowledge, the adequacy of those two tests to determine whether the problem at the administration building was an isolated problem?

A Could I have that read back, please?

(The pending question was read by the reporter.)

MR. ZAMARIN: I object to the form. I think he talked about more than two tests. You were talking about the one by the chlorination and one by the diesel generator building?

MR. PATON: I was specifically referring to whether all the tests were taken. If you want me to repeat the question, I will. I will state for the record that my question is couched in terms of whether all the tests that you mentioned or all the borings that you mentioned were adequate.

THE WITNESS: Yes.

BY MR. PATON: (Resuming)

Q Who did you hear discuss this subject?

A I don't recall specific people.

Q Was there discussion by more than one person?

A I believe there were various discussions.

Q Can you tell us what those discussions were?

A These would have been after the diesel generator building problem, when we go back and look at the validity of the two tests that were taken. Evidently they were not enough.

Q So you were indicating that now we are in hindsight. Is that what you are saying?

A Yes.

Q Tell us what those statements were, unless you have completed your answer.

A It is completed.

Q The statements were that the tests were not enough.

A It appears evident from the results of the diesel generator building settlement that they were not enough.

Q You don't have any argument with that conclusion, do you?

A No.

Q Do you have an opinion as to whether there is any connection between the settlement problem at the administration -- do you have an opinion now, based on

Power that has some responsibility for that area? In other words, Consumers doesn't just turn this over to Bechtel and say they don't want to hear any more. There must be some contact man or liaison man or somebody that Bechtel reports to for this information.

A Yes.

Q Who is that?

A They would report it to Tom Cooke, or they might have reported it to Don Sibbald.

Q Okay. Did you ever hear -- what is the other gentleman's name?

A Don Sibbald.

Q Did you ever hear Tom Cooke or Don Sibbald make any comment about the result that Bechtel obtained from making the borings?

A Yes.

Q What comment was that?

A That they were adequate. Don Sibbald told me that they were adequate, the results were adequate.

Q Did he express to you any misgivings or difficulty about Bechtel's conclusion?

A No, not that I can recall.

Q Mr. Horn, I want to ask a question about Criterion 16 of 10 CFR, Part 50, Appendix B, and I want to -- can I have the book, please? I want to ask you this question

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of:	)	Docket Nos. 50-329-OL
	)	50-330-OL
CONSUMERS POWER COMPANY	)	50-329-OM
	)	50-330-OM
(Midland Plant, Units 1 and 2)	)	
	)	

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I hereby certify that copies of the foregoing Second Supplemental Memorandum in Support of Intervenor Barbara Stamiris' Motion to Litigate Dow Issues were mailed, proper postage prepaid, this 5th day of October, 1983, to:

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