J. ALLEN

DRAFT

Midland Units 1 & 2

Job 07220

Evaluation of Statistical Study Made by U. S. Testing Co. (Accepted by Bechtel Engineering and Q. C.) to Establish Approval of Troxler Nuclear Guage for Field Density and Moisture Determination.

by: T. Nehil

6/13/79

JIMMY:

HERE IS THE REVIEW OF THE TROXLER DATA.

GEOTECH
HOUSTON
DISTRIBUTION

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RFT	
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Mgr	
Eng	
DB	FILE

SB 16431

This evaluation was undertaken in response to suggestions from Bechtel QA and Geotech that the Troxler Nuclear Guage was responsible for field density tests plotting outside the zero-air-void curve on moisture-density plots of cohesive fill placed in the Midland plant area. It was felt that the initial studies which resulted in approval of the Troxler might give some indication of its accuracy. Primary reference is Item "I" attached to a letter from K. Rademacher of U. S. Testing Co. to E. Felton of Bechtel, dated 5/30/74. (see Appendix A).

The findings of the U. S. Testing study were that 1) no correction factor was required for moisture content determined by means of the Troxler, and 2) that a correlation coefficient of .98 existed between the Troxler and oven-dry moisture data.

The first step in evaluating these findings was to correct arithmetic errors contained in Item I. The difference between Troxler and oven-dry moisture contents was miscalculated 5 times in 30 tests. The recalculated average deviation is identical, however, to the initial value of +0.12%, and thus the conclusion is correct that no overall correction factor can be applied to the Troxler.

In evaluating the second finding, again arithmetic errors were found in the U. S. Testing report. However, as the correlation of .98 was ~~apparently~~ not calculated for the same data as shown in Item "I" nor did it appear reasonable based on the broad scatter of the data shown in the attached graph, the coefficient was recalculated. (see Fig. 1)

SB 18-132

Assuming the regression curve to be a 45° line through the origin, indicating perfect correspondence between the Troxler and oven-dry methods of moisture

determination, then the correlation coefficient, r, may be calculated as:

$$r = \sqrt{1 - \frac{Syx^2}{Sy^2}}$$

where: Syx = standard error of estimate

$$= \sqrt{\frac{\sum_{i=1}^{n} (yi - yic)^2}{n - n_d}}$$

n = no. of data points

yi = individual Troxler value

yic = corresponding oven-dry value

nd = no. of parameters to be evaluated, i.e. 2

n-nd = no. of degrees of freedom, i.e. 28

Sy = standard deviation of sample

$$= \sqrt{\frac{\sum_{i=1}^{n} (yi - \bar{y})^2}{n - 1}}$$

$\bar{y}$ = average Troxler value

$$= \left(\sum_{i=1}^{n} yi \right) / n$$

Using the corrected data of Item "I":

$\bar{y}$ = 12.907

Sy = 2.347

Syx = 1.808

r = .637

SB 18433

A correlation coefficient of .637 would indicate a moderate relationship at best between the Troxler and oven-dry methods. In addition, the standard error of estimate indicates that 95% of all Troxler values will be within ± 3.6 % of the oven dry, 68% with ±1.8%. This in turn means that errors of ± 5 pcf can be anticipated in dry density calcualtions based on the Troxler moisture determination.

Note that the second set of data which was used for computation of the .98 correlation coefficient has an average deviation of +1.6% for the Troxler, indicating that a correction factor would be required. Again assuming the regression curve to be a 45° line through the origin, then the standard error of estimate for this data (after correcting arithmetic errors) is 1.842 and the correlation coefficient is .719. If a correction factor of -1.6% is applied to all Troxler values, the standard error of estimate drops to 0.686 and the correlation coefficient becomes .966, which would have been somewhat more acceptable. U.S. Testing did not do this however.

Thus the conclusion here is that the Troxler nuclear densometer was not accurate enough for use in field moisture determination and that the U.S. Testing findings did not properly represent the condition of the data.

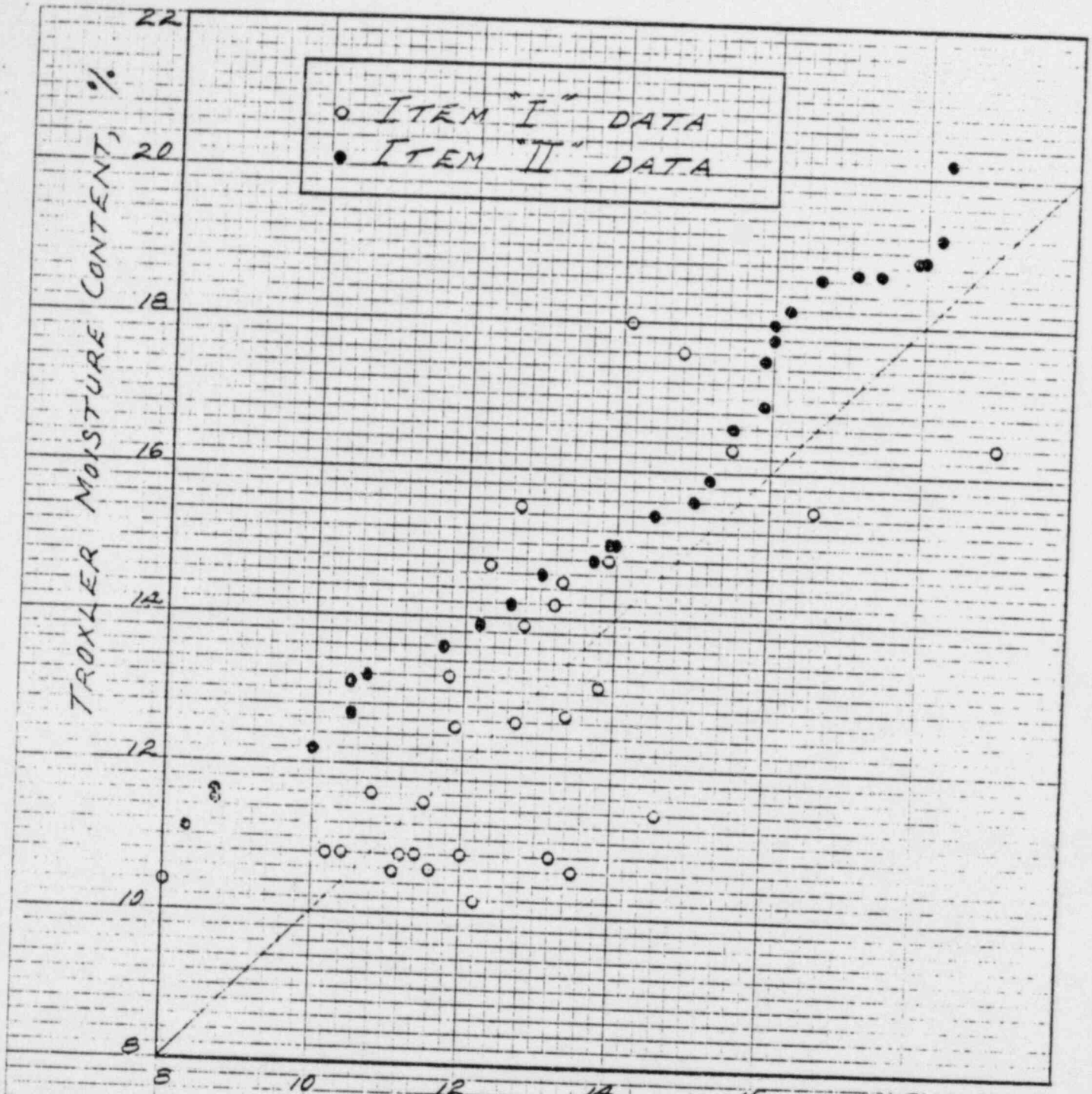

FIG. 1: PLOTS OF TWO DATA SETS USED IN U.S. TESTING CO. REPORT

SB 19435

46 6702

APPENDIX

A

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

Testing & Inspection:
concrete
structural steel
soils
asphalt

Quality Control
Construction Supervisc
Investigations.

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

Attn: Mr. E. E. Felton

Re: Specification 7220-C-208
Section 9.1 Para. G and
Specification 7220-C-210
Section 12.4.2 & 12.4.4

Sir:

As per the above referenced specifications we hereby request authorization to implement the use of a nuclear device during determination of field moistures and densities. One Troxler model 2400 surface moisture-density gauge is currently on site and operable, with a second on loan from Consumers Power which will be available for use also.

Our field studies, as reported in the attachment, have shown a comparison between the sand cone method currently in use, and the nuclear devices. Upon approval the nuclear devices will be put into service. In addition the current sand cone equipment will be held in reserve against breakdown and to provide future comparisons if required or requested.

Please make your determinations on this matter and advise us. If there are any questions regarding this equipment, the tests involved or the Comparison Study please do not hesitate to call.

Respectfully,
United States Testing Co., Inc.

Kenneth [illegible]
Trademaster
Laboratory Chief

SB 19437

Attachment: U.S.T., Report of Comparison Study of the Troxler Nuclear Gauge
cc: Mr. D. Edley, U.S.T., Hoboken, N.J.

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

Testing & Inspection:
concrete
structural steel
soils
asphalt

Quality Control
Construction Supervisor
Investigations.

REPORT OF COMPARISON STUDY ON THE TROXLER NUCLEAR GAUGE FOR USE ON THE MIDLAND NUCLEAR SITE

Upon receipt of the Troxler Nuclear Gauge a comparison study was begun to determine its accuracy, precision and repeatability in relation to the Sand Cone density (ASTM D-1556) now in use. This report has been written as a conclusion to the results obtained in our field study.

Apparatus and Methods

The nuclear moisture denisty gauge used in the comparison was manufactured by Troxler Laboratories of Raleigh, North Carolina, compac 2400 series, Serial No. 2228, and was factory calibrated on October 9, 1973. A factory representative fully checked field operation on November 26,1973. Sand cone density tests were performed with the six inch sand cone and one gallon jar as per ASTM D-1556. Calibration was performed as specified by ASTM for the sand cone apparatus. Personnel performing tests were experienced in their respective tests and followed procedures as outlined in the applicable ASTM and manufacturer's recommendations.

Field Tests and Conditions

For the comparison test between the two methods several areas of uniform, undisturbed, compact soil were selected of an area approximately 15 x 30" each. Due to the method of test it was possible to perform one, then the other method of test over the same area. Three tests by each method were performed in an area on five different dates, which provided varying moistures on the same soil types. On

SB 19438

specific occasions, an undisturbed sample was carefully cut with a mold of predetermined volume in order to provide a third method of verifying the actual density and moisture. Care was taken to eliminate all variables due to personnel, equipment etc., in order to obtain accurate values for each test. Laboratory determinations and calculations were carried out in the usual manner and the results recorded, for later analysis. In addition to the above, a second series of tests was performed as follows. During a six week period, during which actual earth work was underway, comparison tests were performed. Prior to the sand cone test, a test using the nuclear method was performed. Then on the same location, a sand cone density was performed. Results were calculated and also recorded for later analysis.

Results and Analysis

Test sets performed in the controlled areas explained earlier showed the following results:

The nuclear method yielded results which indicated the moisture content to be approximately 3.8% over the oven dry method which was used in the computation of the sand cone test and the undisturbed sample.

The wet density was found to be approximately 7.0 pcf less with the nuclear method than the results obtained with the sand cone.

Neither the sand cone nor the nuclear method of testing duplicated the dry densities obtained with the undisturbed samples.

The latter series of tests performed during actual earthwork tended to show the limited control of conditions, and although the overall results were not as conclusive as the controlled test results, the

same trends were evident.

Here reference is made to a study performed by J.F. Redus of the Corps of Engineers by the U.S. Army at Vickspurg, Mississippi in 1955, which compared the various methods of determining volumes, as used in density tests. The methods and apparatus which were tested and compared include the water balloon, 6" sand cone, drive cylinder and oil method. In these comparisons the apparatus used in the sand cone density was found to be the most accurate of the above methods. The tests performed also showed the volume computed by this method to contain a test error of approximately 2.5%, on a controlled test volume. Computation also showed that 90% of the actual values computed yield test hole volumes which were approximately 4% less than the actual laboratory volumes.

The results which were published and released by the Corps of Engineers tend to substantiate the findings of our field studies concerning the actual volumes verses the sand cone volumes. If the findings of the Corps of Engineers are assumed to be correct, the values computed with the sand cone and the values obtained with the nuclear method very nearly coincide. With a correction factor as determined by ASTM D-3017 for the moisture content, the variation from the actual moistures would be less than 1%. The dry densities shown with the nuclear method would be less than those tested with the sand cone method, however, the values obtained with the nuclear method would be closer to the actual dry density of the material tested.

SB 18-142

Conclusion

Although no direct correlation between the two methods can be determined, the lower dry density values which may be shown by the nuclear method would serve as a positive additional safety factor in the final percentage compaction figure. In light of the above and other references, such as ASTM D-3017-72 Appendix, it is felt the great savings in time

same trends were evident.

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The results which were published and released by the Corps of Engineers tend to substantiate the findings of our field studies concerning the actual volumes verses the sand cone volumes. If the findings of the Corps of Engineers are assumed to be correct, the values computed with the sand cone and the values obtained with the nuclear method very nearly coincide. With a correction factor as determined by ASTM D-3017 for the moisture content, the variation from the actual moistures would be less than 1%. The dry densities shown with the nuclear method would be less than those tested with the sand cone method, however, the values obtained with the nuclear method would be closer to the actual dry density of the material tested.

Conclusion

SB 18440

Although no direct correlation between the two methods can be determined, the lower dry density values which may be shown by the nuclear method would serve as a positive additional safety factor in the final percentage compaction figure. In light of the above and other references, such as ASTM D-3017-72 Appendix, it is felt the great savings in time

with which moisture-density results can be computed and used, that the nuclear method could be implemented on this project as a useful tool in fill control.

Keith Rademacher

Keith Rademacher
Laboratory Chief
Midland, Michigan

Interoffice Memorandum

To Jack Jeffers

Date April 30, 1974

Subject Job 7220 Midland Project
Use of Troxler Nuclear Density Probe
Spec. C-208
G-0-397

From T. C. Valenzano

Of Construction

Copies to J. Connolly

At Midland, Michigan

We hereby recommend the use of the Troxler Nuclear Density probe for determining in-place field densities based on review of the test information and ASTM D-2922-71, standard method of test for density of soil and soil-aggregate in place by Nuclear methods. Section 3.2.1 of ASTM D-2922-71 states calibration curves should be checked and that the most accurate method of checking is with blocks of a known density. U. S. Testing checks the machines each morning with blocks supplied by the manufacturer of the Troxler, and K. Rademacher says the machine checks against the factory calibration curve within 0.5 lb./c.f. This is within acceptable tolerances.

Use of the Troxler for moisture determination is also recommended, but with the following qualification: We feel that U. S. Testing's correlation report is somewhat inconclusive for moisture determination and that further comparisons should be conducted prior to using the Troxler exclusively for moisture on Q-list fills. As previously discussed with your Mr. Bob Brineman, an oven dry check will be made on at least the first 30 moisture tests made with the Troxler. The extablished correlation curve will then be periodically checked by the same 30 curve method. The resulting data should provide adequate correlation support for the use of the Troxler in both Q and Non-Q list areas.

The use is authorized in the specifications and the use will greatly improve the speed and accuracy of field tests.

T. C. Valenzano

TCV/DG/kt

SB 18443

5024 (10-72)

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

May 21, 1974

United States Testing Company, Inc.
1415 Park Avenue
Hoboken, New Jersey 07030

Attention: D. Edley

Dear Mr. Edley:

Job 7220 Midland Project
Subcontract 7220-C-208
Nuclear Density Device
B-C-208-20

We hereby recommend the use of the Troxler Nuclear Density probe for determining in-place field densities based on review of the test information and ASTM D-2922-71 Standard Method of test for density of soil and soil-aggregate in place by Nuclear methods.

Use of the Troxler for moisture determination is also recommended, but with the following qualification: Your correlation report is somewhat inconclusive for moisture determination and further comparisons should be conducted prior to using the Troxler exclusively for moisture on Q-list fills.

The use of a Nuclear Density Device is authorized in the Specification and its use will greatly improve the speed and accuracy of field tests..

Very truly yours,

E. E. Felton

EEF/JCC/HJS/ja

cc: T. C. Valenzano
K. Radamaker
R. C. Brineman

SB 18-1-44

United States Testing Company, Inc.
Engineering Inspection Division
1415 PARK AVENUE
HOBOKEN, NEW JERSEY 07030 (201) 792-2400 (212) 943-0468

May 30, 1974
UST Ma-2

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

Attn: Mr. E. Felton

Re: Troxler Nuclear Gauge
Correlation

In response to your letter of May 21 1974, further comparisons between the Troxler Nuclear Gauges and oven-dry methods of moisture determinations have been made. Attached (Item "I") is a comparison as outlined by ASTM D-3017-72 and the manufacturers recommendations. In addition a statistical correlation was also performed and is attached for information purposes (Item "II").

Please give your considerations to this matter and advise as pertains to implementation of correction factors and use on Q-listed fill areas. If there are any questions please do not hesitate to call.

Respectfully,

United States Testing Co., Inc.

K Rademacher

Keith Rademacher
Lab Chief - Midland jobsite

Attachments

cc: D. Edley, UST, Hoboken, N.J.

KR/kls

SB 18445

Item "I"

MOISTURE CONTENT CORRELATION

Between

TROXLER NUCLEAR SURFACE MOISTURE DENSITY GAUGES

and

OVEN DRY MOISTURES

As per the guidelines set forth by the manufacture's manual, and by ASTM D 3017-72 a correlation was established between the two methods.

Test data was collected between May 30, 1974 and June 4, 1974 on various site areas and soil types. Two Troxler devices were used to determine the moisture content by the nuclear method. The test area was then removed and tested as per ASTM D 2216-71 (Laboratory Determination of Moisture Content of Soil), with the exception that the moisture samples ranged from 6 to 22 lbs. each in order to make a more accurate determination on the larger area encompassed by the Troxler. A sample set of 30 tests was collected and used in the computations. ASTM D 3017-72 section 6.3.1, requires an accuracy of $\pm.5$ lb/ft^3. Correlation results exceeding this would require a correction factor. Our correlation check showed the Troxler to be, on the average +.12% higher than the oven dry determination. This deviation from the average is within the Troxler stated precision of $\pm.2\%$.

Based on this correlation, a correction factor is not required.

SB 18446

Item "I"

MOISTURE CONTENT CORRELATION DATA

Between

TROXLER NUCLEAR SURFACE MOISTURE DENSITY GAUGE

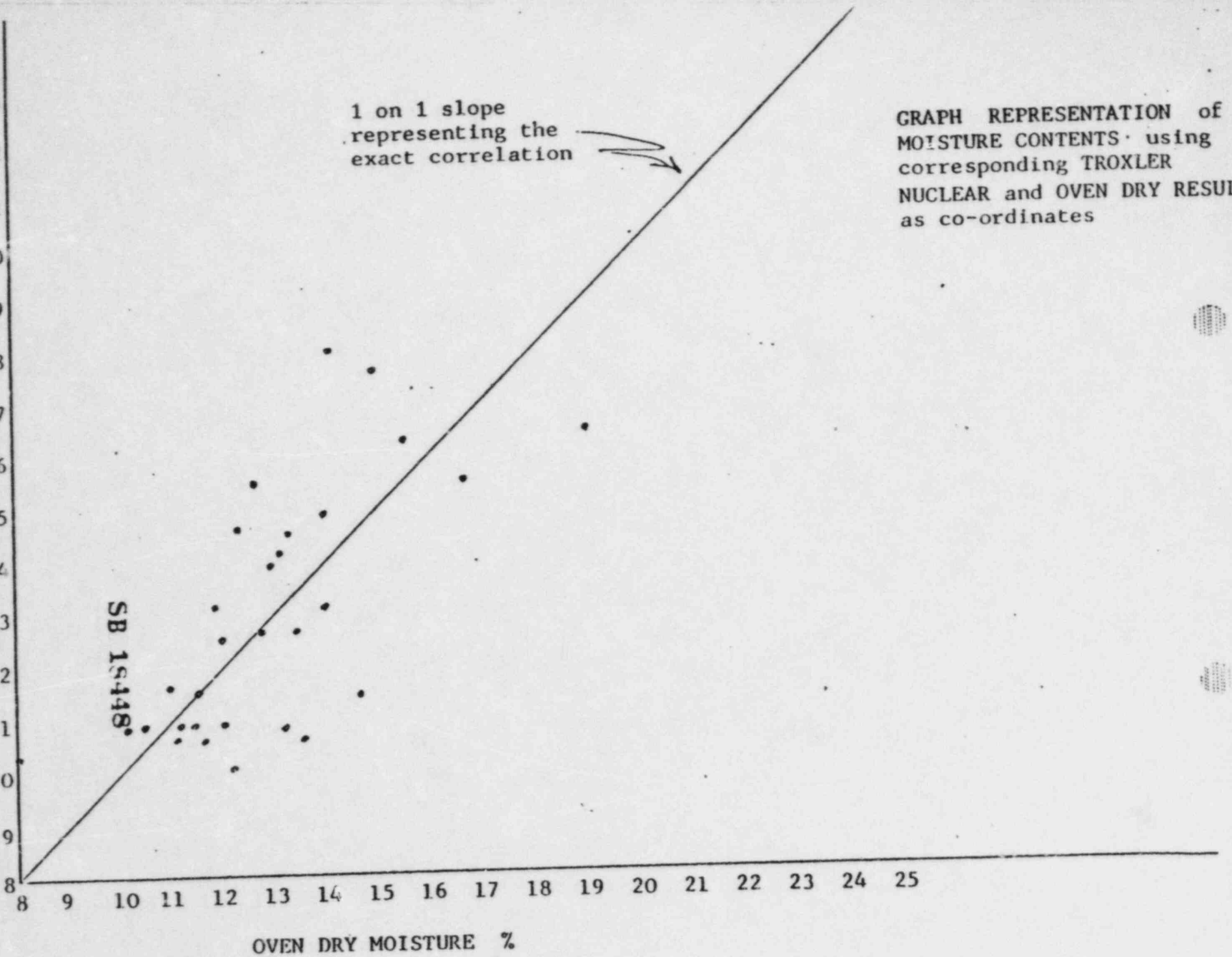
and

OVEN DRY MOISTURES

No.	TROXLER MOISTURE (%)	OVEN-DRY MOISTURE (%)	DIFFERENCE (%)	No.	TROXLER MOISTURE (%)	OVEN-DRY MOISTURE (%)	DIFFERENCE (%)
1.	16.4	19.0	-2.6	16.	10.2	12.2	-2.0
2.	14.8	13.9	+ .9	17.	17.6	14.8	+2.8
3.	15.5	16.6	-1.1	18.	15.5	12.7	+2.8
4.	13.1	13.8	- .7	19.	13.2	11.8	+2.4
5.	14.2	13.2	+1.0	20.	16.3	15.5	+ .8
6.	10.8	11.2	- .4	21.	10.6	11.6	-1.0
7.	11.4	14.6	-3.2	22.	12.5	11.9	+.6
8.	10.6	13.5	-2.9	23.	10.6	11.1	- .5
9.	10.8	10.2	+ .6	24.	14.5	13.3	+ .8
0.	10.8	13.2	-1.4	25.	18.0	14.1	+3.9
1.	10.8	11.4	-1.6	26.	10.8	12.0	-1.2
2.	10.4	8.0	+2.4	27.	10.8	10.4	+ .4
3.	11.5	11.5	±0.0	28.	12.7	13.4	-1.3
4.	11.6	10.8	+ .8	29.	14.7	12.3	+2.4
5.	12.6	12.7	- .1	30.	13.9	12.8	+1.1
							+3.7

SB 15447

+3.7 ÷ 30 = +.12% Ave. Deviation


1 on 1 slope
representing the
exact correlation
GRAPH REPRESENTATION of
MOISTURE CONTENTS · using
corresponding TROXLER
NUCLEAR and OVEN DRY RESULT
as co-ordinates
SB 1548
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OVEN DRY MOISTURE %

Item "II"

STATISTICAL CORRELATION

Between

TROXLER NUCLEAR SURFACE MOISTURE DENSITY GAUGES

and

OVEN DRY MOISTURES

The most frequently used correlational technique is product-moment correlation denoted by the symbol "r". The reason for the name "product-moment" correlation becomes obvious if one studies the algebraic manipulations illustrated in the formula for small-group product-moment correlations.

$$r = \frac{\mathcal{E}_{xy}}{\sqrt{\mathcal{E}_{x^2} \times \mathcal{E}_{y^2}}}$$

A "moment" is the sum of the score deviations from the mean after these deviations have been raised to some power and divided by "n". Since correlation deals with two tests, one "moment", and one therefore arrives at a "product-moment".

Results of thirty random samples, which were taken during the course of work at the Midland Nuclear Power Plant, were correlated in this particular analysis. The methods of testing used were the Troxler 2401 series Nuclear Surface Moisture Density Gauge (X) and oven drying samples (Y) according to ASTM D-2216 (Standard Method of Laboratory Determination of Moisture Content of Soil). The material tested was from zones 1 and 2, with both methods of testing being performed at the same locations. Basically, the test procedures incorporated are on a physical test vs. electronic device basis with the test results being translated into a numerical result. We believe that without a definite correlational procedure of statistical analysis there can be no true picture given of the Troxler vs. oven dried sample test results.

According to statistical procedure, the derived correlational coefficient is applied to the following scale:

± .00 to ± .20 - Indicates very slight or no relationship

± .20 to ± .40 - Indicates low relationship

± .40 to ± .70 - Indicates moderate relationship

± .70 to ±1.00 - Indicates high to perfect correlation between two sets of test scores.

The scored correlational coefficient of our test results was ± .98.

The Troxler Nuclear Gauge is a more efficient method of testing, eliminating human error, and giving a clearer picture of the area tested. Although not universally approved in the soil testing field the Troxler's results still have a very high correlation with sand cone, a proven but older method, which has too many flaws and inherent variances of error.

All statistical references were derived from statistical research and lectures given by Dr. Robert Sheehan of West Virginia University and his staff. Also specific reference can be made to A. L. Edwards' Statistical Method, New York; Holt, Rinehart and Winston, 1967.

CORRELATION STATISTICS

Using (X) as the representative symbol for Troxler moisture results and (Y) as the representative symbol for oven dry moisture results the correlation coefficient (r) can be determined giving you a correlation between the results of two small groups of test results.

mean of X = 15.7

mean of Y = 14.0

Item "II"

X	x	x^2	Y	y	y^2	xy
.2	4.5	20.25	18.3	4.2	17.64	18.90
.2	3.5	12.25	18.2	4.1	16.81	14.35
.9	3.2	10.24	18.0	3.9	15.21	12.48
.9	3.2	10.24	17.9	3.8	14.44	12.16
.7	3.0	9.00	17.4	3.3	10.89	9.90
.7	3.0	9.00	17.1	3.0	9.00	9.00
.6	2.9	8.41	16.6	2.3	5.29	6.67
.2	2.5	6.25	16.2	2.1	4.41	5.25
.0	2.3	5.29	16.0	1.9	3.61	4.37
7.8	2.1	4.41	16.0	1.9	3.61	3.99
7.5	1.8	3.24	15.9	1.8	3.24	3.24
6.9	1.2	1.44	15.9	1.8	3.24	2.16
6.6	.9	.81	15.5	1.4	1.96	1.26
5.9	.2	.04	15.2	1.1	1.21	.22
5.6	-.1	.01	15.0	.9	.81	-.09
.5.4	-.3	.09	14.5	.4	.16	.12
.5.0	-.17	.49	14.0	-.1	.01	.01
.5.0	-.7	.49	13.9	-.2	.04	.14
14.8	-.9	.81	13.7	-.4	.16	.27
14.6	-1.1	1.21	13.0	-1.1	1.21	.36
14.2	-1.5	2.25	12.6	-1.5	2.25	2.25
13.9	-1.9	3.61	12.2	-1.9	3.61	3.61
13.6	-2.1	4.41	11.7	-2.4	5.76	5.04
13.2	-2.5	6.25	10.7	-3.4	11.56	8.50
13.1	-2.7	7.29	10.5	-3.6	12.96	9.72
12.7	-3.0	9.00	10.3	-3.8	14.44	11.40
12.2	-3.5	12.25	10.0	-4.1	16.81	14.35
11.6	-4.1	16.81	8.7	-5.4	29.16	22.14
11.5	-4.2	17.64	8.7	-5.4	29.16	22.68
11.1	-4.6	21.16	8.3	-6.0	36.00	27.60

$$r = \frac{\mathcal{E}_{xy}}{\sqrt{\mathcal{E}_{x^2} \times \mathcal{E}_{y^2}}}$$

$$r = \frac{232.05}{\sqrt{205.54 \times 274.66}}$$

$$r = \frac{232.05}{\sqrt{56453.616}}$$

$$r = \frac{232.05}{237.59}$$

$$r = .9766825 \quad \text{or} \quad .98$$

KEY:

$\mathcal{E}$ = sum of

r = correlational coefficient

SV = standard of variance

The above statistical computation and correlation performed by Richard Peck, of United States Testing Co., Inc.

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

August 6, 1974

RECEIVED
AUG 14 1974
BECHTEL POWER CORP.

United States Testing
P. O. Box 449
Midland, Michigan 48640

JOB 7220
PER C-DCV-45

Job 7220 Midland Project

Bechtel Purchase Order No. Not Applicable
7220-C-208-26

Gentlemen:

To eliminate confusion regarding our requirements for documentation, proper service, and calibration of instruments sent to you, the following instructions should be completed in all cases.

1. A certification sheet supplied for completion by you will be included with every instrument sent for calibration. This form will be partially completed by us and is to be completed fully by you. No empty spaces should remain upon return to us with calibrated instrument. A copy will be supplied with this letter.

2. The instrument shall be calibrated to within manufacturer's specifications for accuracy.

3. Each instrument to be calibrated must be properly identified. There should be a Bechtel Power Corp. number, such as BPC-M-100 and a job number, ex. 7220 permanently inscribed on each instrument. Once again there will be a certification sheet supplied and the BPC number will be entered in the space marked Bechtel MSL S/N.

4. The space provided for calibration procedures used shall be filled in to contain a description of the appropriate calibration procedure and a copy of this procedure shall be attached to the cert. to be returned to Bechtel. Any further comments or special procedures should be explained under comments.

5. Calibration standards or test instruments shall be described, including name, model, manufacturer's S/N, traceability to NBS and entered on Calibration Standard Used on certification sheet.

SB 18453

6. ~~The above requirements must be accomplished and included with the returned instruments, i.e. pressure gauges free of oil and soiled, no later than ten day after receipt of instruments to be calibrated.~~

7. The certification must be signed by appropriate authority.

8. Both the packing list and invoice must have the cost of the calibrations performed and a reference to the Bechtel Purchase Order Number included.

Any questions regarding these instructions or discrepancies found in examination of instruments, should be directed to:

Bechtel Power Corporation
Job #7220
3500 E. Miller Road
P.O. Box 2167
Midland, Michigan 48640

Attention: Bob McQueen

To confirm your acceptance of these requirements and instructions, please copy this letter for your files and send original with signature and title of authorized personnel below to Robert McQueen at address above.

Signature

Title

Very truly yours,

E. E. Felton

EEF/RRM/vs

NOTE: Due to the fact that calibration performed by U. S. Testing is a gratis as-time permits item 6 can not be adhered to. All efforts will be made to promptly calibrate and return items sent to us however.

K. Rademacher
Lab Chief

SB 18454

J. N. Allen
5/4/77

NOTES ON U.S. TESTING DATA

✓ 1. Over use of some lab Proctor curves

✓ 2. Occasional use of a different Proctor to clear a failing test

✓ 3. Many points above the ZAV curve

✓ 4. Some points above 56,000 FT-lb. effort (100% 1557)

✓ 5. Calculation errors noted on some data sheets. Checked

✓ 6. Some BMP Proctor curves used repeatedly even with a history of high % of failures.

✓ 7. Some clearing retests too far away - over 20' in case

✓ 8. One failed test "cleared" by a retest run 3 mts before the one that failed.

✓ 9. Compactive effort was very erratic varying from over 60,000 FT-lbs (indicated) to less than an indicated value of 10,000 FT-lbs.

X 10. In place moisture was up to 8% from opt. which is 6% off of spec.

X 11. Absolute w ranged widely from about 8% to 24%

✓ 12. All tests w/ γ not right at 95% to 100% of BMP can not be called "Pass" or "fail" since U.S. testing assumed vertical lines for w. γ [sketch] opt. slanted.

✓ 13. If w, γ points are converted to %G. many answers are ridiculously high.

14. About 25% of test results plot with in BMP spec

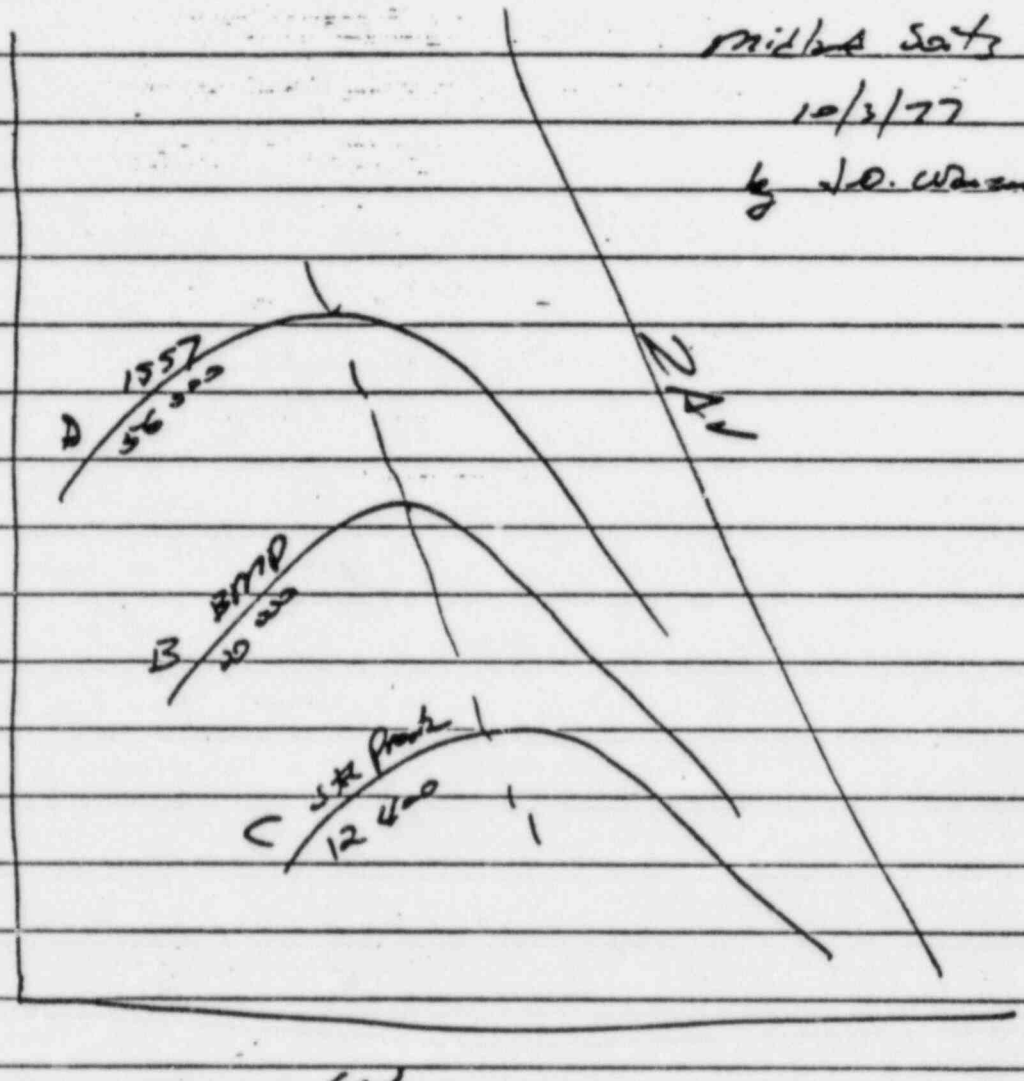
15. About 39% of test results plot within MP spec.

✓ 16. Cases where D_R test used in clay zone & BMP in sand zone (some mat'l may have been placed in the wrong zone)

✓ 17. Nuc [illegible] ±2 %

SB 18507

Middle Salt
10/3/77
by J.D. Wrenk



	opt. w	$\gamma_{dry\ max}$	CBR @ Max D
A	12.7 %	129.5 PCF	94.5 psi
B	14.0 %	117.0 PCF	57.2 psi
C	15.0 %	112.8 PCF	5 psi

$94\% B = 10\% A$

		% of space or not feasible	% out of BMP spec.
BMP	200	49%	69%
	255	57%	80%
	260	72%	78%
	262	64%	78%
	269	35%	65%
	270	60% estimate	75% est.
	271	67%	86%
	277	63%	96%
	278	80%	92%
		549 ÷ 9 = 61% Ave. Bad	670 ÷ 9 = 74.5% out of BMP Spec.

This does not mean that the other 39% is Good - just that it plots in a zone that is acceptable.

Only about 25% of test results really met spec.

3-19-79

MIDLAND PROJECT — KARL WIEDNER

JOB 7220-101

PLANT AREA FILL

PROBLEM AREAS

1. DIESEL GENERATOR BLDG & PEDESTAL — Q-LISTED
2. SERVICE WATER STRUCTURE — Underpin or remove & reconstruct, " Take out of the argument by a positive fix.
3. CONDENSATE STORAGE TANKS & UNIT #1 MAIN TRANSFORMER FDN. — NON-Q — Surcharge.

Computer files.

POTENTIAL PROBLEM AREAS

Tech OK. 1. DIESEL FUEL OIL TANKS — Q-LISTED

and Mech. Insurance 2. BORATED WATER TANKS — -" -

water, tanks & maybe others.

3. UNDERGROUND PIPING & DUCT BANKS — Q & NON Q

Serv. Water piping & elect. duct banks.

4. RETAINING WALL @ C.W. & SERV. WATER STRUCTURE — -" - Tie to dike

5. GUARD HOUSE - Have to satisfy client.

6. CONTROL BUILDING (PART OF AUX BLDG) — Q-LISTED

Looks OK.

SB 18527

MIDLAND PROJ.
JOB 7220-101

2-19-79
K. WIEDNER

POSSIBLE CAUSES

1. SPECIFICATION - COMPACTION REQMT
   95% VS. 100% BMP.

2. CONSTRUCTION METHODS/PROCEDURE

3. INSPECTION/SUPERVISION/SURVEILLANCE

4. TESTING* - FULL RELIANCE ON TEST RESULT

*) MOST PROBABLE CAUSE

Bechtel Incorporated

Interoffice Memorandum

To S. S. Afifi

Date March 27, 1979

Subject Midland Nuclear Plant
DRAFT Response to NRC Questions
Docket No. 50-329 and 50-330
Job 7220-101

From J. H. Allen

Of ~~H&CF-Geotech~~

Copies to File

At Houston

Attached are some rough drafts of some of the NRC questions that pertain to Geotech. I find that I can't be more specific or detailed without drawings, data and other records located in the Ann Arbor office.

If you still need for me to help prepare the final draft, I can travel back to your office on Tuesday morning, April 3.

As discussed with you, it appears we could make Terry Claunch available for about a 30-day period to review soil placement at Midland or one of your other job sites.

Please let me know if you need our help.

J. H. Allen

J. H. Allen
Manager,
Geotechnical Services
Houston

JHA:bam

Attachments: 4-page text
6 photos

SB 19529

QUESTION 4

ANSWER 4 The acceptance criteria used to judge the acceptability of the fill program will be based on performance of the fill during preloading. Settlement with time will be analyzed to determine when preloaded structures or areas will undergo no additional detrimental settlement upon removal of the preload. It is not expected that the preload fill will cause compaction to the density requirement set forth in the PSAR.

Field instrumentation records during preloading indicate that settlement occurs rapidly as load is added. Pore pressures are rapidly dissipated due to the granular nature of the fill, which allows consolidation of the fill to proceed rapidly. Plots of settlement versus time for a given preload application are shown in Figure _____ .

Table _____ gives settlement under preloading, expected rebound upon load removal, and subsequent total residual settlement of key structures.

QUESTION 5

ANSWER 5 It is not expected that the preloaded fill will meet original requirements set forth in the PSAR. Acceptance criteria is expected to be based on performance of the major structures during preloading. Subsequent to removal of the preload, settlement will continue to be monitored until a time history is developed for the structures that will allow accurate prediction of future operation.

QUESTION 6

ANSWER 6.A It is not expected that PSAR criteria will be met by surcharging the tank areas. Current records on the diesel generator building indicate that settlement occurs rapidly as load is added. A soil surcharge equal to the tank loading is expected to cause sufficient settlement during the time the load is applied to prevent subsequent operating damage. Residual settlements will be monitored to establish a time history for the tanks. Pipe connections to the tanks can be adjusted if required.

ANSWER 6.B Diesel fuel oil storage tanks are buried in the fill and even when full of oil cause very low net loads. The same procedure followed for the borated water storage tanks will be followed for the diesel fuel storage tanks as well as other tanks considered critical to plant operation or shut down.

QUESTION 9

ANSWER 9 Soil properties of fill material above about Elevation 615, in general, do not meet the original compaction criteria. The containment building penetrates all fill and is founded on undisturbed glacial till. Borings made in the auxiliary building, control tower, service water pump structure and other associated structures have defined the extent of the questionable fill material. Plotted logs and soil profiles are shown in Figure _____ .

QUESTION 10

ANSWER 10 Portions of the auxiliary building and service water pump structure built over fill have been bored and tested to determine in place soil properties. Remedial measures such as compaction or chemical grouting, or underpinning are being considered.

QUESTION 11

ANSWER 11 Borings have been made through all building foundations likely to be resting on fill. These borings, along with those adjacent to the buildings, have provided definition of fill extent and properties.

QUESTION 14

ANSWER 14 Based on observed settlements for the diesel generator building and soil properties determined from the current drilling and testing program, settlement analyses to predict future settlements have been made. Table _____ compares originally predicted settlement with that currently anticipated.

TABLE _____

STRUCTURE	SETTLEMENT PREDICTED BY PSAR (FT)	SETTLEMENT CURRENTLY PREDICTED (FT)
Diesel Generator Building		
Service Water Pump Station		
Borated Water Storage Tanks		
Diesel Fuel Oil Storage Tanks		
Unit 1 Transformer		
Condensate Storage Tanks		
Auxiliary Building		

(Discussion of Stresses & Cracks)

QUESTION 15

ANSWER 15 Two seismic Category I structures are located partially on questionable fill and partially on good fill or undisturbed soil.

ANSWER 15.1 Service Water Intake Structure

This structure was constructed with about two-thirds of the structure founded on undisturbed glacial till and the other one-third at a higher elevation on questionable fill. Calculations indicate that the portion on fill could be modified structurally to act as a cantilever without need for static support from the fill; however, it would be seismically unstable. For this reason the structure will be modified to provide positive structural support through the fill and into underlying undisturbed soil for the cantilevered portion. Support will be in the form of piles. Horizontal forces during a seismic event will be carried by the base of the structure originally on undisturbed soil and the additional support will prevent an overturning tendency.

ANSWER 15.2 Auxiliary Building

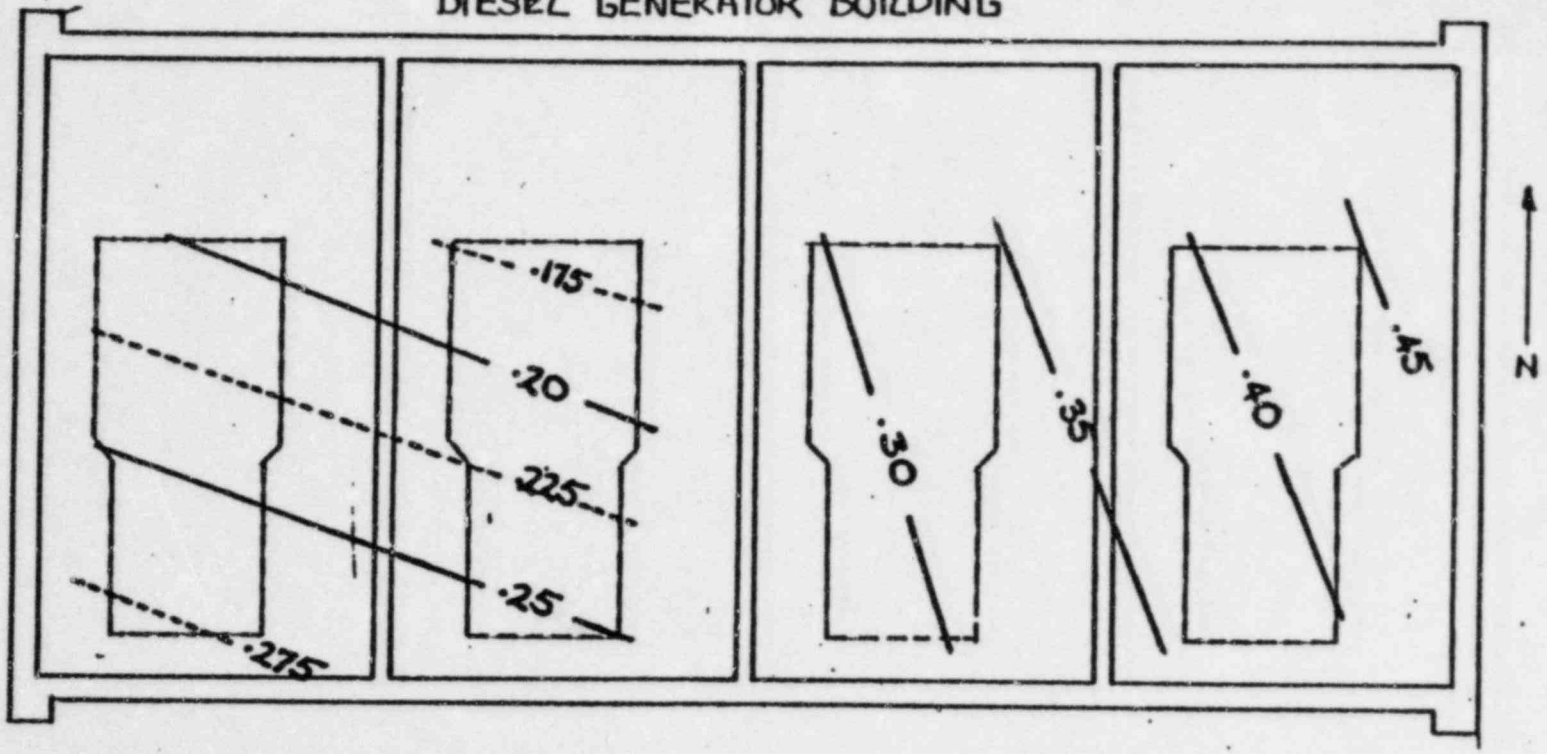
The majority of this building is founded on undisturbed soil. The wings on either side are at a higher elevation and are supported on a combination of lean concrete fill and soil fill. A grouting program to densify sands beneath these areas is planned. Borings indicate the control tower foundation soils to be in accordance with original specifications.

QUESTION 16

ANSWER 16 Plant area fill is settling under its own weight and may tend to settle differentially throughout the area. Borings are being made along the pipe alignments to assess the likely extent and magnitude of differential settlement. Potential pipe stress due to differential settlement is being investigated. If found to be excessive, supports necessary to alleviate excessive stress will be installed.

SB 19510

DIESEL GENERATOR BUILDING



SETTLEMENT MARKERS : TOTAL SETTLEMENT OF PEDESTALS to 3-16-79
Readings in Feet ; Total Surcharge of 1100 psf (10 Feet)

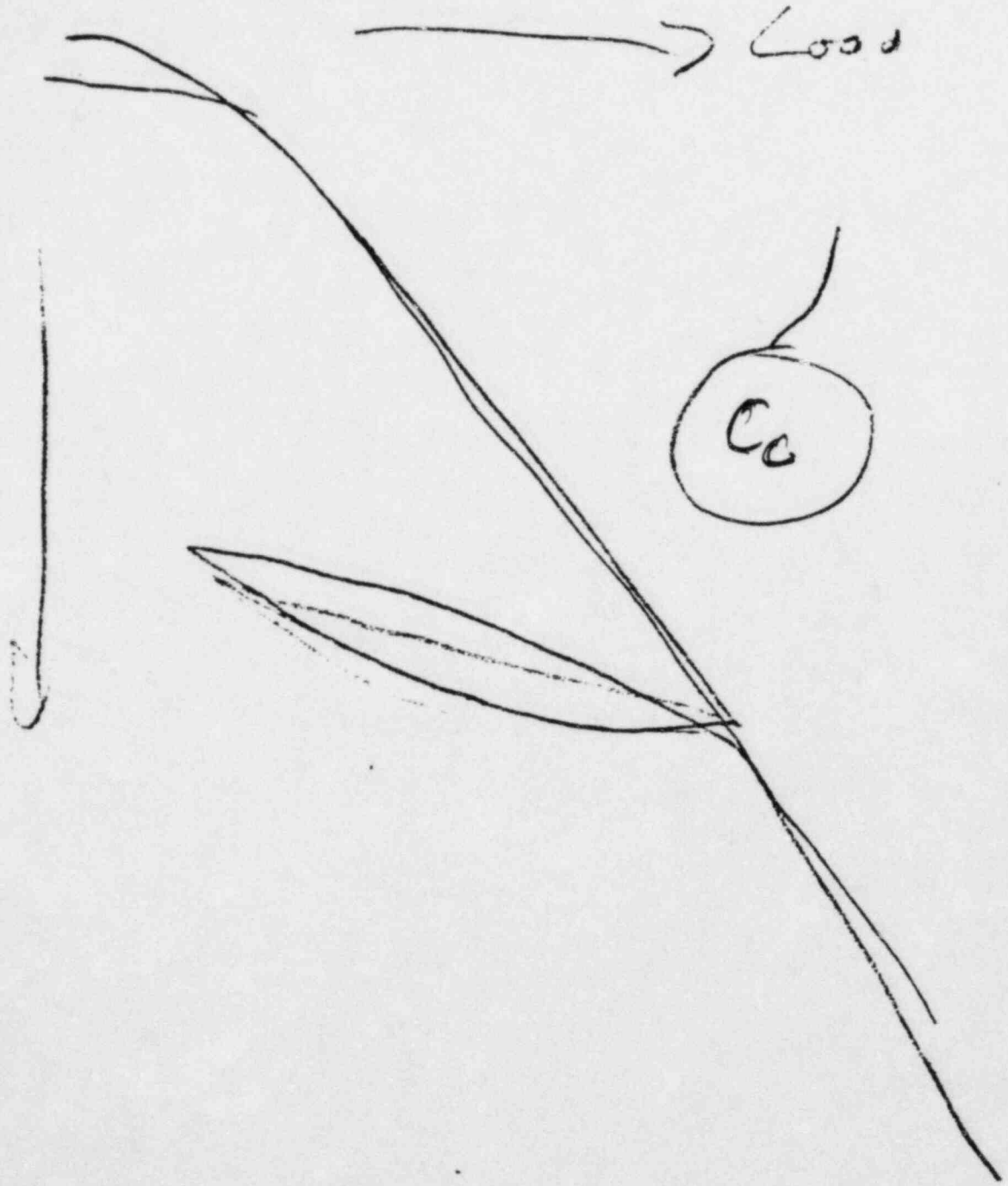
CALCULATION SHEET

CALC. NO. _____ REV. NO. _____

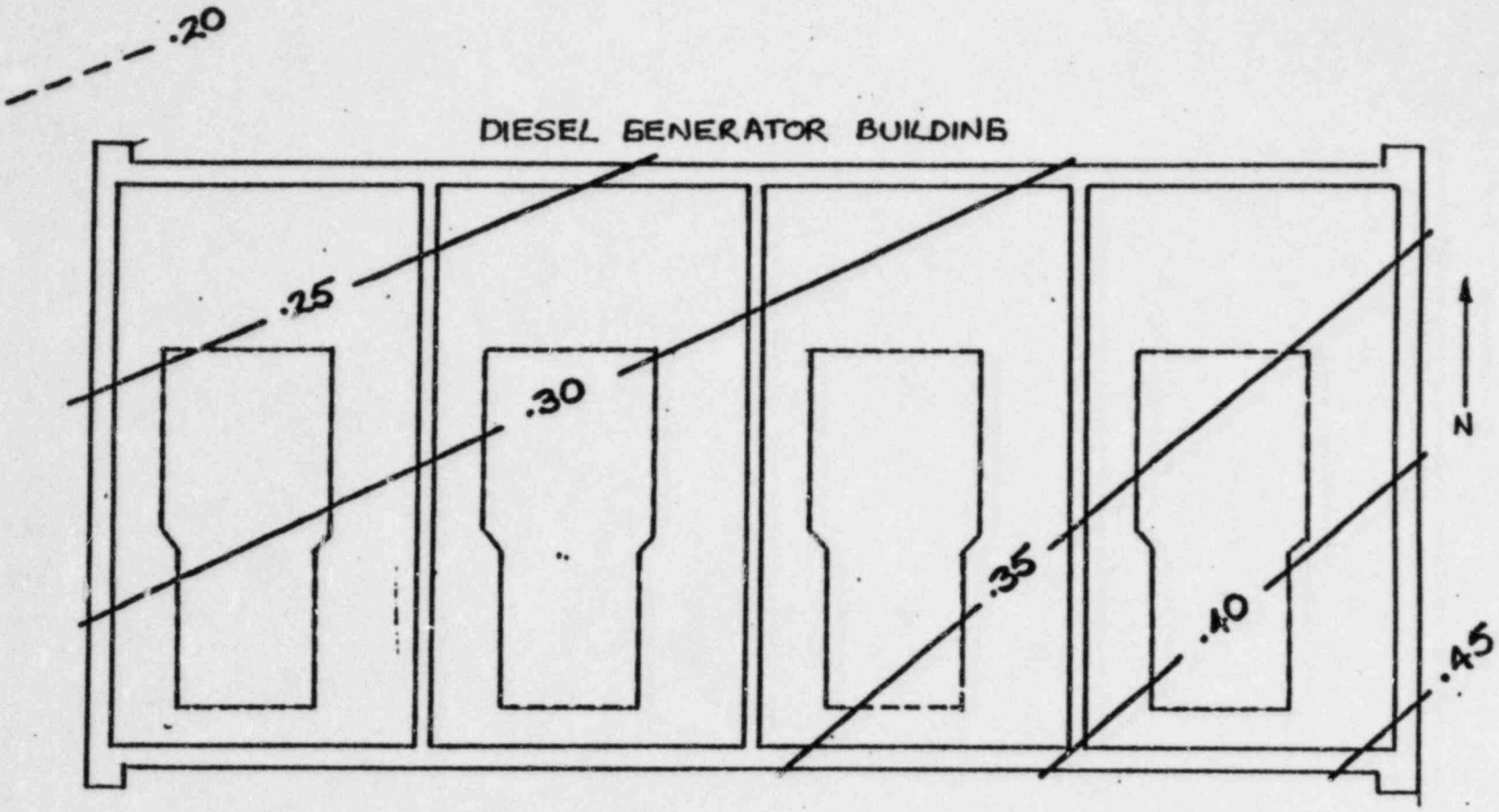
ORIGINATOR _____ DATE _____ CHECKED _____ DATE _____

PROJECT _____ JOB NO. _____

SUBJECT _____ SHEET NO. _____



SB 19541

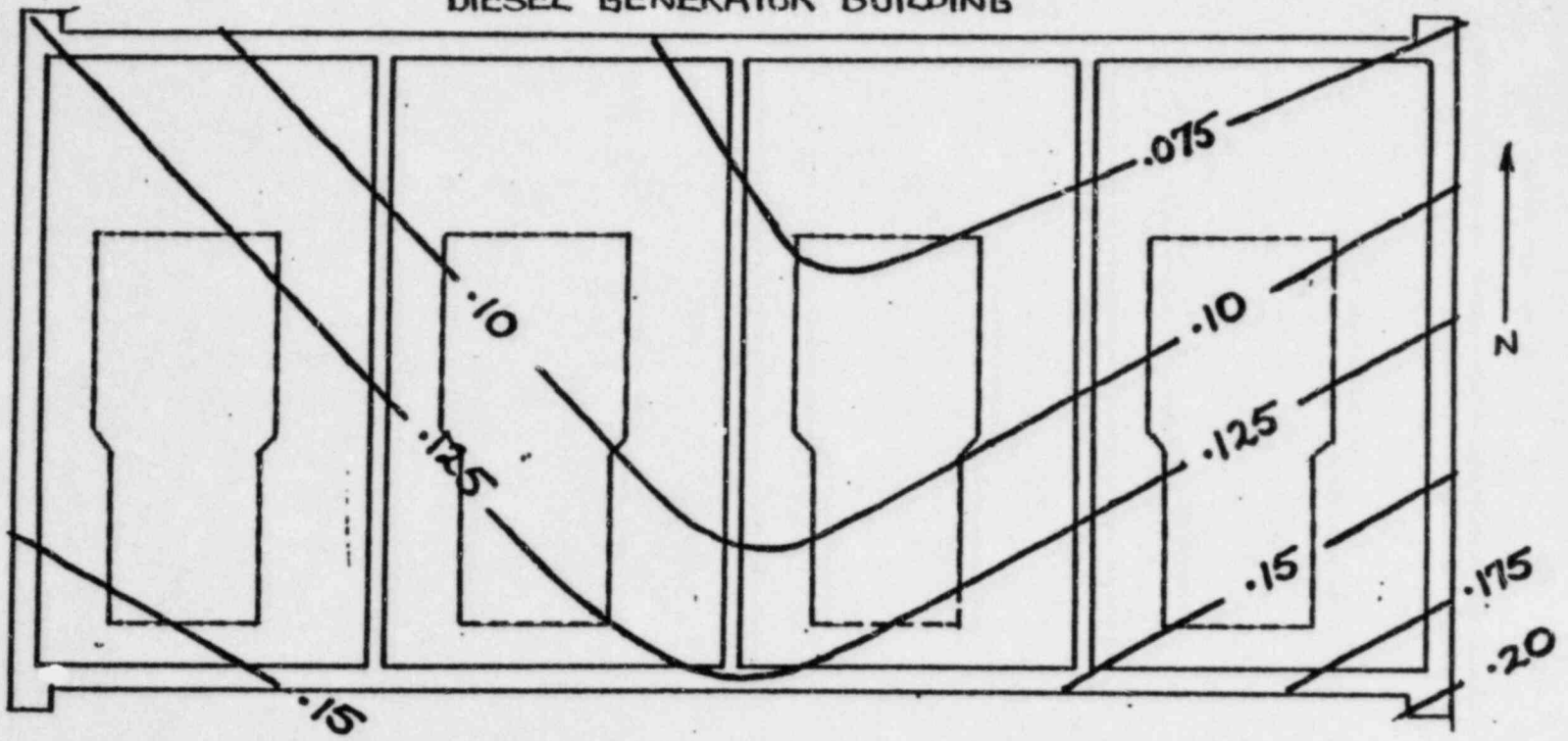


SETTLEMENT MARKERS : TOTAL SETTLEMENT OF BUILDING WALLS to 3-16-79
Readings in Feet ; Total Surcharge of 1100 psf (10 Feet)

SB 19542

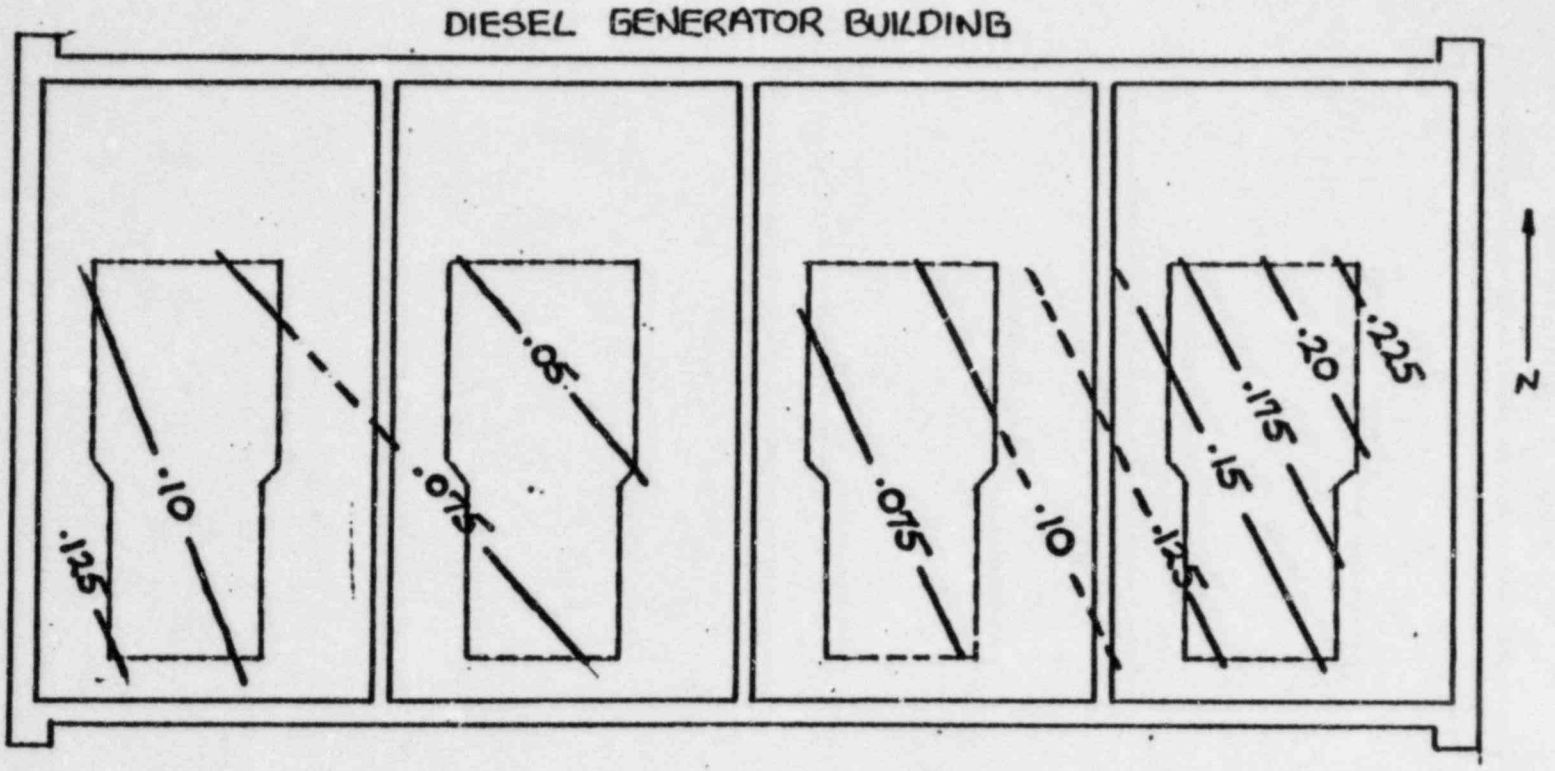
SB 18543

DIESEL GENERATOR BUILDING



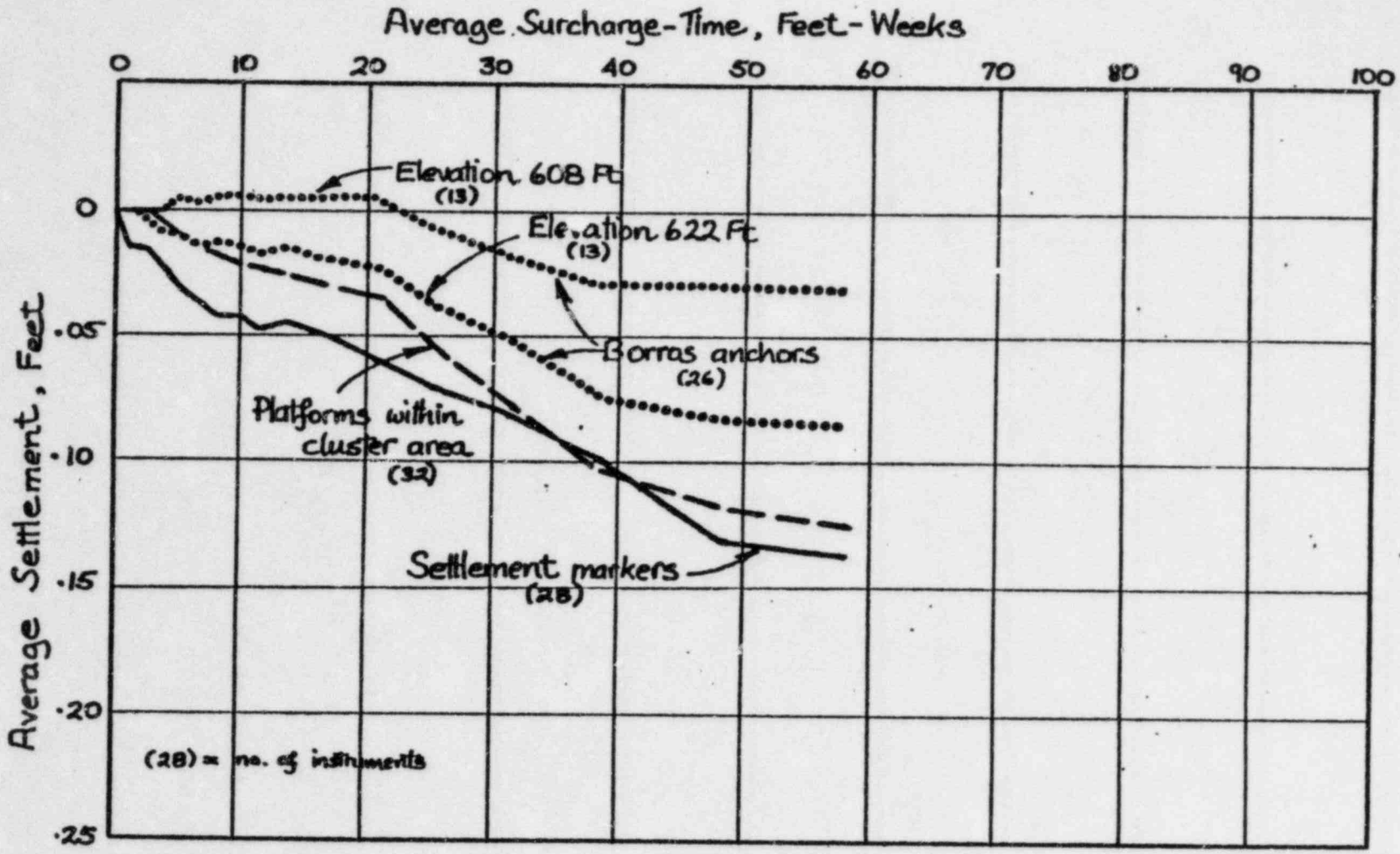
SETTLEMENT MARKERS: TOTAL SETTLEMENT OF BUILDING WALLS to 7-15-78
Readings in Feet; No Surcharge; Electrical Ducts Attached

SB 13544

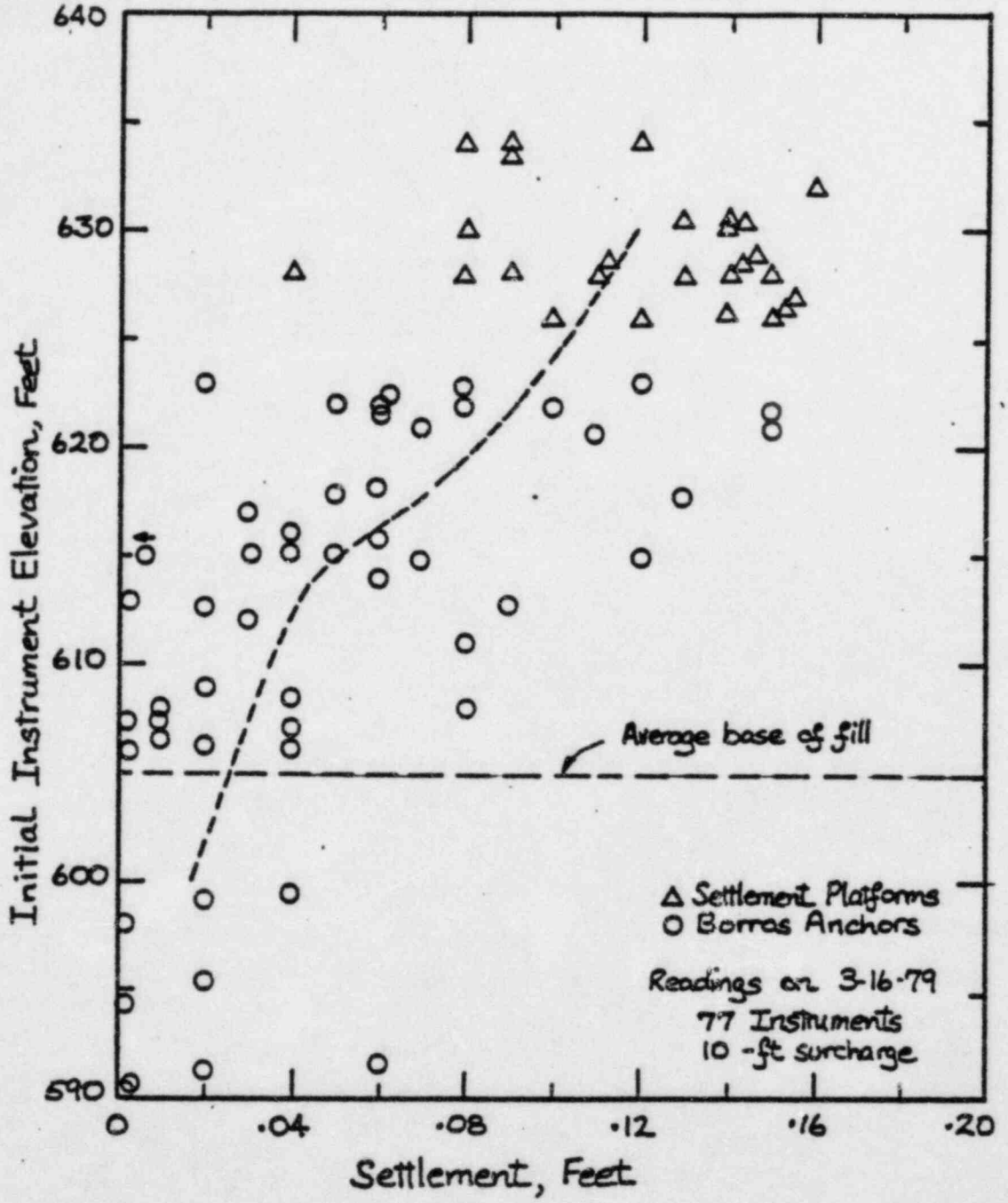


SETTLEMENT MARKERS: TOTAL SETTLEMENT OF PEDESTALS to 9-15-78
Readings in Feet; No Surcharge; Electrical Ducts Attached

SB 18545



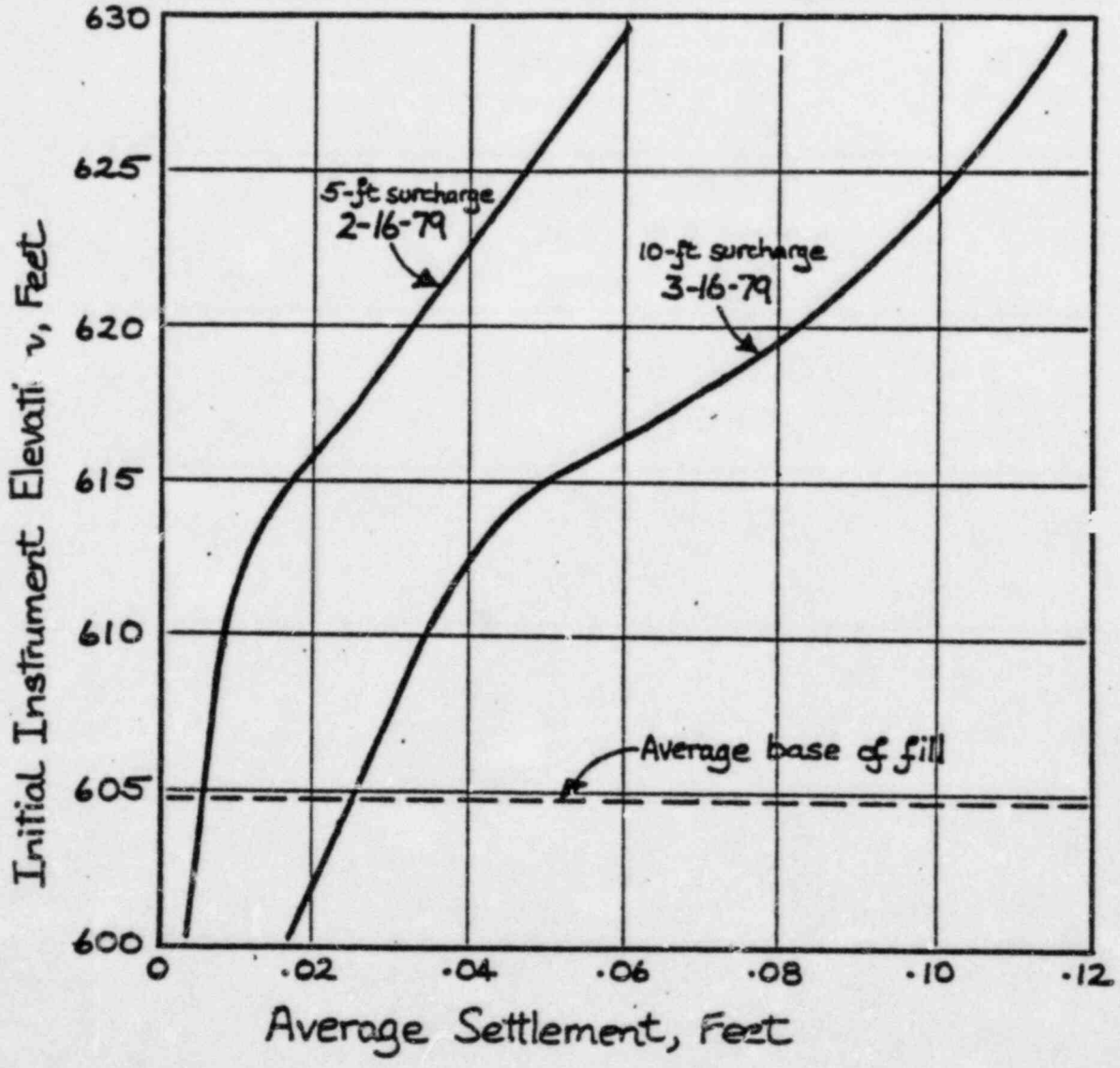
DIESEL GENERATOR BUILDING: AVERAGE SETTLEMENT VS. SURCHARGE-TIME



DIESEL GENERATOR BUILDING

BORROS ANCHORS & SETTLEMENT PLATFORMS

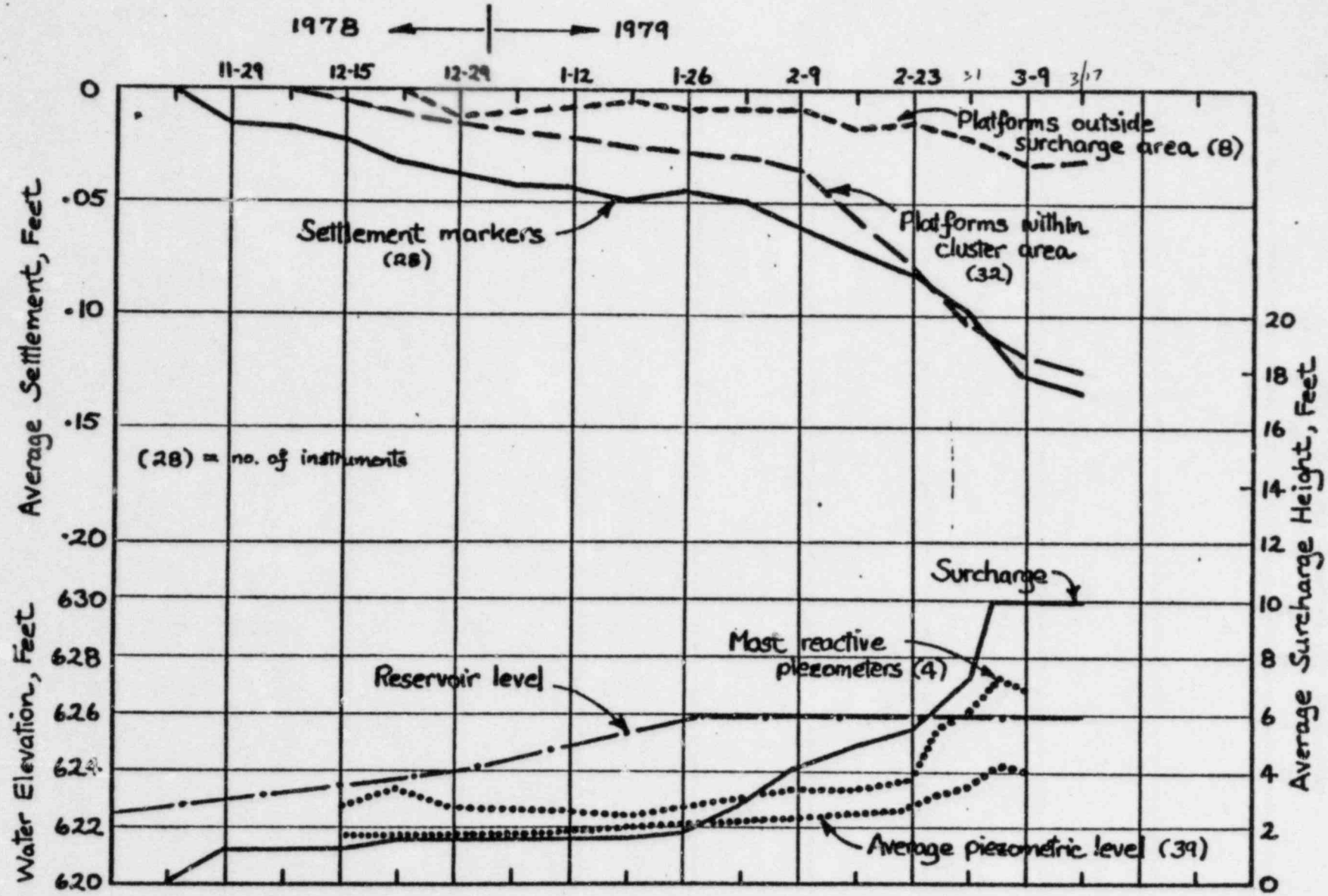
SB 19546



DIESEL GENERATOR BUILDING

BORROS ANCHORS & SETTLEMENT PLATFORMS

SB 10547

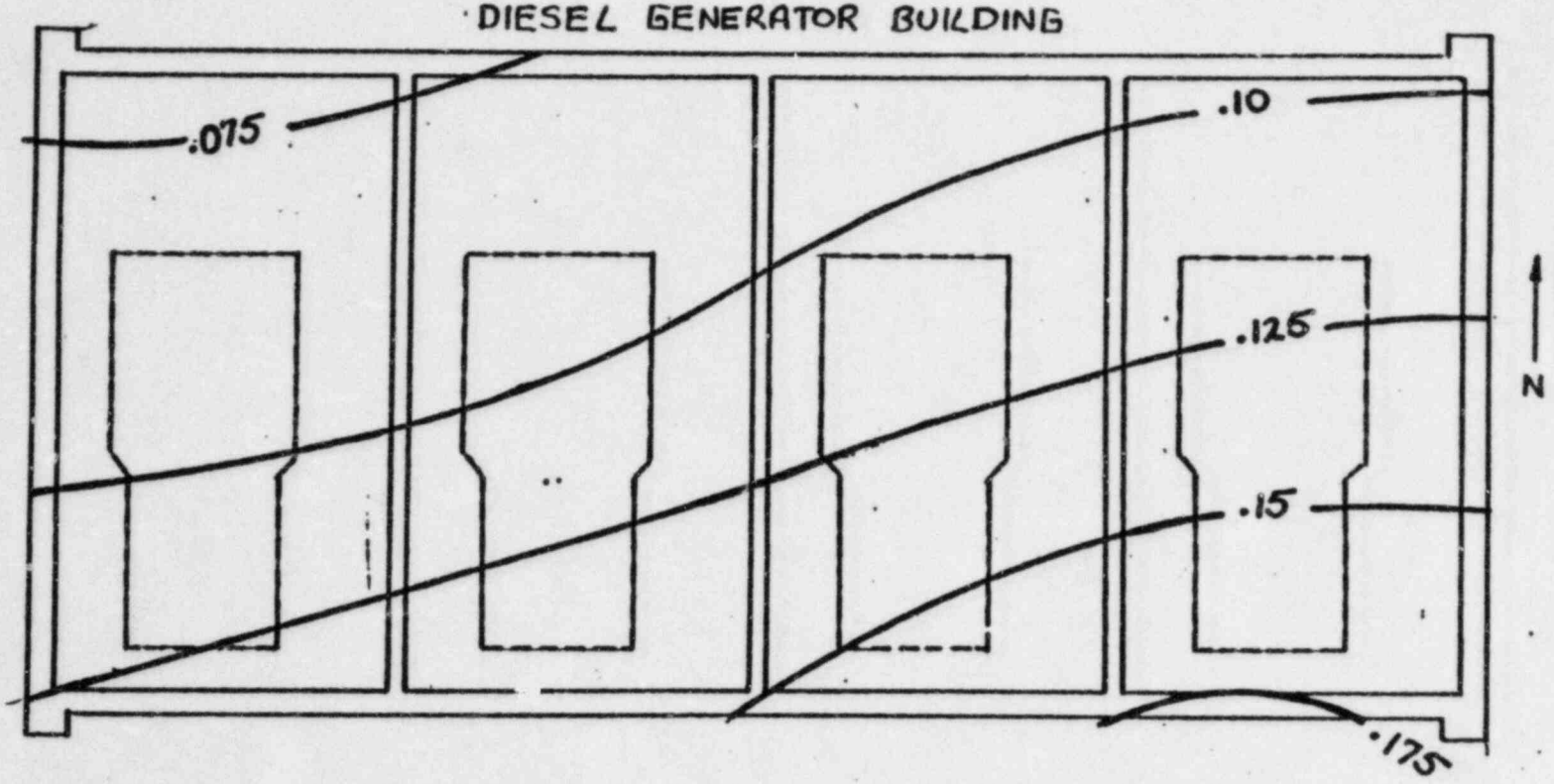


DIESEL GENERATOR BLDG: AVG SETTLEMENT, SURCHARGE & WATER LEVEL VS TIME

SB 19548

SB 19549

DIESEL GENERATOR BUILDING

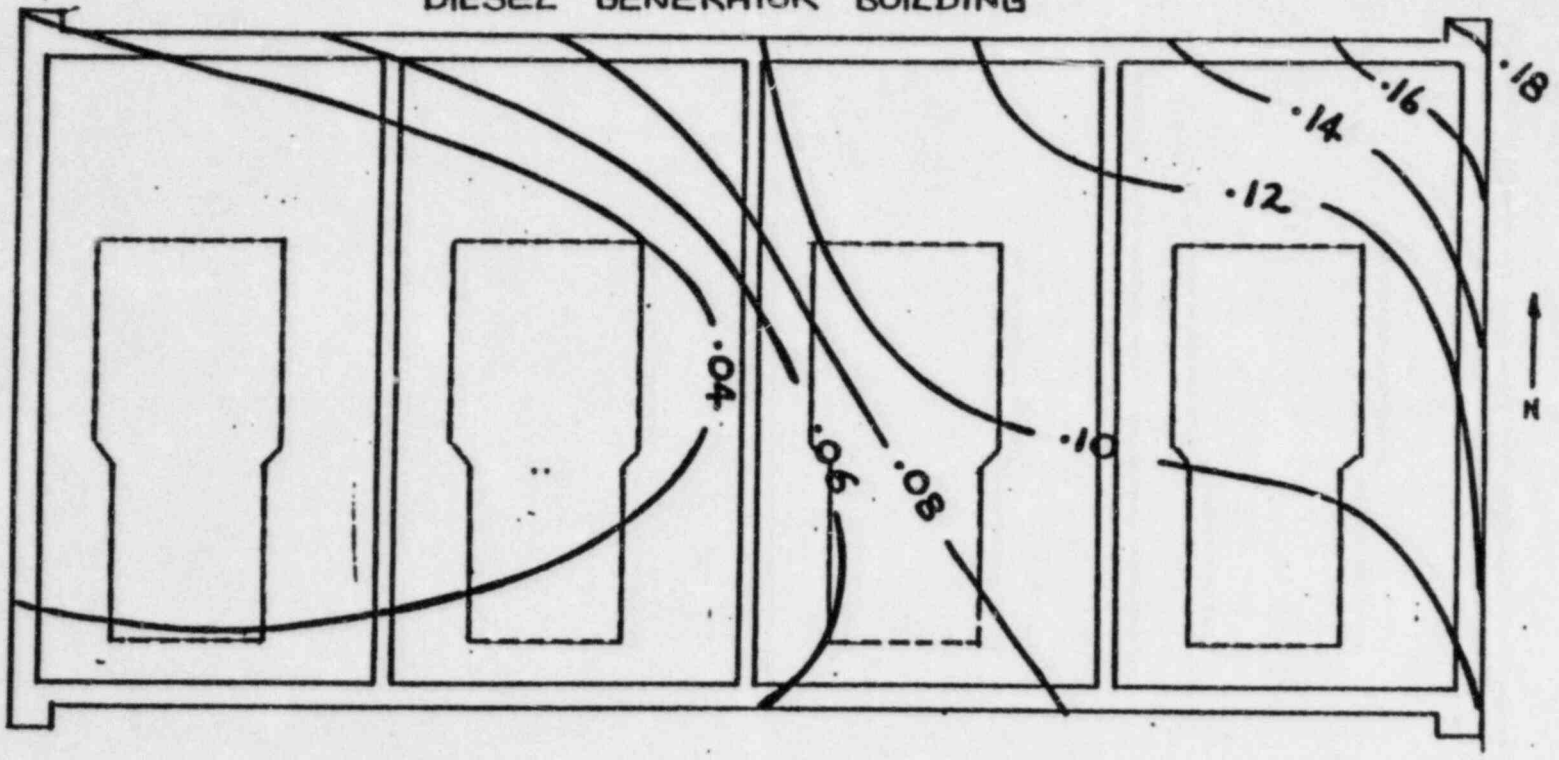


SETTLEMENT MARKERS : DIFFERENTIAL SETTLEMENT, 12-8-78 to 3-16-79

Readings in Feet ; 950 psf Surcharge added in Period

BUILDING WALLS & PEDESTALS

DIESEL GENERATOR BUILDING



SETTLEMENT MARKERS : DIFFERENTIAL SETTLEMENT, 9-15-78 to 12-8-78

Readings in Feet ; Electrical Ducts Isolated in Period

BUILDING WALLS & PEDESTALS

Bechtel Associates Professional Corporation

Inter-office Memorandum

To S. Afifi

Subject Soils Compaction Equipment

Date August 1, 1980

From L.H. Curtis

Of Engineering

At Ann Arbor

File 0294

Copies to [redacted] (all w/a)
S. Blue
B. Dhar
M. Elgaaly
W. Ferris
E. Hughes
E. Rumbaugh
J. Rutgers
J. Wanzeck
K. Wiedner

Please prepare a complete response to the attached letter. In addition to addressing items 1 through 5 of the letter, also please address circled sentences numbered 6, 7, and 8.

Please answer these questions in a form that can be readily included in a letter to Consumers Power Company. The preferred form of response is a memorandum from you to me, referring to this memorandum and the CPCo letter, with an attachment listing and repeating each question, verbatim, followed by the response.

In the attached letter, Mr. Cooke states that he wants all questions resolved prior to resumption of Q-listed backfill. Since this is a schedule-critical item, please respond as soon as possible, on a high-priority basis.

L.H. Curtis

L.H. Curtis

LHC/mmb

Attachment: CPCo letter Serial CSC-5183, 7/24/80

Written Response Requested: Yes

SB 18702

7-31-80

Midland Project: P.O. Box 1963, Midland, Michigan 48640 • (517) 631-0961

JOB 7220

	ACT	INFO	ORIG
PROJ ENGR			✓
ASST PE DES PROD			✓
ASST PE ?			✓
ASST PE ? Jim C			
ASST PE L&S			
ASST PE PAC			✓
ASST PE PES			✓
LIC & SAFETY			
MECH			
NUC SYSTEM			
PLANT DES			
ELECT			
CNTL SYS			
CIVIL/STRUCT			✓
ARCH			
QE			
CTR/SUBCON PL			
ENGNG MGR			✓
PROJ MGR			
PROC MGR			
PRIME: K. Wieland			✓
CONST COORD			✓
S.A. Li	✓		
ADMIN			✓
J. Wan Beek			
FILE NO			

P/SE Engineer. ASNP. INC

July 24, 1980

Mr. L. H. Curtis
Bechtel Power Corporation
P.O. Box 1000
Ann Arbor, MI

MIDLAND PROJECT GWO 7020 - SOILS PLACEMENT RESUMPTION
File: 0485.16 UFI: 00234(S), 71*01 Serial: CSC-5183

As you are aware the field is attempting to expedite implementation of the resolution of various audit findings in order that soil-placement may continue this year during the good weather. Based on conversations with various Bechtel field personnel, it is my understanding that Bechtel Engineering is now placing equipment speed and frequency requirements in the specification, to be checked at the site. If this is the case, I have several questions as noted below:

1. Is this requirement being placed on all equipment or just specific pieces of equipment?

2. Are there any other sites where this requirement is being implemented across the board?

3. Are there sites other than Bechtel that are required to produce this data?

4. Considering the fact that a properly maintained piece of equipment should have acceptable frequency characteristics and a knowledgeable operator, especially one who is limited by the specific location the equipment is being utilized, should know how to operate this piece of equipment, (This is further augmented by the fact that generally tests verify the end result), what value will be received for the additional effort expended?

5. If Engineering deems this to be a requirement, do we have written verification that this requirement was augmented during the test pad/ equipment activities, or was this left up to the judgement of the witnessing GeoTech Engineer at the time?

6. In summary, this new requirement, if placed on the site, would be an expensive burden and time consuming. I have a desire to know whether or not there are any benefits to be obtained from a standpoint of the quality of the end

SB 18703

product or enhancement of schedule. Furthermore, I am curious to know how we will relate to work done in the past if it is now deemed to be appropriate to place this requirement in the Spec. In other words, if it is necessary, why didn't we do it before and how can we say that the past work is satisfactory. I would appreciate your response at your earliest convenience, since it is my desire to have all questions resolved prior to resumption of Q-listed backfill without future interruptions on the appropriateness of the specification requirements.

T. C. Cooke
Project Superintendent

TCC/sd

CC: WRBird, CPCo
DEHorn, CPCo
DBMiller, CPCo
JARutgers, Bechtel
GSKeeley, CPCo

Bechtel Associates Professional Corporation

Inter-office Memorandum

K. D. B.
APR 30 1980
A G

To L. H. Curtis

Date 22 April 1980

Subject Midland Units 1 & 2-Job 7220
Consultant Services
on Plant Fill (S-173)

From S. S. Afifi

Of Geotechnical Services

Copies to S.L. Blue
P. K. Chen
B. Dhar
J.O. Wanzeck
K. Wiedner
1320, 2140

At Ann Arbor 10D5
7220-80-122

RECEIVED
APR 23 1980
BECHTEL
A.A. 7220

REFERENCES: 1. Letter from L. S. Rubenstein (NRC) to S.Howell (CPCo) dated April 1, 1980

2. IOM from B. Dhar to J. O. Wanzeck dated April 10, 1980

Attached you will find a description of services to be performed by consultants R. B. Peck, A. J. Hendron, Jr., C. H. Gould, M. T. Davisson and R. Loughney on plant fill as requested in Reference 2 and outlined in Reference 1.

A copy of this information was hand carried to S. Lo of project on April 21, 1980.

Jowanzeck /For SSA
S. S. Afifi

JOW/lap
Attachment

JOB 7220

	1
ASST PE T	✓ 4/28/80
ASST PE P	
ASST PE F	
FIELD	
CONST COORD	
FSAR	
ADMIN	
FILE NO	D50 C670.2

SB 18724

R. B. Peck and A. J. Hendron, Jr.

1. Continue to review results of field settlement measurements.

2. Review approaches to settlement evaluations.

3. Review FSAR subsection pertinent to the fixes such as surcharging, underpinning and permanent dewatering.

4. Participate in evaluating results of field measurements to be taken during and after installation of the permanent dewatering system and results of load tests on caissons to be conducted during underpinning.

5. Make periodic visits to the site to observe construction operations.

M. T. Davisson

1. Reviews the technical specifications for furnishing, installing and testing closed end pipe piles for the service water pump structure.

2. Observes pile load testing and reviews the pile load test data.

3. Makes periodic visits to the site to observe pile installation procedures, review pile driving records, and inspection reports.

R. W. Loughney

1. Reviews the design of the permanent dewatering system being performed by Bechtel.

2. Reviews the technical specifications for installation of the system.

3. Makes periodic visits to the site to observe the permanent dewatering system installation.

4. Reviews construction inspection reports.

5. Reviews results of performance tests made on the permanent dewatering system after installation.

C. Gould

1. Reviews the technical specifications for underpinning of the auxiliary building.

2. Reviews the design details to be submitted by the subcontractor.

3. Instruct the inspectors on what to lock for in inspecting construction activities and in understanding the specifications.

4. Makes periodic visits to the site to review construction activity and field inspection records.

5. Reviews results of field installation load tests to be performed on the caissons.

FIELD CHANGE REQUEST

PAGE 1 OF 1

No. 201

PROJECT NO. 7220

O No. 1.002

3. DATE MO 10 DAY 4 YR 74

1. REF. SPEC. OR SPEC. C-210 REV. 3

5. TITLE Plant Fill

6. INITIATION ENGRG ☒ VENDOR ☐ (IDENTIFY) NAME

7. EXISTING CONDITION Plant fill material as specified in Exhibit "D" of 7220-C-210

8. CHANGE REQUEST / SKETCH

Natural water seepage has been experienced on the ramp leading down to the west side of Containment #1. In order to stop this flow, a mixture of cement and existing soils is proposed to be placed for a depth of approximately 3 inches in the area involved. This material will then be covered by plant fill as originally specified.

This request is only for this one location and its sole purpose is to allow for continued effective work in the plant area until such time as the plant fill is completed in its entirety.

The above mixture will be compacted and placed to the same requirements as is the rest of the plant fill. The cement by volume will be approximately 10%.

Approximately 75 cubic feet of cement will be needed for this work.

SB 18926

10. REVIEWED BY:

CIVIL Richard Drake Date 10-4-74

ELECT. Eric Kaya 10-4-74

MECH. [illegible] 10-4-74

WELDING [illegible] 10-4-74

9. PREPARED BY: James Sandifer

11. APPROVAL OF FIELD DISPOSITION:

[illegible] Project Field Engineer 10-7-74 Date

12. PROJECT ENG'R'G APPROVAL YES ☐ NO ☐ PROJ. ENGR.: [illegible] 11-20-74

REMARKS: [redacted] This FCR, when signed by project and C.A. will be filed in the [illegible]

WHITE - PRINT COORDINATOR

[illegible]

QC - 2 FCR REV 2 1-77

To [redacted] A. Maz[redacted]

Date [redacted], 1974

Subject Job 7220 Midland Project
Structural Backfill
Specification 7220-C-211
BCBE 319

From E. E. Felton

Of Construction

At Midland, Michigan

Copies to R. L. Rixford
J. H. Allen

During April, 1974, civil procedure C-301 was replaced by Specification 7220-C-211, Rev. 0. At this time the field requested that a finer cohesionless and free draining material than that specified be considered; i.e., a material with 95-100% passing the #40 sieve. Reasoning for this was that the finer material is locally available within five miles from the jobsite as compared to twenty miles or more for the material specified and is available at a much lower cost. Some concern existed on possible liquefaction of this material and because of the time needed to fully test and evaluate it, the finer material was denied.

The field would like to continue to pursue this material. Please inform us of the testing required.

[redacted]

E. E. Felton

EEF/RAG/kt

Midland Units 1 & 2
Bechtel Job 7220-001
4 April 1974

TRIP REPORT

DATE: 29 March 1974

LOCATION: Midland Jobsite

ATTENDEES: S. S. Afifi

SUBJECT: Examine Progress of Drilling and Testing Program

DISCUSSION

The purpose of this trip was to examine the progress of the drilling and testing program in connection with the quality control of the dike construction.

Most borings recommended in the north plant dike area were complete. Jim Wanzeck estimated that the remainder of the drilling in the dike will be complete by the end of the week of April 1. Testing was already in progress. Everything appeared to be under control. Based on results available at the time, it was evident that only a low percentage of tests did not satisfy the required compaction criteria.

SSA:mbh

SB 18985

Bechtel Associates Professional Corporation

Inter-office Memorandum

C-208 PR

To R. A. Martinez

Date 28 January 1974

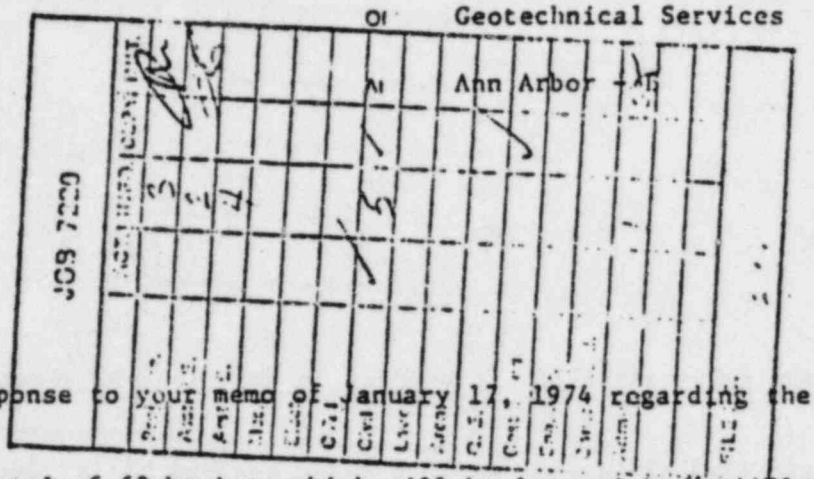
Subject Earthwork Testing Frequency
Job 7220

From J. H. Allen

Of Geotechnical Services

At Ann Arbor - M

Copies to S. S. Afifi
R. Rixford
R. K. Sullivan
1320,3410
C-210, C-208



This is in response to your memo of January 17, 1974 regarding the above subject.

We propose a total of 63 borings which will be located in West Plant Dike (ST 00 + 00 to 05 + 37), North Plant Dike (ST 00 + 00 to 10 + 13), and Northeast Plant Dike (ST 26 + 35 to 32 + 92).

Boring locations, depth of borings and required tests from each boring are shown on the attachment. This information was previously discussed with your group and transmitted informally.

We estimate the program to cost about $30,000. Drilling can be completed in approximately four week. Testing will go parallel with drilling and should be completed within an additional six weeks.

We see primarily two alternatives to proceed with the program: 1) going for bidding for both drilling and testing, and 2) requesting Raymond to perform the drilling and U.S. Testing to go ahead with the laboratory testing. The first alternative involves a delay of approximately one month. In any case, we feel that drilling and testing should be made with Geotech's supervision.

We hope this information answers your questions. We would appreciate hearing from you as to how you would like us to proceed.

J. H. Allen

SSA:mbh
S.A
Attachment

SB 18987

(C)

DATE

SIGN BY Martin M. DRAGICEVIC DATE 12-10-73 CHECKED BY SHEET NO 1

PROJECT MIDLAND NUCLEAR UNIT, UNIT 1&2 JOB NO 7220-C-710

SUBJECT SUMMARY TEST BORING LOCATIONS - P.C. LISTED PLANT AREA FILL FILE NO

DIKE	Number Test borings zone (1)	Number Test borings zone (2)	Total Number Test borings	Number U-tests zone (1)	Number U-tests zone (2)	Total U-tests	Total Number S.T. Penetrations
TEST PLANT DIKE	4	2	6	28	16	44	24
NORTH PLANT DIKE	20	16	36	254	266	520	298
NORTHEAST PLANT AREA (1)	11	10	21	51	75	126	31
TOTAL	35	28	63	333	357	690	353

NOTE: TEST-PIT SUBSTITUTION FOR T.Bs. AT NORTHEAST DIKE (PLANT AREA FILL) IS ANTICIPATED, EITHER FOR ZONE (1) OR ZONE (2) MATERIAL

SB 18988

DATE _____

Main Training DATE 1/19/73 CHECKED BY _____ SHEET NO 7

Hibbard Mystic ... JOB NO 7720-C-710

Cost Estimations - Restraint Theory - Q.C. Listed Area Fill FILE NO _____

	ZONE I MATERIAL			ZONE II MATERIAL			GRAND TOTAL FOOTAGE
	Number borings	Number feet per boring	Total footage	Number borings	Number feet per boring	Total footage	
West Plant Dike	4	14	56	2	14	28	84
North Plant Dike	20	15	300	16	19	304	604
N.E. Dike (Mantissa only)	11	5	55	10	12	120	175
TOTAL	35	—	411	28	—	452	863

Note: Above listed total footage is based on assumption that drilling will start from elevations as follows:

Dike	Elevation
West Plant Dike	624±
North Plant Dike	624±
N.E. Dike (Mantissa only)	617±

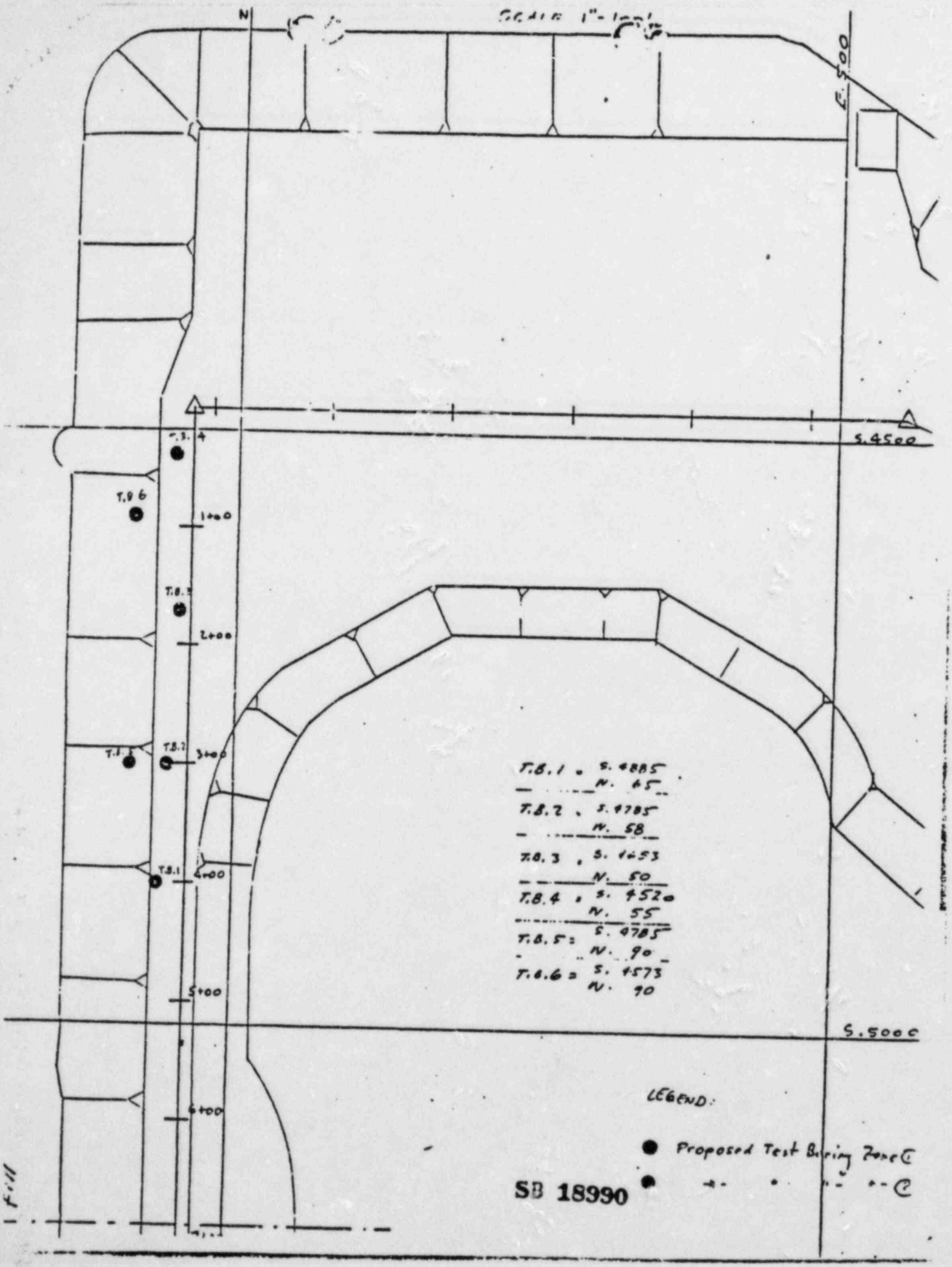
Assumed: a) Cost per linear foot = $25.00 (Includes moving the rig from boring to boring, drilling, sampling, Shelby tubes w/handling, labor cost, mobil. & demob, tests)

b) Time of performance = 40 feet/day/rig

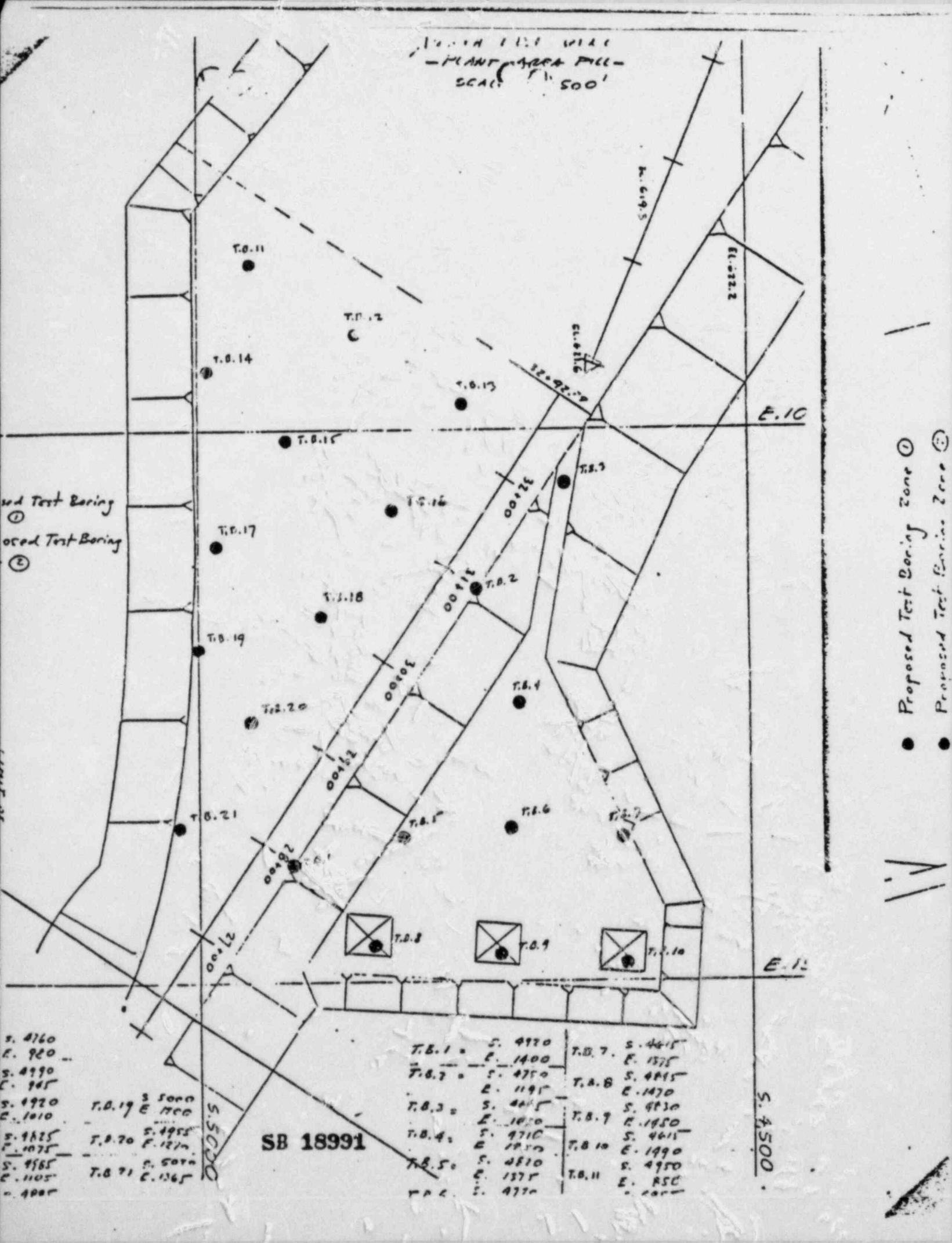
TOTAL COST = 863 x 25 = $21,575

ENGINEER TIME = 21.6 SAY 22 working days/rig

SB 18989


N
Scale 1"-100'
E. 5000
S. 4500
S. 5000
T.B. 4
T.B 6
1+00
T.B. 5
2+00
T.B. 3
3+00
T.B. 2
T.B. 1
4+00
5+00
6+00
T.B.1 . S. 4885
N. 45
T.B.2 . S. 4785
N. 58
T.B.3 . S. 4453
N. 50
T.B.4 . S. 4520
N. 55
T.B.5 = S. 4785
N. 90
T.B.6 = S. 4573
N. 90
LEGEND:
Proposed Test Boring Zone
Fill

SB 18990


—PLANT AREA FILL—
SCALE 1" = 500'
T.B.11
T.B.12
T.B.14
T.B.13
T.B.15
T.B.3
T.B.16
T.B.17
T.B.2
T.B.18
T.B.19
T.B.4
T.B.20
T.B.21
T.B.5
T.B.6
T.B.7
T.B.8
T.B.9
T.B.10
E.10
E.11
S.5000
S.4500
Proposed Test Boring Zone ①
Proposed Test Boring Zone ②
T.B.1 S. 4970 E. 1400
T.B.2 S. 4750 E. 1195
T.B.3 S. 4415 E. 1070
T.B.4 S. 4710 E. 1370
T.B.5 S. 4810 E. 1375
T.B.7 S. 4415 E. 1375
T.B.8 S. 4915 E. 1470
T.B.9 S. 4930 E. 1950
T.B.10 S. 4615 E. 1990
T.B.11 S. 4950 E. 850
T.B.19 S. 5000 E. 1100
T.B.20 S. 4955 E. 1270
T.B.21 S. 5070 E. 1365
SB 18991

TRIP REPORT

DATE: September 27-30, 1977

LOCATION: Midland Units 1 & 2
Midland, Michigan

SUBJECT: Structural Backfill Investigation Borings

ATTENDEE: J. B. Givens - Geotech-Soils

During the four day drilling program, four holes, L_N, H_T, E, and D, were drilled through the backfill. In addition, three shallow holes, L_{NA}, L_{NB}, and H_{TA}, were drilled to obtain bulk samples for compaction tests. The boring logs are attached.

Split spoon samples were placed in sample jars and hand carried to Ann Arbor. Tube samples and bulk samples were taken to the U. S. Testing Soils lab at the site, and the assignments listed on the attachment were given to John Speltz, of U. S. Testing. I told John to report the results to us and Jerry Morris, Bechtel field engineer, as soon as possible. John said that results should be expected the week of October 3.

Daily field reports were completed by Curry Long, Bechtel subcontracts, with my input at the site.

Jerry Morris told me that Bechtel plans to excavate the fill under the administration building footings being investigated to Elevation 613 and replace the excavated material with lean concrete. He also told me that the CMP that was found in the south end of the excavation will be cut off and plugged prior to backfilling.

JBG/lag
Attachment

Bechtel Associates Professional Corporation

Inter-office Memorandum

To	R. L. Castleberry	Date	4 November 1977
Subject	Midland Units 1 & 2-Job 7220-301 Piezometer Monitoring Program	From	S. S. Afifi
		Of	Geotechnical Services
Copies to	S. L. Blue P. K. Chen R. Rixford G. Tuveson [redacted] 1320, 3410	At	Ann Arbor 10(D)5 7220-77-132

REFERENCE: IOM, 7220-C77-0170, dated October 24, 1977, from R. L. Castleberry to S. S. Afifi

In response to your reference IOM, a preliminary technical specification for installation of piezometers in the cooling pond dikes has been transmitted to R. Rixford on October 24, 1977. The estimated subcontract lump sum is about $30,000 on actual time spent plus material cost basis.

We recommend that Bechtel field provide surveying for the piezometer locations and working pads on slopes as needed.

S. S. Afifi

pkc
PKC/lag

SB 19694

GEOTECH
DISTRIBUTION
DRAFT
SOILS 2
CEOL
H&H 1
HH5/GREXC
Proj Engr
JOB 7220 FILE 3990
REC'D NOV 21 1977

TELECOPY TO: G. THYESON

SUBJECT Report on failure of grade beam @ 0.4 line - Administration Building.

I DESCRIPTION OF CONDITION

By routine survey check of August 23, 1977, the top surface at col line on the north end of subject grade beam was found to be 3½" below its design elevation. The south end of the beam at its tie into the steam tunnel wall was at its design elevation, however, there was approximately ½" separation between the beam and the wall. The beam was not structurally cracked. Soil conditions at the time of the failure were per the attached sketch. There was no visible evidence of soil heaving, cracking, sluffing, or water flow at any point on the 3:1 slope to the north of the subject beam, nor was there any visible soil disturbance on either side of the beam looking from the top.

To confirm that the beam was not incorrectly surveyed originally the beam was surveyed again the week of August 29. Additional settlement of approximately ½" was noted and the beam was approximately ½" out of plumb, leaning to the west.

No settlement was found from surveys of all other administration building footings and the steam tunnel walls.

SB 19695

II INITIAL EVALUATION OF FAILURE

After evaulation of the conditions by both Field and Project Engineering, it was determined that the 0.4 line foundation could not be economically stabilized and reinforced

CALCULATION SHEET

DESIGN BY F. T. AGUE DATE 11/21 CHECKED BY

PROJECT MIDLAND 7720

SUBJECT ADMIN BLDG - SOIL CONDITIONS

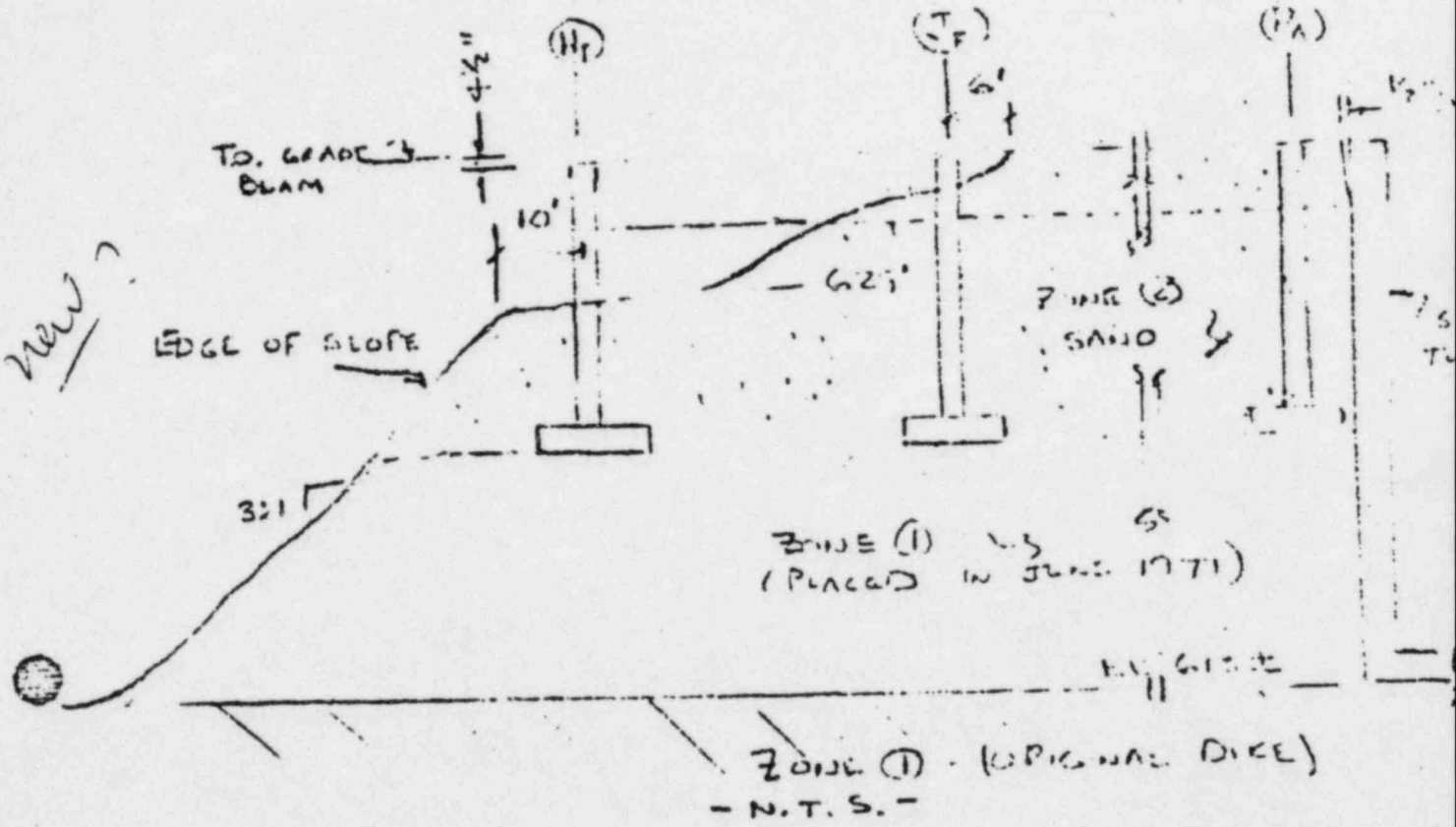
DATE

SHEET NO

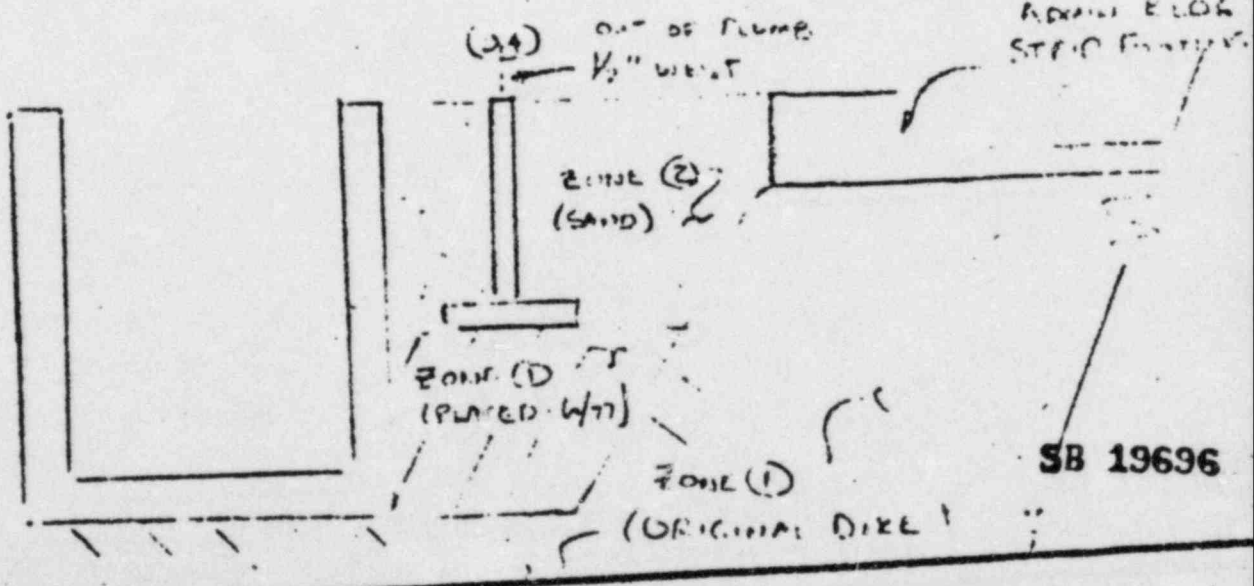
JOB NO

CALCULATION NO

FILE NO



SECTION THRU O-1 LINE - LOOKING EAST



SB 19696

Because the cause of the failure was not apparent from the facts at the time of discovery, it was determined that additional testing and observations would be required during removal of the beam to determine the cause and the best method of replacement.

III RESULTS OF TESTING

A) Original Material Testing

Attachment #1 includes the reports of the in place density tests taken during placement of the zone 1 (clay) material under the footings in June 1977. This material was from a Field stockpile which includes material taken from many excavations into the dike and different areas of the plant as well as other approved sources. The differences in grain size, texture and other structural properties of this material account for the fact that the Bechtel modified Procter tests taken in different locations of the stock pile range in optimum dry density from 117 lb/ft^3 to 132.9 lb/ft^3. The proctor maximum dry density value was selected by the testing technician using bottled samples of each relevant procter in the lab for visual comparison to the compacted sample. New procter tests were run by the test lab when ever a new or questionable material was encountered. A new proctor test was also run for a minimum of every 10,000 yards of compacted fill placed. As new tests were taken, old samples were disposed of.

The results of all tests taken in the fill under the 9.4 line footing indicate that the material was properly compacted to 95% of optimum d Several tests in the area failed originally, however, all failing le were re-conditioned and re-compacted and all were re-tested and foun acceptable, prior to continuing removal.

B) Material Testing and Observations During Footing Removal

(September 1977) There were several rains and almost continuous surface water.

The investigation program called for removal of all Zone 2 (sand) and the Zone 1 placed in June of 1977 (see sketch #1). Slope protection using plastic mats and de-watering was continuously maintained during excavation to protect the adjacent zone 1 material (placed prior to 1977) and the remaining administration building footings supported by that fill. Surveys run during and after the footing removal on adjacent footings and steam tunnel walls indicated no settlement or disturbance of those structures.

The zone 2 material, a free draining sand material, did not show visual evidence of disturbance or movement throughout its depth. The mud mat under the footings, for the few which could be cleaned prior to break-up and removal did not show structural cracking.

The zone 1 (clay) material placed in June 1977 below footing to elevation 614 was tested at each footing location at varying elevations by taking field density test and corresponding moisture tests (see attachment #2). The material was moist and easily penetrated by hand probing with a ½" rod. Field density and moisture tests in accordance with ASTM D-1556 during material removal were done using current proctor maximum densing optimum moisture information (which was probably not appropriate as the fill was placed 3 to 4 months before the tests). The fill was found to fail specification requirements in either moisture or densi-

SB 19699

modified procter curve was then run on a sample of this material (see attachment #3) using this procter as standard the in place density of this material (average = 117 lb/ft³) averaged 99% of the optimum compaction density. Of the 15 tests taken, 4 showed density below the above average compaction and one test was below 83% of the optimum compaction density.

Six unconfined compression test (ASTM D-2166-66) were run between elevation 614 I and Elevation 622" in this material during footing removal. (See attachmetn #4) The minimum unconfined bearing strength (q) is 5 Kips/sq. ft. The co-efficient of cohesion (c) is C = .25 k/ft². and the ultimate bearing capsity is approximately [illegible]

Test borings were taken at two locations column line 0.4 and L.4, and 0.4 and HT after footing removal and prior to removal of the zone 1 material below the footing at elevation 622'. The boring machine utilized a 2" split shelby spoon and was capable of constant sampling. Sampling and testing conducted in accordance with instructions from a Bechtel Geo. Tech. Representative. Testing included standard blow counts, unconfined compression tests and procters boring logs and tests results are attachment #4. The low bearing capasity of zone 1 material placed in June of 1977 was confirmed both by blow counts and unconfined compressions tests or this material. The borings extended into the original glacial till at approximate elevation 590' ±. The results of blow counts in the dike material below elevation 614 indicated that material was sound and suitable for foundation. Further proc and Field density testing of the material below elevation 614 indic

SB 19700

IV ANALYSIS

It is evident that the low bearing capacity of the zone 1 material placed in June of 1977 between elevation 614 and 622 is the cause of this failure. If the unconfined bearing is taken to be : $T_c = .5$ kips/ft² and $T_w = 1$ T/ft² the 12 feet of sand overburden on the footings (Approximately 12 Ft Depth @ 120 #/ft = 1440 #/ft²) would overstress this material.

The cause of the reduced bearing capacity of this material cannot be conclusively established. The materials high moisture content apparently contributed to the reduced bearing capacity. When capacted to 95% of the optimum density this material is relatively impervious to water and even when saturated, it would allow a maximum of about 15% moisture.

It would be changed to $C = 0.2$ kips/ft² if at max density

Not clear

The questionable material had a higher maximum density than the maximum density selected by the testing technicians for comparison of in place densities, which resulted in ~~a average~~ an average actual compaction of 90% rather than the required 95%. Although the reduced in place density should not directly result in such settlement under dry conditions. It did contribute in some measure to increased water permeability of the soil. Considering the unusually wet conditions after this material was placed and the possibility that ground water seepage was introduced into the material in question, it is also possible that the slope to the north of these footings softened and failed. As indicated previously in this report, there was no visable evidence of such failure, and the 3:1 slope should have been adequate enough to sustain the fill; however, under conditions of reduced internal soil strength, this condition might have contributed to the problem. Vibration introduced by compaction equipment used to place the [illegible]

this would not affect soil under footings if kept moist after placement

D

(sand) above the questionable material also contributed to the proble-.

In summary, although no single factor was found to be the definitive cause, the low bearing capasity of the material directly below the footings resulted in the failure. As borings and tests on the surrounding materials indicated they were suitable for foundation, removal of the questionable material was determined to be the appropriates solution of the proble-.

To further assure that existing footings in the ad-inistration buildin were not disturbed by the removal and replacement of the 0.4 line footings, a load test of the footings on column lines P.4 and N.L was conducted in accordance with ASTM D1194-72. The full design load was applied and maintained for the 24 hours on each footing. Results of the tests (attachment #5) were reported to Project Engineering and were found accentable.

SB 13701

ADMINISTRATION BUILDING FOUNDATION LOAD TEST

STRIP FOOTER AT COLUMN LINE Mk

Date of Test: 11/11/78

Monitored By: D. BILLINGS
J. KERCHER
SURVEY: SMITH,
FRIMODIG, DURHAM

Weather Conditions: OVERCAST

Temperature at Time of Incremental Loading: 30°

Remarks: (1) NO PROBLEMS ENCOUNTERED WITH SHIM SETTLEMENT OR STABILITY OF SURVEY POINTS
(2) SURVEY CREWS CHANGED SHIFTS BETWEEN 3 AND 4 HOURS AFTER START OF TEST, AND AGAIN FOR THE FINAL READING.

SB 19702

ADMINISTRATION BUILDING FOUNDATION LOAD TEST

STRIP FOOTER AT COLUMN LINE Nk

Time (Hrs.)	Column Line 0.9 Actual Load (Tons)	Gauge Reading (psi) Req'd.	Gauge Reading (psi) Actual	Top of Pier Elevation (Ft.)	Column Settlement (In.)	Column Line 0.6 Actual Load (Tons)	Gauge Reading (psi) Req'd.	Gauge Reading (psi) Actual	Top of Pier Elevation (Ft.)	Column Settlement (In.)
			Top of Angle Bar 106						Top of Angle Bar 106	
1:30 PM 0	0.0	0	0	634.211	0	0.0	0	0	634.182	0
1:40 PM 0.00 - 0.25	9.3	450	450	634.213	0	15.5	750	750	634.182	0
1:55 PM 0.25 - 0.50	18.6	900	900	634.213	0	29.9	1450	1450	634.180	1/32
2:15 PM 0.50 - 0.75	28.9	1400	1400	634.213	0	45.4	2200	2200	634.180	1/32
2:35 PM 0.75 - 1.00	38.2	1850	1850	634.213	0	59.8	2900	2900	634.180	1/32
2:40 PM 1.00 - 1.25	48.5	2350	2350	634.212	1/64	75.3	3650	3650	634.180	1/32
3:00 PM 1.25 - 1.50	57.8	2800	2800	634.212	1/64	89.7	4350	4350	634.180	1/32
3:15 PM 1.50 - 1.75	67.0	3250	3250	634.213	0	105.2	5100	5100	634.179	1/32
3:30 PM 1.75 - 2.00	76.3	3700	3700	634.214	0	119.6	5800	5800	634.178	1/32
3:45 PM 2.00 - 2.25	86.6	4200	4200	634.213	0	135.1	6550	6550	634.176	5/64
4:00 PM 2.25 - 2.50	95.9	4650	4650	634.212	1/64	150.6	7300	7300	634.177	5/64
4:15 PM 2.50 - 2.75	105.2	5100	5100	634.212	1/64	165.0	8000	8000	634.178	1/32
4:30 PM 2.75 - 3.00	115.5	5600	5600	634.213	0	180.5	8750	8750	634.176	5/64
5:30 PM 4.0	115.5	5600	5100	634.212	1/64	180.5	8750	8750	634.177	5/64
9:04 PM 5.0	115.5	5600	5500	634.212	1/64	180.5	8750	8700	634.180	1/32
6.0	115.5	5600	5500	—	—	180.5	8750	8750	—	—

SB 19703

[redacted] ELEVATION BUILDING FOUNDATION LOAD TEST

STRIP FOOTER AT COLUMN LINE Nk

Time (Hrs.)	Column Line 0.0 Actual Load (Tons)	Gauge Reading (psi) Req'd.	Gauge Reading (psi) Actual	Top of Pier Elevation (Ft.)	Cumulative Settlement (In.)	Column Line 0.6 Actual Load (Tons)	Gauge Reading (psi) Req'd.	Gauge Reading (psi) Actual	Top of Pier Elevation (Ft.)	Cumulative Settlement (In.)
7.0	115.5	5600	5550	—	—	180.5	8750	8700	—	—
*										
12:02 AM 12.0	115.5	5600	5600	634 212	1/64	180.5	8750	8750	634 174	3/32
7:30 AM				634 212	1/64				634 172	1/8
1:30 AM 24.0	115.5	5600	5600	634 208	1/16	180.5	8750	8750	634 173	1/8
24.0	0.0	0	0	634 213	0	0.0	0	0	634 175	5/64
					Permanent Deflection (0")					Permanent Deflection (5/64")

* Record Additional Readings Below If Required.

(Elev should be acc. to ± 0.005)

SB 13704

ADMINISTRATION BUILDING FOUNDATION LOAD TEST

STRIP FOOTER AT COLUMN LINE Pa

Date of Test: 11/8/77

Monitored By: D. BILLINGS
J. KELLEHER
SURVEY: SMITH,
KIMOCK, DURHAM

Weather Conditions: LIGHT RAIN / FOG

Temperature at Time of Incremental Loading: 55°

Remarks: (1) JACKS AT COLUMN LINE 0.6 WERE SHIMMED WITH STACKS OF THIN PLATES WHICH WERE THE CAUSE OF AT LEAST 1/4" OF SETTLEMENT READING (ELEVATIONS WERE TAKEN FROM TOP OF SHIM PACK). (2) FAULTY PUMP NECESSITATED UNLOADING OF COL. LINE 0.6 AFTER 18.5 TONS HAD BEEN APPLIED. PUMP WAS REPLACED AND LOAD RE-APPLIED WITHIN 5 MINUTES [illegible] AFTER START OF TEST AND BEGIN TAKE THE FIRST READINGS.

SB 13705

ADMINISTRATION BUILDING FOUNDATION LOAD TEST

STRIP FOOTER AT COLUMN LINE Pa

Time (Hrs.)	Column Line 0.9 Actual Load (Tons)	Gauge Reading (psi) Req'd.	Gauge Reading (psi) Actual	Top of Pier Elevation (Ft.)	Cumulative Settlement (In.)	Column Line 0.6 Actual Load (Tons)	Gauge Reading (psi) Req'd.	Gauge Reading (psi) Actual	Top of Pier Elevation (Ft.)	Cumulative Settlement (In.)
AT 11:45 AM				Top of Spin-jack					Top of Marker Bar	
0	0.0	0	0	635.067	0	0.0	0	0	634.177	0
.00 - 0.25	9.3	450	600	635.049	7/32	15.5	750	800	634.173	3/64
.25 - 0.50	18.6	900	900	635.047	15/64	29.9	1450	1500	634.173	3/64
.50 - 0.75	28.9	1400	1400	635.042	5/16	45.4	2200	2200	634.170	5/64
.75 - 1.00	38.2	1850	1850	635.039	11/32	59.8	2900	2900	634.178	—
.00 - 1.25	48.5	2350	2350	635.037	23/64	75.3	3650	3650	634.178	—
.25 - 1.50	57.8	2800	2800	635.033	13/32	89.7	4350	4350	634.178	—
.50 - 1.75	67.0	3250	3250	635.030	7/16	105.2	5100	5100	634.177	0
.75 - 2.00	76.3	3700	3700	635.028	15/32	119.6	5800	5800	634.177	0
.00 - 2.25	86.6	4200	4200	635.028	15/32	135.1	6550	6600	634.177	0
.25 - 2.50	95.9	4650	4650	635.027	31/64	150.6	7300	7300	634.177	0
.50 - 2.75	105.2	5100	5100	635.026	31/64	165.0	8000	8000	634.177	0
.75 - 3.00	115.5	5600	5600	635.027	31/64	180.5	8750	8800	634.176	0
4.0	115.5	5600	5600	635.019	37/64	180.5	8750	8700	634.165	9/64
5.0	115.5	5600	5600	635.018	19/32	180.5	8750	8500	634.170	5/64
6.0	115.5	5600	5600	635.019	37/64	180.5	8750	8550	634.165	9/64

SB 19706

[illegible] STATION BUILDING FOUNDATION LOAD TEST

STRIP FOOTER AT COL [illegible] LINE Pa

Column Line 0.9

Time Hrs.)	Actual Load (Tons)	Gauge Reading (psi) Req'd.	Gauge Reading (psi) Actual	Top of Pier Elevation (Ft.)	Settlement (In.)
7.0	115.5	5600	5600	635.017	39/64
*					
12.0	115.5	5600	5600	635.017	39/64
*					
24.0	115.5	5600	5600	635.018	19/32
24.0	0.0	0	0	635.026	31/64
					PERMANENT DEFLECTION ≈ 1/2" - 11/64"
					(≈ 1/4" SEE REMARKS)

* Record Additional Readings Below If Required.

Column Line 0.6

Actual Load (Tons)	Gauge Reading (psi) Req'd.	Gauge Reading (psi) Actual	Top of Pier Elevation (Ft.)	Settlement (In.)
180.5	8750	8500	634.168	7/64
180.5	8750	8800	634.166	1/8
180.5	8750	8800	634.162	3/16
0.0	0	0	634.173	3/64
				PERMANENT DEFLECTION ≈ 3/64

SB 19707

Bechtel Associates Professional Corporation

Inter-office Memorandum

To	R. L. Castleberry	Date	7 October 1977
Subject	Midland Units 1 & 2-Job 7220-001 Administration Building	From	S. S. Afifi
		Of	Geotechnical Services
Copies to	S. L. Blue J. Hink G. Tuveson [redacted] 1320, 3410	At	Ann Arbor 10(D)5 7220-77-123

Pursuant to our meeting with J. Hink, G. Tuveson, J. O. Wanzeck, and S. S. Afifi, we submit the following:

Based on recent borings, September 1977, at the administration building, excavating the soil to Elevation 613.0 and replacing with lean concrete should be adequate. If the concrete has not already been placed, this area may be checked by driving 1/2" to 1" rod approximately two (2) feet into the soil at Elevation 613.0.

The attached sketch shows our recommended backfill procedure. If this method is carefully followed, we feel further problems with this area will be remote.

As to the existing slab and footing, they should be monitored carefully to insure there is no further settlement. We would propose test loading this area to insure there is no problem with this part of the structure. Grouting also may be an alternate, if practical.

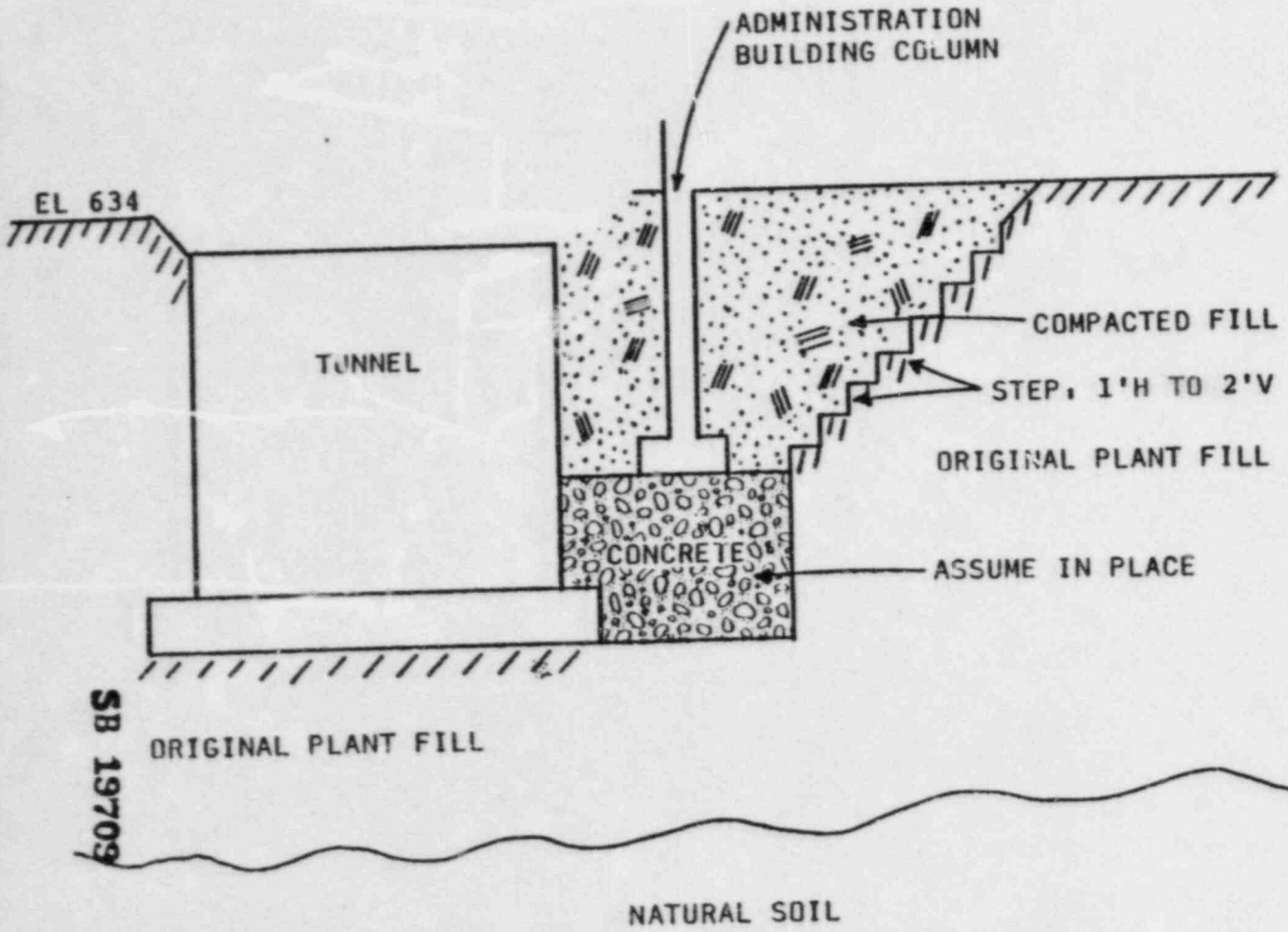
Any further questions, please do not hesitate to contact us.

S. S. Afifi

JOW/lag
Attachment

SB 19708

EXAMPLE OF BACKFILL PROCEDURES
TO BE USED AT THE
ADMINISTRATION BUILDING



NOTES:

1. HAND COMPACTED CLAY $^{max}_{4"}$ LIFTS.
2. HAND COMPACTED SAND $^{max}_{6"}$ LIFTS.

SB 19709

JOB 7220
MIDLAND UNITS 1 & 2

ORDER-OF-MAGNITUDE
COST ESTIMATE
FOR
CORRECTIVE ACTIONS

	S/C	FIELD	ENG & HO	TOTAL
1. Bearing piles for the Service Water Pump Structure, including a pile bearing test.	$ 100,000	$ 300,000	$ 100,000	$ 500,000
2. Underpinning of Electrical Penetration Rooms and the Main Feedwater Isolation Valve Pits, including pit temporary supports.	$ 3,250,000	$ 300,000	$ 250,000	$ 3,800,000
3. Area Dewatering for Underpinning.	$ 500,000	$ 150,000	$ 50,000	$ 700,000
*Contingency plan for temp. support of Aux. Bldg.:				
-initial cost of plan		$ 190,000	$ 10,000	$ 200,000
-total cost if required	((	$ 370,000	$ 30,000	$ 400,000))
4. Chemical Grouting for the Railroad Bay of the Aux. Bldg. and the Diesel Gen. Bldg. as required, including a grout testing and specification program.	$ 1,500,000	$ 200,000	$ 300,000	$ 2,000,000
TOTAL FOR THESE ITEMS:	$ 5,350,000	$ 1,140,000	$ 710,000	$ 7,200,000
		-or-		
	(($ 5,350,000	$ 1,320,000	$ 730,000	$ 7,400,000))

Costs not indicated on this sheet:

1. Diesel Generator Bldg. Surcharge
2. BWSTs and Condensate Tanks
3. Diesel Oil Tanks
4. Underground Utilities
5. Cause investigation and support to NRC question responses.

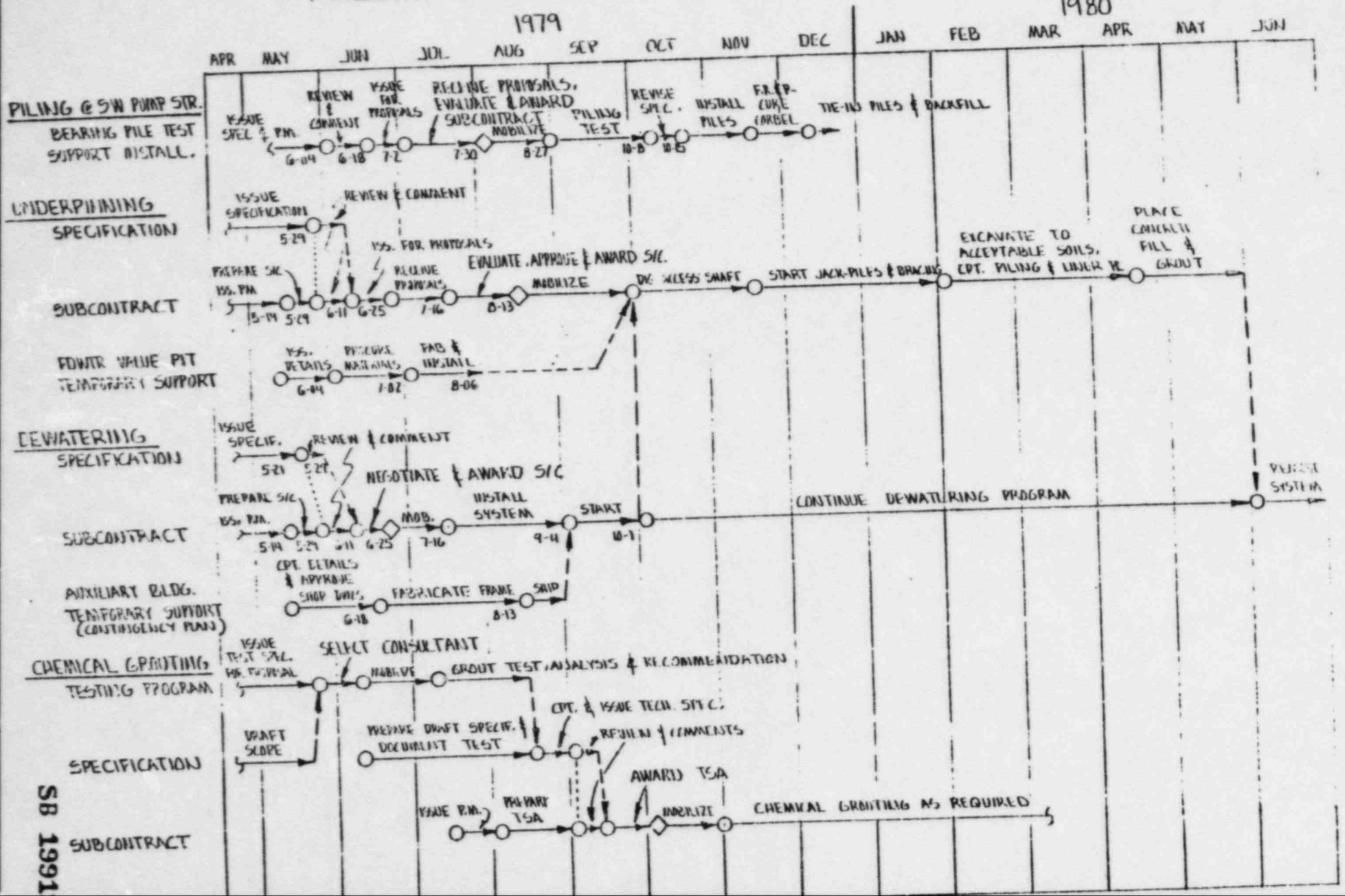
SB 19916

AAO - 5/11/79

NAO 5-12-79

JOB 72
MIDLAND UNITS 1 & 2

PRELIMINARY SCHEDULE FOR CORRECTIVE ACTIONS



SB 1991

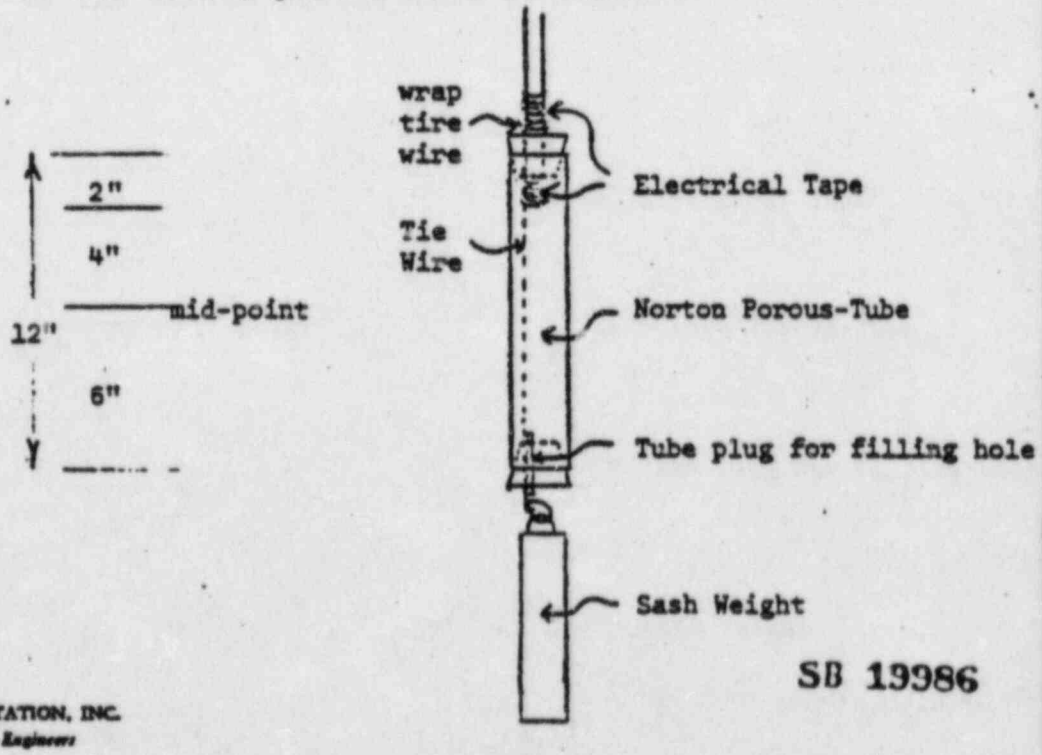
PROCEDURE FOR INSTALLING SINGLE TUBE

POROUS-TUBE PIEZOMETERS

1. While piezometer borehole is being drilled and cased, uncoil a length of piezometer tubing which is about 10 feet longer than th length needed for the piezometer installation. Stretch this out on a flat area and anchor the ends. Then mark with a black permanent-rite magic marker 1 foot intervals above and below the ground surface level that should line up with the piezometer tube during installation. In measuring, place the tip end of the tubing on the four inch mark on the measuring tape. This allows for lengths being measured from the center of the Norton tube after it is connected to the plastic tube. The one foot marks should be labelled with the distance from the piezometer tip center. Leave the piezometer tube stratched out on the ground and intact with the rest of the coil until the exact length of the piezometer installation is known. This also allows the tube to relax some of its coil. While being store, all free ends of the piezometer tubing should be plugged to assure that no foreign materials will enter the tubing.

2. Also while the borehole is being drilled, boil several of the Norton-porous tubes in water to purge air from the pores. This can be done on the site by using a Coleman stove and a couple of lab pans. If weather conditions are freezing, be careful to boil only those tips which will be readily used.

3. When the borehole is ready for installation, cut the marked tubing length as required. Recoil this piece and connect the unmarked end to the Norton porous-tube as follows:



SB 19986

SOIL AND ROCK INSTRUMENTATION, INC.
Geotechnical Instrumentation Engineers

After connecting porous tube, submerge it in a bucket of clean water and transport this to the borehole.

4. Connect wires of a small water pump to the drill rig battery. With the free end of the piezometer tube attached to the input side of the pump, draw the water in the bucket into the tip and through the tubing. Replace the water in the bucket as this is done. Then with the piezometer tubing connected to the output side and a bucket of clean water connected to the input side of the pump pump water into the tip as it is being placed in the borehole. Throughout this procedure be sure that as little air as possible contacts the piezometer tip.

5. Before the tip is placed in the borehole, the cased hole should be filled with clean water and the tamping hammer used to check the depth of the hole. The tamping hammer cable is graduated in foot intervals for convenience in measuring. The depth of the case hole should be a foot and a half below the depth of the center of the tip should be placed. A half foot of clean Ottawa sand should then be placed in the borehole and allowed to settle. Quantities of backfill materials are premeasured in a small clean container. The piezometer assembly is then lowered into the hole to the depth its center should be located at. This is indicated by the one foot marker on the piezometer tubing. The stick up of the casing should be taken into account in determining depth from ground surface. In this state of suspension in the borehole, the piezometer tip is then backfilled with Ottawa sand in one foot intervals to a level of 1½ feet above the center of the tip. After each interval, the tamping hammer is left in the casing and the casing pulled unti the top of the sand level is even with the bottom of the casing. Enough sand is backfilled so that the tamping hammer cable, while in the borehole, indicates a level 1½' higher than the mark on the piezometer tube.

6. When the proper amount of sand has been placed around the tip, the casing is pulled to this level and the sand is then tamped well The depth below ground surface at the center of the tip is at this time checked once again and recorded. If the sides of the borehole will support themselves for a short distance, then the casing is pulled above the sand about a foot. A foot of bentonite pi pellets are then slowly dropped into the hole allowing more than a second of time for each foot of drop. While the pi pellets are being dropped one by one about three per second, a strong upward pull should be made on the piezometer tube. This allows the pi pellets to drop easily around it. When these have been given enough time to reach the bottom, the tamping hammer is slowly lowered until it rests on the bentonite plug. The bottom of the tamping hammer shou be even with the bottom of the casing. If it is even or lower, the plug should be well tamped and the casing raised another foot and

the procedure continued until the proper length of bentonite plug has been installed. The depth of the top of the plug is indicated by the depth of the tamping hammer below the ground surface. If by chance, the bentonite plug were above the bottom of the casing, the casing should be raised a half foot and the tamping hammer used slightly to sink the plug. If the plug does not immediately sink below the casing, do not tamp any more, but insert the 1" plastic grout tube and push the hammer and bentonite plug past the casing. Remove the grout tube and tamp the plug then, attempting to clean the bentonite out of the end of the casing. It should be noted that usually any tamping of a plug in the casing will result in nothing more than a tighter plug in the casing. Thus, extreme caution should be exercised in dealing with this situation.

7. When the proper length of bentonite plug has been installed, another piezometer can be lowered or the remainder of the hole backfilled with grout. The grout should be pumped into the bottom of the hole through the grout tube until the hole is completely filled. The casing is pulled and the level of grout restored.

8. A five foot length of protective pipe is inserted in the hole over the piezometer tubes. These tubes are pulled taut as this is done. The pipe is then blocked up at a certain height above the ground and the grout allowed to set. When this is achieved, the piezometer tubes are labelled inside the pipe and then cut off level with the pipe. A vented cap is then placed on the pipe. The pipe is labelled with its borehole number.

Bechtel Associates Professional Corporation

Post Office Box 1000
3621 South State Road
Ann Arbor, Michigan 48106

CONFERENCE NOTES NO. 156

CONSUMERS POWER COMPANY

MIDLAND PLANT UNITS 1 AND 2

BECHTEL JOB 7220

DATE: Friday, March 15, 1974

LOCATION: Atomic Energy Commission Offices, Bethesda, Maryland

ATTENDEES:	CPCo	Bechtel	AEC-DOL
	M. Hanson	J. Allen	D. Budge
		S. Mackay	L. Heller
		J. Hink	S. MacKay
		J. Clements	

SUBJECT: Investigation of Soils in the Vicinity of the Reactor Buildings at the Midland Plant Site

DISCUSSION:

A meeting was held between the AEC-DOL Staff, Consumers Power Company, and Bechtel to resolve questions raised by Mr. Budge during a visit to the Midland Plant site on March 6, 1974. The questions involved the types of soil and the possibilities of geological faults in the soil around the reactor building foundations.

During the course of the meeting, Bechtel presented and discussed the following information:

1. Bechtel Sketches:
   - SK-C-247 Area plan showing borings made in conjunction with the "Investigation of Sand Below Class I Components"
   - SK-C-261 Soil Profiles
   - SK-G-1 Site Plan with Dike and Boring Locations
2. Bechtel Drawings:
   - C-44 Plant Area Construction Excavation
   - C-10 Boring Location Plan and Index
   - C-11 through C-21 Boring Logs
   - C-28 Boring Logs
3. Soil Reports by Dames and Moore, Volume I and II.

4. Boring Logs D1 through D60

5. Approximately 70 Midland site progress photographs

6. Approximately 40 Midland site progress 35 mm slides

7. Scale model of the Midland plant site soil/geology profiles

Mr. Allen explained that some of the information presented had not been seen before by the AEC-DOL Staff because it was not part of the Preliminary Safety Analysis Report. This material, he pointed out, would be included in the Final Safety Analysis Report.

Mr. Budge explained that he was mostly concerned about the area Northwest of the Unit 1 containment building where he had observed some sand strata abutting against clay. Jimmy Allen and Sherman Mackay, using the soil/geology model they provided, described the soil profiles in this area. The Midland Plant Class I structures are sited on highly compacted, high strength clay (glacial till) which forms a good foundation material. Mr. Mackay identified this till as Wisconsin age (5-12,000 years old). Overlaying the glacial till are lake bottom or beach sands. Some horizontal stratification seen in the sands north and west of the auxiliary building are continuous with no offsets in evidence. This is good evidence that faulting is not present.

Mr. Heller asked why waterproofing material was placed over the till in the excavation area. John Hink explained that a waterproofing membrane was placed under all structures to protect them against seepage from the cooling pond which will be at a higher elevation. Mr. Allen added that dewatering facilities at the site included a sump pump, and large diameter wells located on the north and east sides of the excavation.

Mr. Budge asked why the soil samples from 1968-1970 boring work had been discarded. Mr. Allen said Dames and Moore used to keep boring and soil samples for only 2 years and then discarded them. However, the policy now is to retain all samples until after completion of the job.

Mr. Budge also asked about subsidence surveys. He indicated that Dow Chemical Company did surveys every three years beginning in the 1950's and ending in 1968, and inquired whether such a program would be reinitiated by Consumers. Mr. Hanson explained that Consumers and Bechtel already have plans for a subsidence surveillance program.

In reviewing the site progress photographs presented, Mr. Budge requested that certain photographs be enlarged to allow him to study the sand/clay interface more closely. The subject photographs are:

Photograph No. 127 - North End of Auxiliary Building Base Slab Formwork 7-14-70

Photograph No. 134 - North End of Auxiliary Building Base Slab, elevation 568' 8-2-70

Photograph No. 138 - Northern End of Auxiliary Building Foundation 8-5-70

In addition, Mr. Budge requested a copy of the 8" x 10" aerial photo
Midland Nuclear Plant GWO 7020
Vessels 1 & 2 - Auxiliary Building
Looking North
Work Order 76 3 July 73

He asked if Bechtel could provide an overlay on this aerial photograph showing the location of borings D1 and D3. Mr. Allen assured him that this could be done.

At the conclusion of the meeting, Mr. Budge was provided with a list of the material presented by Bechtel at the meeting. He said he would include this list and the above requested photographs in his final trip report. Mr. Budge said he was satisfied with the explanation presented and would not require another visit to the site. He does not see any major problems with the site excavation or foundations.

Action Item Summary	Responsible Party
1. Provide D. Budge with 8x10 enlargements of the three photographs indicated above.	J. Hink
2. Provide D. Budge with an 8x10 copy of the above indicated aerial photograph with a boring location overlay.	J. Hink
3. Expand the scale model of soil/geology profiles to the area west of the site (and send the model to D. Budge for his review and return.)	J. Allen

Prepared by J. A. Clements
J. A. Clements

Approved by J. C. Hink
J. C. Hink

Bechtel Associates Professional Corporation

Post Office Box 1000
3621 South State Road
Ann Arbor, Michigan 48106

CONFERENCE NOTES NO. 156

CONSUMERS POWER COMPANY

MIDLAND PLANT UNITS 1 AND 2

BECHTEL JOB 7220

MARCH 15, 1974

TOPICS:

1. Resolve AEC-DOL questions concerning the types of soil and the possibilities of geological faults in the soil around the reactor building foundations.

Prepared by:

J. A. Clements

Approved by:

J. C. Hink

P. A. Martinez

M. P. Hanson

SB118978

Bechtel Associates Professional Corporation

Post Office Box 1000
3621 South State Road
Ann Arbor, Michigan 48106

CONFERENCE NOTES NO. 156

CONSUMERS POWER COMPANY

MIDLAND PLANT UNITS 1 AND 2

BECHTEL JOB 7220

MARCH 15, 1974

TOPICS:

1. Resolve AEC-DOL questions concerning the types of soil and the possibilities of geological faults in the soil around the reactor building foundations.

Prepared by:

J. A. Clements

Approved by:

J. C. Hink

P. A. Martinez

M. P. Hanson

8311180979

Bechtel Associates Professional Corporation

Post Office Box 1000
3621 South State Road
Ann Arbor, Michigan 48106

bcc: J. Hink w/a
J. Allen w/a
S. Mackay w/a
J. Clements w/a

March 26, 1974

LLC - 306

Consumers Power Company
1945 W. Parnall Road
Jackson, Michigan 49201

Attention: Mr. M. P. Hanson

Subject: Consumers Power Company
Midland Plant - Job 7220
March 15, 1974, AEC-DOL
Conference Notes
File: 0270, 0279, 0281 all w/a

Gentlemen:

Enclosed are four (4) copies of the conference notes for the March 15, 1974, meeting with the AEC-DOL Staff in Bethesda, Maryland. We are proceeding on all action items as required.

Please show your approval of the conference notes by signing and returning one copy of the cover sheet.

Very truly yours,

for D. A. Martinez
Project Engineer

JAC/pff

SB118980

Midland Units 1 & 2
Bechtel Job No. 7220-001
9 July 1974

TRIP REPORT

DATE: July 1, 2 and 3, 1974

LOCATION: Midland Nuclear Plant

ATTENDEE: J. O. Wanzeck

SUBJECT: General Review of Site

DISCUSSION

1) Answered two (2) questions for Don Horn, QA Representative for Consumers Power Company.

   Questions:

   Q: What is Zone Two material?
   A: Random fill.

   Q: What are moisture requirements in Zone Two Non Q area?
   A: None

2) Put in a field change request on Specification C-210; 13.7 to include ASTM D2049 on cohesionless soil.

3) Geotech was requested to make sure that all borings were received by project, I stated as far as I know all borings have been received by project.

J. O. Wanzeck

JOW:lab

SB119170

Midland Units 1 & 2
Bechtel Job 7220
3 September 1974

TRIP REPORT

DATE: August 26-29, 1974

LOCATION: Midland Nuclear Plant

ATTENDEE: J. O. Wanzeck

SUBJECT: General Review of Site

DISCUSSION

Discussed moving of intake structure with Jack O'Sullivan in Ann Arbor.

R. Rixford of Ann Arbor office discussed frequency of testing on sands and some questions on trip reports. These were cleared up.

Did some research on moisture density and natural moistures at site for information.

Working on Zone 1 & 2 west Miller dike.

Working on south dike east of Sassee Road Zone 1.

Placing riprap on south dike west of Sassee Road.

All soils work is progressing well.

Four troxler nuclear devices now available at the site.

J. O. Wanzeck

JOW:lab

SB 19185

Midland Nuclear Plant
Job 7220-001
20 September 1974

TRIP REPORT

DATE: September 9, 10, 11 and 12, 1974

LOCATION: Midland Nuclear Plant

ATTENDEE: J. O. Wanzeck

SUBJECT: General Review of Site

DISCUSSION

Okayed the foundation from Station 7+20 west plant dike to Station 5+50 north Miller dike east of $\mathbb{Q}$.

Cautioned Canonie's foreman that lifts will not be more than 12". This was in the area of the east plant dike between Stations 17+00 and 21+00.

Riprap being placed on sections of west and south dikes.

Soils crews working good with no delays to subcontractor.

Okayed inspection trench from Station 4+30 west plant dike to Station 8+00 north Miller dike.

Well in area of Station 5+50 west plant dike still not plugged as of this date. It will be plugged later.

J. O. Wanzeck

JOW:lab

Bechtel Associates Professional Corporation

Inter-office Memorandum

To	S. S. Afifi	Date	23 October 1978
Subject	Midland Units 1 & 2-Job 7220-001 Backfill Study Trip Report August 26 - October 11, 1978	From	A. S. Marshall
		Of	Geotechnical Services
Copies to	S. L. Blue R. L. Castleberry w/a H. H. Burke/W. R. Ferris w/a T. E. Johnson w/a P. Martinez w/a J. O. Wanzeck w/a K. Wiedner w/a 1310, 3120 cc: A. Boos, J. F. Newgen J. Gehs	At	Ann Arbor 10(D)5

Transmitted with this memo is a trip report summarizing my activities at the Midland site during August 26 through October 11, 1978.

Austin S. Marshall

A. S. Marshall

ASM/lap
Attachment

SB:19232

Midland Units 1 & 2
Job 7220-001

TRIP REPORT

PERIOD: August 26 through October 11, 1978

LOCATION: Midland Power Plant
Midland, Michigan

SUBJECT: Backfill Study

ATTENDEE: A. S. Marshall - Geotech/Soils

Backfill Study

During the backfill study, borings were drilled in the following areas:

1. Diesel Generator Building
2. Condensate Water Tanks
3. Unit 1, Unit 2 and Startup Transformers
4. Category I Water Lines
5. Retaining Walls
6. Service Water Buildings
7. Tank Farm
8. Radwaste Building
9. Administration Building
10. Cooling Tower
11. Evaporator Building
12. Chlorination Building
13. Discharge Structures
14. Diesel Fuel Tanks
15. Guard House
16. Proposed Bullock Creek Bridge

Split spoon, shelby tube, and Osterberg tube samples were taken from the borings. Dutch cone penetrations were made in the diesel generator building area. Test pits were excavated in which sand cone density tests were taken and a bulk sample was taken from one pit. Test pit

locations included the north end of the east bay of the diesel generator building, just east of the condensate water tanks, and along the north side of the tank farm.

Samples were transported and tested by Goldberg-Zoino-Dunnicliff and Associates, Inc.

Observations on Backfill Placement

The following observations were made on backfill placement during the period:

1. Materials were placed and compacted in lift thicknesses exceeding those specified.

2. Heavier equipment appeared to be required to achieve compaction on clays.

3. Clays compacted in confined areas with vibratory plate compactors were often only compacted in the upper few inches of each lift.

4. Areas were being backfilled as "temporary" without field engineering's awareness.

5. Clay backfill materials were not being disced to breakdown the large "clumps" that did not appear to breakdown during compaction.

6. Field inspection of backfill operations by engineering personnel was very limited.

7. Materials observed 20 feet northwest of the primary water makeup tank indicated soft materials might underlie this area.

Upon discussion of the above mentioned observations with Al Boos and Jim Betts the following actions were taken:

1. Materials were to be compacted within limits specified for sands and in 6-inch loose lifts for clays.

2. A procedure was implemented through which "temporary" fill would be located and documented for later removal and replacement.

3. A disc was brought on-site and was used to breakdown the size of the clay "clumps" at the stockpile.

4. Field inspection was increased by field engineering by placing a field engineer over backfill, and only backfill.

5. Soft materials observed at Elev. 628 just northwest of the primary water makeup tank were excavated to about Elev. 617 and replaced with compacted materials.

Dike Inspection

Mr. Don Sibbald of Consumers Power Company and A. S. Marshall made a detailed dike inspection on October 11, 1978. The upstream and downstream slopes and off-dike areas were inspected for seepage, riprap problems, erosion, animal burrow holes, cracks and other potential signs of distress. The inspection did not indicate any signs of distress.

Proposed Pipe Bridge Study

One boring was drilled on each side of Bullock Creek. The slopes on which the abutments are to be constructed are very steep and are covered with tall grass. The creek bottom area appeared to be faced off with soil-cement.

Copies of boring and dutch cone logs will be presented later.

A. S. Marshall

A. S. Marshall

ASM/lap
Attachment

TRIP REPORT

PROJECT	JOB NUMBER	DATE(S) OF TRIP
Midland	7220-001	20,21,23,24 August 1979

RAVELER(S) NAME AND POSITION

D. F. Hollingshead, J. O. Wanzeck, W. C. Paris, Jr., K. F. Davis, Engineers from Geotech

Jeff Carey, Pat Faliniino, Divers from Construction and Maintenance Diving Company

RIP TO/PURPOSE

Inspection of the riprap on the inner slope of the cooling pond dikes.

ERSONS CONTACTED

ESULTS (USE ADDITIONAL PAGE IF NECESSARY)

During the week of August 13, 1979, Geotech was notified by field personnel that areas on the cooling pond dike inner slope had experienced damage of the riprap and filter material. The objective of the field trip was to identify the problem areas and to ascertain the extent and possible cause of damage.

Hollingshead, Paris, and Davis left Ann Arbor on August 20, 1979. At the jobsite we contacted Chuck Willson, Head Field Surveyor, to discuss details of a preliminary survey he had taken of the damaged dike area. Mr. Willson mentioned that he had given Don Sibbald of Consumers Power Company copies of the dike cross-sections taken. We met with Mr. Sibbald and were given a copy of the cross-sections taken.

Sibbald indicated he had access to the onsite meteorological data and would make it available for Bechtel. It was agreed that Davis would inspect this data the following day.

Mr. Sibbald made arrangements for access to the dikes and we left to begin our inspection. The inspection began on the northwest dike and proceeded completely around the pond. In general, the 1V:3.5H slope seemed to be relatively uniform along the northwest, west, and south dikes. The riprap most visible to the eye (i.e. on the top of the slope and above the water surface) seemed to average closer to 6-8 inches in size rather than the 8-12 inches given in the specification. In a few locations along the northwest and west dikes the riprap appeared to have sloughed

FOLLOWUP ACTION NEEDED (IDENTIFY ANY SPECIFIC COMMITMENTS)

PREPARED BY (NAME)	SIGNATURE	LOCATION	DATE
K. F. Davis	K. F. Davis	AAO 10 D 5	August 30, 1979

DISTRIBUTION

SB119254

down slightly into the pond forming a small berm directly under the water surface. (Water surface elevation was 626.4 feet per Mr. Sibbald). In these areas the slope was protected by riprap.

The southeast corner and numerous areas along the slope of the east dike indicated damage had occurred, apparently due to wind waves (see attached photos). Driftwood and other debris present above the water surface demonstrates that the prevailing wind direction during severe storms was out of the west. The debris line formed on the slope indicated wave runup of 3.5 to 4.0 feet. A wide berm consisting mainly of filter material was present along the edge of the water surface. At cross-section No. 17 shown in Figure 1 (sta 12 + 35 on the east dike), the impermeable clay material was exposed indicating the entire riprap and filter layers in this area had been washed into the pond. The average riprap size on the south half of the east dike does not appear to meet the 8-12 inch average size specification.

The riprap on an area just southeast of the transmission tower bases on the northeast dike consists of extremely small size rock (see photos). Further investigation would be needed to determine if the riprap is intact beneath this filter material.

We checked in with Sibbald before leaving the site and discussed the damaged dike areas. He indicated he thought the first noticed displacement of riprap occurred after breakup of the ice sheet that had formed on the pond. Mention was made of some high velocity wind storm that have hit the site and may have caused or contributed to the dike damage.

Hollingshead, Paris, and Davis left the jobsite approximately at 5:00 p.m. Hollingshead and Paris returned to Ann Arbor. The following morning was spent inspecting the records beginning March 1, 1979. The computer output gives 15 minute average speeds and directions at 10 meter, 60 meter, and 91.5 meter elevations above ground level. Average is defined as the arithematic mean between the maximum and minimum instantaneous measurement recorded within the 15 minute period. Ground elevation at the tower is 614 feet. Two major storm periods were identified. The first occurred April 6, 1979. The peak 15 minute average windspeed recorded at the 10 meter gage (corresponding to elevation 646.8 feet) was 39 mph coming out of the WNW direction and occurred between 5:00 - 5:15 p.m. The average speed between 4:00 to 6:00 p.m. was about 37 mph. The other major storm occurred June 20, 1979, and was by far the most severe in recent months. The Midland jobsite experienced a 5 hour power failure during which time no records are available from the meteorological tower. The last observed windspeed measurement was 65 mph. Trees were reportedly uprooted in the city of Midland.

In the afternoon Davis, Wanzeck and Al Boos of construction inspected the damaged portions of the dike. Boos agreed to arrange for a diver to inspect the underwater portions of the dike.

Wanzeck and Davis then inspected the baffle dike slopes. A small berm was noticed along a portion of the west slope in the north half of the baffle; however, the baffle slopes appeared to be in good condition. The area on the northeast dike

small size riprap stone was observed and inspected. Wanzeck was of the opinion that when the transmission tower bases were placed a berm was constructed on the dike slope to facilitate heavy equipment. After construction, the berm material was probably leveled over the riprap material.

Davis left the jobsite to return to Ann Arbor. Wanzeck had other unrelated field inspection to be made and returned to Ann Arbor later that day.

On August 24, 1979 Davis, Wanzeck and Sibbald met with the divers at the site. A TV monitor and videotape camera was setup so that the underwater portion of the dike could be observed on shore. A diver inspected the dike slope below the water level from approximately 500 feet west of the southeast corner to approximately 1,500 feet north of the corner. He had been informed of the design slope of the dike, the riprap and filter material, the dike toe elevation, and possible problems that could be present. Once in the water he immediately observed that approximately 10 feet out from the water's edge the berm sloped very steeply down to the original slope. From this point down to the toe the slope appeared to be quite uniform. One question-able area was identified. However, after viewing the area on the monitor it was concluded that the indentures being observed were tractor marks which occurred prior to pond filling. The slope below the water surface was not believed to be damaged. A number of underwater still photographs were taken using a 35 mm camera.

As requested by construction, one of the divers investigated the concreted slope around the pond makeup-outfall pipe. The area was covered with a layer of silt. The diver could not see nor feel anything that would be described as excessive erosion. A videotape was made of the area. The divers mentioned that due to the clouded water from the silt, little contrast would be visible on the tape.

The divers along with Wanzeck and Davis left the jobsite after completion of this inspection.

SUMMARY

1. Many areas along the inner slope appear to have average riprap stone 6-8 inches in size as compared to the 8-12 inches given in the specification. It is possible that the larger stone is beneath the surface stone or further down the slope under the water surface.
2. An area of possible concern is on the inner slope of the northeast dike where extremely small riprap stone was found near the transmission tower bases. The designed riprap is possibly intact beneath the finer material but this needs to be verified.
3. The inner slopes of all dikes other than the east dike and southwest corner (including the baffle dike) have experience little if any damage. In a few areas on these dikes the riprap has sloughed slightly down the slope. The complete slope remains protected by riprap.
4. In a number of locations on the inner slopes the riprap layer appeared non-uniform in thickness as evidenced by the growth of weeds between the stones.
5. Damage has occurred on the inner slope of the southeast corner and east dike due to wind waves. The impermeable clay material is exposed in one area.

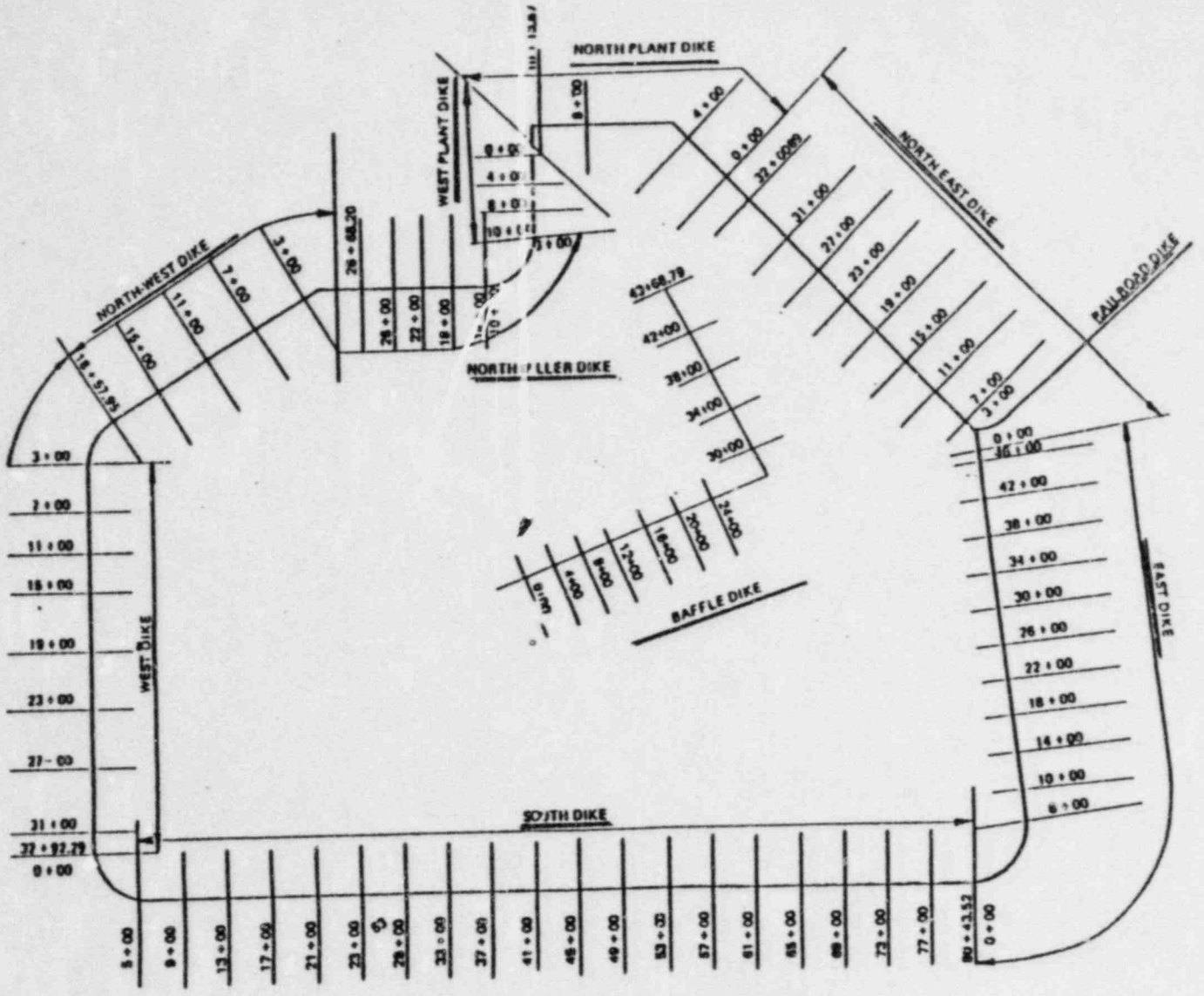
   It appears that one or two severe wind storms could have caused waves of sufficient height to account for the observed damage. Over water wind speeds

of approximately 80 mph occurred at least once earlier in the year. Formation of an ice sheet on the pond during the winter may have contributed to the erosion.

6. The portion of the inner dike slopes beneath the water surface have experienced no noticable damage in the areas investigated.
7. Severe erosion of the concreted slope around the pond makeup outfall pipe appears not to have occurred during filling of the pond.

RECOMMENDATIONS

1. To ensure that no damage has occurred below the pond watersurface, a complete inspection by diver is recommended. Inspection would be mainly visual; however, some spot checks of the riprap sizes and coverage layer thickness is recommended.
2. Above the water surface elevation it is recommended that a cut be made through the top riprap and bottom filter layer at selected sections of the inside dike slope. This information will be necessary to determine further erosion potential of the dike and to evaluate the need for remedial actions.
3. A survey of the inner dike slope sections should be carried out starting from the dike road centerline down to the lower edge of the riprap. Along with the as built dike section survey, the extent of riprap movement can be evaluated.
4. Consumers Power Company has indicated they have a series of aerial photographs of the plant site area available. Copies of these photos should be obtained and studied to determine during which periods of time the erosion occurred.



S31925

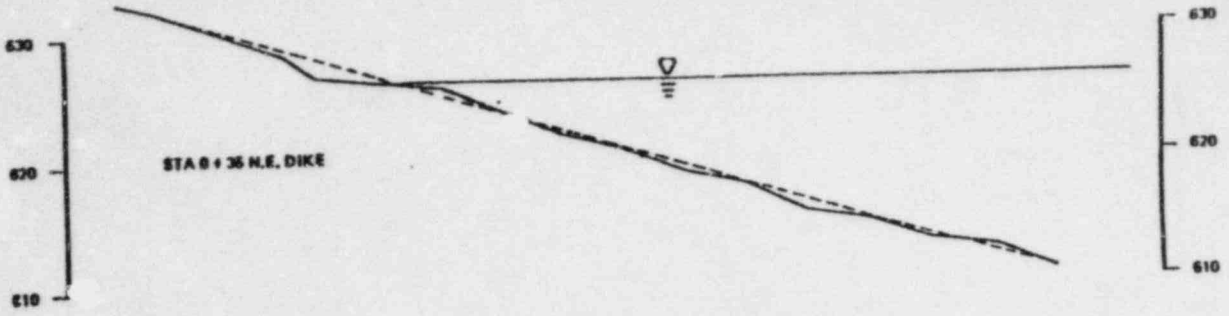
BECHTEL
ANN ARBOR

MIDLAND POWER PLANT

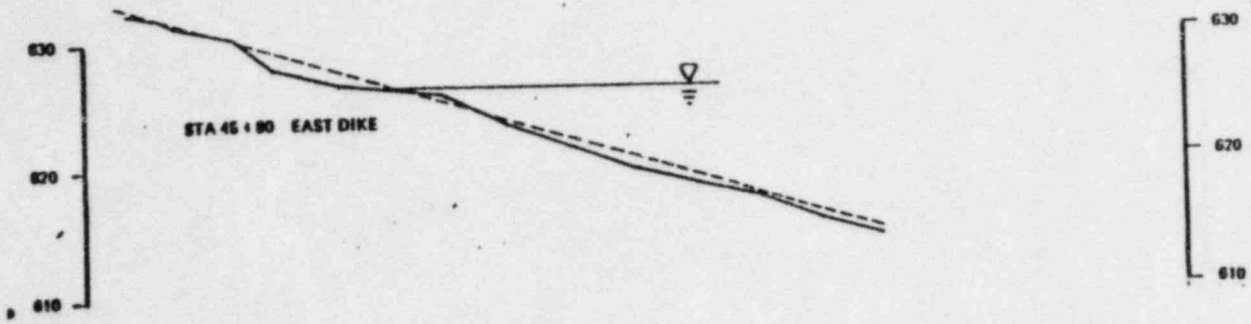
COOLING POND SURVEY POINTS 6-5-71

	JOB NO.	DRAWING NO.
	7220	FIGURE 1

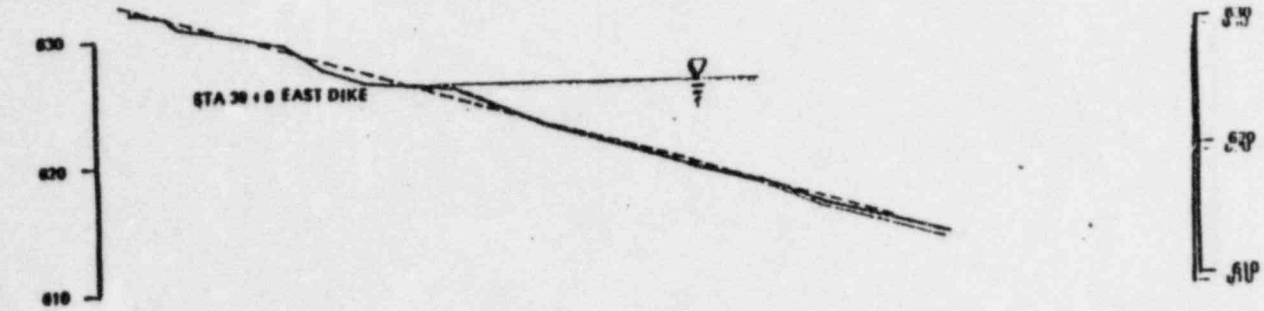
SEC. 1



SEC. 2



SEC. 3



SS 19259

Sections in book 118N PP 31-52
All stationing approx

Sections taken 8-18-79
Plotted 8-19-79

1. SURVEY WAS TAKEN AUGUST 18, 1979
2. WATER SURFACE ELEVATION IS 624.4
3. TOP OF SLOPE IS ROAD SHOULDER

0 5 10 20

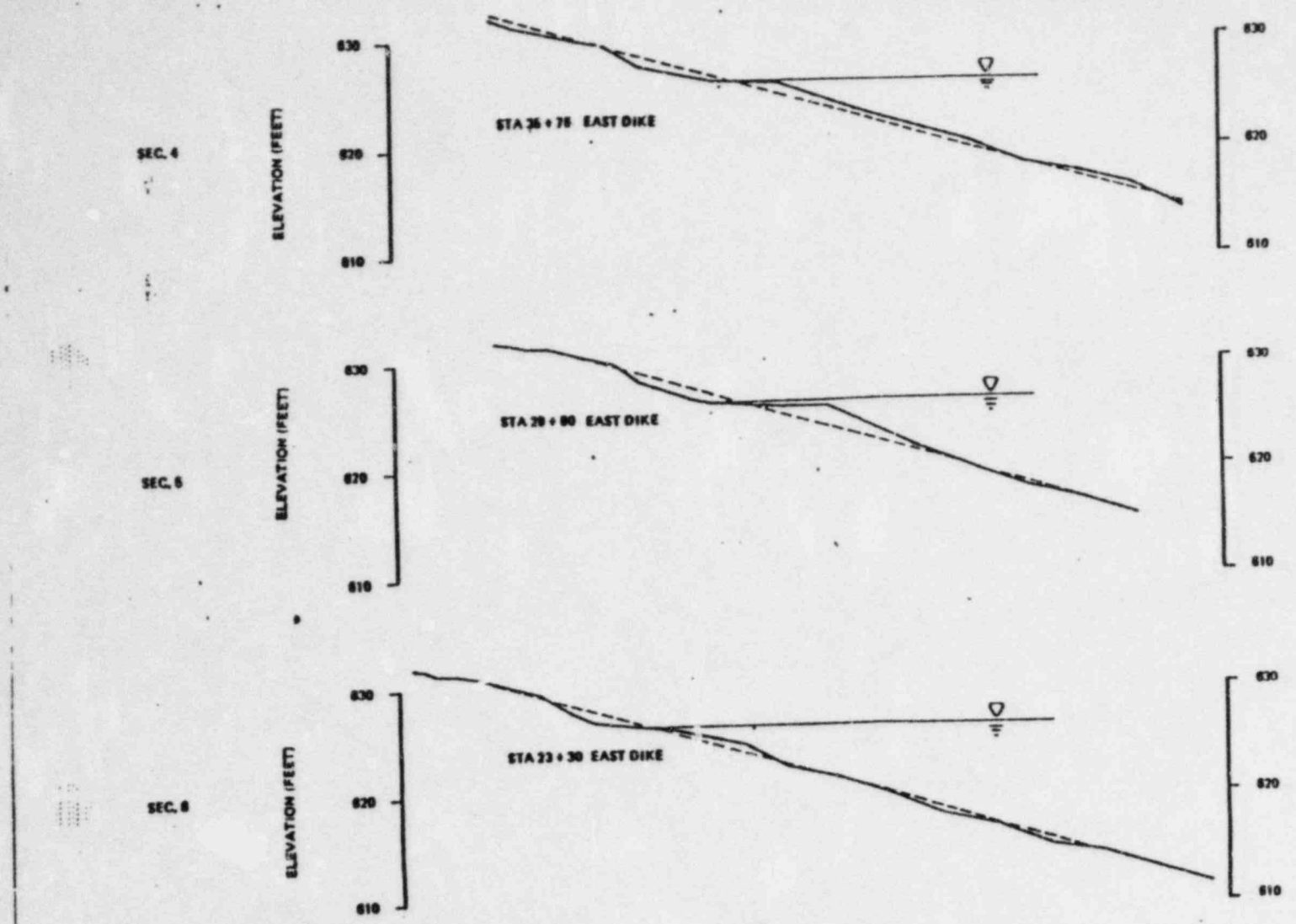
SCALE IN FEET

BECHTEL
ANN ARBOR

MIDLAND POWER PLANT

CROSS SECTIONS OF COOLING POND
DIKE RIVER SLOPE SHEET 1

	7220	FIGURE



S3.19280

Sections in book 11811 PP 31-62
All stationing approx

Sections taken 8 18 79
Plotted 8 19 79

1. SURVEY WAS TAKEN AUGUST 18, 1979
2. WATER SURFACE ELEVATION IS 626.4
3. TOP OF SLOPE IS ROAD SHOULDER

0 5 10 20

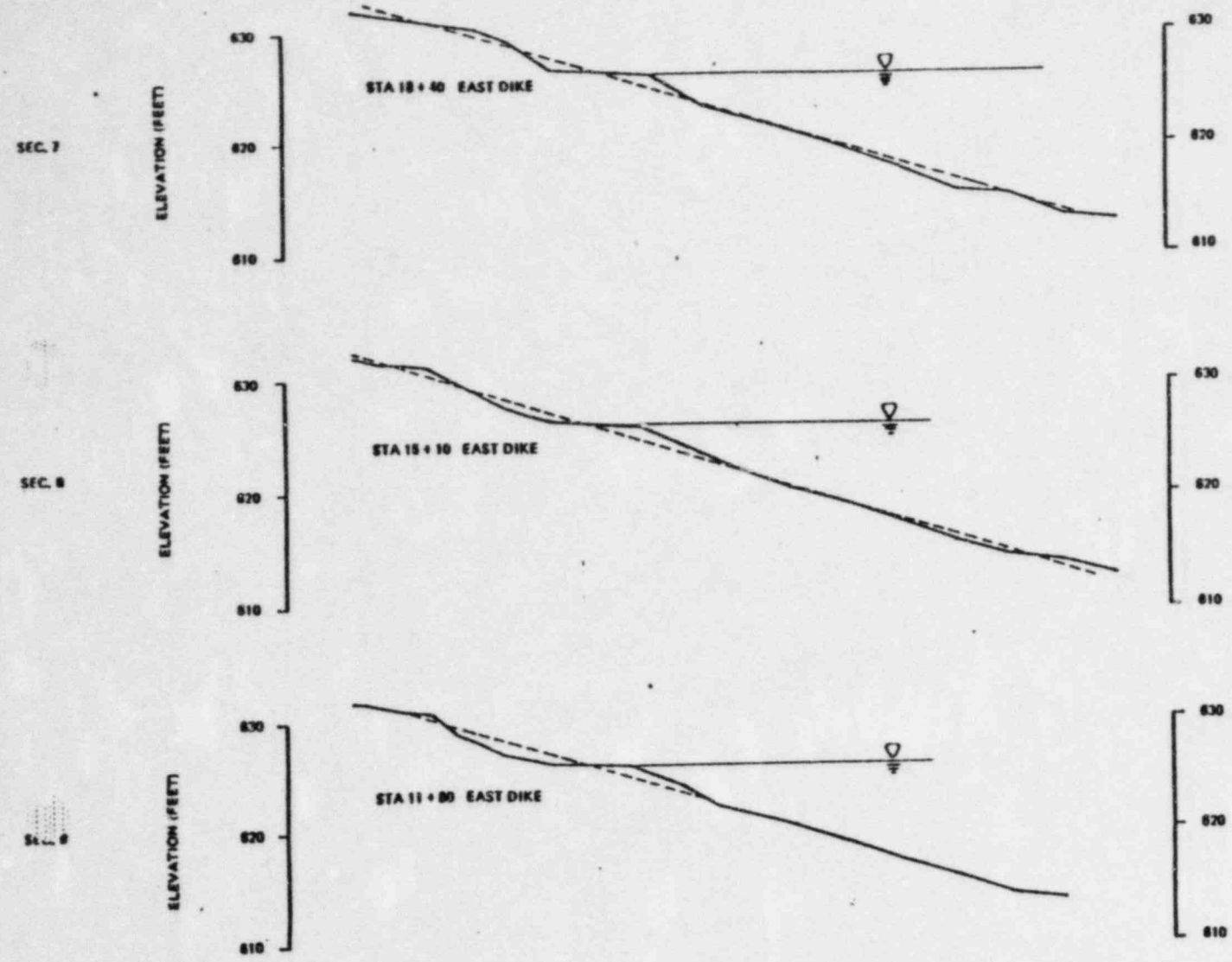
SCALE IN FEET

BECHTEL
ANN ARBOR

MIDLAND POWER PLANT

CROSS-SECTIONS OF COOLING POND
DIKE INNER SLOPE SHEET 2

7220	FIGURE



S3:19261

Sections in book 11BN PP 31-522
All stationing approx.

Sections taken 8-18-79
Plotted 8-19-79

1. SURVEY WAS TAKEN AUGUST 18, 1979
2. WATER SURFACE ELEVATION IS 626.4
3. TOP OF SLOPE IS ROAD SHOULDER

0 5 10 20 30
SCALE IN FEET

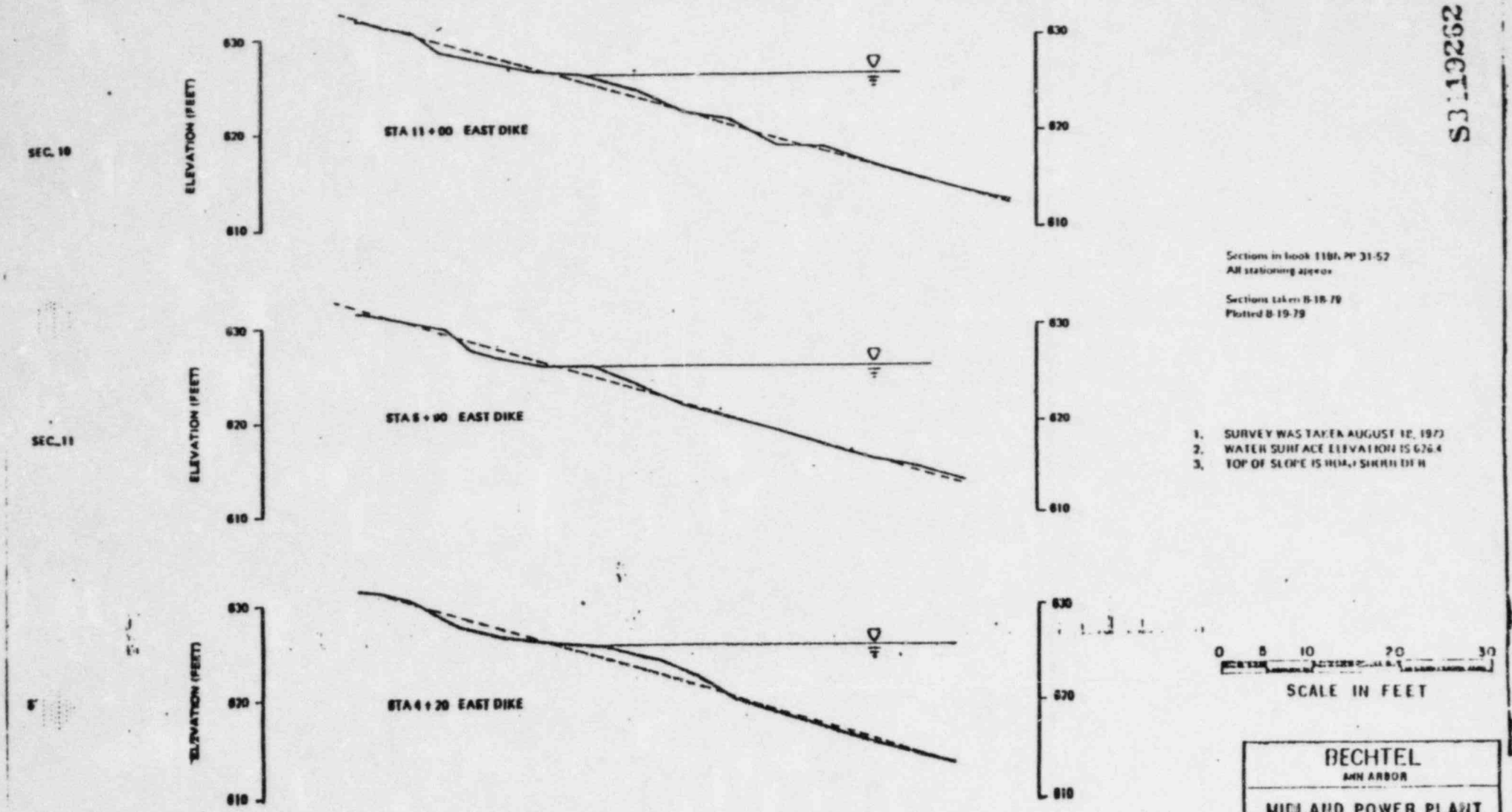
BECHTEL
ANN ARBOR

MIDLAND POWER PLANT

CROSS SECTIONS OF COOLING POND
DIKE INNER SLOPE SHEET 3

7220 FIGURE

S3:13262



Sections in book 1181, PP 31-52
All stationing approx

Sections taken 8-18-79
Plotted 8-19-79

1. SURVEY WAS TAKEN AUGUST 18, 1979
2. WATER SURFACE ELEVATION IS 626.4
3. TOP OF SLOPE IS HORIZONTAL SHOULDER

0 5 10 20 30
SCALE IN FEET

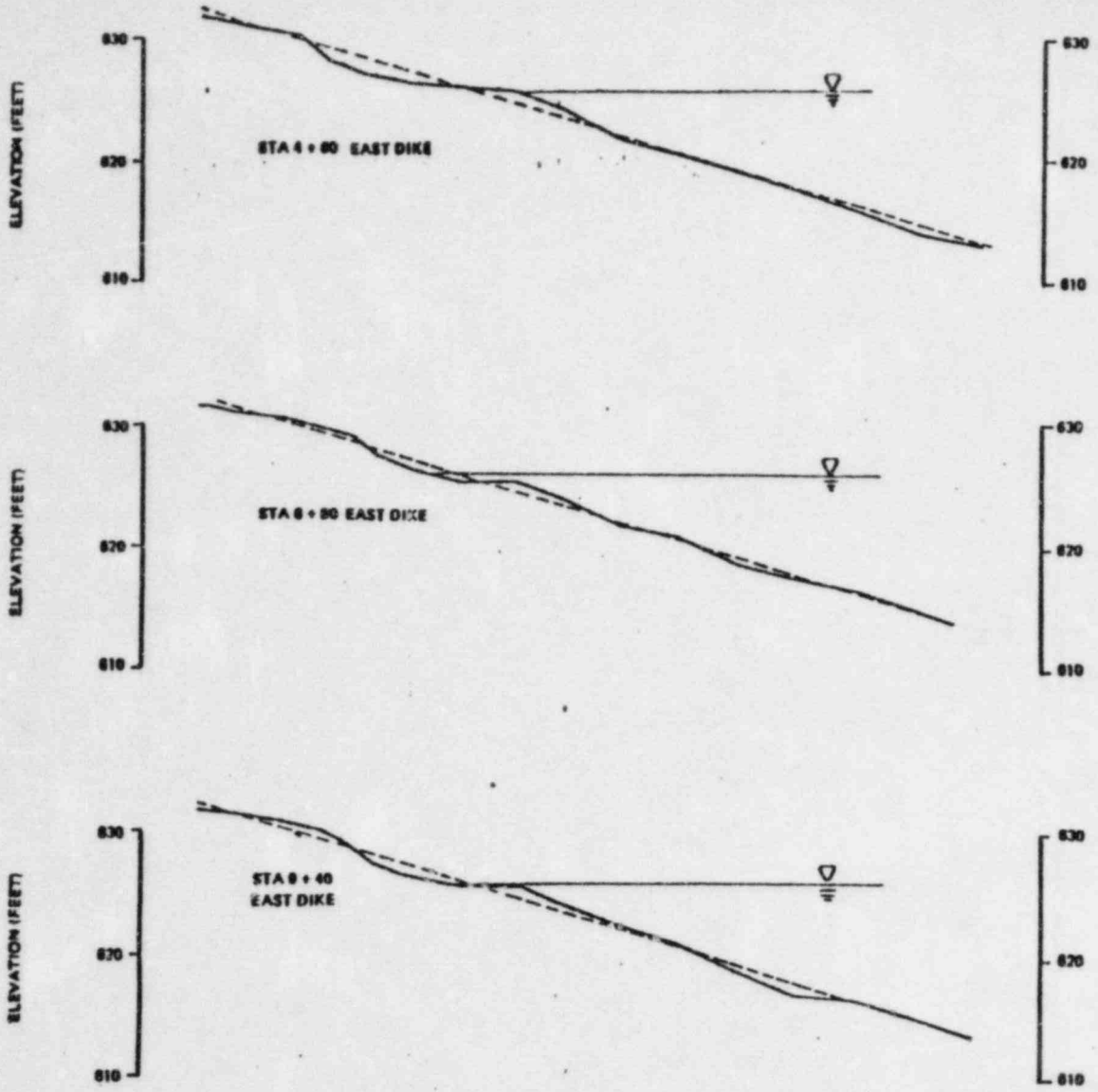
BECHTEL
ANN ARBOR

MIDLAND POWER PLANT

CROSS SECTIONS OF COOLING POND
DIKE INNER SLOPE SHEET 4

JOB NO. 7220 | DRAWING NO. FIGURE

S3 19263



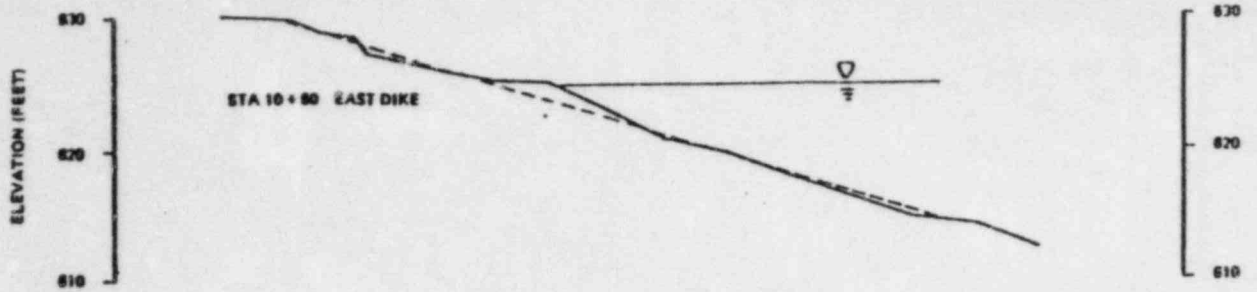
Sections in book 11BN PP 31-62
All stationing approx

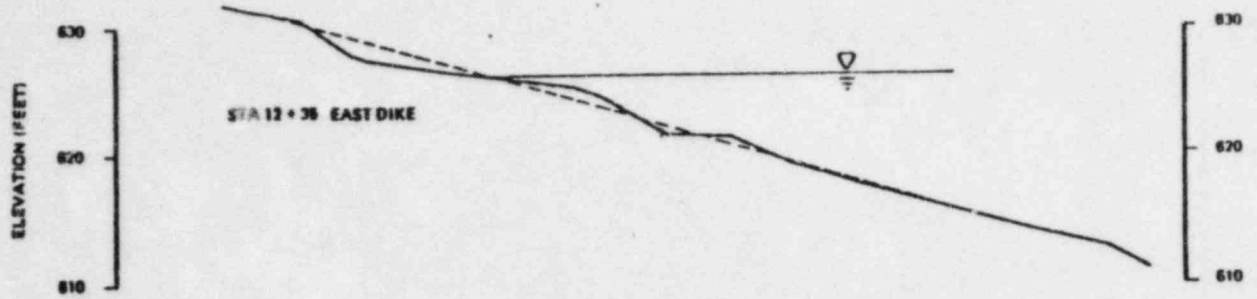
Sections taken 8-18-79
Plotted 8-19-79

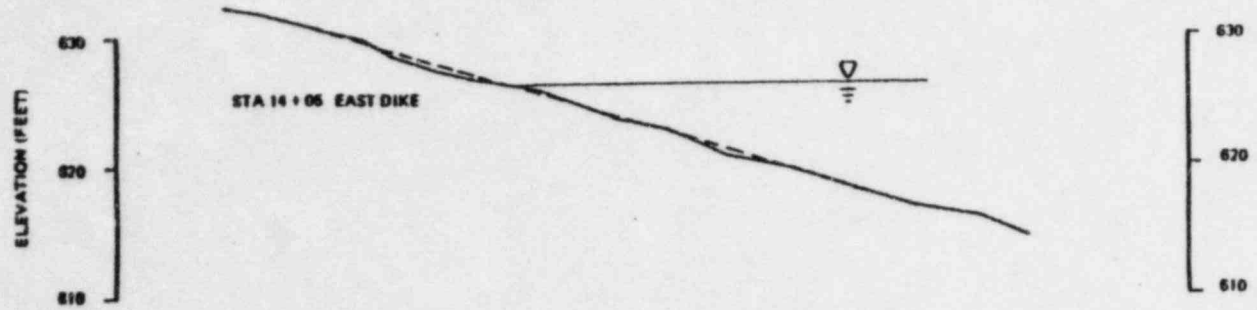
1. SURVEY WAS TAKEN AUGUST 18, 1979
2. WATER SURFACE ELEVATION IS 624
3. TOP OF SLOPE IS ROAD SHOULDER

0 5 10 20 30
SCALE IN FEET

BECHTEL ANN ARBOR		
MIDLAND POWER PLANT		
CROSS SECTIONS OF COOLING POND DIKE INNER SLOPE SHEET 5		
JOB NO. 7220	DRAWING NO. FIGURE	







Sections in book 118N PP 31-51
All stationing aspro.

Sections taken 8-18-78
Plotted 8-19-78

1. SURVEY WAS TAKEN AUGUST 11 '78
2. WATER SURFACE ELEVATION IS 624
3. TOP OF SLOPE IS ROAD SHOULDER

0 5 10 20

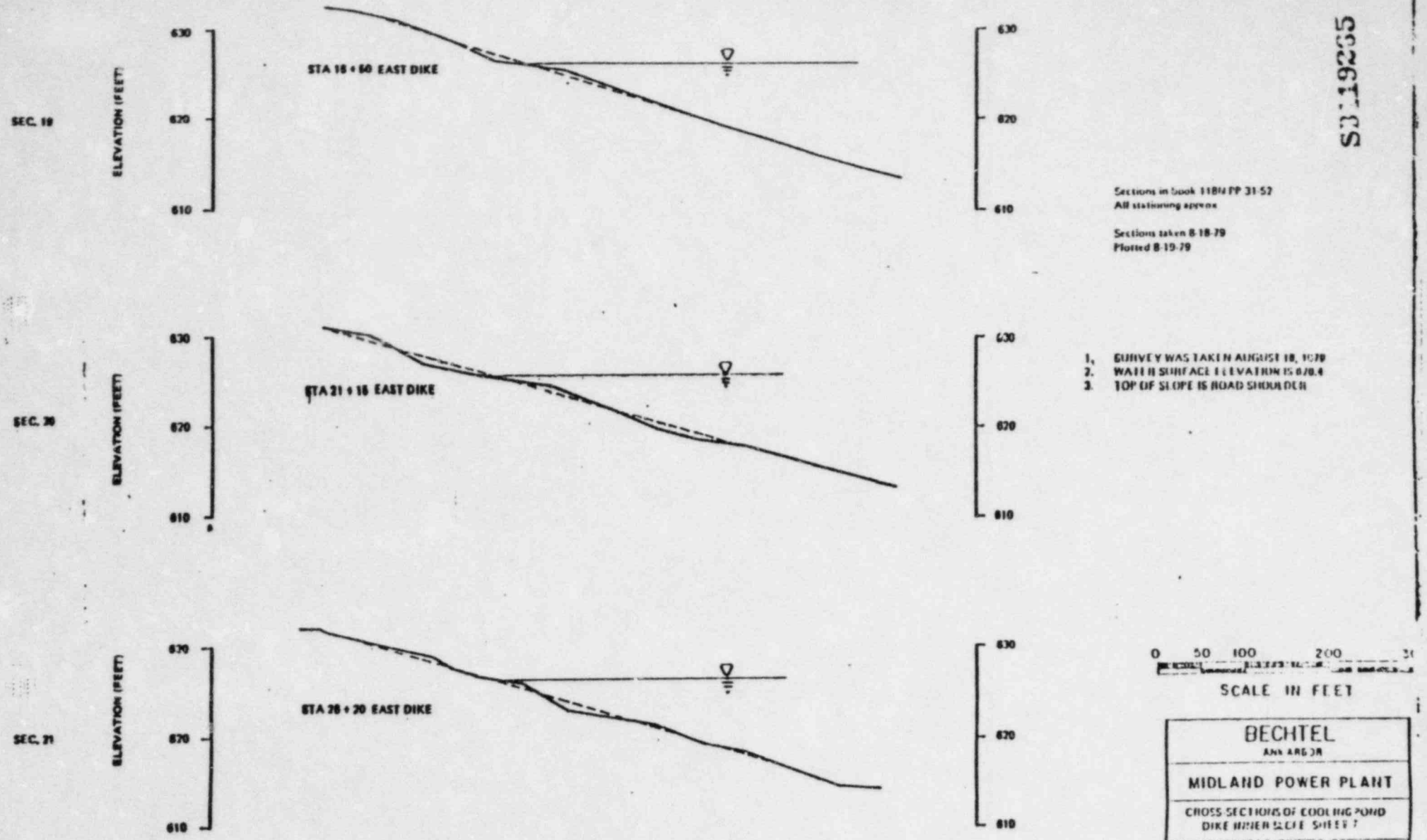
SCALE IN FEET

BECHTEL
ANN ARBOR

MIDLAND POWER PLANT

CROSS-SECTIONS OF COOLING POND
DIKE INNER SLOPE SHEET 1

7220 FIGURE



Sections in book 11814 PP 31-52
All stationing approx

Sections taken 8-18-79
Plotted 8-19-79

1. SURVEY WAS TAKEN AUGUST 18, 1979
2. WATER SURFACE ELEVATION IS 618.4
3. TOP OF SLOPE IS ROAD SHOULDER

0 50 100 200

SCALE IN FEET

BECHTEL
ANN ARBOR

MIDLAND POWER PLANT

CROSS SECTIONS OF COOLING POND DIKE INNER SLOPE SHEET 7

	7220	FIGURE

8311190265

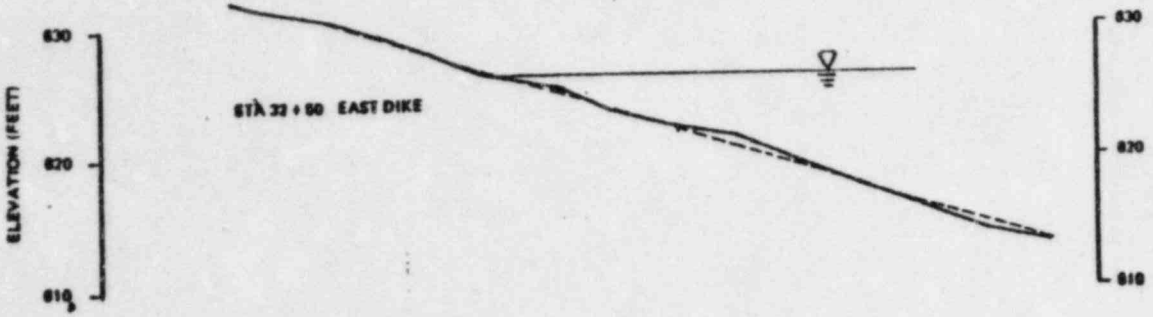
S3.19239

Sections in book 11016 PP 31-52
All stationing approx

Sections taken 8-18-79
Plotted 8-19-79

1. SURVEY WAS TAKEN AUGUST 18, 197[illegible]
2. WATER SURFACE ELEVATION IS 62[illegible]
3. TOP OF SLOPE IS ROAD SHOULDER

SEC. 33



0 5 10 20

SCALE IN FEET

BECHTEL
ANN ARBOR

MIDLAND POWER PLANT

CROSS SECTIONS OF COOLING POND
DIKE INNER SLOPE SHEET 8

[illegible]	7220	FIGURE

G. Richardson
2-9-79

Diesel Generator Building

Introduction

In Order to Establish the five most probable causes of the Diesel Generator Building one must first make a determination as to whether it was Bechtels' or Consoles' in both operations which resulted in the placement of the materials which are not capable of supporting the structure. I have indicated below those areas I feel are most probable based on my knowledge of the problem gained by review of documents and debriefing of personnel interviewed by the NRC.

Potential Causes

I Inspection of field operations (NOT including work in test lab)

A. Bechtel Operations: QC inspection of "Q" listed operations not sufficient in detail and time spent to assure Construction operations (lift thickness, compaction etc) and Testing (Methods and selection of RMP Curve) were done adequately.

a cause only if lift thickness, soil testing shown widespread inadequacy.

Supportive information:

QCI C-1.02 "Compacted Backfill" calls for "S" (V) surveillance for Materials, placement and Testing. Only inspect in for start of placement. "S" (V) is for visual surveillance as often as necessary (decision by QCE) To assure adequacy.

QC has stated they spent from 10-20% of time on soils operation including test result reviews. QC Testing stated QC was on job only about 1% of time.

Note: QCI C-1.02 Rev 2 in effect, rev 0 issued 10/76 both approved by CPCo QA.

should be reported? NCR?

NO

should be reported by QC

Supportive evidence would be:

- absence of B superintendents
- absence/qualification of test technicians
- " of BQC

SB119517

B. Canonie Operations: Inspection by Canonie QC not sufficient to assure compliance to specifications. Surveillance by Bechtel QC and Audits by Bechtel QA may not have been frequent enough to assure Canonie placed materials properly.

Supportive Information:

QCI C1.10 "Earthwork Subcontract Surveillance calls for SI(V) Surveillance Inspections of Subcontract operations on a regular but Not full time basis. QCI approved by CPCo

If this is a case then we must assure The first line inspection by Canonie QC (full time) was not adequate.

QA audits were One:

8-15-75 sub control
8-15-75 earthwork control
8-6-76 earthwork control
9-17-76 Sub control
8-9-77 earthwork control
10-4-77 sub control

Canonie's QA program does provide for daily left checks, corrective action and daily reports but does not provide a step by step instruction for inspections in the magnitude of a QCI

? Did Canonie have a QCI - no (a QA manual) + Daily, NCR, Left Thumb report
Experience of Canonie inspectors (Graduate civil - Ann Dr Steen)
Training program of Canonie inspectors - one more

SB119518

II Testing

Testing may not have been adequate to assure proper compaction and control in that result may have been inaccurate resulting higher than actual compaction being reported

- Improper selection of BMP curves from family of curves for density and moisture.
- Family of curves not updated at a regular basis and representative of materials placed
- Confusion as to when to control moisture.

Supportive information

- Administration Building investigation resulted in conclusion that selection of proper BMP Curve by UST was in error.
- Use of family of curves and determination of proper curve by visual means requires considerable training
- Spec 7220-C-209 Table 9-1 only requires a new curve each 10,000 cubic yards placed and does not address need for a new curve when materials change.
- Family of curves in use had curves included that were over two years old. Not confirmed Spec not clear.
- Moisture Content Controlled by compaction Test MC's, Then at borrow and now by compaction Test MC's.

Ref QAR SD-40
CR & NCR M-01-5-9-012

III No requirement to produce monthly summaries of test results for evaluation by Field/R.E./Geo Tech. Specifically

- Cubic yards placed / Test frequencies
- % of failing tests
- % of failing Tests not corrected
- Compaction/moisture averages / histograms etc.
- Corrective actions taken on failing tests
- Plots of test locations
- Summary of test results

Perhaps - lack of visibility of test data?

IV. Testing frequencies / locations of tests under Diesel Generator Building not adequate.

Supportive information

- Test plots for top 10 feet under D.G. B show only one test within the confines of the foundation -

Expansion of III - But would have to be better written to require test deficiencies.

V Construction sequence and methods resulted in less compacted areas that were not identified by Testing / Inspection or where identified were not adequately reworked / retested.

Supportive information:

There was considerable removal of fill for the installation of utilities etc after the initial placement. This increases the chances of pockets of low density materials occurring -

6. In addition to the five above items we must address known deficiencies.
   - PSAR commitment to 100% BMP
   - ESAR inconsistancies
   - Interpretation of Specification C-210
     - ASTM vs BMP
     - Moisture Control
   - Design coordination Project → Geo Tech
   - Use of laborers to control the work and call for tests without documented training.

—

order of magnitude estimates for investigating and fixing problems identified so far:

(in addition to Table)	$ Million	Method
Auxiliary buildings Wings	2	Removal & replacement of poor fill with lean concrete
Control tower	—	additional subsurface investigation is planned to confirm that no corrective action is needed
Auxiliary building Railroad Bay	$0.5	chemical grouting to avoid potential for liquifaction
Service water structure	$1	Removal and replacement of poor fill with lean concrete

The above recommended fixes are based on consultation with a number of underpinning and grouting contractors and consultants. Local dewatering to permit underpinning will be required.

SB119701

3-16-79

DRAFT

ANALYSIS OF MIDLAND PLANT AREA FILL

SOIL TEST RECORD:

FINDINGS TO DATE

Prepared by: T. Nehil

The following report is a brief summary of initial findings in the investigation of the Midland Plant Area Fill Soil Test records. The analysis has been conducted by T. Nehil and J. O. Wanzeck. Though a computer aided analysis is being prepared which will be far more extensive, the present findings were obtained merely by scanning the records.

Most glaring is the departure from Spec. C 208 regarding frequency of soil ~~classification~~ TESTING. According to this spec., Bechtel Modified Proctor and Relative Density classifications were to be established one per every 10,000 cubic yards of fill, with field density tests being made every 500 c.y. Thus approximately twenty tests should be made under any one classification.

1. RD 24 is referenced 196 times
2. RD 55 is referenced 491 times
3. RD 61 is referenced 574 times $\Sigma = 1,261$

4. BMP 270 is referenced 210 times
5. BMP 271 is referenced 135 times
6. BMP 269 is referenced 217 times
7. BMP 277 is referenced 148 times
8. BMP 278 is referenced 81 times $\Sigma = 791$

SB:13831

TOTAL 2,052 AVERAGE $\frac{2052}{8} = 256$ TEST

Thus a relatively small number of classifications were used to represent vast quantities of fill placed. Furthermore, the time span over which a classification

was used has been found to be as much as 24 months.

It is assumed that no single stockpile of a uniform soil type was available for borrow for two years straight. This is supported by the misuse of the classifications which result in field relative densities exceeding 100%. For example, 9% of the RD 24 tests show relative densities greater than 105% with the highest value being 131%. RD 61 tests over 105% represent 15% of the total 574, with the highest value obtained being 137%. RD 55 tests with over 105% relative density comprise 51% of the 491 test, i.e., this classification was misapplied more than half the time. The highest relative density obtained under this class was 142%.

Compaction of cohesive soils at times exceeded 105%. In addition, many tests on cohesive soils show combinations of inplace dry density and moisture content which place them outside the zero-air-voids curve for their assigned classification.

The following table illustrates the trend to misapplication of the BMP test classifications:

Soil Classification Number	% of tests over 105% Compaction	% of tests outside zero-air-voids curve
BMP 278	22	51
BMP 277	11	49
BMP 269	1	12
BMP 271	2	30
BMP 270	4	30

There is a tendency for obvious misuse of a classification to appear very early and yet not be flagged. The very first field density test referencing RD 55 shows 119% relative density, throwing doubt on both the in-situ soil and the classification itself. Another, BMP 278, was first used on 4/1/77. All tests in 4/77 were invalid (i.e. outside sero air voids curve or 105% compaction), as were 57% of the tests made in 5/77. Yet the classification was referenced 52 more times over the next 5 months.

Similar patterns are revealed for the other BMP's referenced above, where discrepancies in the use of a classification were apparent almost immediately, yet QC continued to accept all test results.

The wrong pass-fail criterion was used for non-cohesive soils at various times. From the fall of 1974 to the fall of 1975 <u>all</u> relative density calculations were made by dividing the in-place dry density by the mzximum lab dry density. Many of the tests which passed by the above method fail when properly calculated.

For ex ample MD 215 references RD 24 and show a compaction fo 95%, calculated by the wrong method. When recalculated, the relative density turns out to be 72%, failing. This test was used to clear four other failing tests. None of the bad calculations were ever flagged.

NOTES ON PROCTOR DENSITY

The moisture density curve is a result of plotting to suitable scales the dry densities obtained at various moisture ontents used for the trials. It shows that the range of increasing and decreasing densities are due to the water content of the soil. The highest density indicated by this curve for any moisture content is the standard or proctor density; the water content at which this occurs is the optimum water content.

The zero air void curve may be drawn as soon as the specific gravity of the soil is known or estimated. This curve represents graphically the theoretical maximum density that can be produced under a given moisture content.

We reconize the fact that the density obtained by the standard technique is not an absolute maximum, explains the occurrence of field densities higher than this value obtained during construction. Such densities must be secured below the optimum. However, a density that approaches the zero air voids value might theoretically be obtained, but with much more compactive effort.

Example Specific gravity = 2.63

A cubic foot volume containing 120 lbs. of dry soil is occupied entirely by soil and water. Then the soil occupies 120/62.4 x 2.63 = 0.73 cubic feet. The remainder 1.00 - 0.73 = 0.27^3 must be the volume of water. This water will weigh 0.27 x 62.4 = 16.85 lbs., which when expressed as a percentage of dry soil weight = 16.85/120 = 14.0%. This represents one point on the zero air void curve.

SB:10837

JOW/ci

Bechtel Associates Professional Corporation

Inter-office Memorandum

To	R. L. Castleberry	Date	10 January 1979
Subject	Midland Units 1 & 2-Job 7220-001 Plant Area Fill	From	S. S. Afifi
		Of	Geotechnical Services
Copies to	S. L. Blue H. H. Burke/W. R. Ferris w/a P. Martinez w/a J. O. Wanzeck w/a K. Wiedner w/a 1320, 3410	At	Ann Arbor 10(D)5 7220-79-5

RECEIVED
JAN 19 1979
KARL WIEDNER

Attached you will find J. O. Wanzeck's memo in reference to plant area fill placement records.

We feel that further evaluation of these records would be in the best interest of the project. It is possible that some commitments may not have been met. The matter was discussed with K. Wiedner today and it was agreed the task force will work on the subject.

S. S. Afifi

JOW/lap
Attachment

JAN 16

JOB 7220

	ACT.	IN.	INT.
PROJ. ENGR.		Z	
ASST. P. E. T		T	WOR
ASST. P. E. T			
ASST. P. E. P			
ASST. P. E. F			
MECH.			
ELECT.			
CS			
CIVIL			VXC
P.D.			
ARCH.			
QC			
CTA/JOINT PL.			
PROJ. MGT.			
PROC. MGT.			
FIELD			
CONST. COORD.			
[illegible]			
[illegible]			
K Wiedner			VXC
PIPING			

0170 S1 038

Bechtel Associates Professional Corporation

Inter-office Memorandum

To	S. S. Afifi	Date	10 January 1979
Subject	Midland Units 1 & 2-Job 7220-001 Plant Area Fill	From	J. O. Wanzeck
		Of	Geotechnical Services
Copies to	S. L. Blue 1310, 3410	At	Ann Arbor 10(D)5

I have made a simple review of the plant area quality control records and the following is a brief summary of this review.

Under specification C-210 as monitored by the field testing specification C-208, the following is offered for further evaluation.

1. Relative density test results were used for density control on Zone 1 soil. Zone 1 is classified as cohesive; relative density is used for granular soils.

2. Maximum density as determined by the relative test was used as a basis for arriving at 95% of proctor density (i.e., $\frac{109.0 \text{ Field}}{114.0 \text{ Rd max.}} = 95.6\%$. In terms of relative density, this would be about 40-50%.

3. Failing tests as determined above were also cleared using the same erroneous procedure.

4. RD #55 ($\gamma_{max.} = 109.7$ #lbs^3) was used in many cases to check densities. This may have appeared to be the material described, but in many cases, the maximum density was more than 109.7 lbs per cubic foot as evident by other tests and many cases of relative densities exceeding 100%.

5. Some relative density standards along with BMP standards were changed and passing results were obtained (i.e., MD 858, RD #49 @ 66% was cleared by MD 872, RD #41 @ 110%).

On specification C-211 structural backfill, the major fault I can see at this time is that Zone 3 material was used for structural fill. This material (Zone 3) was specified for the sand chimney in the dikes and has a different gradation than was called for in C-211. I believe that this material is suitable, but it may have a conflict as far as the FSAR is concerned.

We can see from these observations that the findings from the administration building may hold true for other areas of the plant fill. It also indicates the testing lab may not have always had qualified supervision.

I have not yet completed all studies that I am doing but I want to keep you aware of my progress.

SB 10839

J. O. Wanzeck

D1556 – No impact } "zero air voids"
D1557 – No impact }

D2922

3.2.1. "... Because of the variability and scatter inherent in field tests, the technique of ~~comparing average~~ in-place density ~~determination~~ determined in the field by Sand-cone or rubber-balloon methods with the nuclear methods at the same locations is considered less accurate than techniques using blocks or prepared containers."

3.3.1 — Provides a method for adjusting calibration curves using sand density tests. (3-5 lbs ±, no correction. 2.16 + or 2.16 –, make correction.

4.3 – Precision statement. Generally provided by manufacturer. ($P = \sigma/s$, where P = precision, σ = std. deviation, and s = slope, cpm/pcf) Allows $P \leq 1.25$ lbs/ft³

Appendix A, A1.5 —

"... It is believed, however, that if the procedures herein are carefully followed, the standard deviation of the nuclear measured values, in terms of accuracy, will not be greater than on the order of some 3 to 5 lbs/ft³ while in terms of precision or repeatability, determined without moving the test equipment, this should not be greater than on the order of 1 lb/ft³.

A 1.7 —

Advantages	Disadvantages
• Relative ease with which the test can be performed.	• Sacrifices the opportunity to examine the soil in depth
• If information is sought on in-place density and test determinations of maximum density are not involved, many more tests can be performed per day than by the older [sand density / rubber balloon] ~~methods~~ methods.	
• ... apparently erratic measurements can be immediately detected and checked since the nuclear tests are more nearly nondestructive.	

S3113841

Midland Units 1 & 2
Job 7220-001

TRIP REPORT

DATES: December 30, 1977 to April 21, 1978

LOCATION: Midland Units 1 & 2
Midland, Michigan

SUBJECT: Subsidence Surveillance Monitor Installation

ATTENDEE: W. R. Kinzer - Geotech/Geology

During the period from December 30, 1977 through April 21, 1978 and concurrent with several other related programs, a total of 27 subsidence surveillance monitors were installed under my inspection at the Midland Power Plant. The monitors were designed through technical specification 7220-C-75 and issued for construction through subcontract 7220-FSC-319. All drilling, monitor placement, and related work was performed by Raymond International of Chicago, Illinois. All monitors were installed to comply as closely as possible to the design specification with adjustments only to meet local field conditions.

Of the 27 monitors installed during the field work, 25 were of the shallow design with depths varying between 15-1/2 and 60 feet. The two deep monitors were anchored in bedrock at depths of 320 and 413 feet. A listing of all monitors installed with their final depth and approximate as-built coordinates is attached. Boring logs, daily reports, and other related data were transmitted to G. T. LeFevre as they became available. The primary first order survey of the monitors is now underway. Survey data should be available in mid-May.

W. R. Kinzer

WRK/lag

GEOTECH
ANN ARBOR

Telephone call

ROUTE S. L. Blue

BY [redacted] OF AAO-Geology

TO M. J. Adair OF SFO-Geology

DATE 27 February 19 78 TIME

SUBJECT Midland Units 1 & 2 - Top of Rock JOB NO. 7220-001
1400, 3210

I advised Bud that rock had been encountered at 160.0' in an observation well boring about one mile east of the plant (where rock is over 340 feet down). Bud recommended we review all nearby borings and other geologic information that might provide an answer as to the significance of this bedrock high. I told Bud we would use this approach.

GTL/lag

SJ 21534

Bechtel Associates Professional Corporation

Inter-office Memorandum

TELECOPY

BEBC-2480

To J.F. Newgen

Date October 4, 1978

Subject Midland Plant Units 1 & 2
Job 7220
Instructions for Obtaining
Soil Samples

From R.L. Castleberry

Of Engineering

At Ann Arbor

Copies to File: 0274, C-79-PR
[redacted] Swanberg
S. Afifi
L. Basinski
J. Betts
A. Marshall
W.B. Barclay
L. Dreisbach
Com Log

The following instructions are to be used to assist in obtaining soil samples from the diesel generator building area and other areas of soil investigations associated with CSA 7220-C-79(Q).

This program is being implemented by the Geotech soils engineering representative at the site.

Standard penetration tests, test pits, auger borings, Dutch Cone tests, undisturbed sample borings, and bag samples are performed as required. The location, depth, and selection of the type borings, tests, and samples are determined by the Geotech engineer at the jobsite with project engineering input as necessary.

The borings should be maintained at all times to prevent hole cave-in. The use of casing or drilling mud is permitted. Where drilling mud is to be used, Bentonite, Attapulgite, Revert, approved equal, or any combination thereof should be used to advance soil borings below the groundwater level. When rotary drilling methods are used, the fluid in the borings should be maintained at all times above the groundwater table.

Penetration tests and split-barrel sampling shall be taken in accordance with ASTM D 1586. The samples obtained should be placed in glass jars and sealed with vapor-seal screw lids. Each jar should be clearly identified using a waterproof marker or label that is firmly attached to the jar showing the job designation, date, boring number, sample number and depth, length of recovery, and standard penetration resistance. The samples should be protected from freezing and direct sunlight.

Teletype Message

TYPE DOUBLE SPACE · BE BRIEF

TELETYPE USE ONLY				
MESSAGE NUMBER		OPR. INL.	DATE	
DSG	TELTEX	TWX	TELEX	OTHER
		X		

CHECK APPROPRIATE BOX:					CHARGE ACCT. CODE: 7220-001
Night Ltr.	Full Rate	Report Delivery	YES	NO	NUMBER TO BE CALLED No number in book.

MESSAGE ADDRESSED TO	ADDRESSEE	ADDRESS	LOCATION (CITY, STATE OR COUNTRY)
	Loughney Dewatering, Inc.	2280 Grand Avenue	Baldwin, New York 11510
	ATTN: Mr. Richard W. Loughney		

MESSAGE SECTION - If additional addresses are required continue to list below:

Subject: Consumers Power Company
Midland Units 1 and 2
Invitation for Proposal 7220-C-88
Area Dewatering System

The items listed herein confirm the information that was discussed/agreed to in the meeting held on July 5, 1979 in Ann Arbor.

1. The location of the dewatering holes inside the structure shall be located around existing equipment as required to sufficiently lower the groundwater table. The Contractor will assist the Subcontractor in determining the locations of these holes.
2. Contractor will take soil borings at locations to be used as well points and record the type of soil removed. These boring logs will be made available to the Subcontractor.
3. The borings will be turned over to the Subcontractor for installation of the Eductor wells.
4. The minimum area to be dewatered shall be under the valve pit structure and at the ends of the Auxiliary Building penetration rooms of both Units 1 and 2.

SB 24819

PIF: L. D. Sokol, R. L. Castleberry, P. A. Martinez, A. G. Horner, J. F. Newgen, W. J. Barrett J. Jeffers/P. Pinchuk, J. Hook, W. Jones, K. Wiedner, S. Afifi, S. Lo, ~~B.~~ C. McConnel, J. P. Retts, C. J. Weems, D. E. Sibbald

DATE	SIGNATURE	LOCATION & EXT.	ORIGINATORS COPY:
09/79	Anne Kimball, Subcontract Supervisor	12030/8 7555	8XB-1628

Ann Arbor Area Office

Teletype Message

TYPE DOUBLE SPACE • BE BRIEF

TELETYPE USE ONLY				
MESSAGE NUMBER		OPR. INL.		DATEL
DBG	TELTEX	TWX	TELEX	OTHER

CHECK APPROPRIATE BOX:					CHARGE ACCT. CODE:
Night Ltr.	Full Rate:	Report Delivery:	YES	NO	NUMBER TO BE CALLED

MESSAGE ADDRESSED TO	ADDRESSEE	ADDRESS	LOCATION (CITY, STATE OR COUNTRY)
	Loughney Dewatering, Inc.		

MESSAGE SECTION - If additional addresses are required continue to list below:

However, the Contractor reserves the right to extend the area of dewatering to include all of the auxiliary building penetration rooms for Units 1 and 2.

5. The scheduled dates in the proposal will be moved back (delayed) 14 days.

6. The specification will be changed to allow for one pump in lieu of two pumps. This will result in a deduct from the pricing of $27,000, assuming 270 calendar days of pumping.

7. The total submitted price in the Invitation for Proposal should be $581,020, in lieu of $580,020.

8. Prior to installing the dewatering equipment in the ground, the Contractor will determine, and inform the Subcontractor, which well points will be made permanent. Any cost changes resulting from this will be negotiated at a later time.

9. If the Subcontractor can classify the work as being "Underground Work" then the Contractor shall be entitled to this additional cost savings.

10. Except as specifically noted above, the changes listed do not affect the original proposal submitted June 22, 1979.

SB 21820

11. In order to have the pre-award meeting on July 13, 1979, as discussed, it is necessary that you notify the undersigned of your acceptance of the above no later than July 10, 1979.

DATE	SIGNATURE	LOCATION & EXT:	ORGANIZATION CODE:

November 1, 1978

BLC-6747

Mr. G. S. Keeley
Project Manager
CONSUMERS POWER COMPANY
1945 West Parnall Road
Jackson, Michigan 49201

Midland Units 1 and 2
Consumers Power Company
Bechtel Job 7220
CONTINUATION OF DIESEL GENERATOR BUILDING WORK
Files 0614/2801

Dear Mr. Keeley:

This letter is to formalize the items discussed during our meeting of October 25, 1978, at the Midland jobsite. We advised that the consultants' recommendation on the course of action for the diesel generator foundation question is expected by November 7, 1978. Preliminary discussions with the consultants, however, have [redacted] -- either [redacted] anticipated settlements throughout its life and modifying the design, or [redacted] to incur most of the settlement prior to plant operation. In either case it would be desirable that the subsurface soils be monitored for movement. Recognizing that there will be some interval between obtaining the consultants' recommendation and embarking on whatever plan is ultimately approved, at this meeting we outlined our plan of activities for continuation of diesel generator building construction and preparation for the possible surcharging of the building area. SB 25347

Specifically, we propose to:

(1) Proceed with modification work on the building. This includes releasing any settlement restraints imposed by the electrical duct banks and then grouting any gaps which exist beneath the building foundations to insure adequate contact with the underlying soil.

(2) Concurrent with this activity we plan to proceed with installation of soil settlement monitors in and around the building.

(3) In preparation for the possibility that surcharging may be undertaken, we will proceed with the design and installation of measures to protect the turbine building and adjacent transformer areas from any effects of the surcharge.

(4) We will also proceed with the installation of any frost protection measures which may be needed. We currently envision using a layer of sand for this protection.

(5) Prior to and after releasing the electrical duct banks, we will perform survey measurements on the ends of the casing for the condensate pipes. We will also perform visual inspection and gap measurement for the following pipes: condensate at casing entry and exit, service water at building entry, and diesel oil at building entry. Visual inspection shall be for physical damage or the potential of damage due to settlement. Gaps will be measured at the top, bottom, and sides of pipes.

Since our meeting we have developed order-of-magnitude cost estimates which show that the release of the duct banks and grouting will cost approximately $125,000, and soil monitors will cost $135,000, and the preparations for surcharging will cost $240,000.

The advance measures for protection of the turbine building and transformer area and frost protection, which are required only if preloading is used, would provide a schedule advantage if started at this time should preloading be decided upon.

So that the underlying soil may be subject to conditions anticipated for plant operation, we request that you proceed to fill the cooling pond to its design level of elevation 627.

SB 25348

As we currently envision having the diesel generators for Unit 2 available for hot functional testing on the first of March, 1980, it is imperative that the construction schedule be maintained. Our current schedule requires that construction be resumed by March 1, 1979, at the very latest. It is highly desirable to have the weight of the building in place as soon as possible in the event preloading is undertaken. We therefore request your concurrence to resume building construction.

Bechtel Power Corporation

As the builders risk insurance for the Midland Project is furnished by Consumers Power Company, we ask that you notify your insurers of the large settlements being encountered and take whatever steps are necessary to preserve rights under the insurance applicable to these circumstances.

As there is considerable urgency to these items, it is our hope to be able to start work immediately. We will discuss any questions or comments you may have at the meeting tomorrow, November 2, 1978.

Very truly yours,

P. A. Martinez
Project Manager

PAM/pp

cc: T. C. Cooke
D. B. Miller

SB 25349

D R A F T

TELECOPY T. C. COOKE
MIDLAND JOBSITE - CONSUMERS POWER COMPANY

(DRAFT November 13, 1978)

Mr. G. S. Keeley
Project Manager
CONSUMERS POWER COMPANY
1945 West Parnall Road
Jackson, Michigan 49201

Midland Units 1 and 2
Consumers Power Company
Bechtel Job 7220
CONTINUATION OF DIESEL
GENERATOR BUILDING WORK
Files 0614/2801
Reference: BLC 6747, Martinez to
Keeley, Nov. 1, 1978.

Dear Mr. Keeley:

This letter is to advise you of recent activities relating to the Midland diesel generator building and modification to the activities previously identified in the Reference.

A meeting was held with the soil and instrumentation consultants, Dr. Peck, Dr. Hendron, and Mr. Dunnicliff, on November 7, 1978. Drs. Peck and Hendron recommended surcharging the diesel generator building area to incur most of the settlement prior to plant operation, determine the effects of this settlement and then adjust building elevations as required. The alternate approach discussed in the Reference of accepting the building's anticipated settlement, has two major drawbacks in the views of the consultants. First, it is not feasible to predict the long term settlement from the boring samples due to the large variation in samples. The settlement will have to be predicted based on soil monitoring. Second, if there (continued on next page)

are to be difficulties with the underground utilities due to the settlement it would be better not to have them occur when the plant is operating.

Based on the above recommendation, our proposed activities in the Reference were outlined to the consultants. The consultants advised making the installation of soil instrumentation the highest priority so that a data base can be developed prior to applying surcharge. They also advised using for greater effectiveness a lower depth of surcharge extended further from the building perimeter. They felt that approximately a 15-foot depth placed in increments of 10 and 5 feet with 20-foot berm placed with 2-to-1 slope should be sufficient but the soil monitoring data may indicate if more surcharge with a maximum of 20-foot dep or a longer consolidation time is required.

In addition, the consultants recommended that the cooling pond be filled to its operating level of elevation 627 just after surcharge is placed but after it was explained that the filling may take 30 to 60 days they recommended proceeding with filling the pond as rapidly as possible. They concurred that construction should also continue on the structure to add load early in the surcharge period.

Construction has been proceeding with the proposed activities. However, due to existing conditions some modification to the monitoring program before releasing electrical ducts is required. The south ends of the two condensate pipe encasements have been exposed. The condensate pipe centerlines were found to be located slightly below the centerline of the encasement sleeves. We will proceed to measure the gap at the top ~~gap~~ and to install vertical rods on the pipe and encasement to permit monitoring of any relative movement during surcharging. On the north ends we will be monitoring only the gaps from inside of the turbine building.

SB 25351

Construction will conduct the activities related to preloading in accordance with directions issued by Project Engineering. Project Engineering will base the preloading plan on the consultants' recommendations.

While we have received approval to proceed with limited construction and are proceeding to the point of concrete placement, we again request your approval to proceed with concrete construction of the building as soon as possible.

Very truly yours,
P. A. Martinez
Project Manager

PAM/pp

SB 25352

Kao

INCONSISTENCIES DISCOVERED TO DATE

1) References:

a. Dames & Moore Report (Page 15)

b. Standard No. 7220-C-501, "Civil & Structural Design Criteria"(Page 8)

"Filling operations shall be performed under the technical supervision of a qualified Soils Engineer who will perform in-place density tests in compacted fill to verify that all materials are placed and compacted in accordance with recommended criteria."

Bechtel Field did not have a Soils Engineer on site. Not true.

2) References:

a. Dames & Moore Report (Page 14)

b. Bechtel Specs C-210 and C-211

Dames & Moore - "All fill and backfill materials should be placed at or near the optimum moisture content in nearly horizontal lifts approximately six to eight inches in loose thickness."

Bechtel Specs - C-211, Section 5.2.2 - "However, in no case shall the uncompacted lift thickness exceed 12 inches."

Obviously, these two requirements conflict.

3) References:

a. Dames & Moore Report (Page 15)

b. Bechtel Specification C-211 ←

Dames & Moore - "In addition, no compacted soils should be allowed to freeze. If fill or backfilling operations are discontinued during periods of cold weather, it is recommended that all frozen soils be removed or recompacted prior to resumption of operations."

Bechtel Spec - "No backfill shall be placed upon frozen surface nor shall any frozen material be incorporated in backfill."

This does not address the question of removal or recompaction upon resumption of work.

SB 22301

4) References:

a. Bechtel Design Standard C-501

b. Bechtel Spec C-211

Bechtel Design Standard - Table of Minimum Compaction Criteria

Purpose of fill support of structure	-	On site Sand soil Percent relative density 85% (D2049-69)

Spec C-211, Section 5.5.1 - "Cohesionless (sand) material shall be compacted to not less than 80% relative density.... by ASTM D. 2049"

Spec and Design Standard conflict.

5) References:

a. Dames & Moore Report (Page 14)

b. FSAR Page 2-7

c. Drawing C-44

Dames & Moore - "It is recommended that all areas in which the final grade will be raised by placement of fill be stripped of all topsoil and other unsuitable soil if any and be thoroughly proof rolled."

FSAR - "All loose in-site sands, soft or compressible clay soils, and organic soils will be excavated in the Turbine Building area."

Bechtel Drawing C-44, Note #4 - "Within the excavation area shown all loose surficial sands with relative density less than 75% shall be removed."

Added to this drawing 8/23/75.

Boring logs show us that the soil was not removed, however, it may be greater than 75%.

6) We question the Method USE TO Select The proctors. Errors in reported compaction probably resulted from selection of LOWER MAXIMUM density Proctors. See Bechtel LETTER TO U.S. Testing dated 2-1-78. ?

SB 22302

Fill Below Original Beam at 0.4 Line

5-1-78

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

	DESCRIPTION OF TEST	ELEVATION OF TEST	TEST RESULTS AT COLUMN HT	TEST RESULTS AT COLUMN L	TEST RESULTS AT COLUMN
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 Test No. 136
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.
4.	Reported % Compaction	617' ±	101%	96%	97.6%
5.	% Compaction Using In-Place Proctor	617' ±	89.3%	89.9%	87.5%
6.	Compacted Fill Density Tested After Beam Removal	617' ±	*Dry Density = 119.7 lb./ft.3	Up & 0.4 Dry Density = 117.5 lb./ft.3	Dry Density = 108.5 lb./ft.3
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 submitte for information only to Bechtel. Copies of reports are included as Attachment N

SB 22303

DRAFT: FOR ENGINEER'S USE IN CORRESPONDENCE WITHIN BECHTEL

Bechtel Associates Professional Corporation

Inter-office Memorandum

To H. W. WAHL

Date

Subject MIDLAND PLANT UNITS 1 & 2
JOB 7220
Plant Area Earthwork.

From [redacted] P. A MARTINEZ

Of ENGINEERING

Copies to FILE: C-210, C-211, 0294.
R. L. Castleberry,
T. E. Johnson.
K. WIEDNER.

At ANN ARBOR

The following is in response to the queries raised by various people regarding the earthwork on Midland proj.

1. Introduction: The latest specification for Construction the embankments in the plant area is C-210. Majority of the fill in the plant area was placed during the spec. C-210 between 1973-74 and 1975-76. The major portion of the embankment was constructed by Concrete Construction Corporation under field administered subcontract 7220-C-210. Testing of materials, compaction was conducted under subcontract 7220-C-202.

The spec. C-210 is C-10 [illegible] was issued on 1973. At that time the spec. C-10 embankment was on

R.A.C.

[redacted]

P. A. MARTINEZ.

SB 22304

ENCLOSURES (PLEASE INDICATE)

(IF ADDITIONAL SPACE IS REQUIRED, PLEASE ATTACH A SHEET OF LINED PAPER.)

the construction of cooling pond dikes to rail road embankments. However, certain sections of the specification included the plant area fill also. This is due to the fact that some dikes are located within the plant area limits. The Testing of embankment materials, compaction etc. was carried out under a separate field administered subcontract Nitro-E-8.

2. Criteria used for Embankment Construction.

A. Specification C-10:

Foundation Preparation - After clearing and grubbing the acceptability of foundation to be determined by Contractor.

Proof rolling on acceptable foundation

- 4 passes of 50 ton rubber tired roller for dikes and Railroad embankment
- 2 Passes of 50 ton rubber tired roller for plant area.

B. Embankment Construction - R/R, Dikes and areas shown on drawings.

Suitability of materials to be determined by the Contractor and Subcontractor to make necessary tests to determine the acceptability of materials. ~~Contractor~~ Contractor to determine the degree of compaction and other requirements by laboratory tests.

Moisture Content: ASTM D 2216.

SB 22305

Gradation: ASTM D422

In place density: ASTM D1556.

Max. Lab. Density and optimum moisture content for cohesive materials. } ASTM D-1557 met D provided the Sa is prepared to Eche method.

for Cohesionless Materials - ASTM D2049.

Placement: Materials to be placed i layers (loose) not exceeding 12 inc for clayey, random fill and sandy materials. In areas not accessible to heavy rollers the placement l limited to 4 inches.

Moisture Content: To be within ±2 percentage points of the optimum

Compaction - for materials described under placement 4 passes of 3 to ton roller.

SB 22306

It should be noted that there was no indication of the degree Compaction to be achieved. In essen the degree of required compac was to be determined by perfo This type of performance specificatio

requires constant surveillance by people who are familiar with earthwork operations. There are evidences that the earthwork was constantly supervised by qualified soils engineers during 1969 thru 1970.

C. Specification C-8.

This specification was the basis for determining the adequacy of placing and compacting embankment materials under Subcontract 7220-C-10.

Specification C-8 required only Proctor test to determine max. laboratory density and optimum moisture content although Spec. C-10 required ASTM D 1557 method for cohesive materials. For cohesionless materials ASTM D 2049 has been referenced.

Frequency of Testing Embankment materials

Lab Compaction	—	1/20,000 yds or 1 test/day
Relative density	—	1/20,000 yds "
Field density	—	1/20,000 yds "
Moisture content	—	1/10,000 yds.

3. PSAR Commitments:

A. 1967 Dames & Moore report.

- The permanent flood protection [illegible] (dikes) may be constructed from on site materials. Placement to be in 12 inches layers compacted to 85% max. density based on AASHO T-180-57 spec.
- Fill for support of structures and around to be accomplished using granular materials placed in 8 inches layers and compacted to 95-100% of max density determined by AASHO spec. T-180-57

Material requirements were modified to use onsite materials for support of structures by Amendment 1 to the PSAR.

B. 1968 Dames & Moore Report.

SB 22308

Fill should be placed in layers of 6 to 8 inches and compacted to 95% & 100% of max density determined by ASTM D 1557-66T for cohesive soils and cohesionless soils respectively

c. 1969 Soils Report by Dames & Moore.

It was recommended that the fill operations be supervised by qualified soils engineer. Fill shall be placed in layers of 6 to 8 inches at or near optimum moisture Content Compacted to 100% of max. density determined by modified ASTM D-698 method (so called the BECHTEL (modified proctor) TEST) for cohesive soils to support structures. For sand soils the relative density, to be 85 % per ASTM D 2049.

SB 22309

4. DISCUSSION:

It is noted that the PSAR Commitments were not reflected in the specification C-10 for the plant area fill. Review of project files reveal that some plant area fill was constructed during 1968 thru' 1970. Various correspondences discuss the requirement for compaction in the plant area fill viz 6 passes of 50 ton rubber tired roller. These correspondences also indicate that minimal laboratory testing was conducted to determine the adequacy of fill and there was supervision by qualified

Soils engineers. The project was shutdo during 1970 and reactivated in late 1972.

Project resumed earthwork activitie during 1973. Specification C-210 was prepared during this time and the Contract was awarded to Lenone Construction Company.

5. Specification 7220-C-210.

It appears that the basic form of Spec. C-210 followed the original C-10 with several modifications and included the Quality Assurance requirements. Since all the Class-I structures and systems were not situated, the whole plant area was designated as Q-listed and was identified on Engineering drawings.

SB 22310

Specification C-210 included the requirements for Construction of RIR embankments, Construction of adjacent areas and plant area fill. Areas adjacent to structures (all and areas where motorized rollers are not accessible, structural backfill material was specified and [illegible]

included in the subcontract 7220-C-2

A. Criteria for placing fill in the plant area

- foundation to be approved by Contract
- Testing of embankment materials is referenced to the dike section.
- Placement is also referenced to dike section. w/ 12" thick layers
- Moisture control is tied to the dike section.

- Compaction - for cohesive soils it is 95% of max. density determined per ASTM D 1557. D.
  for cohesionless soils - 80% relative density determined by ASTM D 2049 ~~Spec.~~

B. Testing of all materials placed in the embankment was conducted under Spec. 7220-C-208. SB 22311
Specification C-208 was prepared on the lines of Spec. C-8 - with several modifications. This specification required that Max. lab density for soils shall be determined per ASTM D-1557 meth D or per Bechtel, TEST which direct

by Contractor.

Frequency –

Field density & moisture content } – 1/300 yds

Compaction, grain size & specific gravity } – 1/10,000 yds

c. Specification 7220-C-211.

This specification was originated to include areas, within 3 feet of exterior walls of structures and not accessible by motorized rollers. These areas may be used as support for other structures.

Criteria.

Foundation to be approved by field En

Placement – max 12 inches Layer and to determined by the performa & the Compaction equipment used.

SB 22312

Moisture Control } – No specific limits; but to be conditioned as dry as practical

Compaction – 95% max density / ASTM 1557
or Bechtel Test. Cohesive
Non-cohesive plastic

– 80% Rel. density - ASTM D2
for Cohesionless soils

Testing Frequency

Large areas 1/500 yds
Confined areas 1/10 yds to 100 yd
as determined by
the field engineer

6. Project Design Criteria.

Project design Criteria discusses the requirement of Compaction for Various Conditions. Basically these requirements reflect the commitment of the PSAR - Dames & more report of 1969 & includes the supervision of earthwork by qualified soils Engineers.

SB 22313

DISCUSSION:

It is seems that the project specifications adhered to the PSAR ~~requ~~ Commitments only in certain areas Viz moisture content and material requirements. However, there are some descrepancies with the commitments. The placement of materials does not meet the PSAR requirements because the spec. requires 12 inch layers versus 6 to 8 inches. 12" layers will be pretested for adequacy, and may not be a deficiency The Compaction indicated in the spec meets it. Commitment of 100% of max density determined by Bechtel test, Versus 95% of ASTM D1557 method D, for cohesive soils [The ASTM D-1557 method D requires 56,000 ft lbs of energy per cubic foot of soil and the Bechtel test requires only 20,000 ft lbs of energy per cubic foot of soil. See attachment A for a graphical comparison Variant to 1.] For cohesionless soils spec. requires 80% relative density versus 85% Commited in the PSAR. This however may not lead to a difference because of the characteristics of materials used.

SB 22314

It is apparent from various correspondence that field engineering had doubts about using the right compaction criteria. It is also evident that a Soils engineer was supervising the fill operations during 1973 to 1974. Responsibilities were outlined by the project engineer to the various parties involving fill operations including the Soils Engineer. Soils engineer was responsible for guiding field construction in areas of testing and selection of materials etc.

Unfortunately, Bechtel field was using the Bechtel test and approving the tests based on 95% using Bechtel test. The basic reason for this confusion is that the testing requirement for plant area fill is referenced to the dike section of the spec. C-210. Field although requested for a clarification in writing, the letter was left unanswered for unknown reasons. SB 2315

It is also noticed that the supervision by a qualified Soils Engineer was only occational

for period 1975 to 1977.

It appears that the qualified soils engineers realized that the compaction requirements that are used in the field doesn't meet the PSAR commitment, but was at a stage major earthwork was done. Ofcourse, this discrepancy was notified to the project in reply to the field's request for clarification on this subject of compaction.

In reality, the compaction was to have been achieved at 95% of max. density determined by Astm D1557 method D as intended in the plant fill section of the spec. C-210. The determination of max density based on BECHTEL TEST WAS TO HAVE been used only when directed by the field engineer. However, it would have been alright to use Bechtel test if the acceptance was based on achieving 100% compaction.

SB 22316

The 80% relative density was

used in the specifications C-211 based on the recommendations of soils engineers (Geocon).

It is also noticed that there are no specific criteria for use of Compaction equipment in the spec. The plant area compaction was mainly intended to be the end result spec. This would mean there would have to be closer supervision and/or control of the fill during placement and compactio

Rao/

SB 22317

Brief Summary of findings from Vari
Files; D&M Report and FSAR

1. Files: Earthwork Specification C-10 was
formulated by Geotechnical grou
This spec. requires tests per BMP
& min 90% Compaction requirements
referred to Mine dwgs also.

Spec C-8 rev. 0 required Compa
to BMP. Client was aware of te
letter from J. H. B to Kessler 5/15/69
A report written by R.L. Kaleza
indicates that some plant area fill
was placed during winter & this
is substantiated by a report from
R. R Sadler.
A discrepancy was noticed in deter
Compaction by Sand Cone & balloon t
Reported by Kaleza & Kar.

2. D&M Report — PSAR Vol. 4
1967 report requires 95 to 100% o
max dry density per AASHO Spec.
T-180-57. — Thickness limited to 8 in cle

1968 - June Report -
Requires 95% for cohesive & 100%
Cohesionless soils based on ASTM D1557-6
Thickness 6-8 inches loose

SB 22318

1969 - March.

Requires 100% of max dry d
& 85% Rel density. Recommends
that filling operations should be
supervised under qualified Soils
Engineer. Includes a recc that
filling should not be done durin
winter time. Layer 6 to 8" loose

Back Fill operations continued until
end of 1970.

1973 - Spec. C-210 and C-208 were issue

13.7

Spec. C-210 & requires 95%
Compaction based on ASTM D 1557.
13.4 refers to Sec. 12.4 for
testing requirements.
Para 12.4.5 requires BMP. test
This is only for information to the
SubContractor. Actual test is to be
Conducted under C-208
Spec. C-208 Sec. 9.1 requires compa
tests to be conducted either ASTM 155
or BMP when directed by the
Contractor.

During 1974, june 15, project was m
aware of the fact that there was co
confusion existed w/ field in regard
to the requirements of compaction
ASTM 1557 or BMP.

6/19/74 Project was advised by
Geotech(SP) that fill under structures
should be compacted to 95% o
ASTMD1557. By now project under
field was only using BMP.

It seems like Geotech was all
along aware of the BMP method
that was used in the field. July
74 Project delineated the responsibi
of various groups involved. It clea
indicates that Geotech is responsibl
for all earthwork operations inclu
testing.

Several NCRs concerning compac
moisture and frequency of testing
were written during 1974. These
NCRs (26, 55, 88) were primarily
dispositioned by Geotech. Geotech
used BMP as the basis for disposit
these NCRs.

SB 22320

July 25, 1974 field requested for
a clarification in regard to compac
req't. (BCBE 370) Geotech responded

to that on 9/13/74. This Conclud
with a Statement that further test
& Comparison of 13 MP Vs 1557 Should
be made to justify BMP. This also Suggested 85%
Rel. density.

A response to BCE 370 was
prepared but never was issued

It is also evident that a Soils
Engineer was present during 1973 & 19
There is no evidence of a Geotech
rep. during 1975 thru' 78 to Super
the backfill operations.

There is also a correspondence from
Geotech (Jow) which indicates that
there is no moisture rest for
Zone 2 in non Q Areas. Admin bl
is in a non Q Area.

A more detailed report will
be made regarding problems w/
barrel materials, placement & testing

Finally, FSAR indicates only the
use of 95% BMP.

SB 22321

Rao.

Dry run after NRC entrance to Tank 4/30
Need outline – presentation, discussion

1. History
2. Exploration & Testing
3. Consultants Report
4. Galagher concerns
   be ready also in case NRC and consultant
   similar to CPL concerns
5. Structural Considerations

NRC FINDINGS. 11/27/78.

1. Functional or Program Area Inspected.

e. Other Activities to be planned.

1. There is no plan at this ... to take any borings in the coal pond dikes to verify the integrity.

2. Visual inspection of crack and settlement monitoring is being continued.

f. Other structures being monitored.

3. Emergency diesel oil tanks are buried underground and is not being monitored for settlement at this time. Instead, Condensate tank (300,000 gals cap; Stainless) non-q foundations are being monitored

2. Review of test data of soil borings — Comments if any from Region.

3. Review of FSAR Commitments SB 22323

a. Yes. Table 2.5-14 indicates Controlled Compacted Cohesive material under Dia.

However this is erroneous. Section 2.5.4.
indicates onsite excavated material
used as fill material & table 2.5-1
identifies the different zones & mate
Dwg. C-109 is the governing document
type & materials to be used in
embankment construction. The mate
to be used in the area 10' away
from dike Ref. line is Zone-2 or
random fill. There is no gradi
requirement for Zone-2 material

Note: 1. Lean Concrete was permitted as
fill under Spec. C-211(E) in areas
within 3' of outside walls & slabs,
or in areas where material (SDT
rollers could not be ~~E~~ used. Confined
under D/G bldg., areas around duct ba
and pipelines lean concrete could
have been used.

2. Section 2.5.4.10 (Bearing Capacities)
discusses only compacted fill for struc
above ELV. 602' and does not
mention cohesive soils. Foundation
D/G Bldg. control compacted fill

SB 22324

3. The design criteria for plant
embankment construction is outlined
in Sec. 2.5.5.2

4. Figures 2.5-49 & 2.5-50 indicate the construction of dike/plant area fill. The area fill is an integral part of dike and is designated by same material.

3 b. FSAR Commitment (Contd.)

FSAR table 2.5-21 has been referenced under section 2.5. - Embankments & Dams - specifically under subsection 2.5.6.4.1 for plant & dikes. Summary of compaction requirements (table 2.5-21) is misinterpreted for dike construction. The dike has 6 zones & materials 1 (1A), 2, 3, 4, 4A, 5, 5A etc. Zone 1 (1A) is cohesive, (2) random, 3 is cohesionless (sand drain), (4) is gravel (also 4A) 5 (5A) is riprap. (6) is topsoil.

The 4 roller passes was a minimum requirement for construction of dike with a 50-T roller. In addition to this field density tests were performed to determine the degree of compaction (95% of max dry density). Since the plant dikes except in the plant area are non-safety related, C-C dikes

SB 22325

get involved in the testing methods for dike construction.

For plant area fill, the minimum requirement (table 2.5-9) for [illegible] is to end result of 95% of dry density. Spec. C-210 section 13 reflect this requirement. Therefore, QC Instruction did not include the requirement of 4 passes, instead required the frequency and degree of compaction (by tests) for plant area fill. In essence the objective was to achieve the required degree of compaction and not the method of compaction for plant area fill. Therefore, Spec. C-210 doesn't require 4 passes for plant area fill.

3(d) Yes FSAR FIG. 2.5-37 does indicate the fdn ELV for D/G bldg. at 634 and is erroneous. However, Section 2.5.4.10 does mention that bldg. fdns are placed min 4½ feet below grade and table 2.5-14 references the fdn ELV for D/G bldg. at 629.5'. It is [illegible] ELVs and 629.5'. The final fdn elvs. were not established at the time of preparing FSAR document. These will be revised in the future

SB 22326

4. Review of specifications for site soil activities.

The statement made by the inspector is true.

It was the intent to obtain 95% of max dry density determined by ASTM D 1557 Method D. However the confusion existed because the method of testing was referenced to the dike portion of the work. Strictly speaking the testing methods may not even apply since actual testing was carried out under spec. C-208. C-208 gives an option to conduct tests similar to Seabed test (20,000 ft lbs/ft³ energy) or ASTM D1557 method D (56,000 ft lbs/ft³ energy) as directed by the field Engineer. Thus, the objective of achieving 95% of Compaction based on ASTM D 1557 could have been fulfilled. But, the soil testing was carried under Seabed method & there is no sense in crying over the spilt milk!

However, the review of the cumulative relative frequency versus percent compaction reveals that 95% of the time a compaction of more than 95% was obtained!

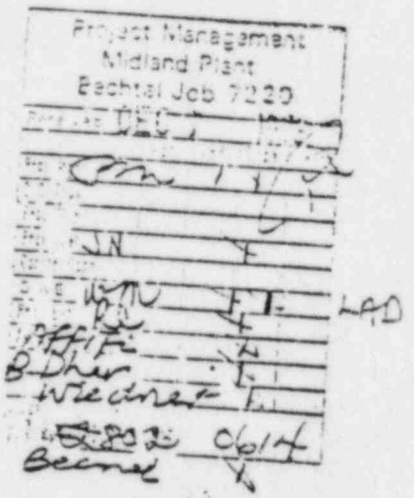
SB 22327

It is true that Dames & Moore did recommend 6 to 8 inches lifts for placing soil but based on test fills constructed 12 inches lifts could be compacted to the requirements & the specifications.

Couple of m/c Vs density curves for D/G fill may appear to be steep.

5. NRC 4/R 326.2 Loose sand
This has been cleared in the recent addendum & FSAR

Consumers Power Company



December 7, 1978

Mr. P. A. Martinez
Bechtel Power Corporation
P.O. Box 1000
Ann Arbor, MI 48106

MIDLAND PROJECT CWO 7020 - DECEMBER 3 & 4, 1978
NRC VISIT REGARDING DIESEL GENERATOR SETTLEMENT
File: B3.0.3 Serial: CSC-3663

While this is not a set of minutes or an open item action list, during the subject visit several issues or questions were raised or inferred as noted below:

1. New settlement readings taken after duct bank freeing would seem to indicate the building may be pivoting about a north-south axis located somewhere in the vicinity of the condensate pipes. This raised a question concerning the potential hard spot developed by the 20" condensate line encased in the 24" lines surrounded by concrete and possibly resting on well compacted sand. If this is the case, we should examine the Diesel Generator Building structure in the vicinity for cracks in the concrete and consider the possibility of cutting loose the condensate lines immediately adjacent to the Diesel Generator Building.

2. When Mr. Ferris discussed possible causes, he made the point that it may be impossible to state the exact cause and that the more immediate concern was the remedial action. Although we concur that remedial action is most important, it should be noted that Mr. Gallagher took strong issue with this point in that I & E believed cause determination to be mandatory and relative "to preclude repetition," etc. This aspect should receive more attention.

3. During this discussion it was noted that instrumentation will show when surcharge may be removed. In response to the NRC question regarding same, it was also noted that most settlement should occur rapidly as the area is being preloaded and that total settlement could take weeks or months. Our final response will have to provide sufficient rationale for determination that required settlement has taken place and answer the question of how we arrived at what was required.

4. Bechtel agreed to provide R. Cook a list of the equipment (small hand equipment and vibratory rolling equipment) which Bechtel utilized for compacting the fill from El 616' to El 624' in the Diesel Generator Building.

5. Perim, Mr. McConnell's discussion regarding [illegible], Mr. Gallagher questioned the possible interference by the 20" condensate line. Bechtel should in-

SB 22329

vestigate and document the effects of additional outside pressure on the condensate lines resulting from the preload. Again Bechtel should consider cutting same at this point in time since it appears that it could be acting as a cantilever type restraint with the fixed end being the Turbine Building wall and/or the well compacted sands existing in that area. In a separate discussion, Mr. Don Miller noted that we have to consider the effect of rupture of the condensate line and subsequent flooding on a Class I structure during a tornado and/or an earthquake.

6. Mr. Gallager appeared to find Mr. Dahr's explanation connected with VII a. 1), table oversite, unacceptable or at least extremely difficult to accept. Bechtel should be prepared to completely satisfy the NRC concern in this area.

7. VII a. 7) Mr. Gallager appeared to find the ± 2% Industrial Standard discussion unacceptable. Bechtel should be prepared to completely satisfy the NRC concern in this area. We believe Mr. Gallager's question not only relates to the characteristics of the proctor curves in terms of optimum moisture content but additionally whether the material being placed relates to the selected proctor. To go a little further, he may be questioning the validity of your tests; i.e., was it really 80% or 95% compaction.

8. In my opinion, we should be prepared to fully address Mr. Heller's summary comments regarding the fact that the response to the Diesel Generator Settlement questions will have to improve or exceed the reviewer's expectations. Mr. Heller was discussing the fact that the construction permit was based on the original reviewer's examination of the program, and that licensing will now have to judge whether or not the modification program meets or exceeds the construction permit intentions and qualifications. This would seem to indicate that our responses are going to undergo an extremely critical review and that none of our answers will be acceptable unless they can withstand the most intense scrutiny. It would also appear that this will become part of the operating license hearings. In that respect, I cannot emphasize too strongly the need for absolute documented accuracy and the strongest argument in our responses.

As a separate issue we are also extremely interested in as early as possible resolution to the Turbine Building basement wall problem and preload relative of the area between the Turbine Building and the Diesel Generator Building.

I am submitting this list of items for your review and consideration as part of the overall development or resolution to the Diesel Generator Settlement problem. No response is required at this time.

T. C. Cooke
Project Superintendent

TCC/sd

SB 22330

Teletype Message

TYPE DOUBLE SPACE · BE BRIEF

MESSAGE NUMBER	OPR. INL	DATE

DBG	TELTEX	TWX	TELEX	OTHER

CHECK APPROPRIATE BOX | CHARGE ACCT. CODE:

Night Ltr. | Full Rate | Report Delivery YES NO | NUMBER TO BE CALLED

MESSAGE ADDRESSED TO	ADDRESSEE	ADDRESS	LOCATION (CITY, STATE OR COUNTRY)
	BECHTEL POWER CORP	3500 E. MILLER ROAD	MIDLAND, MICHIGAN 48640
	ATTN: J.F. NEWGEN		

MESSAGE SECTION - If additional addresses are required continue to list below:

BEBC- 2647

SUBJECT: CPCO/MIDLAND PLANT - JOB 7220

SETTLEMENT MONITORING FREQUENCY

FILE: 0274, C-76, C-2640

REFERENCE: BCBE-2153 DATED 1/9/79

THIS IS A COMPLETE RESPONSE TO THE REFERENCED LETTER. YOU ARE REQUESTED TO CONTINUE THE MONITORING OF SETTLEMENT MARKERS AS SPECIFIED IN BEBC-2508 DATED 10/26/78, EXCEPT THE FOLLOWING BUILDINGS MAY BE MONITORED ON A 60-DAY BASIS.

1) CIRCULATING WATER STRUCTURE

2) SERVICE WATER STRUCTURE

3) EVAPORATOR BUILDING

4) MAKEUP PUMP STRUCTURE

5) RIVER INTAKE STRUCTURE

ENGINEERING NEEDS TO REVIEW TWO MORE SETS OF READINGS ON THE COOLING TOWER BASIN MARKERS BEFORE CHANGING OVER TO A 60-DAY CYCLE.

R. L. CASTLEBERRY

COPIES TO: L. DASILKSI, COM LOG

SB 22331

DATE	SIGNATURE	LOCATION & EXT.	ORGANIZATION CODE
	R. L. CASTLEBERRY	6A 7220	7PB-0610

AAO-17-1

ORIGINAL TO TELETYPE

Teletype Message

TYPE DOUBLE SPACE · BE BRIEF

DBG	TELTEX	TWX	TELEX	CT

CHECK APPROPRIATE BOX | CHARGE ACCT. CODE

Urgent | Full Rate | Report Delivery YES | NO | NUMBER TO BE CALLED

MESSAGE ADDRESSED TO	ADDRESSEE	ADDRESS	LOCATION (CITY, STATE OR COUNTRY)
	BECHTEL POWER CORP.	3500 MILLER ROAD	MIDLAND, MI 48640
	ATTN: J. F. NEWGEN/J. BETTS		

MESSAGE SECTION - If additional addresses are required continue to list below:

BEBC-2508

SUBJECT: CPCO/MIDLAND PLANT - JOB 7220

PLANT SITE SETTLEMENT MONITORING

FILE: 0274, C-210, C-211R

UNTIL FURTHER NOTICE, THE SETTLEMENT MARKERS SHOWN ON DRAWING 7220-C-994, REV 1 SHALL BE MONITORED IN ACCORDANCE WITH SPECIFICATION 7220-C-76, EXCEPT ON THE FOLLOWING CYCLES.

1) DC MARKERS - 7-DAY CYCLE

2) CONTAINMENT, AUXILIARY BUILDING, AND TURBINE BUILDING MARKERS - EXISTING 60-DAY CYCLE

3) ALL OTHER MARKERS - 14-DAY CYCLE

THIS SUPERSEDES ANY PREVIOUS INSTRUCTIONS ON MONITORING FREQUENCIES INCLUDING THOSE SHOWN IN DRAWING 7220-C-994, REV 1.

R.L. Castleberry

JR/js

COPIES TO R. MARTINEZ, K. WIEDNER, L. BABINSKI (FIELD), R. SCHULMAN (FIELD), B.C. MCCONNEL, COM LOG

DATE	SIGNATURE	LOCATION & EXT		ORGANIZATION CODE
10-24-79	R. L. CASTLEBERRY	6A	7220	7PE-2118

AAO 17 1

SB 22333

RAC

Bechtel Associates Professional Corporation

Inter-office Memorandum

To	R. L. Castleberry	Date	29 December 1978
Subject	Midland Units 1 & 2-Job 7220-001 Request for Design Data and Calculations	From	S. S. Afifi
		Of	Geotechnical Service
Copies to	S. L. Blue A. S. Marshall [redacted] W. R. Ferris J. O. Wanzeck K. Wiedner 1320, 3410	At	Ann Arbor 10(D)5 7220-78-118

We request you provide us with the following:

~~1. Design calculations for the~~ retaining wall structures adjacent ~~to the service water building.~~

~~2. Design calculations for the diesel generator pedestals.~~

3. Maximum allowable differential settlements for the retaining walls, transformers, tanks, guard house, and underground Class I pipelines.

4. The following information will be required for all the structures:

   a. Estimated design (superimposed) load, foundation type and contiguation (mat vs. spread) and elevation.

   b. Settlement benchmark readings vs. time from the initial reading to the present time. — PK has

   c. Actual applied load vs. time for the partially completed structures. — Pending BEBC 2 1/9

5. Locations of buried Class I utilities. — PK has this.

~~This needs to be transmitted to Geotech before January 13, 1979 in order to answer NRC Question 362.4 in February 1979.~~

P. K. Chen
for S. S. Afifi

PKC
PKC/lap

Completed 1/12/79

SB 22334

12/31/74 FCRC-20 was approved by Geo regarding material & conditions. 6" ϕ to 12/16" cone for bulk Gravel. This has not been reflected in C-206.

10/29/74 Backfill adjacent to T/B bank mat could be Zone 2. (No evidence & transmitting this info to field could have been by telephone. This was in regards to a request from field J Sarchet to RLR 10/29 This is although adjacent to T/B slo 95% BMP was used Portion of Fill could have been under Rdg & ∈ Xformer Pads.

2/27/78 QAR SD-40 indicates that no m/c Checks have made prior to placing & Compaction. BCBE-1533 was revised after July 77. SB 22337

7/21/75 RLR to RLC - Q. [illegible] the importance of keeping w/ the [illegible]

C-210 reg'ts Was emphasized.

11/18/77 — moisture requirement: Ques
BCRE 1669, BERC 1998, telecon
Hook/Rao 10/13/77, 10/10/77.

9/30/75 — Afifi to J.F.N Geotech
Was aware of the fact that
majority of testing was done
using BMP. - Connie claim.
Geotech obtained all soils
info. from field..

3/8/76 — W.R. Ferris to Afifi Nuclear
method of testing. telecon
S. Rao/J. Church. 4/12/76
m/c is important.

10/11/73 — J.L. Allen to PAM
Relates to use of BMP (95%
in selected areas specified by ES rep.
BCRE 104 Transmittal Ltr. Sand, C/C
questions & rep. Serial 415 T.C.C.
to Nangen 8/19/74. - See Compaction Ltr

SB 22338

7/1, 7/2/73, 74 JCW entered C/C & H
No m/c requirement for Sand
& Non Q Fill - maxima file.

4/24/74 – Trip report by SSA delineates request from field to have a soils Eng & their involvement. See report by Gerald Pile.

9/18/74 R Grote to KLR
Expresses concern by Co re. use of approved rollers Vs 95% compaction spec.

8/19/74 Report by JOWS, regard % Compaction & Cohesionless material 80% & frequency & testing. material from Allegheny Dep. was excellent - compaction spec

8/12/74 – Field had problems w/ attaining reqd. compaction & cohesionless soils – JAH indicated to use more H2O - see Compaction Spec

SB 22339

7/12/74 RWS/Afifi states 80% Rel. Dr. is = 95% of Hilf's D 1557. - Compaction

9/19/74 C. A. Hunt Co to RLR expressi
Concern regarding method &
Compaction - rollers not used
- End result @ 75% D155
- BE&C 831 does not ref.
95% D1557. - Compaction file

6/25/73 J. Allen to P. Burcin Co
to JCH, RLR requests the
use of Nuclear device f
testing

1/17/74 Testing Frequency PAM to
Allen NCR C-26. requests
evaluation - NCR, Fell file

1/28/74 Allen to PAM Suggest
results of testing to this point
NCR C-26 - NCR file - BE&C
Geotech's supervision for bearing

3/29/74 Geotech SSA to PAM
Relates that soil is variable
testing freq. should not be reduc
- NCR file

SB 22340

7/13/73 Adjacent to Structure
completion backfilled by & compacted on by PAM/

10/31/68. B.H. Randolph to Thon J.G. indicates Geotech will [illegible] types & dwgs for dikes. — General

2/17/69 B.H. Randolph to Thon requests alignment in vic. [illegible] fdn. Diesel Bldg & S.W. Pumps — D.G. Bldg. pole.

2/26/69 Mtg. Eng. & Geotech.

Loose sand, Compaction Backfill around Structs. by Boat Ob Bldg. SWPS. — Compaction [illegible]

Criteria

7/2/74 PAM to J. Allen Responsibilities & work. — Completion

6/19/74 Project became aware of BMP — all fill telecon SFA/RLR. SF. indicated [illegible]

SB 22341

6/15/74 R Grote / JCH. Project was made aware [illegible]

Confusion 1557 — Field used BMP
— Compaction file.

2/1/73 Client expresses concern
about Compaction — Compaction f

7/30/73 Eng PAM to Selitemet
includes Nuclear device. to
C-210.

11/8/73 RK Sullivan to PAM
Indicates that the end result
is based on the type & roller
to obtain required Compaction

12/16/78 R. L. Kaleszka's report

Some fill was placed in the
plant area during December
discussed loose sand & BMP.
Compaction file

9/16/68 Spec. C-10 was written w/
BMP by Geotech. — Compaction f
J. Guida

4/17/69 rev. 0 C-10 issued for bids
w/ BMP. — Compaction file

SB 22342

12/9/70 E W. State report by Sedla

Indicates some back fill w
placed during adverse weath
condition as 1969.
Indicates adjacent to structu
designated struct. backfill &
Compactive effort 100% — Compa
pile

C-8 rev. 0. required only Br
test. Page 13. Compact- pile

1974. West ½ D/G Bldg. to ELV 580.
" 595'
" 600'.
This area includes Partly New & E...

1975 North ½ GD House & SW ½ Unit 1 Xfmr.
Must be above ELV. 600'.
Upto EL. 605
" 610.
South ½ GD House & both CHANGE-HOUSE EAST
– 610'

Underneath D/G Bldg. & E & W ½ D/G.
– El. 610.

E, West, SE ½ D/G Bldg.
→ – 615',

1976 W. ½ SW D/G, South ½ ED/G.
– EL. 625

South ½ D/G.
– 610' – Doesn't make sense
West 1/2 ½ D/G & S, SW ½ D/G.
– El. 615'
SW. ½ former D/G 620'
SW ½ D/G West 1/2 – 623
NE/SE former ½ D/G. 620
E ½ D/G 615

SB 22344

E e_b D/G Unit 2 Extrm - 620

Underneath D/G Unit 1 Side - 620.

Unit 1 Extrm West e_b D/G 630

1977 S & SE e_b D/G Cond. tank & Fuel oil tank area. 625

Unit 2 D/G (E 1/2 e_b Side Unit 2)
- 625

Southern 1/2 e_b D/G - 620.

entire D/G - 625
entire D/G - 632
South side e_b D/G - 632

Telephone call

page 1 of 2

ROUTE

BY A. Bow OF B Fell

TO John Heil/Carl Turner B Ass

DATE 8/21 '78 TIME 1:30

SUBJECT Settlement of Diesel Gen. Bldg JOB NO 7307

Diesel Generator Bldg - settlement first noted in 7/78 - worst case noted 3¼"

Background: all structures on 6'± mudmat. Field has been recording settlements for last month or so — AE developing measurements made to date (see attached page). AE further noted that the pedestal foundation slab have settled more than the bldg — in some cases it appears that the structural wall is spanning over the mudmat (i.e. a ruler can be inserted between the mudmat and structural foundation.

Field needs immediate support — i.e. the [illegible]

SB 22360

Telephone call

Page 2 of 2

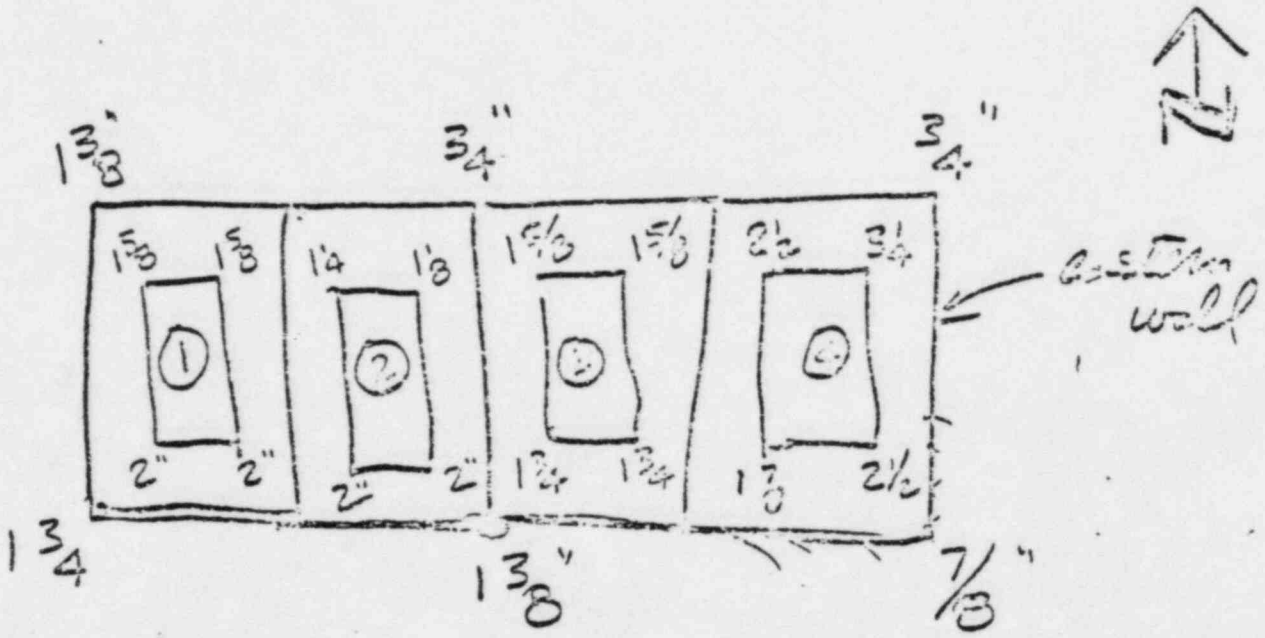
Hours Newsom – 517-631-7336
Boos – 517-835-5424

BY _____ OF _____ ROUTE _____

TO _____ OF _____

DATE _____ 19__ TIME _____

SUBJECT _____ JOB NO _____



1.) no cracking @ the edge

2) wetsield settling, the eastern wall appears to be spreading

3) D/C Bldg up to Elev. 650 ±, no slab cracking yet for most part

4) [illegible]

SB 22361

Rao,

Would you please contact P.K. Chen re CPCo comments on FSAR section 2.5.4

Brad

362.8 Phreatic Surface

6 of Pg 2.5-52 Several Compaction equipment were used to achieve the compaction criteria indicated in table 2.5-9. Test pads for various rollers were constructed and described in sec 2.5.6.4.1

SB 22362

Kao
4/26/79

Comments from R. Wheeler.
A/E R.H.W

1. This is a true statement. Dwg C-44 rev. 3(b) included notes pertaining to removal of loose sand. C-44 was included in the scope of work under C-10.

2. This pertains to general plant area fill. ~~For fill~~ ~~areas other than in areas around Aux, Reactor & Sta~~ It is a fairly accurate statement. O.K. pkc Include word approximately

3. Input possibly from QC. Construction should provide the information. Then, Greate can incorporate in the text.
Read ¶#1 of 22 NRC's
Table 2.5.10 indicates that zone ③ was imported. This could have been used on random fill. Construction should provide the source of the imported sand. onsite & offsite materials used for construction

5. N.I. As far as Connie was concerned it was 4". It was in rev. 5 that req't was deleted from C-210. In the dike area 4" was used by Cons C-211 has 12" - What did Const. do before C-211 Not clear

6. Did not have this info. This may be included if felt necessary. Construction should provide such information See more on 19 1.

SB 22363

7. ~~[redacted]~~ Not clear ~~[redacted]~~ - This implies to work done under C-210. 2.5.21 indicates cement cut structures See Comment 5.

8. Not true! Density tests were plotted on project dwg C-45 to come up w/ these figures. (See RMW's Q. ~~—~~ include limit

9. No contest. ~~Construction Can probably Clarify~~ Yes, Ask construction

10. See Comment # 2. and agency

11. This is the QA/QC program. What is the function of QC program. what does it do?

12. This pertains to the Slopes of plant fill north of Power block.
The dikes were none & so this is true

13. Fig. 2.5-22 ? ~~Cannot find it in FSAR~~ SWPS is founded on Till T=C
There are 22A & 22B.

14. ~~Geotech Can probably Consult~~
→ The table provides summary of all permeabilities performed. When these tests were made, degree of % R.D. for the cohesionless soil has not been determined.

15. Yes

16. ~~Electrical~~. Probably ~~Can~~ a note can be added. Since there are no req'ts for Zone 2, [illegible] Sand could ~~be~~ be used. [illegible]

17. Geotech.. later

SB 22364

18. Req't & plant fill is delineated in table 2.5-9. ~~—~~ [illegible] x ref. 2.5-2

1. COMMENTS ON SECT. 2.5 (From Bob Wheeler)

1. Page 2.5-51 - Sect. 2.5.4.5.1 - "Engineering design drawings required that loose sands be removed.....in Earthwork subcontract." Statement is not accurate; a) Not in subs scope of work. b) Dwg. was revised too late to remove such sands i.e. fill covered the sands in question.

2. 2.5.4.5.3 Fill - Pg. 2.5 - 51 - "Up to 35' of fill....." In some areas more than 35' fill was placed.

3. Table 2.5-9 - Compaction Criteria Note 6: No evaluation of proposed compaction equipment was performed.

4. 2.5.4.5.3 Fill - "Onsite excavated.....". Imported pit run sand was also used. — Add some reference to the imported sand.

C-210

5. Page 2.5-52 - "All fill & backfill was placed to.....Table 2.5-21" Table 2.5-21 is titled for Dikes - Also note 3 say same lift thickness requirements were used for plant fill. This is not true for power tampers (4" lifts) 12" lifts were used.

6. Page 2.5-52 - "The compaction equipment discussed in Section 2.5.4.4.1 was used.....". This section does not include all equipment (large used. Example: The Dyno-Pac rented from Fisher is not included. The Tampo rented from Bechtel is not included.

7. Pg. 2.5-52 - "In areas not accessible to heavy compaction equipment .....4". Layers were used". This is not true - 12" lifts were used per spec C-211.

8. Pg. 2.5-52 - "Figures 2.5-66 through 2.5-69.....placed beneath and around seismic Catagory I structures." I would strongly suspect that the tables represent plant area fill and is not confined to the areas denoted above. (Include piping)

9. Pg. 2.5-61 - Sect. 2.5.4.10 - "The Turb. Bldg. & T.G. are supported on Mat foundations on Compacted fill". (predominately on Backfill Concrete)

10. Pg. 2.5-71 2.5.5.1 - Refers to 35' of fill, see comment #2.

11. Pg. 2.5-52 - "The fill program was approved by a QC....."
What is "fill program." ?

12. Pg. 2.5-72 - "The Material, Placement, Compaction specs, Construction Procedures and Control of Earthwork fill.....comparible to Cooling Pond dikes."
Material - was comparable
Specs - Differed
Construction Procedure - Differed
Control - Obviously differed
(Plant fill operations should be addressed separately)

13. Fig. 2.5-22 - Shows Serv. H_2O on clay - I thought it was on sand.

SB 22366

14. Table 2.5-4 - Summary of permeability tests - Since requirements for job were 80% R.D., why does this table show 70% R.D. for samples used to determine permeability.

15. Table 2.5-6 - No 95% of BMP were tested for direct shear. Yes

16. Table 2.5-10 - Should include imported sand under source for Zone 2.

17. Table 2.5-13 - "Controlled compacted Clay fill". Should this be random fill - and the values should reflect.

Table 2.5-9

18. Table 2.5-21 - Another table should be developed to delineate the requirements for the plant fill.

SB 22367

ESAR SEC.	CONFLICT / CONCERN. SPEC. C-210	SPEC. C-211	C-501	Rema
2.5.6.9 Fig. 2.5-54 BMP.				
Table 2.5-9 EC% Rel. D. 95% BMP				

SB 22368

CONFLICT / CONCERN.

FSAR SEC.	SPEC. C-210	SPEC. C-211	C-501	Remar
2.5.4.2.6 BMP - Mod. fm ASTM D1557-(1) @ 20,000 ftlbs APP. 2B-24 indicates BMP is Mod. ASTM D698 w/ 3 lyrs. 10#, 18" drop & 15 blws	Yes. C-210 requires BMP - 4 layers 10# 18" drop 25 blws Upter rev. 5 & SCN 9001 ASTM D1557.	Yes Same as C-210.	None.	Affects C-208. Pg. 25 These were changed by SCN
2.5.4.2.8. Reference BMP as Mod. ASTM D1557 for permeability App. 2B refs. Pg. 42 for Permlty The discussion is on Pg. 41 No mention of ASTM.	C-210 reference ASTM D2434			C-208 Does not mention ASTM D24 in the te But refs. Codes & S
Appendix 2B. E. Page ref. is 102 used of 103.				

SB 22369

REVISIONS BY DATE

FILE 5692-

CHECKED BY DATE

BY DATE

METHOD OF PERFORMING COMPACTION TESTS
(STANDARD BECHTEL METHOD)

SOME APPARATUS FOR PERFORMING COMPACTION TESTS

INCLUDES, 1/30 CUBIC-FOOT CYLINDER WITH REMOVABLE COLLAR AND BASE PLATE, AND 10 POUND RAMMER WITHIN SLEEVE.

IN THE STANDARD BECHTEL METHOD OF COMPACTION A PORTION OF THE SOIL SAMPLE PASSING THE NO.4 SIEVE IS COMPACTED AT A SPECIFIC MOISTURE CONTENT IN THREE EQUAL LAYERS IN A STANDARD COMPACTION CYLINDER HAVING A VOLUME OF 1/30 CUBIC FOOT, USING FIFTEEN 18-INCH BLOWS OF A 10-POUND RAMMER TO COMPACT EACH LAYER

THE WET DENSITY OF THE COMPACTED SAMPLE IS DETERMINED BY WEIGHING THE KNOWN VOLUME OF SOIL: THE MOISTURE CONTENT, BY MEASURING THE LOSS OF WEIGHT OF A PORTION OF THE SAMPLE WHEN OVEN DRIED: AND THE DRY DENSITY, BY COMPUTING IT FROM THE WET DENSITY AND MOISTURE CONTENT. A SERIES OF SUCH COMPACTIONS IS PERFORMED AT INCREASING MOISTURE CONTENTS UNTIL A SUFFICIENT NUMBER OF POINTS DEFINING THE MOISTURE-DENSITY RELATIONSHIP HAVE BEEN OBTAINED TO PERMIT THE PLOTTING OF THE COMPACTION CURVE. THE MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT FOR THE PARTICULAR COMPACTING EFFORT ARE DETERMINED FROM THE COMPACTION CURVE.

THE STANDARD BECHTEL METHOD OF COMPACTION IS IDENTICAL TO A.S.T.M. TEST DESIGNATION D698 MODIFIED TO REQUIRE 20,000 FOOT-POUNDS OF COMPACTIVE ENERGY PER CUBIC FOOT OF SOIL.

SB 22370

DAMES & MOORE

CONFLICT / CONCERN.

FSAR SEC.	SPEC. C-210	SPEC. C-211	C-501	Rema
2.5.4.5.2 & 2.5.1.2.5.3	uplift 0.03 to 0.06 lbs/sq.ft. 0.25 lbs/sq.ft.		0.03 to 0.25 lbs/sq.ft. is quite acceptable.	
2.5.1.2.5.4.1	Pg. 2.5-20 indicates no grd. mvt.	Pg. 2.5-21 indicated grd. mvt.	also Pg. 2.5-26 indicates grd. mvt.	
Fig. 2.5-23	Total load uniform Bound is ab. ± 30' Surface Nature - Avg depth to bedrock is 12 to 15' w/a max. of 40'			
Page 2.5-50	Sec. 2.5.2 ... refer to fig 2.5-1	Bed. ...		
Page 2.5-51	0.8(2.5-1.5) ... 1.6 ... (2.5-1.5) ...			

SB 22371

CONFLICT / CONCERN.

FSAR SEC.	SPEC. C-210	SPEC. C-211	C-501	Rem
2.5.4.3.4.1 Pg. 2.5-47 should be revised to include 1978 & borings. Table 2.5-8 indicates borings taken in 1978 in 1979				
2.5.4.3.5.1 Pg. 2.5-48 & 2.5.4.5.1 Pg. 2.5-51	25 to 30' fill → 35' fill			
FILL 2.5.4.5.3 Pg. 2.5-51 & 52 Table 2.5-21. 12" & 4" layers Also proctor (Pg. 2.5-52) BMP-1557 mod. to 20,000	12.5.1, 2.5.2, 11.5.3 8" & 4" layers SCN 9001.	Same as C-210. but no mention of 4" layers.	SB 22372	
Table-11 proctor for every [illegible]	-	C-210	-	SCN 901 1 Proctor per densi test or as dire by Engr

TO	ATTN: J.F. NEWGEN		

MESSAGE SECTION - If additional addresses are required continue to list below:

BEBC- 3301

SUBJECT: CPCO/MIDLAND PLANT - JOB 7220

SOILS WORK COMPACTION

FILE: 0274, C-211, C-210, C-0465

REFERENCE: QUALITY ASSURANCE STOP WORK REPORT 6

THIS IS A COMPLETE RESPONSE TO THE REFERENCED Q/A STOPWORK REPORT 6. THE RAMMER-TYPE COMPACTOR (POGO STICK) RV4B HAS BEEN SATISFACTORILY QUALIFIED FOR USE IN COMPACTING SOILS REQUIRING THE FOLLOWING:

1) 80% AND 85% DENSITY FOR STRUCTURAL BACKFILL SAND AND RANDOM SANDS WITH 4 INCH LAYERS AND 8 PASSES.

2) 90% AND 95% DENSITY DETERMINED IN ACCORDANCE WITH ASTM D1557 METHOD D FOR CLAYEY SOILS WITH 4 INCH LAYERS AND 8 PASSES.

THE TEST FILLS FOR QUALIFYING THE RAMMER-TYPE COMPACTOR WERE MONITORED BY THE ONSITE GEOTECHNICAL ENGINEER.

SB 22377

[redacted]s L.H. CURTIS

COPIES TO: L. CURTIS, L. DREISBACH, W. MORING, CORR LOG, S. BLUE, J. O. WANZECK

DATE	SIGNATURE	LOCATION & EXT:		ORGANIZATION CODE:
7	L.H. CURTIS	6A	7220	7PE-2118

AAO-17-1

ORIGINAL TO TELETYPE

ME ADDR			
	ATTN: L.E. DAVIS		

MESSAGE SECTION - If additional addresses are required continue to list below:

BEBC- 3411

SUBJECT: CPCO/MIDLAND PLANT - JOB 7220

NCR-2307

FILE: 0274, C-211-PR, C-0465

REFERENCES: 1) IOM, G. KRZISNICK TO J. WANZECK AND J. BETTS, 11/2/79

2) IOM, S. AFIFI TO L. CURTIS, 11/8/79

REFERENCE 1 REQUESTED THAT PROJECT ENGINEERING DISPOSITION SOIL TESTS S-16, S-17, AND S-19 FROM NCR-2307. USING THE TEST NUMBERS FROM THE DENSITY REPORT FORMS, REFERENCE 2 DISPOSITIONS THESE TESTS AS FOLLOWS:

RD-16 - RD-26 TAKEN IN THE VICINITY SHOWS ACCEPTABLE COMPACTION. BORING AX-14 SHOWS A HIGH BLOWCOUNT AT ELEVATION 586.5

RD-17 - RD-25 AND RD-18 SHOW ACCEPTABLE COMPACTION IN THIS AREA, AND BORING AX-11 SHOWS HIGH BLOWCOUNTS AT ELEVATION 586.5

RD-19 - RD-13 SHOWS ACCEPTABLE COMPACTION IN THIS AREA.

L.H. CURTIS

[redacted]

COPIES TO: W. BARCLAY, J.P. BETTS, L.H. CURTIS, J.O. WANZECK, COM LOG

SB 22378

DATE	SIGNATURE	LOCATION & EXT:		ORGANIZATION CODE:
11/ 79	for L.H. CURTIS	6A	7220	7PE-2118

AAO - 17 - 1

ORIGINAL TO TELETYPE

TELECOPY

Bechtel Associates Professional Corporation

Inter-office Memorandum

BEBC- 8471

To L.E. Davis

Date November 16, 1979

Subject Midland Plant Units 1 & 2
Job 7220
Earthwork - Qualification of Compaction Equipment

From L.H. Curtis

Of Engineering

At Ann Arbor

Copies to File: 0274, C-211-PR

S. Blue
P. Corcoran
L. Curtis
J. Wanzeck
Com Log

Reference: IOM from S.S. Afifi to L.H. Curtis, 9/4/79

The following equipment have been qualified for use based on test fills and field tests monitored by geotechnical services (reference).

A. Structural and Random Sands

1. Wacker vibratory plate with 8-inch outriggers (model DVU 3001)
   (a) all area requiring 80% RD
   (b) 4-inch lifts and eight passes

B. Clays

1. Vibro plus (model CA-25 PD)
   (a) All areas requiring 90% compaction
   (b) Five to six-inch lifts and eight passes per lift

2. Wacker J-foot tamper (model GVR 2204)
   (a) All areas requiring 90% compaction
   (b) Four-inch lifts and six passes per lift

3. Vibro plus dynapact (model CF-43)
   (a) All areas requiring 90% compaction
   (b) Eight-inch lifts and six passes per lift

4. Wacker vibratory plate with 8-inch outriggers (model DVU 3001)
   (a) All areas requiring 90% compaction
   (b) Four-inch lifts and six passes per lift.

for W.L. Shewell
L.H. Curtis

[redacted]
11/14/4

SB 22379

Copies to S. L. Blue
B. Dhar
J. O. Wanzeck
J. Newgen
J. Betts
W. D. Bailey
1320, 3410

At Ann Arbor 10 D 5
7220-79-180

B.D. This is for ya info. Thanks Rao

The following compaction equipment is qualified for use based on test fills and field results as monitored by Geotech.

A. Structural and Random Sands

1. Wacker vibratory plate with 8" out riggers (model #DVU 3001)
   (a) all area requiring 80% RD
   (b) 4" lifts and 8 passes

B. Clays

1. Vibro plus (model CA-25 PD)
   (a) all areas requiring 90% compaction
   (b) 5"-6" lifts and 8 passes
   (c) this equipment is capable of getting 95%, 1557, but with much more compactive effort

2. Wacker 3 foot tamper (model GVR 2204)
   (a) all areas requiring 90% compaction
   (b) 4" lifts and 6 passes per lift
   (c) this equipment is capable of getting 95% 1557, but with additional compactive effort.

3. Vibro plus dynapact (model CF-43)
   (a) all areas requiring 90% compaction
   (b) 8" lifts and 6 passes per lift

4. Wacker vibratory plate with 8" out riggers(model DVU 3001)
   (a) all areas requiring 90% compaction
   (b) 4" lifts and 6 passes per lift

SB 22380

dated July 27, 1979).

If there are any questions, please call J. O. Wanzeck of this office.

J. O. Wanzeck / FE 551
S. S. Affel

JOW/nm

SB 22381

Bechtel Associates Professional Corporation

Inter-office Memorandum

BEBC- 3431

To L.E. Davis

Date November 16, 1979

Subject Midland Plant Units 1 & 2
Job 7220
Earthwork - Qualification
of Compaction Equipment

From L.H. Curtis

Of Engineering

At Ann Arbor

Copies to File: 0274, C-211-PR

S. Blue
P. Corcoran
L. Curtis
J. Wanzeck
Com Log

Reference: IOM from S.S. Afifi to L.H. Curtis, 9/4/79

The following equipment have been qualified for use based on test fills and field tests monitored by geotechnical services (reference).

A. Structural and Random Sands

1. Wacker vibratory plate with 8-inch outriggers (model DVU 3001)
   (a) all area requiring 80% RD
   (b) 4-inch lifts and eight passes

B. Clays

1. Vibro plus (model CA-25 PD)
   (a) All areas requiring 90% compaction
   (b) Five to six-inch lifts and eight passes per lift

2. Wacker J-foot tamper (model GVR 2204)
   (a) All areas requiring 90% compaction
   (b) Four-inch lifts and six passes per lift

3. Vibro plus dynapact (model CF-43)
   (a) All areas requiring 90% compaction
   (b) Eight-inch lifts and six passes per lift

4. Wacker vibratory plate with 8-inch outriggers (model DVU 3001)
   (a) All areas requiring 90% compaction
   (b) Four-inch lifts and six passes per lift.

for L.H. Curtis

[redacted]
11/14/4

SB 22382

BECHTEL
ANN ARBOR

MEMORANDUM

TO Rudy Baltazar LOCATION Q.E Ann Arbor

FROM Jon Heck / B. Dhar DATE Monday Nov. 19 19 79

SUBJECT G-33 Specification JOB NO 7220

FILE C-211, C-230, C-0161.2

This is to confirm our verbal discussion this date that lean concrete backfill, as discussed in Memorandum B. Dhar to R. Baltazar dated 10-29-79 is NOT to be included in the next revision of Specification G-33

This change is at the request of CP&L as identified in CP&L Serial 7878 dated 11-5-79

[redacted]

B. Dhar

cc: T. Johnson

SB 22383

Bechtel Associates Professional Corporation

Inter-office Memorandum

To L. [illegible] Curtis

Subject [illegible]land Units 1/2-Job 7220-001
[illegible]ettlement: Condensate Water
Store Tanks

Copies to S. L. Blue
P. Dhar
C. McConnel
K. Wiedner
1320, 3410

Date 29 January 1980

From S. S. Afifi

Of Geotechnical Services

At Ann Arbor 10 D 5
7220-80-28

REFERENCE: IOM from D. Dhar to S. L. Blue, dated 22 January 1980

We have reviewed the above memo and would recommend leaving the water in the tanks to determine long term settlement.

If we understand correctly one (1) tank has already been emptied. This should be re-filled and settlement reading recorded until further notice, on a weekly basis.

If you have any questions, please call J. O. Wanzeck of this office.

Joe Wanzek for/SSA
S. S. Afifi

JOW/nn

JOB 7220				
	ACT	INFO	COPY	INIT
PROJ ENGR				
ASST PE T		/		PWO
ASST PE T				
ASST PE T				
ASST PE P				
ASST PE P				
MECH				
ELECT				
CS				
[redacted]				
PD				
ARCH				
CE				
CTR ENGR PL				
PROJ MGR				
PROC MGR				
FIELD				
CONST COORD				
FSAR				
ADMIN				

SB 22418

SW-4 - 160/ft SW-5 - 151/ft SW-7 150/ft SW-8 130

soil represented by the failing tests.

Test MDR-671 at elv. 582.5' has been evaluated using boring SW-8, SW-7, SW-4 and SW-5. It is noted that these borings do not extend upto Elv. 582.5'. High blowcount are encountered towards the end of the boring indicating acceptable soil. The proposed piling would carry the structural loads and thus, the failing tests would not affect the structural integrity.

b. Orientation for tests MDR-621, MDR-655, MDR-672, MDR-691 and MDR-656 considered northwest wall of SWPS as north wall.

Borings SW-1, SW-3, SW-4, SW-7, SW-8 and SW-5 indicate high blowcounts with acceptable soil. Hence the proposed piling and dewatering system would reinforce the structure. Therefore, the failing tests would not be detrimental to the structure.

Jose 4-10-80

6. Project Engineering Concurs that the orientat
used for locating MDR-686 was different fro
that used to locate tests MDR-621, MDR-68
MDR-672 and MDR-691. However, Project Engineer
has reevaluated these tests Considering the permit
two orientations and offers the following.

a. Orientation for tests MDR-621, MDR-685, MDR-67
MDR-691 and MDR-686 Considered northeast w
of Service water pump structure (SWPS) as
north wall.

Disposition of tests MDR-621, MDR-685, MDR-691, MDR-
at elevations 562.7', 589', 595 and 596' respectively were ba
on the evaluation of borings SW-5 and SW-13. Boring
PD-37, SW-5 and SW-13 extend to elevations 552.5', 588' and
597' respectively. The elevations of the tests
vary between 562.7' to 595'. Except for PD-37,
SW-5 & SW-13, the bori
do not extend to Elv. 562.7'. The high blow
counts encountered at the end of the boring indic
acceptable soil. Considering the planned in-situ an
dewatering system, structural integrity of the
SWPS would not be adversely due to the

4-10-87

SB 22560

MDR 621 E 828 S 5031

MDR 672 E 794 S 5027

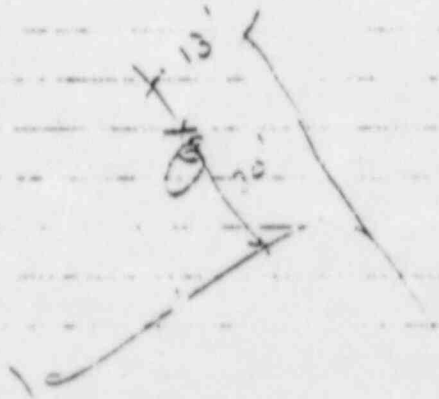
MDR 655 E 837 S 5066

MDR 656 E 798 S 5009

691 E 850 S 5072

MDR 671 5031.25

5027 E-157



5-8
5071

SB 22561

BECHTEL
ANN ARBOR

MEMORANDUM

TO Jim Desmond LOCATION Midland
FROM Dick Grote DATE May 24 19 7
SUBJECT Structural Backfill JOB NO. 7220
c.c. Frank Teig FILE C-211

Recently you have raised the following questions concerning Spec. C-211:

1) Did I receive Project Engineering approval for backfill materials placed in areas inaccessible to motorized rollers?

At the time I question Project Engineering on this specification requirement and they agreed that such approval was neither necessary or practical. Consequently, they drafted BEBC-805 (attached) that approves material that meets backfill material requirements for the contiguous area. In most cases, when not in the dike section, this means that Zone 2 is acceptable material for areas inaccessible to motorized rollers.

I am surprised that this memo is not included in the C-211 correspondence file.

SB 22652

BECHTEL

ANN ARBOR

MEMORANDUM

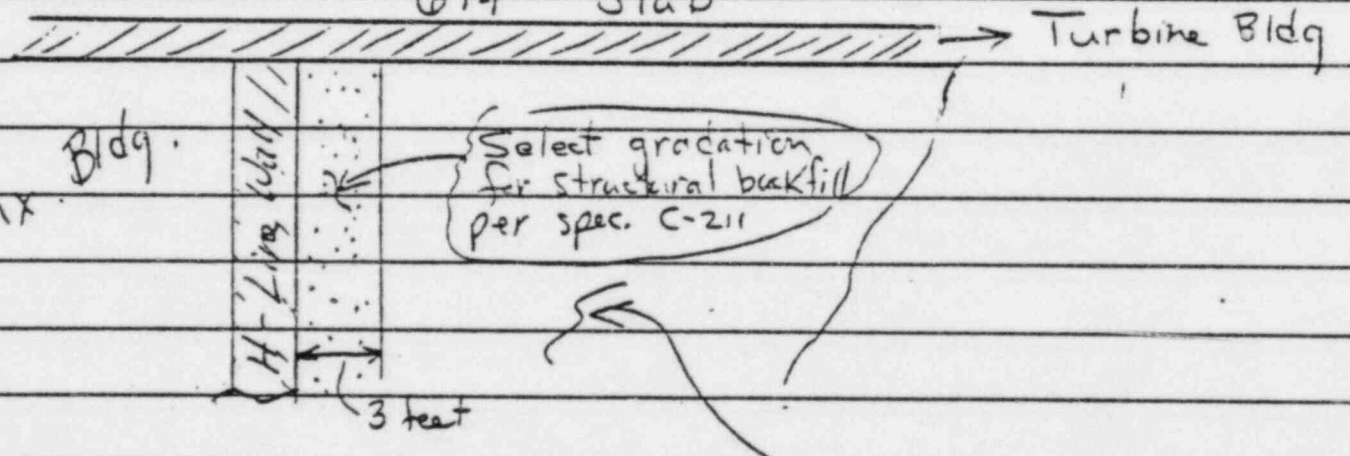
LOCATION

DATE 19

JOB NO.

FILE

2. Why is structural backfill material only req'd. within 3 feet of a bldg. wall and not under a structure? For example:



Answ.: In most cases Zone 2 ⟶

SB 22653

You questioned this because it "didn't make sense." At the time, I felt the same way and questioned Project Engineering. They confirmed that only the 3 feet needed structural gradation material. I confirmed what they told me in BCBE-370. They sent BEBC-456 back stating that our understanding was correct. I have not included copies. If you can't find

BECHTEL

ANN ARBOR

MEMORANDUM

TO _____ LOCATION _____

FROM _____ DATE _____, 19__

SUBJECT _____ JOB NO. _____

FILE

them, let me Know.

I have also attached copies of two items I noticed in the file that you should be aware of. I think I gave you and Bill O'Dell each (copies of BE-BC-829 before I left. But just in case, here is another copy. I didn't agree with all that they required, but got no relieve in my first cut @ arguing with them.

I hope that items 1 & 2 clear up the questions you had. If not, do not ~~hesitate~~ hesitate to give me a call.

Dick

SB 22654

R. L. Castleberry

Job 7220 Midland Project
Structural Backfill
Specification 7220-C-211
BCBE-584

J. C. Hink

May 8, 1975

J. F. Newgen

Construction

Midland, Michigan

Ref: BCBE 319 dated June 5, 1974

The purpose of this memo is to again pursue the testing required to determine whether or not a cohesionless material with 95-100% passing the #40 sieve would be acceptable for structural backfill. This matter was addressed in BCBE 319 and to date no response has been received.

To our knowledge, the gradation requirements for the structural backfill sand were established and the finer material denied because of possible liquefaction problems with the finer material. It is our intent to have the necessary testing performed to determine if the finer material is subject to liquefaction.

The impetus behind our letter, BCBE 319, was primarily cost consideration, i.e.; the finer material is available at a much lower cost. Under the present plan 4E, the cost of structural backfill material to support that plan is increasingly important.

We therefore request your assistance in evaluating this alternate as soon as possible.

J. F. Newgen

JFN/TCV/RAG/sv

SB 22656

File C-23

Telephone call

BY R. Grote OF B. Midland

TO L. Kirkpatrick OF B A.A.O.:

DATE July 16 - 75 TIME 2:30 P.M.

SUBJECT Plant Backfill - Spec. C-210

ROUTE Valenzano

Connally

Richardson

Knoll

JOB NO. 7220

The purpose of this telecon was to request clarification and interpretation of the intent of section 13.5 of Specification 7220-C-230 Rev-4.

Section 13.5 states: "Material placement procedures shall conform to Section 12.5." I asked Bob if the 5th paragraph of section 12.5 (relating to 20 feet differential with a 3:1 slope applied to slopes occurring in the plant fill during backfill operations (dike sections in the plant fill excluded)? Bob told me no, it did not. The intent of the reference was for other items covered by 12.5 and that ~~this~~ exception to this item ~~to~~ had not been listed.

Due to the nature of the dike, it is important that any termination and subsequent continuation be thoroughly bonded together and therefore additional emphasis has been given to such bonding in the specification. This is not a requirement for plant area fill and is not required (dike sections within the plant fill excluded)

R. Grote
7/16/75

SB 22655

R. L. Castleberry

May 7, 1975

Job 7220 Midland Project
Construction Facilities in
Plant Backfill
BCBZ 583

J. F. Newgen

Construction

Midland, Michigan

The purpose of this memo is to address the installation of temporary piping and electrical items in and around the plant fill and the subsequent treatment of these installations after abandonment.

We propose the following guidelines for the installation and abandonment of such items:

1) Trenches for piping, conduit runs, etc., that are in the plant area and that do not cross the dike reference line may be backfilled with a random Zone 2 material unless the installation is within the three feet of structural backfill material. In that case, the trench will be backfilled with the same structural backfill material. When there is no longer a use for the installation, it may be abandoned as is.

2) Trenches for piping, conduit runs, etc., that do cross a dike reference line, but are above elevation 627', may be backfilled with a random Zone 2. When there is no longer a use for the installation, it may be abandoned as is.

3) Trenches for piping, conduit runs, etc., that do cross a dike reference line and that are below elevation 627' will be backfilled with the same material as was removed for excavation of the trench. When there is no longer a use for the installation, it will be either removed followed by backfilling to restore the original condition or left in place and plugged with a minimum of two feet of concrete in each end.

These guidelines are not intended to address the quality or compaction requirements of this backfill. They are outlined in drawing C-45, and the applicable specifications.

The installations however, are not addressed in the applicable specifications, and for this reason, we request your concurrence or comments on establishing these guidelines.

JFN/RAG/kt

J. F. Newgen

5/12/75

SB 22657

Telephone call

BY R. Grote OF CB Midland
TO R. Rixford OF CB H.O.
DATE Sept. 19, 74 TIME 2:15 P.M.
SUBJECT Compaction Requirements in Q-list Fills
ROUTE Valuation Church
File C-210
JOB NO. 7220

I called R. Rixford concerning compaction requirements for specification C-210. He was in agreement with the following summarization of compaction requirements:

Non-Q Dikes (method spec.)

Compaction ~~is~~ acceptance is based on moisture conditioning and 4 passes with a 50-ton rubber tired roller (or equivalent roller)

Q-list Plant Area Fill ("end product" spec)

Compaction acceptance is based on meeting an "end product" requirement, i.e. 95% of maximum density only. No method of acheiving this "end product" is specified or is required. The Subcontractor can use any equipment he chooses as long as he acheives 95% maximum density.

Rixford fully agrees with the above summarization.

R. Grote

SB 22662

2/2

Telephone call

ROUTE Valmont
Crouch
File C-214

BY _____ OF _____

TO _____ OF _____

DATE _____ 19 _____ TIME _____

SUBJECT _____ JOB NO. _____

I made an analogy (an exaggeration admittedly but applicable) that if the compaction could be acheived with a herd of mules walking over the fill it would be acceptable as long as we got the required 95% compaction. Kirkford agreed.

R. Dietz
9/19/74

SB 22663

September 12, 1974

Consumers Power Company
P. O. Box 1963
Midland, Michigan 48640

Attention: T. C. Cooke

Dear Mr. Cooke:

Job 7220 Midland Project
Structural Backfill
Specification 7220-C-211
BCCC-603

We have reviewed your letter of August 7, 1974, concerning structural backfill materials and submit the following in answer to questions asked in that letter:

1) We do expect that some problems will be encountered in the referenced area with rain water. The magnitude of such problems will be contingent upon the amount of rainfall and the elevation and condition of backfill at the time. Controlling surface run-off is a preventive measure to minimize damage to the surface. Prior to continuing the fill, the surface would require reconditioning.

2) The compaction required by Specification 7220-C-211, Revision 0 is adequate for structural sand backfill. In fact, the compaction specified is specifically for a granular, cohesionless material.

3) We do plan on utilizing other structural backfill materials than sand. Such materials may be either random Zone 2 or concrete. Selection of the type of backfill will be on a case-by-case basis with such items as volume, accessibility, area use, and schedule taken into account. For example, the use of concrete in the area immediately south of the Auxiliary Building was considered economically feasible when consideration was given to: schedule, potential damage that would be done to sand if the area should become flooded, and to the limited amount of work space available for efficient use of compaction equipment. As the backfill elevation rose to the point that the area was adaptable to efficient use of compaction equipment and the flooding potential was somewhat reduced, concrete remained feasible when consideration was given to area usage, i.e., crane pads, and to support for the access pipeway between the Turbine and Auxiliary Buildings.

SB 22664

It would be unwise to rule out any future use of concrete for backfill, at this time. As was the case with backfill to elevation 584' south of the Auxiliary Building, other situations will arise that prove concrete to be the most feasible. For instance, areas north of the Auxiliary Building and under the neutralizer sump have recently been reviewed.

We plan on using structural backfill sand adjacent to structures, as required, and a random fill thereafter in areas that can effectively tolerate larger equipment. We plan on using only structural backfill sand in more confined areas.

We believe the above to be a complete response to your questions.

Very truly yours,

E. E. Felton

EEF/RAG/bk

J. C. Church

Job 7220 Midland Project
Specification 7220-C-210
Paragraph 13.7
7220-C-210-23

June 24, 1974

T. C. Valenzano

Construction

Midland, Michigan

We have reviewed your June 10, 1974 IOM concerning compactive effort required on Zones 1 and 2 in the plant and berm backfill areas. We agree with your interpretation; i.e., a 95% of maximum density is the acceptance criteria, and the number of roller passes listed in Paragraph 12.8.1 does not apply to plant and berm backfill. We feel that the specification is now clear, and no FCR is required.

T. C. Valenzano

TCV/RAG/bk

SB 22667

P. A. Martinez

Job 7220 Midland Project
Structural Backfill
Specification 7220-C-211
BCBE 319

R. L. Rixford
J. E. Allen

June 5, 1974

E. E. Felton

Construction

Midland, Michigan

During April, 1974, civil procedure C-301 was replaced by Specification 7220-C-211, Rev. 0. At this time the field requested that a finer cohesionless and free draining material than that specified be considered; i.e., a material with 95-100% passing the #40 sieve. Reasoning for this was that the finer material is locally available within five miles from the jobsite as compared to twenty miles or more for the material specified and is available at a much lower cost. Some concern existed on possible liquefaction of this material and because of the time needed to fully test and evaluate it, the finer material was denied.

The field would like to continue to pursue this material. Please inform us of the testing required.

Please contact R. Crote if any further information is required.

E. E. Felton

EEF/RJC/kt

SB 22668

MEMO

FROM - G. RICHARDSON 5-31-79

To: KARL WIEDNER KW

DRAFT MINUTES FOR YOUR REVIEW AND COMMENTS PRIOR TO DISTRIBUTION

I WILL DISTRIBUTE TO OTHERS FOR COMMENT WHEN YOU OK.

YES - GO AHEAD

KW 5/31/79

SB116151

G. RICHARDSON
5-31-79

MEETING NOTES NO _____

MIDLAND PLANT UNITS 1 AND 2

CONSUMERS POWER COMPANY

BECHTEL JOB 7220-101

DATE: MAY 30, 1979

PLACE: ANN ARBOR, MICHIGAN

SUBJECT: DIESEL GENERATOR BUILDING
POSSIBLE CAUSES AND ACTION ITEMS

ATTENDEES:

BECHTEL	CPCO
M. WIEDNER	D. SIBBALD
J. HOOK	R. WHEELER
G. TUVESON	D. HORN
J. HINK (PART TIME)	T. THIRUVENGADAM
C. MCCONNEL (PART TIME)	C. HUNT
J. WANZECK	
A. BOOS	
G. RICHARDSON	
R. SIMANEK	

PURPOSE: THE MEETING WAS HELD IN THE OFFICE TO DISCUSS THE ACTION ITEMS AND POSSIBLES CAUSES APPENDED TO MEETING NOTES NO. 934 DATED 3-12-79 AS ATTACHMENTS 1 AND 2

SB116452

ITEMS DISCUSSED:

I REVIEW OF THE STATUS OF THE ACTION ITEMS LISTED IN ATTACHMENT 1 TO MEETING NOTES 934.

1. CONFIRM MATERIAL COMPATIBILITY ADEQUACY.

J. WANZECK STATED THAT PLACEMENT OF SAND IN TRENCHES IS NOT A PROBLEM IF THE MATERIAL HAS BEEN PROPERLY PLACED.

ACTION: GEO-TECH WILL PROVIDE AN I.O.M. TO CLOSE OUT THIS ITEM.

2. CONFIRM LOW BLOW COUNT ON RADWASTE BUILDING.

THREE ADDITIONAL BORINGS INSIDE THE RADWASTE BUILDING RESULTED IN NO LOW BLOW COUNTS. THIS ITEM IS CLOSED.

3. CONFIRM ELECTRICAL DUCT BANKS IN THE YARD

TWO ADDITIONAL BORINGS NEAR DUCT BANKS BETWEEN THE SERVICE WATER STRUCTURE AND THE TURBIN BUILDING AND OTHER BORINGS HAVE ESTABLISHED THE SOIL CONDITIONS. ANY FURTHER ITEMS WILL BE TRACKED BY THE RESPONSE TO THE SL.S.T.F REQUEST. THIS ITEM IS CLOSED.

4. TABULATED LIST OF TEST RESULTS.

GEO-TECH HAS TABULATED ALL TEST RESULTS AND HAS ISSUED A PRELIMINARY REPORT FOR INHOUSE REVIEW.

ACTION: GEO-TECH TO ISSUE DRAFT REPORT FOR CPCO REVIEW BY 6-11-79.

5. CHECK WATER LEVEL AROUND SITE

INSTALLED PIEZOMETERS AROUND THE SITE INDECATE AN AVERAGE WATER LEVEL OF ABOUT 625.5 FEET. THIS ITEM IS CLOSED

6 EVALUATE WHO PLACED FILL (WHEELER STUDY) UNDER ALL SEISMIC CATEGORY I STRUCTURES.

THIS IS COMPLETED FO THE DIESEL GENERATOR BUILDING AND SERVICE WATER STRUCTURE. REVIEW OF OTHER AREAS IS IN PROGRESS

ACTION: CONSTRUCTION/CPCO COMPLETE STUDY BY 6-8-79.

7. CHECK 1977 STOCKPILE AND RAIN WATH.

REVIEW OF RAINFALL DATA INDECATES SUMMER, 197 WAS NORMAL AND NOT A DRY YEAR. THIS ITEM IS CLOSED

8. WHAT FILL WAS PLACED DURING WINTER OF 1976

THIS ITEM IS BEING COMPLETED WITH ITEM 6

9. REVIEW WORK AND TESTING IN THE TIME FRAME BELOW ELEV 615':

THIS ITEM IS BEING COMPLETED WITH ITEM 6

II REVIEW OF THE PRELIMINARY POSSIBLE CAUSES DISCRIBED IN ATTACHMENT 2 TO MEETING NOTES 934 WAS ACCOMPLISHED THIS RESULTED IN REVISIONS TO THE LIST. THE REVISED LIST OF PRELIMINARY POSSIBLE CAUSES IS ATTACHED

PREPARED BY: _____

REVIEWED BY _____

ATTACHMENT 1
TO MEETING NOTES
NO _____.

MIDLAND UNITS 1 AND 2
BECHTEL JOB 7220-131

PRELIMINARY
POSSIBLE CAUSES

DISTINCTION OR CHANGE	POSSIBLE CAUSE	COMMENT
1) Time difference between placement of fill and construction of facility.	No	Cannot cause insufficient compaction.
2) PLACEMENT METHOD - LIFT THICKNESS	YES	PRELIMINARY TESTS INDICATE SOME EQUIPMENT MAY NOT BE CAPABLE OF COMPACTING A 12" LIFT. INVESTIGATION CONTINUING. ACTION: GEO TECH.
- MOISTURE CONTROL	NO	MATERIAL PLACED DURING PERIOD WHEN MOISTURE CONTROL WAS NOT IMPLEMENTED IS GENERALLY IN THE TOP TWO FEET OF FILL
- COMPACTION EQUIPMENT	YES	EQUIPMENT USED TO BE EVALUATED FOR 9" LIFTS TO ORIGINAL STANDARDS ACTION: GEO-TECH.
- TYPE OF MATERIALS	NO.	MATERIALS HAVE SHOWN TO BE COMPACTABLE IN TEST FILLS.
- COMPACTIVE EFFORT	YES	TO BE EVALUATED WITH LIFT THICKNESS AND EQUIPMENT

SB116455

3) Theoretical comparison of BMT compaction vs settlement.	YES	COMPARE EFFECTS OF DIFFERENT COMPACTION LEVELS ACTION: GEO-TECH.
4) SPEC C-211		
- GENERAL	YES	INCLUDE WITH ACTION 2
- FROST PROTECTION OMITTED	YES	INVESTIGATE IMPACT (REFER TO PART I, NO 9 OF THIS REPORT)
- FLOODING OF TRENCHES	YES	POSSIBLE CAUSE IN LOCALIZED AREAS OF SAND FILL AREAS - NOT A CAUSE IN CLAY FILL
5) TESTING		
- METHODS - EQUIPMENT - RESULTS/REPORTS - RETESTS - REVIEWS/EVALUATIONS - PERSONNEL	YES	INVESTIGATE IMPACT ACTION: GEO-TECH
6) Increased test frequency & location for small areas.	Yes	Investigation of frequency/distribution IN PROCESS ACTION; CONS'T./CPCO
7) DIFFERENT CONTRACTORS		
- PERSONNEL QUALIFICATIONS	NO	REFER TO NO 16
- DIFFERENT INSPECTION METHODS	YES	REFER TO NO 15
- PLACEMENT METHODS	YES	REFER TO NO 2

SB116456

8) EXTENSIVELY REEXCAVATED AREA	NO	ADDITIONAL INVESTIGATION INDICATES SIMULAR PROBLEMS IN AREAS WHERE REEXCAVATION WAS NOT ACCOMPLISHED
9) MOISTURE INTRUSION IN GROUND	YES/NO	NOT A PROBLEM IF PROPERLY COMPACTED - POSSIBLE PROBLEM IF UNDERCOMPACTED AND DRY OF OPTIMUM
10) Lean concrete fill.	No	
11) Pond filled March 1978.	~~Yes~~NO	See 9.
12) Stockpiled material - Weathering - Drying out	NO	SEE NO 13
13) 1977 dry year.	NO	1977 WAS NOT A DRY YEAR.
14) Own weight settlement (calcs).	No	Cannot cause poor compaction.
15) INSPECTION PROCEDURES AFTER 3/17	YES	INVESTIGATION INTO INSPECTION PROCEDURES USED BY BECHTEL AN CANONIE INDICATE THAT INSPECTION OF BECHTEL OPERATIONS WAS NOT AS INTENSE AS FOR CANONIE OPERATIONS ESPECIALLY AFTER 10/76. INSPECTION CALLOUT WAS SURVEILLANCE AND RELIED HEAVILY ON THE TEST RESULTS TO ASSURE PROPER PLACEMENT.

16) PERSONNEL NO REVIEW OF PERSONNEL QUALIFICATIONS FOR BECHTEL, CANONIE ANN US TESTING INDICATES THE PERSONNEL PROBABLY HAD SUFFICIENT EDUCATION, EXPERIENCE AND TRAINING TO CARRY OUT THE TASKS ASSIGNED TO THEM.

17) Effects of 1974-75 slo

DRAFT

CONFIDENTIAL

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

This review of the quality control tests of the earth fill at the Midland Site was made as a result of settlement of the diesel generator building in excess of that predicted. Soil samples obtained in borings indicated that soil conditions beneath the structures are not compatible with the quality of fill indicated by the control tests 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.

SOME FILL REWORKED MANY RETESTS

WHAT ABOUT FILL ACCEPTED VIA NCRs BY ENGINEERING.

The review showed a large number of discrepancies in the test results as outlined in the following paragraphs. Review comments are based on the technical specifications and subcontract documents agreed to by U. S. Testing Company. The ability of the personnel to do the testing work was judged on the basis of personnel resumes and previous documented work experience of U. S. Testing Company.

WHAT IS LARGE?

1. Overuse of Laboratory Test Compaction Curves.

Table 9-1 of specification 7220-C-208, Page 14B required one field density and moisture content test be taken for each 500 cubic yards of fill placed. It also required one compaction, grain size, and specific gravity for each 10,000 cubic yards of material. This gives a ratio of 20 field density tests to 1 laboratory compaction test. The actual ratio ranged from this as shown in Table A attached. In fact, some of the individual laboratory compaction tests were used to determine percent compaction for serveral hundred field density tests taken over a period exceeding two years. Even though no time requirements

or more at 1/30 if tests are taken at a greater frequency than 1/40

for the period of use of laboratory tests are ~~ified~~, it is unlikely that any borrow source in this area would be of such u~~~~form character that such extended use of a compaction curve, truly represe~~ive of a large quantity of material, would be applicable. Listed below are selected laboratory test data results indicating the wide range of soil properties that were encountered.

TEST	MIN DENSITY Lbs/FT³	MAX. DENSITY (Lbs/FT³).	OPT. MOISTURE (PERCENT)
BMP (B) 269		127.3	10.0
BMP (B) 278		117.0	15.2
BMP (B) 279		140.8	5.7
** RD 24	100.9	119.2	
RD 55	90.2	109.7	
RD 61	109.3	125.3	

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

2. Questionable Retests.

A field test that fails to meet standards dictated by the selected laboratory test data must normally be cleared by another field test made in the same area after corrective action has been taken. In the procedure adopted by U. S. Testing Company this test result would then be compared to the appropriate laboratory compaction curve. In some cases the "clearing" of a failed density test was resolved by using another laboratory compaction curve with lower maximum density so that the apparent percent compaction was increased sufficien to meet the requirements of the specification. In other cases tests labeled "failed" were incorrectly "cleared" related to the same laboratory test. An example of this is shown on Table B attached. As shown on Table B test No. 372 failed at 69.5 percent compaction. A note on Test 376 indicates that it was used to clear test 372. However, Test 376 gives a lower percent compaction than did test 372. It should also be noted that test results for Test 376 contain arithmetical errors which, in fact, gives about 56 percent compaction

rather than 38.3 which is still unacceptable.

In some cases, retests to clear a "failed" test were taken in the same area or at the approximate same elevation. Many retests were over 20 feet from the failed test location and some were over 200 feet from the original test location. In general, if after a failing test, the whole area is reworked, the retest location is not too critical assuming that the correct laboratory curve is used for comparison. However, in this area, work areas were relatively small, and soil characteristics and properties showed considerable variation necessitating retest in the immediate vicinity of the failing test. Retests should be taken in the same lift or soil layer that had previously failed. In some cases retests were taken at elevation differences up to 10 feet from the failed test.

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

It is a probability that there were errors in recording dates for testing or retesting since some retests were dated three weeks prior to the time the original test failed. Some failing tests were marked as "NON C and never cleared by a passing test.

3. Test Results Plot Above Zero-Air-Voids Curve on Compaction Data Plots.

Soils cannot be more than 100 percent saturated; therefore, all field test data points, when plotted as dry density versus moisture content, must be below or to the zero air voids curve as defined by the specific gravity of the material. There are numerous cases in the U. S. Testing Company data where points plot above the zero air voids curve. Figure 1 attached shows a typical laboratory compaction test curve with field test results plotted on it. Many of the field test results plotted above the zero air voids curve, provided the specific gravity is correct this is not possible so that all such points must represent erroneous data. The fact that a large number of test results plot above the zero air

voids curve tends to make all test results que able.

Also referring to figure 1 it would appear that so ensity varied widely or that compactive effort varied widely. Specifications called for compactive effort results as defined by ASTM D 1557 which is slightly over 56,000 ft-lb/ft energy. This was modified to a laboratory test compactive effort of about 20,00 ft-lbs/ft^3 energy, ~~hereafter~~ often 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. According to plots of field data shown on Figure 1, density varied from about 108 lbs/ft^3 to about 130 lbs/ft^3. It is doubtful that the soil classification or other properties would be similar for such 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 slightly over 56,000 ft-lbs/ft^3 energy. The curve plotted on Figure 1 is at about 20,000 ft-lbs/ft^3 energy. For comparative purposes it was determined by ~~Bechtel~~ U.S. Testing in 1974 that 100 percent of specified effort (20,000 ft-lbs/ft^3) is approximately equal to ~~90~~ 95 percent of the maximum density as determined by ASTM D-1557 (56,255 ft-lbs/ft^3). Ref. Fig. This means that a density up to ~~10~~ 5 percent greater (dry density of ~~121.3~~ 123.2 lbs/ft^3) than that specified (dry density of 117.0 lbs/ft^3) could be possible. However, some points shown on Figure 1 ~~gives~~ an apparent density up to 11 percent above that specified.

There were a significant number of arithmetic errors on calculation sheets even through there are signatures on the sheets indicating they had been checked. Over 100 ~~errors~~ errors were found in calculations of relative density ~~from~~ from 8/15/73 thru 12/73.

SB116502

4. Reported use of Questionable Laboratory T Data.

Some laboratory compaction test data were used re, eatedly even though they continued to show suspect field test results. Th could be indicative of questionable laboratory data or the fact that soil was not being placed or compacted according to specifications. At any rate there should have been cause for concern. Subcontract 7220-C-208 Exhibit C, page 17 of 47, No. 2 states "You (U. S. Testing) are to immediately report data that indicates material that does not comply to specifications or procedures."

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

5. Limits of Accuracy and Acceptibility for Test Data.

Figures 1 through 7 attached will be referenced in discussing limits of accuracy or acceptability for field test results as compared to laboratory test data. This is ~~test number~~ BMP 278 which is reasonably representative of all test results.

Specified laboratory compactive effort was 20,000 ft-lbs/ft^3 and field compaction effort was originally specified at about 56,000 ft-lbs/ft^3 but was 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~~ specific soils. Moisture was specified 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. Once field compaction is such that the fill density is significatly 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. As compactive effort is increased, maximum density will be increased and optimum moisutre content will decrease in the laboratory test. This change can only occur in the field to the extent that the field moisture content will permit it. Therefore, to benefit from the increased compactive effort the field moisture content must be lowered. As this indicates, the location of the compaction curve changes with a corresponding change in range of acceptable moisture content relative to optimum. A +2 percent numerical value of moisture content acceptable at the specified compactive effort would be too wet at a higher effort indicating that higher densities for that soil cannot be achieved. Therefore, if the record shows high densities for such material the data (are) or might be ~~are~~ in error. This was ~~apparently by~~ apparently overlooked by U. S. Testing Company. Plots of field data for compaction test BMP278 are shown

IN FILL CASES MATERIAL MUST COMPLY WITH SPEC - THERE IS NO EXCEPTION ALLOWABLE

DO NOT AGREE SPEC IS ±2% AT 95% BY

on figures 4 through 6. The title of each figure gives the assumptions made in plotting data for that figure. In comparing ... es 3 and 4 it is seen that a majority of field tests were made usin: the nuclear device. The two test results shown on figure 4 for the sand cone meth. ...icates one test result on each side of the zero air voids curve. Ironically, the one falling above the zero air voids curve (shown on figure 4) is designated as the only passing sand cone test (shown on figure 6) — by U-S Testing Company.

For a field test result to be classified as "Passing" it must fall within 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 Specification 7220-C-210. It is defined by horizontal lines at 95 percent and 105 percent of specified density, vertical lines through ±2 percent of optimum moisture content, and a line parallel to the zero air voids line indicating saturation about half way between the compaction curve and 100 percent saturation (zero air voids curve). If all data points fall within this area 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 suspect. A review of all data indicates that only about 25 percent of the cohesive soil test results fall within this area.

Figure 7b shows an area where field test results would be acceptable 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.-lbs./ft.^{3}) which is considered to be a practical upper limit. About 40 percent of all field test results would plot in this area.

6. Accuracy of Test Equipment.

Almost all field density tests on cohesive soils were made using the Nuclear Density device. Specification 7220-C-210 section 12.4. . 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 determined by the nuclear device is acceptable when results are compatible with density as determined by ASTM D 1556.

In many cases such a correlation was not made. There are many laboratory compaction curves used where only data from the nuclear device was used for field control. ←

DOES THE ASTM REQUIRE COMPARISON'S FOR EACH INDIVIDUAL CURVE ?

BECHTEL ACCEPTED THIS METHOD BASED ON TEST MADE EARLY IN THE PROCESS — THERE WAS NO FOLLOW UP — WE MUST ACKNOWLEDGE THIS — UST WAS GIVEN TECHNICAL DIRECTION BY QC AND WAS NOT REQUESTED TO RE-EVALUATE THE EQUIP AFTER APPROVAL —

WE SHOULD NOT IGNORE BECHTELS ROLE IN THIS PROBLEM.

7. Relative Density Tests.

Cases were noted where densities in material c .fied on the data sheet as zone 3 (sand) was compared to the maximum density in proctor type tests and other cases where densities in clay soils were com, ed to the maximum density in relative density tests. An error exists in such cases in the record either in the classification of the soil on the data sheet or in comparing field test results to the inappropriate laboratory test data. In general, it appears that relative density tests were used in determining density of sand fill.

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." U. S. Testing Company did not do this. As a consequence many field density test results exceeded 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 showed greater than 100 percent compaction. The highest density recorded was 211.2 percent with the majority of tests over 100 percent falling in the range of 100 percent to about 130 percent.

ARE WE SURE — I THINK THEY DID.

(Erroneously recorded by U.S. Testing as 119.)

found

WHAT IS THE UPPER LIMIT? WHY ARE TESTS BETWEEN 100 - 130% NOT VALID?

Even by using the wet laboratory test method an unacceptably high number of field test results would have greatly exceeded 100 percent. This assumes that the wet test method would increase maximum relative density by 4 or 5 percent which appears reasonable based on some recent wet test results run on comparable material.

7. Conclusions.

In summary, only about 25 percent of the field test results fall within an area that is defined by the specifications and is possible based on the compaction characteristics of soil. About 40 percent of all data points fall in an area considered possible for the given soil as defined by an obtainable compactive effort of 100 percent of ASTM D 1557. Refer to figures 7a and 7b for determination of the areas defined as acceptable.

Since no reliable conclusions can be drawn to clearly define reliable data from unreliable data, all points must be considered suspect and, thus, all of the soils testing data points determined by U. S. Testing Company should be discarded as totally unreliable.

JA/cf

- WHAT ARE THESE LIMITS — WHERE DEFINED — AND BY WHAT AUTHORITY
- HOW MANY OUTSIDE LIMITS WERE ACCEPTED BY ENG. VIA NCRS

- MUST BE REVISED TO BE MORE CONCLUSIVE BASED ON KNOWNS NOT UNKNOWNS
- CAN WE LIMIT THIS TO PLANT FILL OR MUST WE NOW PROCEED TO EVALUATE THE DIKES

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

SB116509

NOTE: Spec. 7220-C-208 gives a ratio of 20 field tests to each laboratory test. or 1/30 or 1/40 etc depending upon frequency in the field.

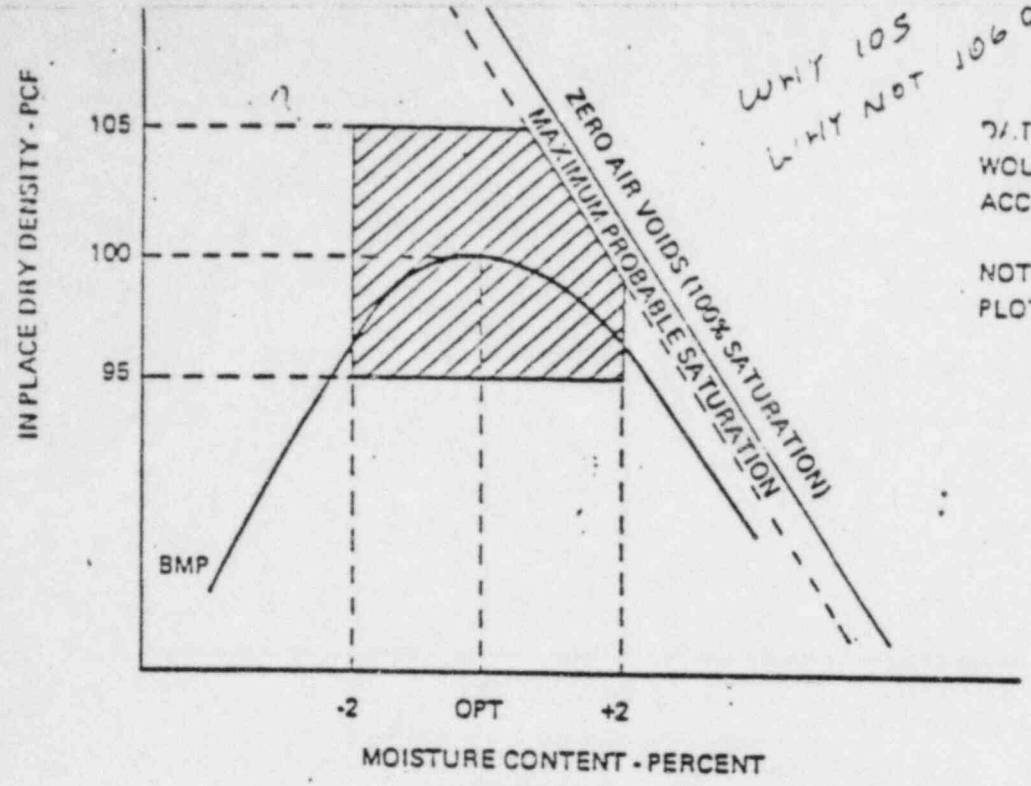


FIGURE 7-A.

DATA POINTS THAT PLOT IN SHADED AREA WOULD BE GENERALLY ACCEPTABLE ACCORDING TO SPECIFICATIONS

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

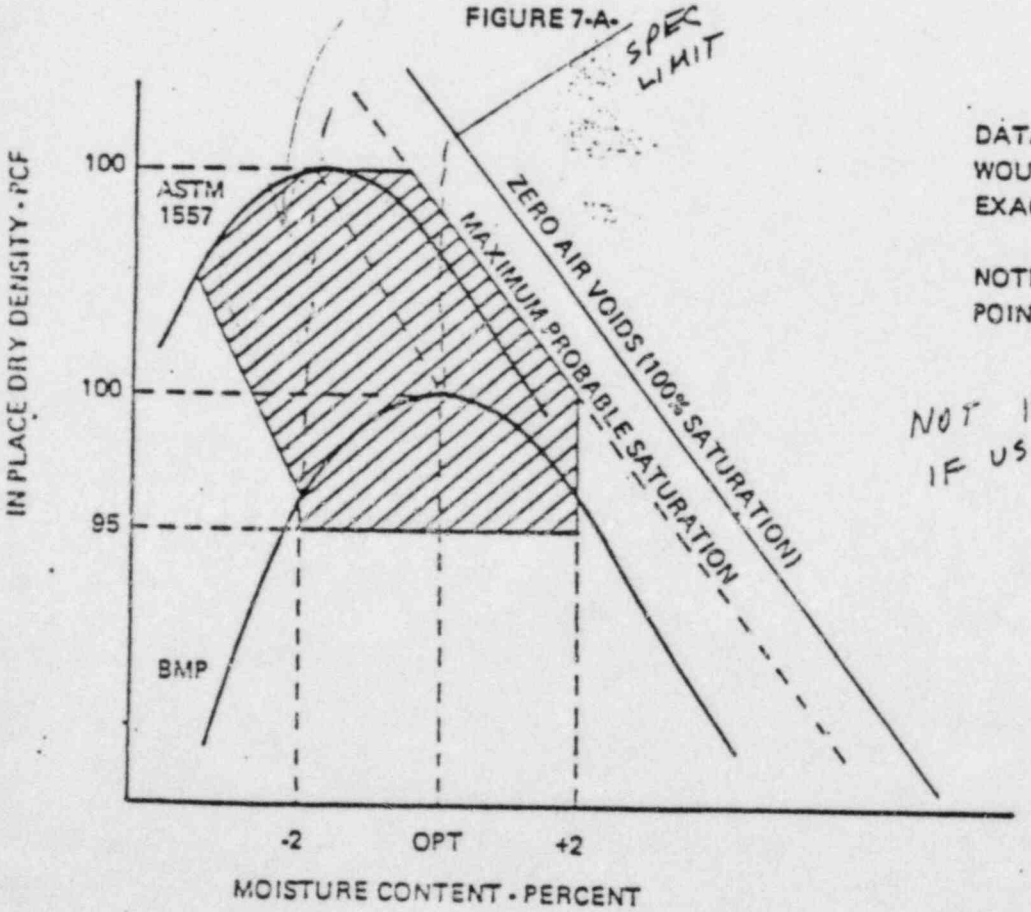


FIGURE 7-B.

DATA POINTS THAT PLOT IN SHADED AREA WOULD BE ACCEPTABLE REGARDLESS OF EXACT SPECIFICATION WORDING

NOTE: ABOUT 40% OF ALL FIELD DATA POINTS PLOT IN THE SHADED AREA

SB16524

RBP

RALPH B. PECK CIVIL ENGINEER GEOTECHN

23 July 1979
J958

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Dr. Sherif S. Afifi
Bechtel Associates Professional Corporation
777 East Eisenhower Parkway
P. O. Box 1000
Ann Arbor, MI 48106

Dear Sherif:

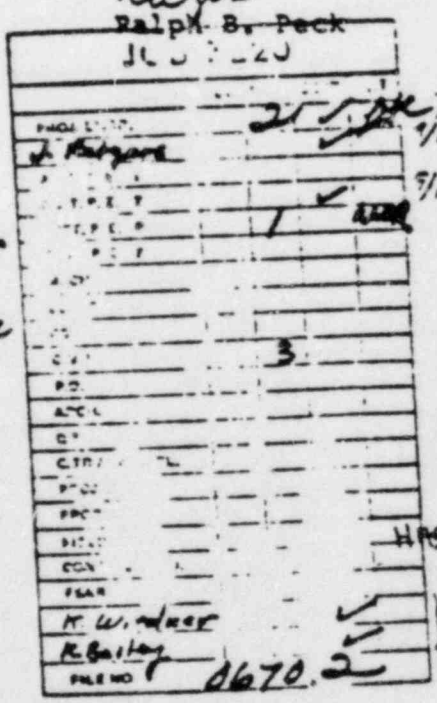
Enclosed is a reconstruction of the remarks I made at our meeting with NRC on July 18.

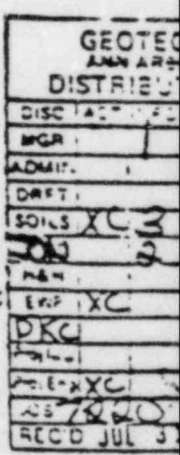
Yours very sincerely,

Ralph B. Peck

RBP/ajj

Enc.





1101 WARM SANDS DRIVE, S.E. ALBUQUERQUE, NEW MEXICO 87123 505-293-24

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COMMENTS BY RALPH B. PECK

(Reconstructed from notes prepared 17 & 18 July 1979)

I have been a consultant to Bechtel on the Midland Project, together with Professor A. J. Hendron, beginning shortly after the settlements were noted in the Diesel Generator Building. I speak for myself and, I hope, for Professor Hendron, who is unable to be here because he is out of the country. I will not discuss anything that you have not already heard this morning. It is my intention, however, to review the proposed remedial measures and to emphasize those aspects that, in my judgment, are of greatest importance.

The investigations at the Diesel Generator Building rather quickly showed that the seat of settlement was in the clay fill underlying the structure. They also showed that the clay fill was extremely variable with respect to its density, its water content, and even its composition. Furthermore, the investigations showed that it would be feasible to surcharge the area in such a way as to stress the subsoil of the structure to levels exceeding the final stresses that would exist under operating conditions.

After consideration of a number of alternatives, it was decided to prestress the subsoil by means of a surcharge. In my view, this procedure had several important advantages. One of these is the opportunity to provide instrumentation, principally piezometers and subsurface settlement gages, that could furnish data permitting a reliable upper-bound settlement forecast. Furthermore, the procedure automatically proof-tested the subsoil with respect to its future settlement behavior. Therefore there would be no need, in determining the acceptability of the foundation, to depend on the results of additional borings, samples, compaction tests, or other similar activities. Such tests would be likely to prove inconclusive on account of the heterogeneity of the fill material, but they would also be irrelevant in view of the knowledge of the actual behavior.

The results of the preload procedure have been convincing. The observed pore pressures were small, smaller than actually anticipated, and they dissipated rapidly. Hence, primary consolidation was accomplished quickly and the curve of settlement as a function of the logarithm of time became linear shortly after the completion of placement of the fill. Therefore, it is possible to forecast the settlement that

would occur at any future time by simple extrapolation, on the assumption that the surcharge will remain in place. Even this amount of settlement would be acceptable. However, the projected settlement determined on this basis is an upper bound, because the surcharge will be reroved and the real settlements will certainly be smaller. In my judgment, the foregoing circumstances eliminate any uncertainties concerning the settlement behavior of the Diesel Generator Building resulting from the underlying clay fill.

The investigation at the Diesel Generator Building also showed, however, the presence of zones of sand, including some portions that were loose. This finding indicated a potential for liquefaction under severe earthquakes, and the possibility of settlement originating in the sands due to shakedown under seismic conditions. The surcharge would, of course, be ineffective to remedy this condition.

Of the various possible remedial measures, grouting, probably using chemicals, would, in my judgment, be feasibl Nevertheless, it would be difficult to be assured that all injected materials had been successfully treated, or that loose zones had actually been injected. Thus, chemical g ing would at best be a piecemeal solution. It would be

difficult to give a positive answer to the question whether all significant zones that might liquefy had been identified and treated.

The chosen alternative to grouting is general permanent dewatering of a large portion of the plant site. This solution has the advantage of being a positive solution to the liquefaction problem. Therefore, it provides positive answers to such questions as those just mentioned. The solution has the further advantage that it can be monitored effectively by simple procedures, primarily by the use of piezometers. In my view, one of the greatest advantages of general dewatering is the margin of safety inherent in the time lag that would be required for recharge of the dewatered zone if the pumps should cease to operate. That is, the beneficial effects of the dewatering would persist for a period on the order of weeks after pumping might be interrupted. Failure of the pumping system because of an earthquake would, therefore, not destroy the protection achieved by the dewatering.

In addition to being a positive solution to the liquefaction problem, wherever any such problem might exist in the dewatered area of the plant site, the drainage will reduce substantially any settlements that might be induced by compact

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of the sands during an earthquake. The present methods of estimating settlements due to seismic shakedown are overconservative, because they are based on the results of laboratory tests on dry sands. Even the settlements estimated on this basis would be acceptable. However the presence of capillary moisture in the soil would greatly reduce the freedom of the sand grains to assume a denser position during vibration. Therefore, I consider that dewatering will essentially eliminate any potential problems of seismic shakedown.

The continuing investigations of the plant area indicated other potential trouble areas. In my view, these potential trouble zones have now been adequately defined by the boring program and other investigations. One such area is the location of the Borated Water Tanks. Beneath these tanks the investigations have indicated better and more consistent subsurface conditions than beneath the Diesel Generator Building. It is proposed to fill the tanks with water as a test load. The filling will constitute full-scale proof tests with respect to the bearing capacity of the subsoil. It is anticipated that the tanks will settle under the test load, and the settlement will increase the bearing capacity. Furthermore by making settlement observations at various depths in the

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subsoil during and after the test loading and by combining this information with stress calculations and theory, it will be possible to make reasonable settlement predictions that take into account the actual subsurface conditions under realistic loadings.

The Electrical Penetration Structures extending from the Auxiliary Building, and the adjacent Valve Pits, are to be underpinned. This is a positive solution that will lead to satisfactory and predictable results irrespective of the nature of the fill materials that may presently underlie these structures. The operations are expedient, in the sense that they are compatible with the general construction schedule. The nine caissons under each of the Electrical Penetration wings will be tested individually to 150 percent of the anticipated loading, and collectively to 100 percent of the anticipated working load. The latter procedure, in which all nine caissons are loaded simultaneously, constitutes a proof loading that will eliminate any doubts concerning the ability of the underpinning to support the structure without significant settlement.

The Diesel Fuel Tanks are buried structures that have already been subjected to a full-scale loading by filling

000077

with water. The settlements under these test conditions were minimal. Whatever settlement of the tanks may occur will be associated primarily with settlement of the underlying and surrounding fill under its own weight. Since the tanks will be settling with the fill, the differential movements between the tanks and the surrounding soil and piping will be minimal, and the connections can be expected to settle approximately equally with the tanks. Therefore, I do not consider that any unusual conditions exist with respect to the Diesel Fuel Tanks, and that attention to details providing reasonable flexibility will satisfy all requirements.

The Service Water Structure lies outside the area of planned permanent dewatering. Therefore the wing presently supported by fill will be picked up by a system of piles. T proposed procedure provides positive support. The piles ar to be designed to carry the structural loads at their buckl ing strength and will therefore be effective even in the ev of liquefaction of the surrounding soil. Since these piles are not clustered in such a way as to stress highly a larg mass of the bearing material, as in the case of the caisso proposed for the Electrical Penetrations of the Auxiliary Building, they are not to be proof loaded as a group, but

be loaded individually to 150 percent of anticipated working load. This procedure is conservative.

In summary, my overall impressions and conclusions concerning the proposed remedial measures are as follows: The investigation has proceeded in a progressive fashion. Like most investigations of this kind, it has not always proceeded in a straightforward way, but has appropriately pursued various approaches. Although it is still continuing in some respects, I consider that it has now disclosed the significant conditions and potential problems associated with the foundation conditions of the site. As a result of the studies, a variety of solutions has evolved. Each solution is suited to the specific conditions and problems of a particular part of the facility. However, the potential for liquefaction has been eliminated once and for all, and many potential uncertainties have been eliminated by full-scale loading or proof testing where such procedures have been found advantageous. In my judgment, this is a strong advantage of the procedures adopted.

Finally, the proposed solutions do not require unreasonable maintenance or monitoring during the lifetime of the plant, and can therefore be adopted with confidence.

PERSONNEL QUALIFICATIONS

AUG 2 2 1979

As part of the cause analysis the education and experience of personnel involved in the soils operations at the Midland Job site were reviewed.

This review indicated that during the course of the Midland Project soils operation (7/73 to date of review) 51% of the personnel assigned to soils had at least: an M.S. in civil or soils; or a B.S. plus one or more years of soils experience, or an equivalent combination of education and experience. This includes Bechtel QC inspectors, Bechtel QC personnel doing reviews only, Canonie QC, U.S. Testing technicians, Bechtel Field Engineers, and Bechtel supervisors.

This indicates that the personnel involved in the soils operations had sufficient education and experience to carry out the tasks assigned to them.

In addition, the review indicated that except for the initial period (7/73 - 1/25) when all personnel were 'new employees', an average of 39% of the senior soils people (described in the previous paragraphs) continued on from one period to the next. For the lower level soils personnel, 38% continued from the initial period over into the 1/75-10/76 period, but only 8% continued on into the 10/76-present period.

Many senior soils personnel were retained during the 1975 slowdown but there was a need to restaff with mostly new lower level personnel in 1976 to support the reactivation of soils activities. This resulted in some decrease in the average experience level of personnel, but sufficient qualified, experienced personnel were available at all times, especially when recognizing that the major portion of the soils work had been already completed.

Based on the foregoing, we have concluded that the qualification/experience level of personnel assigned to the Midland Project soils operations was not a probable (contributing) cause of the settlement problem at the Midland Jobsite.

DIESEL GENERATOR BUILDING

G. RICHARDSON
3-21-79

SUMMARY OF PERSONNEL QUALIFICATIONS

ATTACHMENTS A AND B SUMMARIZE THE EDUCATION AND EXPERIENCE BACKGROUNDS OF PERSONNEL INVOLVED IN SOILS OPERATIONS AT THE MIDLAND JOBSITE. BECHTEL AND CANONIE Q.C. ENGINEERS WERE INVOLVED ONLY IN "Q" WORK. THE INFORMATION FOR BECHTEL FIELD ENGINEERING AND SUPERVISION AND FOR U.S. TESTING COVERS BOTH "Q" AND "NON-Q" WORK.

ATTACHMENT A SUMMARIZES THE PERSONNEL USING LEVELS AS DISCRIBED ON PAGE TWO OF THE ATTACHMENT.

ATTACHMENT B SUMMARIZES THE LEVELS OF PERSONNEL AND IDENTIFIES HOW MANY INDIVIDUALS WERE NEW TO THE JOB OR WERE CARRY OVERS FROM THE PREVIOUS PERIOD. THE EFFECT OF THE 1975 SLOWDOWN CAN BE SEEN IN TWO RIGHT HAND COLUMNS.

CONCLUSION

ATTACHMENT A INDICATES THAT PERSONNEL INVOLVED IN THE SOILS OPERATIONS PROBABLY HAD SUFFICIENT EDUCATION, EXPERIENCE AND TRAINING TO CARRY OUT THE TASKS ASSIGNED TO THEM.

ATTACHMENT B DOES INDICATE THAT THE 1975 SLOWDOWN RESULTED IN THE NEED TO RESTAFF WITH MOSTLY NEW PERSONNEL IN 1976 TO SUPPORT THE INCREASE AMOUNT OF WORK. THIS MAY HAVE RESULTED IN SOME DECREASE IN THE AVERAGE LEVEL OF PERSONNEL BUT SUFFICIENT EXPERIENCED PERSONNEL WERE AVAILABLE AT ALL TIMES.

SS:10986

BASED ON THE ABOVE QUALIFICATIONS OF PERSONNEL SHOULD NOT BE CONSIDERED AS A MOST PROBABLY CAUSE OF THE SETTLEMENT PROBLEM AT THE MIDLAND JOBSITE,

G. RICHARDSON
3/21/79

DIESEL GENERATOR BUILDING
PERSONNEL QUALIFICATIONS

ATTACHMENT
SHEET 1 OF 2

		7/73 – 1/75	1/75 – 10/76	10/76 – PRESENT
BECHTEL Q.C. INSPECTORS	A	• • •	• • • •	• • •
	B	•	–	
	C	–	–	–
	D	–	•	•
BECHTEL QC DOING REVIEWS ONLY	A	• •	• •	• •
	B	–	–	•
	C	–	–	• •
	D	–	–	•
CANONIE QC	A	•	•	•
UT TESTING TECHNICIANS.	A	• • •	• • • • •	• • • • •
	B	•	• •	• • • •
	C	• • • • •	• • •	• • • • •
	D	• •	• • • •	• • • •
BECHTEL FIELD ENGINEERS	A	• • • •	•	• • •
	B	•	• • •	–
	C	–	–	•
	D	–	–	–
BECHTEL SUPERVISORS	A	–	• • • • •	• • •
	B	–	–	–
	C	–	–	–
	D	–	–	–

• = ONE EMPLOYEE.

NOTES: (1) FOR EXPLANATION OF LEVELS SEE SHEET 2

(2) LEVELS ARE BASED ON EDUCATION AND EXPERIENCE AT THE START OF EACH PERIOD. EXPERIENCE GAINED IN PREVIOUS PERIODS HAS BEEN CONSIDERED IN ESTABLISHING LEVELS.

(3) LEVELS ARE BASED ON RECORDS AT MIDLAND SITE. THESE RECORDS FOR BECHTEL FIELD ENGINEERS AND SUPERVISORS ARE NOT COMPLETE.

S3.16987

G. RICHARDSON
3/21/79

BECHTEL

DIESEL GENERATOR BUILDING

PERSONNEL QUALIFICATIONS

ATTACHMENT
SHEET 2 OF 2

QUALIFICATION LEVEL	EDUCATION AND EXPERIENCE (1)(2)
A	-M.S.C.E or M.S. SOILS OR -BSCE + 1 or more years soils experience OR -2yrs College Eng. + 2 or more years soils experience OR - H.S + 3 or more years soils experience.
B.	-BSCE OR - 2yrs College Eng+1 year soils experience OR -H.S. + 2 years soils experience
C	-2yrs College Eng OR - H.S. + one year soils experience
D.	High School

(1) SOILS EXPERIENCE IS EXPERIENCE IN THE PLACEMENT, INSPECTION OR TESTING OF EMBANKMENT OR BACK FILL OPERATIONS

(2) EXPERIENCE INSPECTING HEAVY CIVIL CONSTRUCTION ACTIVITIES SUCH AS DAMS, ROADS, POWER PLANTS, BUT OTHER THAN SOILS, IS CONSIDERED EQUIVALENT ON A TWO YEARS EQUALS ONE YEAR BASIS. FOR SUPERVISORS CONSTRUCTION EXPERIENCE IS CONSIDERED EQUIVELENT TO INSPECTION EXPERIENCE

SB116988

G. RICHARDSON
3/21/79

BECHTEL

DIESEL GENERATOR BUILDING
PERSONNEL
QUALIFICATIONS AND TURNOVER

ATTACHMENT 2

GROUP	LEVEL	7/73 – 1/75 NEW EMP	1/75 – 10/76 CONT. EMP	1/75 – 10/76 NEW EMP	10/76 – PRESENT CONT EMP	10/76 – PRESENT NEW EMP
BECHTEL QC INSPECTORS	A	•••	••	••	•••	
	B	•				•
	C					
	D			•		•
BECHTEL QC DOING REVIEW ONLY	A	••	•	•		••
	B					•
	C					••
	D					•
CANONIE QC	A	•	•		•	
U.S. TESTING TECHNICIANS	A	•••	••	••••	••	•••
	B	•	•	•	•	•••
	C	•••••	••	•	•	•••••
	D	••	••	••		••••
BECHTEL FIELD ENGINEERS	A	••••		•		•••
	B	•		•••		
	C					•
	D					
BECHTEL SUPERVISORS	A			•••••	••	•
	B					
	C					
	D					

• = ONE EMPLOYEE

NOTES: (1) FOR EXPLANATION OF LEVELS SEE SHEET 2 OF ATTACHMENT 1

(2) LEVELS ARE BASED ON EDUCATION AND EXPERIENCE AT THE START OF EACH PERIOD. EXPERIENCE GAINED IN PREVIOUS PERIODS HAS BEEN CONSIDERED IN ESTABLISHING LEVELS.

SB:16989

(3) LEVELS ARE BASED ON RECORDS AT MIDLAND SITE. THIS RECORDS FOR BECHTEL FIELD ENGINEERS AND SUPERVISORS ARE NOT COMPLETE.

BECHTEL

G. RICHARDSON
3/21/77

DIESEL GENERATOR BUILDING
PERSONNEL EMPLOYMEN PERIOD

ATTACHMENT C

	PERIOD EMPLOYED.			
	PRIOR TO 1/75	BEFORE AND AFTER 1/75	AFTER 1/75	AFTER 1/76
U.S TESTING	•••••	•••••	••	•••••
		•		•••••
				•••••
				•••••
				••••

SBL16990

DO NOT INCLUDE IN REPORT

ADDITIONAL COMMENTS.

NOT CONSIDERING QUALIFICATIONS THE HIGH TURNOVER RATE OF PERSONNEL FOR U.S. TESTING COULD BE A FACTOR RELATING TO TESTING ERRORS AND INCORRECT SELECTION OF THE PROPER LABORATORY MAXIMUM DENSITY VALUE.

BECHTEL QC AND FIELD ENGINEERING DID NOT HAVE ANY ONE INDEVIDUAL ASSIGNED SPECIFICALLY TO SOILS. THE PERSONNEL ASSIGNED TO SOILS ALSO HAD OTHER DUTIES. THIS COULD HAVE RESULTED IN LESS THAN DESIREABLE TIME BEING SPENT ON SOILS OPERATIONS BY SOME INDEVIDUALS.

BECHTEL

ANN ARBOR

MEMORANDUM

TO: [illegible]

LOCATION:

FROM: [illegible]

DATE: 19

SUBJECT: NRC [illegible] Qualification

JOB NO. [illegible]

FILE

Attached [illegible] document [illegible] the [illegible] July [illegible] presentation

We [illegible] suggest [illegible] the [illegible] to the NRC under the same cover [illegible] MCAR 24 Interim Report 7

SB:16992

AAO-521

[illegible] Qualifications

As part of the course analysis the education and experience of personnel involved in the soils operations of the Midland jobsite were reviewed.

Attachment A summarizes the education and experience backgrounds of personnel involved in soils operations at the Midland jobsite. The education and experience backgrounds were organized into the following levels:

Level A - M.S.C.E, or M.S. soils
or - B.S.C.E, plus 1 or more years soils experience
or - 2 years engineering college, plus 2 or more years soils experience
or - High school, plus 3 or more years soils experience

Level B - B.S.C.E.
or - 2 years engineering college, plus 1 year soils experience
or - High school, plus 2 years soils experience

SB:16993

Level C - 2 years engineering college
or - High school, plus 1 year soils experience

Level 0 - [illegible]

In establishing these levels, soils experience was considered to be experience in the placement, inspection, or testing of embankment or backfill operations. Experience inspecting heavy civil construction activities such as dams, levees, and power plants, but other than soils, was considered on the basis of two years equivalent to one year. For supervisors, construction experience was considered equivalent to inspection experience

Attachment A indicates that personnel involved in the soils operations had sufficient education, experience and training to carry out the tasks assigned to them and ~~sufficient~~ qualified personnel were available. ~~For all this~~

The number of people assigned to the various aspects were tabulated for three different periods.

7/23 - 1/25 This is the period from recognition of construction to the [illegible] in 1925

1/25 - 10/26 This is the period during which construction was actively supervised and then resumed. The termination of this period corresponds to the recession and cessation of soils activities. It is considered to

BECHTEL

SOILS OPERATIONS

PERSONNEL QUALIFICATIONS

ATTACHMENT

		7/73 – 1/75		1/75 – 10/76		10/76 – PRESENT	
BECHTEL Q.C. INSPECTORS.	A	• • •	A	• • • •	A	• • •	
	B	•	B	–	B		
	C	–	C	–	C	–	
	D	–	D	•	D	•	
BECHTEL Q.C DOING REVIEWS ONLY	A	• •	A	• •	A	• •	
	B	–	B	–	B	•	
	C	–	C	–	C	• •	
	D	–	D	–	D	•	
CANONIE Q.C	A	•	A	•	A	•	
U.S. TESTING TECHNICIANS.	A	• • •	A	• • • • •	A	• • • • •	
	B	•	B	• •	B	• • • •	
	C	• • • • •	C	• • •	C	• • • • •	
	D	• •	D	• • • •	D	• • • •	
BECHTEL FIELD ENGINEERS	A	• • • •	A	•	A	• • •	
	B	•	B	• • •	B	–	
	C	–	C	–	C	•	
	D	–	D	–	D	–	
BECHTEL SUPERVISORS	A	–	A	• • • • •	A	• • •	
	B	–	B	–	B	–	
	C	–	C	–	C	–	
	D	–	D	–	D	–	

• = ONE EMPLOYEE

NOTES: (1) FOR EXPLANATION OF LEVELS SEE ATTACHED

(2) LEVELS ARE BASED ON EDUCATION AND EXPERIENCE AT THE START OF EACH PERIOD. EXPERIENCE GAINED IN PREVIOUS PERIODS HAS BEEN CONSIDERED IN ESTABLISHING LEVELS.

(3) LEVELS ARE BASED ON RECORDS AT MIDLAND SITE. THESE RECORDS FOR BECHTEL FIELD ENGINEERS AND SUPERVISORS ARE NOT COMPLETE.

SB119996

Bechtel Power Corporation

Interoffice Memorandum

To: M. Garclay

Subject: Job 7220 Midland Project
Project QAR SD-40
CLR-02-78-043

Date: February 3, 1978

From: G. L. Richardson

Dept: Quality Assurance

Concurs: J. Klacking ✓

At: Midland, MI Ext: 207

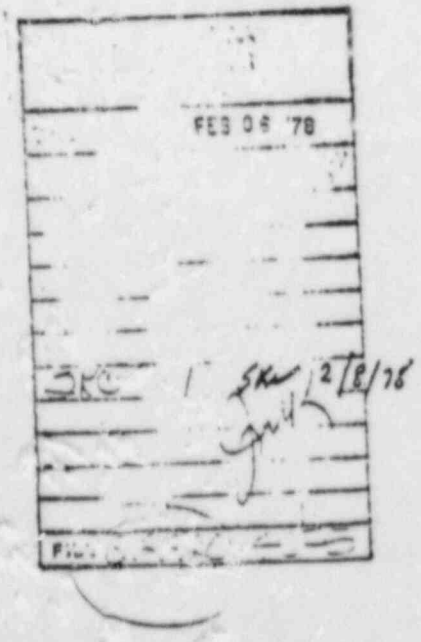
In your response to the subject QAR, which identified problems with moisture tests on soils placement, you indicated on Aug. 11, 1977 that moisture tests will be taken in the borrow areas at the start of the day and as needed to maintain the proper testing frequency.

During review of the records in the QC Vault to verify actions taken in response to QAR SD-40 it was noted that there is no evidence of these record tests being taken. Upon further investigation it was discovered that U.S. Testing maintains a log for these tests and they are not being reviewed by Q.C. We feel that these tests should be maintained in the vault and reviewed by Q.C. for adequacy.

Please take appropriate actions to locate the moisture tests, review these tests and file them in the vault. It is requested that these actions be taken by March 1, 1978 so that QAR SD-40 can be closed out.

G. L. Richardson

GL JGK/sw

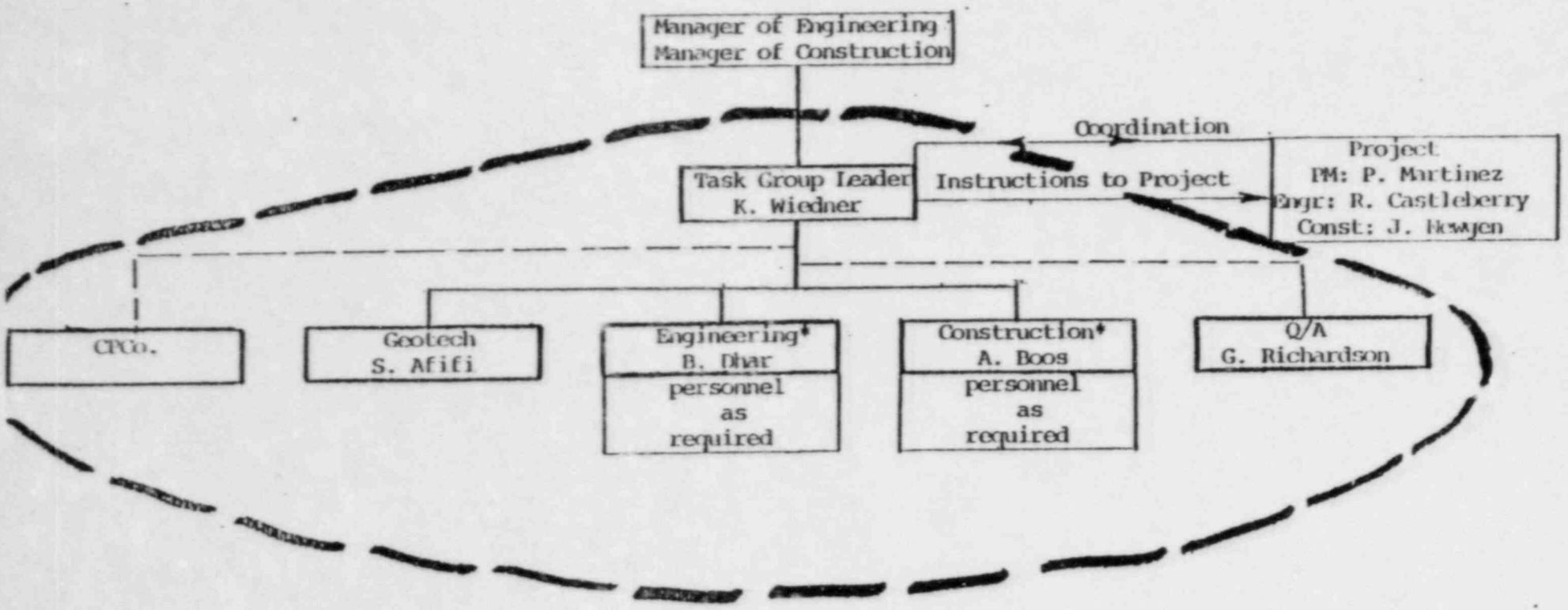


SB143149

I-78-236

MIDLAND PROJECT
JOB 7220-101

DIESEL GENERATOR BUILDING TASK GROUP



SB10S871

*Full time assignments

RECEIVED
BECHTEL POWER CORP
JOB 7220

Telephone call

PER

BY P. A. Martinez OF Bechtel PM

TO G. S. Keeley OF CPCo PM

DATE September 26, 19 78 TIME

SUBJECT RECORDS ON REMOVAL OF NATURAL SANDS JOB NO 7220, MIDLAND 1 & 2

S. E. Afifi
A. Boos
R. L. Castleberry
[redacted]
D. R. Johnson
J. F. Newgen
J. Milandin
W. G. Moring

The call was made to update Keeley on our search for records relating to removal of the natural sands. This search had been started as a result of the April 1978 FSAR question 362.2 which asked for a discussion of the methods employed in mapping and removing the sands under Class 1 structures and beneath non-Class 1 structures if their failure could endanger the adjacent Class 1 structures.

We have records to show that the sand was removed under the main plant power block and under the service water pump structure. From the present boring program it appears that there are no natural sands under the diesel building. We have not so far been able to find records on the tank farm north of the power block or the service water piping or the Class 1 electrical duct runs. We are still reviewing Field Engineering records and expect to be complete with this in about two weeks.

Keeley indicated that Consumers Power intends to discuss this record search with the NRC today. We think that is a good idea to brief them although we do not see it as a major problem yet, since we have so far not encountered any soft natural sands under the Class 1 structures or components. The FSAR question will be answered when the present boring program results have been evaluated.

QA ROUTE	INFO.	ACT.
LQAE	LPD	
VIL (1)		
...		
PIPING		
ELEC		
MECH		
J/D		
SEC'Y		
FILE NO.		

Return for MCAE 24 2.4

P. A. Martinez

PAM/pp

8310080934

AAO-522

Bechtel Power Corporation

Interoffice Memorandum

To W. Holub

Subject Soils Testing
Specification 7220-C-208 & C-210

Copies to

Date March 25, 1974

From G. Richardson

Of Quality Assurance

At Midland, Michigan

Two NCR's have been generated that involve testing of soils in the Q-listed embankments at this jobsite. The first, No. C-26, indicated that the testing frequency for in-place density was 1/2300 yds.^{3} instead of the specified 1/500 yds.^{3} placed. This problem apparently occurred over the entire placement year of 1973. NCR No. C-26 was generated on 12/05/73.

NCR No. C-55 was generated on 1/28/74. (It should be noted that no work has occurred under this contract since December 1973 due to inclement weather and agreement with the subcontractor to do no further work.) This NCR describes numerous tests that failed to meet the requirements for moisture content and were either not reworked or not retested to establish the effectiveness of the reworking of the affected materials.

The probable cause of the above NCR's is one of a lack of communication between Geo-Tech personnel at the jobsite and QC personnel. At the time the work was progressing Geo-Tech was directing the operation, reviewing tests, etc. Good control of testing frequencies and retests was not maintained. The inspection plans in use were brief and did not identify the need for frequent testing. The above problems have been rectified as QC will have surveillance and acceptance responsibilities as defined on the new inspection plans. The new plans are improved and detailed and provide direction for testing and acceptance of materials.

A program to drill and take undisturbed samples in the affected area has been planned. The work is scheduled to start this date and will provide necessary data to properly evaluate the existing conditions of the in-place soils. From this evaluation, any corrective action necessary can be determined by Engineering.

The need for additional training of inspectors was recognized by the field forces. This training is committed to on NCR C-26 and is to be completed prior to the resumption of work. Also the need for closer surveillance of the testing lab was recognized on the NCR. This has been accomplished by assigning a full time QCE to surveillance and technical direction of the lab.

As can be easily determined from the discussion within this memo, the problems identified with the placements of embankments at this jobsite were significant. However, the problems have been identified, further work has not been permitted, action to correct the deficiencies has been taken, the underlying causes have been identified and action to preclude repetition has been taken. It is my opinion that a MCAR-1 issued at this time would serve no useful purpose and would only reidentify a problem that has been previously identified and well controlled.

G. L. Richardson

GLR/vs

GRL-3-74-5

SB109234

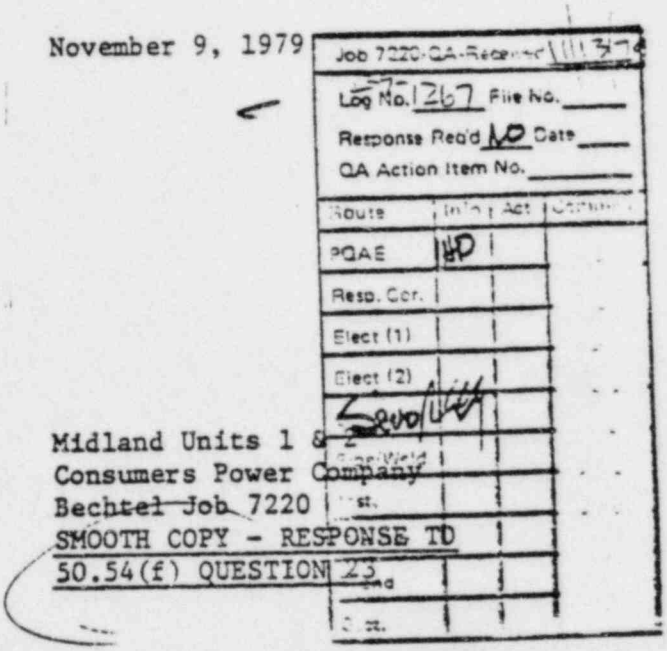
Bechtel Power Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

002659

November 9, 1979



BLC-8438

Mr. G. S. Keeley
Project Manager
Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

Dear Mr. Keeley:

In response to Ben Marguglio's request of November 8, 1979, three copies of the enclosed November 8, 1979, draft were delivered to Ben Marguglio for Consumers Power review today. This draft represents the results of a review of the October 26, 1979, draft at Consumers Power on November 6, 1979, with Messrs. Marguglio, Bird, Horn, Milandin, and Rixford.

Status and comments for each part are summarized as follows:

Part (1) reflects all comments of Consumers Power and Bechtel through November 8, 1979.
Part (2) reflects all comments of Consumers Power and Bechtel through November 8, 1979.
Part (3) is essentially a new rewrite prepared by Ben Marguglio during the November 6, 1979, review. It provides a logic tenor different than recommended in Bechtel's draft of October 26, 1979. This Bechtel response, which was a combined response to parts (3) and (4), said:

- the program was effective
- it had continual assesment and improvement
- we recognize NRC's concern for needing added confidence
- we will report the results of all our actions to NRC
- we will provide rationale as to why these actions provide confidence
- we will look at previous actions in retrospect which were taken on 50.55e and NRC I&E reports (This item was not a firm recommendation.)

002659

The Consumers Power November 6, 1979, version:

- does not say the program is effective - rather says we have confidence based on several reasons, therefore, it is recognized that a response to part (4), program effectiveness, is still necessary
- the program had continued improvement and itemizes those improvements by year
- makes no commitments for further reporting

Both drafts do respond to part (3) which requests more information for material reported in the original report.

Part (3) Consumers draft has not been reviewed by Bechtel Management. The attachment to part (3) reporting the status of action items is not included in the November 8, 1979, draft since it is repeat material and because of the extensive rewrite of format, it could not be readied for today's transmittal. The attachment does not require further review and will be ready for the final transmittal to NRC.
Part (4) to be prepared by Consumers Power as agreed to by Ben Marguglio.

I understand Steve Howell and Ben Marguglio already have the benefit of your general comments.

Very truly yours,

John A. Rutgers
Project Manager

JAR/JM/js

Attachment

cc: P. Becnel
W. Bird w/o Att.
J. Clements
L. Curtis
[redacted]
S. Heisler
D. Horn w/o Att.
S. Howell
B. Marguglio
J. Milandin
F. Porter
R. Rixford
E. Rumbaugh
R. Simanek

8011090396

Bechtel Power Corporation

Inter-office Memorandum

QCFM-8017/AI-917

To L. A. Dreisbach

Subject Midland Project, Units 1&2
CPCo NCR M01-9-0-038

Date June 11, 1980

From E. D. Newman

Of Quality Control

At Midland, Michigan
Job No. 07220

Copies to R. A. Simanek
L. E. Davis

References: (A) CPCo NCR M01-9-0-038, dated 5/15/80
(B) QA AI S-284, dated 5/20/80

This is considered to be Quality Control's complete response to Reference (A) above.

All C-1.02 "Compacted Backfill" QCIR's from 1979 through May 1, 1980, were reviewed for the placement locations of "Q" backfill materials compacted using the equipment listed in Reference (A) above.

The equipment referenced in (A) above are as follows:

1. GP-7000 - Vibrotary compactor - hand operated (BEBC-3162) "Q" & non-"Q".
2. CA-250 - Vibroplus (drum)-self-propslled (BEBC-3162) "Q" & non-"Q".
3. CF-43 - Vibroplus Dynapact - (IOM dated 9/4/79, Afifi to Curtis) non-"Q".
4. RV48 - "Pogo Stick" - hand held (BEBC-3301) "Q" & non-"Q".

The following is a list of "Q" listed backfill areas containing IR No., Date, Area Coordinates, and the Type of Equipment used during compaction. It should be noted that 1) all soil placed in "Q" areas, during this time period, is cohesionless material and 2) for the most part, several different types of equipment were used during the compaction of material.

Should any further questions arise, please contact this office.

E. D. NEWMAN
PROJECT FIELD QUALITY CONTROL
ENGINEER

EDN/SDK/sjc

Response Required: NO

8109521

IR NO.	DATE	LOCATION	EQUIPMENT USED
C-1.02-122	8/30/79	S5143 - S5159 E163 - E177	GP-7000 & GVR-220Y
C-1.02-122	8/31/79	S5143 - S5159 E163 - E177	GP-7000 & GVR-220Y
C-1.02-123	9/5/79	S4600 - S4660 E335 - E370	GP-7000 & GVR-220Y
C-1.02-123	9/6/79	S4600 - S4660 E335 - E370	GP-7000, CA-25D & GVR-220Y
C-1.02-124	9/10/79	S4540 - S4610 E330 - E370	GP-7000 & GVR-220Y
C-1.02-124	9/11/79	S4580 - S4630 E288 - E338	GP-7000 & GVR-220Y
C-1.02-124	9/11/79	S4540 - S4610 E330 - E370	GP-7000 & GVR-220Y
C-1.02-124	9/12/79	S4540 - S4610 E330 - E370	GP-7000 & GVR-220Y
C-1.02-124	9/13/79	S4540 - S4580 E312 - E330	GP-7000 & GVR-220Y
C-1.02-124	9/14/79	S4540 - S4580 E292 - E312	GP-7000 & GVR-220Y
C-1.02-124	9/15/79	S4540 - S4580 E292 - E330	GP-7000, CA-25D & GVR-220Y
C-1.02-125	9/17/79	S4540 - S4580 E292 - E330	GP-7000, CA-25D & GVR-220Y
C-1.02-125	9/18/79	S4625 - S4660 E235 - E300	GP-7000 & GVR-220Y
C-1.02-125	9/18/79	S4540 - S4580 E292 - E330	GP-7000 & CA-25D
C-1.02-125	9/19/79	S4615 - S4660 E175 - E235	GP-7000 & GVR-220Y
C-1.02-125	9/22/79	S4570 - S4635 E250 - E300	CA-25D & GVR-220Y
C-1.02-126	9/24/79	S4535 - S4575 E250 - E300	CA-25D & GVR-220Y

IR NO.	DATE	LOCATION	EQUIPMENT USED
C-1.02-126	9/25/79	S4535 - S4575 E235 - E300	CA-25D & GVR-220Y
C-1.02-126	9/25/79	S4605 - S4635 E250 - E300	CA-25D & GVR-220Y
C-1.02-126	9/27/79	S4600 - S4625 E175 - E220	CA-25D & GVR-220Y
C-1.02-126	9/27/79	S4575 - S4600 E175 - E235	CA-25D & GVR-220Y
C-1.02-126	9/28/79	S4535 - S4605 E235 - E300	CA-25D & GVR-220Y
C-1.02-126	9/29/79	S4555 - S4625 E175 - E235	CA-25D & GVR-220Y
C-1.02-127	10/1/79	S4575 - S4660 E165 - E235	CA-25D & GVR-220Y
C-1.02-127	10/3/79	S4600 - S4660 E100 - E165	GP-7000 & GVR-220Y
C-1.02-127	10/4/79	S4625 - S4660 E120 - E165	CA-25D & GVR-220Y
C-1.02-127	10/4/79	S4629 - S4635 E175 - E182	RV-4B
C-1.02-127	10/6/79	S4600 - S4660 E100 - E125	CA-25D & GVR-220Y
C-1.02-127	10/6/79	S4975 - S5005 E653 - E675	RV-4B & GVR-220Y
C-1.02-128	10/8/79	S4572 - S4660 E100 - E155	CA-25D & GVR-220Y
C-1.02-128	10/9/79	S4585 - S4660 E100 - E165	CA-25D, RV-4B & GVR-220Y
C-1.02-128	10/10/79	S4585 - S4660 E100 - E165	CA-25D, RV-4B & GVR-220Y
C-1.02-128	10/11/79	S4975 - S5005 E653 - E67[illegible]	RV-4B & GVR-220Y
C-1.02-128	10/12/79	S4630 - S4645 E300 - E315	RV-4B & GVR-220Y
C-1.02-128	10/13/79	S4630 - S4645 E300 - E315	RV-4B & GVR-220Y

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IR NO.	DATE	LOCATION	EQUIPMENT USED
C-1.02-129	10/16/79	S4665 - S4672 E135 - E195	RV-4B & GVR-220Y
C-1.02-129	10/16/79	S4570 - S4630 E235 - E300	CA-25D & GVR-220Y
C-1.02-129	10/16/79	S5220 - S5320 E490 - E500	GP-7000 & DVU-3001
C-1.02-129	10/16/79	S4665 - S4682 E180 - E210	RV-4B & GVR-220Y
C-1.02-129	10/17/79	S4665 - S4672 E210 - E285	RV-4B & GVR-220Y
C-1.02-129	10/17/79	S5220 - S5320 E490 - E500	GP-7000 & GVR-220Y
C-1.02-129	10/18/79	S5060 - S5070 E175 - E210	RV-4B & GVR-220Y
C-1.02-129	10/19/79	S5055 - S5075 E175 - E210	RV-4B & GVR-220Y
C-1.02-129	10/20/79	S5055 - S5075 E175 - E210	RV-4B & GVR-220Y
C-1.02-130	10/26/79	S4995 - S5035 E795 - E825	CA-25D, GVR-220Y
C-1.02-130	10/27/79	S5250 - S5310 E483 - E495	RV-4B & GVR-220Y
C-1.02-131	10/30/79	S4645 - S4662 E80 - E95	RV-4B & GVR 220Y
C-1.02-131	11/1/79	S5299 - S5305 E520 - E523.5	RV-4B & GVR-220Y
C-1.02-133	11/12/79	S4888 - S4895 E445 - E455	RV-4B
C-1.02-133	11/14/79	S4888 - S4895 E445 - E455	RV-4B
C-1.02-135	11/27/79	S5100 - S5130 E140 - E150	RV-4B & GVR-220Y
C-1.02-135	11/28/79	S5110 - S5150 E150 - E175	RV-4B & GVR-220Y

IR NO.	DATE	LOCATION	EQUIPMENT USED
C-1.02-136	12/4/79	S4635 - S4665 E325 - E345	RV-4B & GVR-220Y
C-1.02-136	12/6/79	S4790 - S4825 E80 - E105	RV-4B & GVR-220Y
C-1.02-136	12/7/79	S4820 - S4865 E75 - E85	RV-4B & GVR-220Y
C-1.02-136	12/7/79	S4790 - S4825 E80 - E105	RV-4B & GVR-220Y
C-1.02-137	12/14/79	S5085 - S5115 E335 - E365	RV-4B & GVR-220Y
C-1.02-137	12/15/79	S5085 - S5115 E335 - E365	GP-7000 & GVR-220Y
C-1.02-137	12/15/79	S5055 - S5090 E335 - E355	RV-4B, GP-7000, GVR-220Y
C-1.02-137	12/15/79	S5156 - S5185 E175 - E250	RV-4B & GVR -220Y
C-1.02-137	12/15/79	S5035 - S5055 E335 - E365	RV-4B & GVR-220Y
C-1.02-138	12/16/79	S5060 - S5095 E335 - E355	GP-7000 & GVR-220Y
C-1.02-138	12/16/79	S5165 - S5185 E175 - E255	RV-4B & GVR-220Y
C-1.02-138	12/17/79	S5035 - S5060 E335 - E365	GP-7000
C-1.02-138	12/17/79	S5035 - S5050 E315 - E335	RV-4B & GVR-220Y
C-1.02-138	12/17/79	S5172 - S5177 E175 - E255	RV-4B & GVR-220Y
C-1.02-138	12/17/79	S5165 - S5180 E255 - E320	RV-4B & GVR-220Y
C-1.02-138	12/18/79	S5041 - S5056 E310 - E345	RV-4B & GVR-220Y
C-1.02-138	12/19/79	S5035 - S5050 E310 - E345	RV-4B & GVR-220Y
C-1.02-138	12/19/79	S5165 - S5180 E255 - E320	RV-4B

IR NO.	DATE	LOCATION	EQUIPMENT USED
C-1.02-138	12/20/79	S5126 - S5150 E180 - E220	RV-4B, GVR-220Y
C-1.02-138	12/20/79	S5035 - S5050 E210 - E230	RV-4B, GVR-220Y
C-1.02-138	12/20/79	S5035 - S5050 E310 - E345	RV-4B, GVR-220Y
C-1.02-138	12/20/79	S5126 - S5152 E222 - E258	RV-4B, GVR-220Y
C-1.02-138	12/20/79	S5165 - S5180 E295 - E320	RV-4B, GVR-220Y
C-1.02-139	12/26/79	S5126 - S5141 E219 - E254	GP-7000 & GVR-220Y
C-1.02-139	12/26/79	S5126 - S5156 E256 - E291	GP-7000 & GVR-220Y
C-1.02-139	12/27/79	S5126 - S5156 E175 - E215	GP-7000 & GVR-220Y
C-1.02-139	12/27/79	S5126 - S5156 E215 - E255	GP-7000 & GVR-220Y
C-1.02-139	12/27/79	S5035 - S5056 E210 - E260	RV-4B & GVR-220Y
C-1.02-139	12/28/79	S5126 - S5156 E295 - E335	RV-4B & GVR-220Y
C-1.02-139	12/28/79	S5165 - S5185 E320 - E345	RV-4B & GVR-220Y
C-1.02-139	12/28/79	S5035 - S5056 E210 - E260	RV-4B & GVR-220Y
C-1.02-140	12/31/79	S5035 - S5056 E290 - E345	RV-4B
C-1.02-140	12/31/79	S5126 - S5156 E255 - E295	GVR-220Y, RV-4B
C-1.02-140	12/31/79	S5126 - S5156 E295 - E335	GVR-220Y, RV-4B
C-1.02-140	12/31/79	S5165 - S5185 E345 - E390	GVR-220Y, RV-4B

IR NO.	DATE	LOCATION	EQUIPMENT USED
C-1.02-140	12/31/79	S5140 - S5156 E330 - E390	GVR-220Y, RV-4B
C-1.02-140	1/2/80	S5126 - S5156 E295 - E335	GVR-220Y, RV-4B
C-1.02-140	1/2/80	S5140 - S5156 E330 - E390	GVR-220Y, RV-4B
C-1.02-140	1/2/80	S5035 - S5056 E290 - E345	GVR-220Y, RV-4B
C-1.02-140	1/2/80	S5035 - S5056 E215 - E295	GVR-220Y, RV-4B
C-1.02-140	1/3/80	S5165 - S5185 E320 - E345	GVR-220Y, RV-4B
C-1.02-140	1/4/80	S5140 - S5156 E330 - E350	GVR-220Y, RV-4B
C-1.02-141	1/8/80	S5165 - S5185 E390 - E410	RV-4B & GVR-220Y
C-1.02-141	1/8/80	S5140 - S5156 E390 - E410	RV-4B & GVR-220Y
C-1.02-141	1/8/80	S5035 - S5056 E255 - E300	RV-4B & GVR-220Y
C-1.02-141	1/9/80	S5035 - S5056 E300 - E330	GP-7000 & GVR-220Y
C-1.02-141	1/9/80	S5035 - S5056 E330 - E355	GP-7000
C-1.02-141	1/10/80	S5165 - S5185 E410 - E445	RV-4B & GVR-220Y
C-1.02-141	1/10/80	S5035 - S5056 E300 - E355	GP-7000
C-1.02-141	1/10/80	S5140 - S5156 E350 - E390	RV-4B & GVR-220Y
C-1.02-141	1/10/80	S5150 - S5156 E410 - E445	RV-4B & GVR-220Y
C-1.02-142	1/14/80	S5035 - S5056 E285 - E300	GP-7000 & GVR-220Y

IR NO.	DATE	LOCATION	EQUIPMENT USED
C-1.02-142	1/15/80	S5035 - S5056 E270 - E290	GP-7000 & GVR-220Y
C-1.02-142	1/15/80	S5175 - S5200 E440 - E470	RV-4B & GVR-220Y
C-1.02-142	1/15/80	S5165 - S5175 E445 - E485	RV-4B & GVR-220Y
C-1.02-142	1/15/80	S5145 - S5155 E430 - E460	RV-4B & GVR-220Y
C-1.02-142	1/16/80	S5035 - S5056 E270 - E290	GP-7000 & GVR-220Y
C-1.02-142	1/16/80	S5035 - S5056 E240 - E270	GP-7000 & GVR-220Y
C-1.02-142	1/16/80	S5175 - S5195 E470 - E410	RV-4B & GVR-220Y
C-1.02-142	1/16/80	S5145 - S5155 E460 - E490	RV-4B & GVR-220Y
C-1.02-142	1/17/80	S5035 - S5056 E240 - E270	GP-7000 & GVR-220Y
C-1.02-142	1/17/80	S5175 - S5195 E470 - E410	RV-4B & GVR-220Y
C-1.02-142	1/17/80	S5185 - S5205 E468 - E482	RV-4B & GVR-220Y
C-1.02-142	1/17/80	S5165 - S5175 E485 - E505	RV-4B & GVR-220Y
C-1.02-142	1/18/80	S5035 - S5056 E210 - E245	GP-7000, DVU-3001 GVR-220Y
C-1.02-142	1/18/80	S5145 - S5155 E490 - E550	RV-4B & GVR-220Y
C-1.02-142	1/18/80	S5045 - S5056 E245 - E285	GP-7000 & GVR-220Y
C-1.02-143	1/21/80	S5045 - S5056 E245 - E285	GP-7000 & GVR-220Y
C-1.02-143	1/21/80	S5035 - S5056 E210 - E245	GP-7000 & GVR-220Y
C-1.02-143	1/22/80	S5035 - S5056 E210 - E245	GP-7000 & GVR-220Y

IR NO.	DATE	LOCATION	EQUIPMENT USED
C-1.02-143	1/22/80	S5165 - S5175 E445 - E515	RV-4B & GVR-220Y
C-1.02-143	1/22/80	S5175 - S5205 E440 - E482	RV-4B & GVR-220Y
C-1.02-143	1/23/80	S5035 - S5056 E210 - E245	GP-7000 & GVR-220Y
C-1.02-143	1/24/80	S5220 - S5235 E485 - E500	RV-4B & GVR-220Y
C-1.02-143	1/25/80	S5035 - S5056 E210 - E245	GP-7000 & GVR-220Y
C-1.02-143	1/25/80	S5035 - S5056 E245 - E285	GP-7000
C-1.02-143	1/25/80	S5035 - S5056 E175 - E210	GP-7000 & GVR-220Y
C-1.02-144	1/28/80	S5035 - S5056 E210 - E290	GP-7000
C-1.02-144	1/28/80	S5220 - S5235 E485 - E500	RV-4B & GVR-220Y
C-1.02-144	1/29/80	S5035 - S5056 E290 - E355	GP-7000
C-1.02-144	1/29/80	S5235 - S5300 E485 - E500	RV-4B & GVR-220Y
C-1.02-144	1/30/80	S5035 - S5056 E175 - E210	GP-7000 & GVR-220Y
C-1.02-144	1/31/80	S5035 - S5056 E175 - E210	GP-7000
C-1.02-146	2/14/80	S5305 - S5315 E495 - E520	RV-4B
C-1.02-148	2/25/80	S5200 - S5225 E475 - E490	RV-4B & GVR-220Y
C-1.02-148	2/26/80	S5215 - S5225 E520 - E530	RV-4B
C-1.02-148	2/26/80	S5165 - S5225 E515 - E555	GP-7000, RV-4B & GVR-220Y
C-1.02-152	3/24/80	S5035 - S5070 E165 - E175	RV-4B & GVR-220Y

IR NO.	DATE	LOCATION	EQUIPMENT USED
C-1.02-152	3/25/80	S5035 - S5070 E160 - E175	RV-4B & GVR-220Y
C-1.02-152	3/26/80	S5035 - S5070 E160 - E175	RV-4B & GVR-220Y
C-1.02-153	3/31/80	S5300 - S5315 E485 - E520	RV-4B * GVR-220Y
C-1.02-153	4/1/80	S5125 - S5160 E540 - E575	RV-4B & GVR-220Y
C-1.02-153	4/1/80	S5115 - S5130 E530 - E545	RV-4B & GVR-220Y
C-1.02-153	4/1/80	S5070 - S5085 E165 - E175	RV-4B & GVR-220Y
C-1.02-155	4/14/80	S5085 - S5110 E250 - E256	RV-4B & GVR-220Y
C-1.02-155	4/16/80	S5085 - S5110 E250 - E256	RV-4B & GVR-220Y
C-1.02-155	4/17/80	S5085 - S5110 E250 - E256	RV-4B & GVR-220Y
C-1.02-156	4/22/80	S5116 - S5122 E250 - E256	RV-4B
C-1.02-156	4/23/80	S5058 - S5062 E215 - E228	RV-4B
C-1.02-157	4/30/80	S5035 - S5042 E320 - E379	RV-4B & GVR-220Y Equipment Classification: M-B-W Vibrotory (Model GP-7000) - Ground Pounder W/26" X 30" Plate
C-1.02-157	5/1/80	S5035 - S5042 E320 - E379	RV-4B & GVR-220Y "J" Foot Wacker(GVR-220Y) Vibro Plus Self-Propelled (Model CA-25D) "Vibrotory Drum Roller" "Rammer-Type Compactor" (Model RV-4B) - "Pogo Stic "Wacker" Vibrotory Plate W/8" Outriggers (Model DVU-3001)

QUALITY AUDIT FINDING

SA-1

AUDIT DATE: 9/14/76

AUDIT IDENT. NO.: 25-11-2

PROJECT/DEPARTMENT/SECTION	TYPE OF AUDIT	AUDITOR
Midland Units 1 & 2	Construction XXX FIELD OFFICE	G. Richardson J. Hook

AGENDA ITEM	CHECKLIST ITEM	WHERE FOUND	DISCUSSED WITH
N/A	N/A	Canonie QA Manual	J. Connolly

CONTROLLING DOCUMENT, SECTION, PARAGRAPH, ETC.

Quality Control Notices Manual SF/PSP G-1.1

QUOTATION

Section 7.1

"It shall be the responsibility of the Project Field Quality Control Engineer to assure that the work performed by on site subcontractors is done in full compliance with their Bechtel approved Quality Assurance/Quality Control Manuals and other quality requirements of the subcontract documents."

FINDING

Contrary to the above; sections of the Bechtel approved subcontractors QA/QC manual (Canonie Construction Co.) are not being implemented, (some sections may not be applicable.) Upon further investigation, the approved subcontractor's manual is in direct conflict with Project approved specifications.

The following are examples of conflicts between the Canonie QA Manual and Project specifications.

SECTION17.0 Quality Assurance Program for Structural Fill (Soils) - Canonie QA Manual

1) 17.3 Quality of Material - "The soil shall ... contain no more than 40% minus #200 sieve material."

   Spec. 7220-C-210; Table 12-1, sheet 1, "Zone 2 material ... random fill, gradation, no restrictions." (Continued on page 2)

RECOMMENDED CORRECTIVE ACTION

1) Resolve the conflict between Canonie QA Manual and Project specifications.
2) Obtain clarification from Project Engineering as to which portions of this manual are applicable. It is recommended that portions of the manual that are not required be clearly indicated in the manual.
3) Require the subcontract to fully implement all portions of the manual determined to apply.

SCHEDULE COMPLETION DATE	RESPONSIBILITY FOR CORRECTIVE ACTION
10/31/76	PFQCE.

CORRECTIVE ACTION TAKEN

The Canonie QA Manual dated August 16, 1976 and Addendum dated April 5, 1977 to Canonie's QA Manual dated August, 1976 were Project Engineering approved May 23, 1977.

This QA Manual and Addendum resolve conflicts previously noted in Quality Audit Finding SA-1. Canonie Construction Company shall be required to fully implement all requirements of their QA Manual when their work resumes.

DATE COMPLETED	SIGNATURE OF RESPONSIBLE AUTHORITY
6-1-77	PFQCE

CORRECTIVE ACTION VERIFIED BY QA

SB11170S

6-21-77

Block 11 continued:

2) 17.4 "A modified proctor compaction criterion will be used for field control of the backfill operations for soils containing from 12 to 40 percent fines ... work will be performed as described in ASTM designation D 1557-70 method A."

Specification 7220-C-210 Section 12.4.5.1

"The maximum dry density ... will be ... in accordance with ASTM D 1557 method D. Provided that the sample is prepared in four layers, each compacted with 25 blows ... (Bechtel modified proctor density test).

3) 17.5.1 "The in situ dry unit weight of the structural fill will be determined by the following two methods: a) water balloon b) sand cone."

Specification 7220-C-210 Section 12.4.4 "A nuclear density device may be used provided that the results are compatible with those obtained by the specified procedure."

4) 17.6.2 "Modified proctor tests will be conducted with every in situ dry density test..."

Specification 7220-C-208 Section 9.1a, "When directed by the contractor..."

5) 17.6.4 "One grain size analysis will be conducted for every 5,000 cubic yards of fill placed or each day backfill is placed."

Specification 7220-C-208 Table 9-1 "One per every 10,000 cubic yards of fill."

6) 17.8 2) "... all test equipment shall be calibrated and ceritifed at least once every two months.

Specification 7220-C-208 Table 9-1 "Frequency for each item to be submitted by subcontractor for contractor's approval." This involves another approved subcontractor's QA Manual (U.S. Testing Inc.).

SAF - SA-1

Project Quality Assurance
Midland Units 1 & 2 - 7220

Verification of Corrective Action

Method:

X 1. Verify action of response as implemented.
X 2. Review of documentation or attachments to resolve finding.
___ 3. Requirement removed or finding withdrawn.
___ 4. Other: _____

Items Checked: CANONIE QA MANUAL DATED AUGUST 16 1976 AND ADDENDUM DATED APRIL 5, 1977 CLEAR-UP ALL OF THE DISCREPANCIES NOTED ON THIS FINDING EXCEPT ONE; THIS IS #5) CANONIE WAS A MORE STRINGENT REQUIREMENT ON THE FREQUENCY OF TESTS OF ITS PRODUCT PRIOR TO TURNING IT OVER TO BECHTEL. BECHTEL PROJECT ENGINEERING HAS APPROVED THE MANUAL WITH THIS PROVISION INCLUDED AS IT DOES NOT VIOLATE THE SPEC C-208. ALL OF THE OTHER DISCREPANCIES ARE NOW EXAMPLES OF HOW CANONIE WOULD DO THE WORK IF CANONIE WAS DIRECTED TO DO SO BY WAY OF SPECIFICATION

Closeout Documentation (list or attach) ☒ Verified ☐ Not Verified (explain)

QAE

6-21-77
Date

SB11711

Bechtel Power Corporation

Interoffice Memorandum

To J. P. Connolly

File No Q1750

Subject Project QA Audit of Earthwork Subcontractor
No. 25-11-2 9-21-76
GLR-09-76-231

Date September 16, 1976

From G. L. Richardson

Of Quality Assurance

Copies to J. Klacking
P. Martinez
J. Milandin
J. Newgen
J. Church /z

At Midland,MI Ext 207

Attached for your action is the subject audit report. Your response to the findings are due by the date stated on the audit report.

G. L. Richardson

GLR/JGH/sw

Attachment

QA ROUTE	REQ.	ACT.
LQAE	✓	
CIVIL		
ELEC.		
MECH.	9/3	
[illegible]	✓	
FILE		

Q

5024-(2-74)

SB117712

QUALITY ASSURANCE PROGRAM
PROJECT AUDIT REPORT

1 PROJECT: Midland Units 1 & 2
2 JOB NO.: 7220
3 TYPE OF AUDIT: Construction
4 ORGANIZATIONS AUDITED: Earthwork Subcontractor
5 AUDIT NO.: 25-11-2
6 AUDIT DATE: 9/3/76 to 9/15/76
7 AUDITOR: G. L. Richardson
J. G. Hook

8 INDIVIDUALS CONTACTED: T. Lieb, J. Connolly, G. Degeer

9 DESCRIPTION OF AUDIT (SCOPE AND EVALUATION)

This audit was an evaluation of the earthwork subcontractor's compliance to his QA program requirements. The records that were reviewed were 5 of the following: fill placement daily reports, Lift thickness checks, corrective action reports, testing results reports. The Document Control section was reviewed and four descrepancies were found and corrected during the course of this audit; they were, qualifications of personnel file was up dated, the approved job specifications was up dated, and the information for the daily reports and lift thickness checks were transcribed onto the correct form. Six drawings were reviewed for compliance with the drawing control register and found satisfactory.

Except for QAF-SA-1, the areas within the scope of this audit were found to be effectively controlled after the corrective actions to the resolved items were completed.

The finding was agreed to by the PFQCE.

10 DEFICIENCIES NOTED (QAF NO.) (SEE ATTACHED)	ACTION	
	11 RESPONSIBILITY	12 COMPL SCHED DATE
QAF-SA-1; Conflict between Canonie QA Manual and job specifications.	PFQCE	10/31/76

AUDITOR(S) SIGNATURE: J. G. Hook DATE: Sept. 17, 1976

BPC-20604
G1000432-01-01

SB111713

QUALITY AUDIT FINDING

10	SA-1
AUDIT DATE	9/14/76
AUDIT IDENT. NO.	25-11-2

PROJECT/DEPARTMENT/SELLER	TYPE OF AUDIT	AUDITOR
Midland Units 1 & 2	Construction XXX FIELD OFFICE	G. Richardson J. Hook

AGENDA ITEM	CHECKLIST ITEM	WHERE FOUND	DISCUSSED WITH
N/A	N/A	Canonie QA Manual	J. Connolly

CONTROLLING DOCUMENT, SECTION, PARAGRAPH, ETC.

Quality Control Notices Manual SF/PSP G-1.1

QUOTATION

Section 7.1

"It shall be the responsibility of the Project Field Quality Control Engineer to assure that the work performed by on site subcontractors is done in full compliance with their Bechtel approved Quality Assurance/Quality Control Manuals and other quality requirements of the subcontract documents."

FINDING

Contrary to the above; sections of the Bechtel approved subcontractors QA/QC manual (Canonie Construction Co.) are not being implemented, (some sections may not be applicable.) Upon further investigation, the approved subcontractor's manual is in direct conflict with (oject approved specifications.

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1) 17.3 Quality of Material - "The soil shall ... contain no more than 40% minus #200 sieve material."

   Spec. 7220-C-210; Table 12-1, sheet 1, "Zone 2 material ... random fill, gradation, no restrictions." (Continued on page 2)

RECOMMENDED CORRECTIVE ACTION

1) Resolve the conflict between Canonie QA Manual and Project specifications.
2) Obtain clarification from Project Engineering as to which portions of this manual are applicable. It is recommended that portions of the manual that are not required be clearly indicated in the manual.
3) Require the subcontract to fully implement all portions of the manual determined to apply.

SCHEDULE COMPLETION DATE	RESPONSIBILITY FOR CORRECTIVE ACTION
10/31/76	PFQCE

CORRECTIVE ACTION TAKEN

(2)

DATE COMPLETED	SUBMITTED BY RESPONSIBLE AUTHORITY

CORRECTIVE ACTION VERIFIED BY QAS

SB111714

BFC 20861 (+EW3164B 05)

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

June 21, 1977

Consumers Power Company
P. O. Box 1963
Midland, MI 48640

Attention: J. L. Corley

Job 7220 Midland Project
Project QA Audit of Earthwork
Subcontractor No. 25-11-2 Closeout
GLR-6-77-202

Dear Mr. Corley:

Attached for your information is the closeout of the subject audit report.

Very truly yours,

G. L. Richardson

G. L. Richardson
LEAD QUALITY ASSURANCE ENGINEER

GLR/JGH/sw

Attachment

QA ROUTE	INFO.	ACT.
LQAE	✓	
CIVIL (1)		
CIVIL (2)		
MECH		
PIPING		
ELECT.		
INST.		
SECY		
FILE NO		

SB111715

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

October 22, 1976

RECEIVED
OCT 29 1976
BECHTEL POWER CORP.
JOB 7220
PER

Canonie Construction Company
P. O. Box 509
South Haven, Michigan 49090

Attention: Mr. J. McKane

Job 7220 Midland Project
Subcontract 7220-C-210
Q.A. Audit and Findings
C-210-3-175

QA ROUTE	SIGN	DATE
LQAE		
CIVIL		
ELEC.		
MECH.		
PIPING		
FILE	175	0

with Audit 25-11-2

Dear Mr. McKane:

Attached you will find a copy of Quality Assurance Audit Number 25-11-2 and findings.

It is important that you review these findings and initiate the reconstruction of your Quality Assurance Manual to coincide with current specification 7220-C-210 Revision Number Four (4).

Your manual shall eliminate all previous conflicts with specification 7220-C-210. The technical portion shall contain only work you are required to do, as described in the specifications.

It is also important that you reply to this request at the earliest possible date.

Thank you for your cooperation.

Very truly yours,

C. F. [illegible]

CF:JCF/TTT/tjm

cc: J. A. Richards

Q

SB111716

QUALITY ASSURANCE PROGRAM
PROJECT AUDIT REPORT

1 PROJECT Midland Units 1 & 2 — 5 AUDIT NO. 25-11-2

2 JOB NO. 7220 — 6 AUDIT DATE 9/3/76 to 9/15/76

3 TYPE OF AUDIT Construction — 7 AUDITOR G. L. Richardson

4 ORGANIZATIONS AUDITED Earthwork Subcontractor — J. T. Hook

8 INDIVIDUALS CONTACTED [illegible] J. Connally, G. Logan

9 DESCRIPTION OF AUDIT (SCOPE AND EVALUATION)

This audit was an evaluation of the earthwork subcontractor's compliance to his QA program requirements. The reports that were reviewed were 5 of the following: fill placement daily reports, lift thickness checks, corrective action reports, testing results reports. The Document Control section was reviewed and four descrepancies were found and corrected during the course of this audit; they were, qualifications of personnal file was up dated, the approved job specifications was up dated, and the information for the daily reports and lift thickness checks were transcribed onto the correct form. Six drawings were reviewed for compliance with the drawing control register and found satisfactory.

Except for QAF-SA-1, the areas within the scope of this audit were found to be effectively controlled after the corrective actions to the resolution were complete.

The finding was agreed to by the PFQE.

10 DEFICIENCIES NOTED (QAF NO.) (SEE ATTACHED)

ACTION 11 RESPONSIBILITY	ACTION 12 COMPLETED DATE
QAF-SA-1; Conflict between Canonie QA Manual and job specifications.	PFQE 10/31/76

AUDITOR'S SIGNATURE [illegible] DATE [illegible]

SB111717

...and Units ... Inspection ... G. Richardson

/A ... Connally

...ality Control Manual (QC/QA) ...

...ction 7.1

...ibility of the Project Field Quality Control Engineer to assure that ... performed by the subcontractor is done in accordance with the ... Quality Assurance/Quality Control Manual and other quality requirements of the subcontract documents."

...

Contrary to the above citation of the Project procedures documentation (QC/QA Manual [Tanenia Construction Co.] and Project Specifications), as evidenced by the following, as confirmed by further investigation, the approved subcontractor's manual failed to implement adequately the project approved specifications.

The following are examples of conditions known and observed by the Project Specifications.

CRITERION 7.0 Quality Assurance Program for Structural Fill (Soils - Compaction) (QA Manual)

17.3 Quality of Material - The soil shall ... contain no more than 2% by dry weight of sieve material."

Spec. 7220-0-210; Table II-1, sheet ... "Zone 2 material" ... random fill, ... tion, no restrictions." ... (Specification Section 2)

...

Resolve the conflict between Tanenia's QC Manual and Project specifications.

Obtain clarification from Bechtel Engineering as to which portions of this manual are applicable. It is recommended that portions of the manual that are not required be clearly indicated in the report.

Require the subcontractor to fully implement all portions of the manual determined to apply.

...

7/31/75 ...

...

...

...

SB111718

Block 11 continued:

2) 17.4 "A modified proctor compaction criterion will be used for field control of the backfill operations for soils containing from 12 to 40 percent fines ... work will be performed as described in ASTM designation D 1557-70 method A."

Specification 7220-C-210 Section 12.4.5.1

"The maximum dry density ... will be ... in accordance with ASTM D 1557 method D. Provided that the sample is prepared in four layers, each compacted with 25 blows ... (Bechtel modified proctor density test).

3) 17.5.1 "The in situ dry unit weight of the structural fill will be determined by the following two methods: a) water balloon b) sand cone."

Specification 7220-C-210 Section 12.4.4 "A nuclear density device may be used provided that the results are compatible with those obtained by the specified procedure."

4) 17.6.2 "Modified proctor tests will be conducted with every in situ dry density test..."

Specification 7220-C-208 Section 9.1a, "When directed by the contractor..."

5) 17.6.4 "One grain size analysis will be conducted for every 5,000 cubic yards of fill placed or each day backfill is placed."

Specification 7220-C-208 Table 9-1 "One per every 10,000 cubic yards of fill."

6) 17.8 2) "... all test equipment shall be calibrated and ceritifed at least once every two months.

Specification 7220-C-208 Table 9-1 "Frequency for each item to be submitted by subcontractor for contractor's approval." This involves another approved subcontractor's QA Manual (U.S. Testing Inc.).

Bechtel Power Corporation

Interoffice Memorandum

To G. L. Richardson

File No.

Subject Job 7220 Midland Project
O.A. Audit - File No. Q1750
0-1195

Date October 15, 1976

From T. Thompson

Of Subcontract Administration

Copies to J. C. Church

At Midland, MI Ext. 368

We have received a copy of the Audit Finding (File No. Q1750) concerning Subcontract 7220-C-210, Canonie Construction Co.

Since Canonie will only be on the job for approximately another three (3) weeks, we request disposition of your finding be postponed until May 1, 1977. Prior to this time Canonie will submit a new manual which will be reviewed in its entirety prior to 1977 construction.

Thank you for your cooperation.

RESPONSE REQUIRED

YES ☒ NO ☐

T. Thompson

TT/djm

QA ROUTE	INIT.	ACT.
LQAE		
CIVIL		
ELEC.		
MECH.		
PIPING		
FILE	1750	

SA-1 and 25-1-2

RECEIVED
OCT 15 1976
BECHTEL POWER CORP.
JOB 7220
PER

SB111721

Bechtel Power Corporation

Interoffice Memorandum

To J. C. Church

From

Subject Canonie Construction Co. Q.A. Manual
(QAF-SA-1)
GLR-1C-76-259

Date October 25, 1976

From G. L. Richardson

Of Quality Assurance

Copies to J. Connolly
J. Newgen
J. Kiacking
J. Milandin
R. Castleberry

At Midland, MI Ext. 207
Job 7220

Your request for additional time to complete the corrective action on the subject Quality Audit Finding is acceptable.

I recognize that Canonie's embankment placement operations will cease in the near future and will not resume until spring. This will allow ample time to revise their Quality Assurance Manual.

The review and subsequent revisions of Canonie's QA Manual should not be limited to the discrepancies identified but should also address Client and NRC concerns consistent with the previous reviews of other subcontractors. This review should be completed and Project Engineering approval obtained prior to resumption of earthwork in the spring of 1977.

A new completion date to QAF-SA-1 of 5/1/77 has been established.

G. L. Richardson

GLR/cc

QA ROUTE	BMD	ACE
LQAS	✓	
CIVIL	✓	
ELEC.	✓	
MECH.	✓	
PIPE D	✓	
FILE	1750	(25-11-2)

SB111722

QUALITY ELEMENT CHECKLIST COVER SHEET

A

1 AUDIT AREA: Subcontractor Control

2 AUDIT TITLE: Earthwork Subcontractor Control

3 CHECKLIST NO.: 25-11-P-0

B

4 PROJECT: Midland 1 and 2

5 JOB NO.: 07220

6 TYPE OF AUDIT: Construction

7 ORGANIZATIONS AUDITED: Subcontractor/QC/Fd. Engineering

8 AUDIT NO.: 25-11-2

9 AUDIT DATE: 9-3-76 TO 9-14-76

10 AUDITOR: G. L. RICHARDSON

J. G. HOOK

C

11 NO.	12 REFERENCE	13 REVISION	14 DATE
1.	Canonie Construction Co. QA Manual	-	07/26/73
2	Canonie Construction Co. QA Manual Supplement	-	07/26/73

15 REV. NO.	16 PREPARED BY	17 DATE	18 APPROVED BY	19 DATE
0	G. L. Richardson	07/09/75	G. L. Richardson	7/5/75

PAGE 1 OF 3

SB111723 Q

QUALITY ELEMENT CHECKLIST

CHECKLIST NO. 25-11-P-0

PAGE 2 OF 3

ITEM	ELEMENT CHARACTERISTIC	REFERENCE	METHOD OF VERIFICATION	AUDIT RESULT
1.	QA/QC Engineer reporting and responsibilities. CANONIC LETTER DATED 7-9-76. FIG 1 SHOWS ORGANIZATION CHART with QA/QC ENGINEER REPORTING TO THE MANAGER	1(2.0) 2(1.2)	Monitor placement operations and review the organization chart to assure the QC/QA engineer is available to inspect work operations and reports directly to the QA/QC manager with an authority equal to the superintendent.	N.D.
	QC Records. RECORDS ARE PROPERLY INDEXED AND STORED IN A FIRE PROOF FILE. ACCESS IS CONTROLLED BY THE QAE. SIGN OUT SYSTEM IS IN USE. RECORDS ARE REVIEWED BY QAE RECORDS REVIEWED: 1) FILL PLACEMENT QA/QC DAILY REPORT 2) LIFT THICKNESS CHECK 3) CORRECTIVE ACTION REPORT 4) U.S. TESTING REPORTS DATES REVIEWED 7-14; 8-11; 8-20; 8-27; 8-31-76 SPEC NO. C-210 REV OK BUT NO FCR'S RESUME NOT IN FIELD FOR QAE	1(2.5) 2(2.4) 2(A5)	Review the QC records to assure they are properly indexed and stored in a fire proof vault. Access is to be limited to persons authorized by the QAE. Assure a signout system is in use. Assure all records are reviewed by the QAE prior to being filed. The records shall identify the following: a. Inspector or recorder. ok b. Activity monitored. ok c. Date. ok d. Test results. ok e. Acceptability. ok f. Corrective action, if any, required or taken. ok Assure the records include the following: a. Procedures. b. Qualifications of personnel. c. Equipment calabration. d. Inspection reports. e. Material Test Reports. f. Audit results. For all of above check at least one record for each category.	N.D.
	LETTER DATED 1-25-74 (B-C-210-44) OK INSPECTION REPORTS 8-31-76, 8-27-76 8-20-76, 8-11-76, 7-19-76 ALL OK REPORTS FROM U.S. TESTING — OK CANONIE AUDIT REPORT FOR WEEK-ENDING 8-21-76. OK			

THIS ITEM WAS CALLED BACK AT 6P-TC-DATE DURING THIS AUDIT

(D)

Attachment 1 Page 2 of 2
Jan. 1, 1975 Rev. 0

SHIP724

QUALITY ELEMENT CHECKLIST

CHECKLIST NO. 25-11-P-9

PAGE 3 OF 3

ITEM	ELEMENT CHARACTERISTIC	REFERENCE	METHOD OF VERIFICATION	AUDIT RESULT
3.	Document Control Dwg. Rev DATE Rec'd C-103 0 8-6-73 ✓ 104 0 8-6-73 ✓ 109 (Q) 9 6-16-76 ✓ 110 5 6-16-76 ✓ 111 (Q) 7 6-16-76 ✓ 112 7 6-16-76 ✓	1(7.0) 2(6)	Review card file for 3 drawings and one spec. to assure they have been properly controlled. The card must include the number, rev., rev. date, date received, classification and distribution. Compare the revision to the Bechtel Control Register. Assure superceded drawings are segregated.	N.D.
4.	Lift thickness moisture and compaction control. QA/QC daily reports. REFER TO CHECKLIST ITEM #2: DATES CHECKED 7-14-76; 8-11-16; 8-20-76; 8-27-76; 8-31-76 CORRECTIVE ACTION REPORTS 8-23-16 TEST #780 RETEST OF #725 7-24-16 RETEST OF #758 7-24-16 RETEST OF #759 9-27-16 RETEST OF #915	2(A-1) 2(A-2)	Review four QA/QC engineer daily reports and assure the following is included: a. Record of lift thickness (two areas). OK b. Work area limits and zones. OK c. Roller speed checks. OK d. Equipment numbers. OK e. Load counts. OK f. M.C. test results. OK g. Corrective action reports. OK NOTE: QAF SA-1 WHICH COVERS CONFLICTS BETWEEN CANONIE'S QA. MANUAL AND THE JOB SPECS RELATES TO NO PARTICULAR CHECKLIST ITEM NO. BUT DISCREPANCY WAS NOTED DURING THE COARSE OF THE AUDIT. D.W. Hallock 9/14/76	N.D. QAF SA-1

SB11-Q25

TELECOPY

Bechtel Power Corporation

Interoffice Memorandum

To: R. L. Castleberry

File No.

Subject: Job 7220 Midland Project
Backfill Moisture Requirement
Spec. C-210
BCBE-1669R

Date: November 16, 1977

From: J. F. Newgen

Of: Construction

At: Midland, MI Ext.

Copies to: G. Richardson
B. Cheek
G. Tuveson
J. Dean

Confirming verbal requests; please provide written clarification of the 2% tolerence on backfill moisture content during compaction. Although moisture tests are taken both during and sometimes after compaction we have been verbally informed that for Zone I material moisture tests taken within a few days after compaction which do not fall within 2% of optimum moisture shall be cause for rejection of the fill, even though proper compaction is achieved. Information moisture tests taken more than a week after Zone I fill has been properly compacted are not so limited. For Zone II materials these limits can also be extended in accordance with previous written direction.

Your response is required by 11/30/77 in order to process documentation of backfill which was not placed in accordance with the verbal information above, if necessary.

J. F. Newgen

JFN/FGT/jae

5224-(2-74)

SB11 555 (Q)

Bechtel Power Corporation

Inter-office Memorandum

QCFM-5011

To G. L. Richardson

Subject Midland Project, Units 1&2
Moisture Requirements for
Backfill prior to Placement
GLR-02-78-043, QAR SD-40

Copies to
J. F. Newgen w/o
D. R. Johnson w/o

Date July 20, 1978

From W. L. Barclay

Of Quality Control

At Midland, Michigan
Job No. 07220

RECEIVED
JUL 21 1978
BECHTEL POWER CORP.
JOB 7220
PER 204 I-78-282

References: a) BCBE 1802 JNewgen to RCastleberry dated 2/27/78
(with attachments)
b) BEBC 2287 RCastleberry to JNewgen dated 6/1/78

The following is Quality Control's complete response to subject letter GLR-02-78-043 which concerns missing moisture tests, review of US Testing mositure log by Quality Control and a file set-up in the vault.

Reference a) BCBE 1802 revealed subject soil tests were not performed prior to placement on August 9, 1977, September 30, 1977, October 3, 1977, October 4, 1977 and October 5, 1977. Project Engineering was requested to evaluate the acceptability of the material placed on above mentioned dates. Reference b) BEBC 2287, Project Engineering concluded that all soil placed and tested on August 9, 1977, September 30, 1977, October 3, 1977, October 4, 1977 and October 5, 1977 acceptable as placed.

In response to subject QAR which identifies problems with moisture tests on soils placement, mositure tests are being taken in borrow areas at the start of the day and as needed to maintain the proper control of materials being placed. A review of the moisture test is being made by the responsible QC Engineer and filed in the QC Vault.

If additional information is required concerning the above, please contact this office.

QA ROUTE	INFO.	ACT.

W. L. BARCLAY
PROJECT FIELD QUALITY CONTROL ENGINEER

WLB/HDF/ENE/RKS/jmw

Attachments

FILE NO 8321.02

SB11 573

(2)

Telephone call

BY J. G. Hook OF QA - Site

TO S. Rao OF AAO

DATE October 10, 19 77 TIME 1:40

SUBJECT Moisture Requirements For Backfill

CC: ~~XXXXX~~ S. Rao
W. Barclay
G. Richardson
A. Boos
F. Teague
File

JOB NO.

I called Rao, the originator of letter BEBC-1859, to clear up any misunderstanding I had on the letter.

HOOK: In the past, we controlled the moisture by taking the test at the same time we took our density tests. Was this acceptable?

RAO: Yes, it is, as indicated in letter BEBC-1859.

HOOK: Should we continue in the same manner as we have in the past?

RAO: No. Moisture should be controlled in the borrow area prior to compaction.

HOOK: Should a compaction area be rejected because it did not have the proper moisture content (± 2% of optimum) even though the density was acceptable.

RAO: There is no moisture requirements at the time of density testing, only a density requirement. The moisture requirement is prior to compaction.

QA ROUTE	INFO.	ACT.
LQAE	✓	
CIVIL (1)	✓	
CIVIL (2)		
MECH		
PIPING		
ELECT.		
ST.		
SECY		
FILE NO.	w/ CAR-50-40	

Q

SB11 5S-1

0046 (12-67)

Bechtel Power Corporation

Interoffice Memorandum

To R. L. Castleberry

File No.

Subject
Job 7220 Midland Project
Specification 7220-C-210
Quality Action Request
QAR No. SD-40
BCBE-1533R

Date August 15, 1977

From J. F. Newgen

Of Construction

At Midland, MI Ext.

Copies to
G. Tuveson
S. Rao
F. Teague
G. Richardson

Reference: Quality Action Request - QAR No. SD-40

This memo is to bring to your attention item 2 under "Recommended Corrective Action" of the attached "Quality Action Request", wherein we are asked to advise Project Engineering of past moisture testing methods. In the past, it was found that densities meeting the specification requirements could be attained, irrespective of the use of moisture tests, because of the uniformity of materials. Therefore, moisture tests were taken after compaction for determining dry densities and acceptance or rejection was based on compaction tests. Moisture tests were not used to control backfill moisture. This practice has since been changed to making one moisture test each day at the beginning of backfill operations at 500 cubic yards intervals per Spec. C-210, and one after the density of the area compacted has reached 95%.

Based on the above, the Field requests that Project Engineering agree to acceptance of backfill materials installed in the past, along with records thereof, irrespective of the use of the moisture tests.

Please respond by August 26, 1977.

QA ROUTE	INFO.	ACT.
LGAE		
CIVIL (1)	✓	
CIVIL (2)		
MECH		
PIPING		
ELECT.		
INST.		
SECY	Logged	
FILE NO	1533	

J. F. Newgen

JFN/JSPD/cb
Attachment

RECEIVED
AUG 19 1977
BECHTEL POWER CORP
JOB 7220
SB111589 (Q)

5024-(2-74)

Midland Units 1 & 2
Job 7220-101 5 3

MEETING NOTES

DATE: 4 May 1979

LOCATION: Ann Arbor Office

SUBJECT: Midland Soil Test Records

ATTENDEES:
J. Allen
P. Martinez
J. Milandin
T. Nehil
G. Richardson
J. Wanzeck
K. Wiedner

DISCUSSION:

J. Allen of Geotech, Houston, is assisting Ann Arbor Group in the review of the U. S. Testing records.

1. The main points of J. Allen's presentation were as follows:

   a. Proctor & RD standards used too many times and for too long.

   b. Occasional use of a different standard to clear a failing test.

   c. Many moisture-density points outside zero-air-voids curve.

   d. Some moisture-density points plot well above the standard compaction curve.

   e. Calculation errors which were signed off.

   f. Some clearing re-tests too far away (over 10') from initial failure. No information was shown on the record to show the area had been remarked.

   g. Failed test cleared by re-test run three weeks earlier.

   h. Suspect moisture control data, up to 8% from optimum, which is 6% outside of spec. Absolute moisture content varied from 8% to 24%.

In conclusion, he said that about 25% of all proctor tests fell within the BMP spec, and even these could not be accepted without reservation. About 40% of all the tests (including the 25% above) fall within a possible Modified Proctor (D-1557) spec., and everything else would be either failing, suspect, or simply impossible. Similar conclusions could be drawn for all the sands placed.

001222

2. K. Wiedner and G. Richardson raised the point regarding U. S. Testing's responsibility to keep track of how many yards of fill had been placed

SB113433

and thus when it was time for a new lab standard to be made. The spec and the contract needs to be compared on this point.

3. J. Milandin asked what can be done to preclude this from happening in the future and this was not answered in the meeting.

Action Items:

T. Nehil - Resolve whether suspect tests resulted from misuse of the nuclear densometer, or can be traced to individuals of U. S. Testing personnel.

J. Allen, T. Nehil - Prepare a report to be presented at the NRC meeting of May 16 and 17 which would summarize Bechtel Findings.

Tom Nehil

T. Nehil

TN/lap

CC SHHowell
GSKeeley
DBMiller
TCCooke
JJZabritski
JARutgers, Bech-AA
KWiedner, Bech-AA
MEMiller, ILAB

DATE 1/18/80

INITIAL	
___	GSK
X	RCD
X	KRK
___	RLM
___	JAP
___	DGR
___	MHR
___	RLT
___	PCW
___	JJZ
___	DBM
___	TCC
___	JTP
___	
___	CMG
___	
___	
___	

Manual: ___
File: 0485.16

TELECON RECORD

Date January 17, 1980
8:15 AM

Participants	Company
G S Keeley	CP Co
J J Zabritski	CP Co
D Hood	NRC

Subject Soils Issue - Dewatering System

Discussion G S Keeley indicated to D Hood that he was frustrated at the way the NRC Staff did business, especially Lyman Heller's comment at the end of yesterday's meetin that dewatering was not the preferred technical solution. G S Keeley wanted to know what the Staff has in mind since CP Co has spent considerable time and money pursuing the dewatering option and considers it the most conservative way to go. If dewatering is not acceptable, what is?

D Hood replied that it was rather unfortunate the way this issue was raised and it needs to be put in its proper perspective. In the discussion between Walt Ferris of Bechtel and Lyman Heller, Heller was talking as an individual and his opinion did not necessarily represent Staff consensus. Hood indicated that this type of discussion should be valuable to us since it indicated that there are fragmented views on this subject within the Staff. He also indicated that we probably had a right to be concerned as Lyman Heller is the principal Staff reviewer in this area.

G S Keeley replied that this sounds fine but that the Staff has been silent on this issue since the last meeting in July 1979 when we presented the concept to the Staff and Heller with the consultants also in attendance at the meeting.

Cont 002248

SR11.139c

January 17, 1980
8:15 AM

Keeley indicated that we were upset over Heller's insinuations that the dewatering option was not the consensus opinion of our consultants. CP Co is ready to issue the dewatering subcontract and Heller is now casting doubt over the whole issue with his subtle remarks. Keeley also indicated that the statement that the Corp of Engineers may not buy the dewatering system is frustrating. If they will not buy that system, what will they buy? In reply, D Hood indicated that he has a similar type concern in that the soils review has been difficult from a continuity and schedule aspect and that the Staff has not provided timely feedback to CP Co and that CP Co has taken action at its own risk in pursuing the fixes to the soils issue. Hood indicated that the Staff was very much aware of these factors when the Order was issued.

G S Keeley indicated that we have taken a very conservative position on dewatering and what did Heller have in mind? Was it that we can use analysis to show that liquefaction is not of concern or does he believe that underpinning and caissons are required on the diesel generator building? This would have a very significant cost and schedule effect.

D Hood indicated that he understood that Lyman Heller feels that caissons are a more positive approach but Hood indicated that was his opinion and could not himself see that this option was necessarily any better. G S Keeley stated that our consultants had previously indicated that they believed that the NRC would not accept the use of caissons. The consultants also indicated that dewatering was a more positive and conservative approach.

G S Keeley indicated to D Hood that we will answer the NRC's questions based on our present concept of the dewatering system for Staff review and then if necessary have a meeting with Heller to further discuss his concerns. G S Keeley also indicated that he had discussed this subject with S H Howell who was concerned with the whole way this issue is being handled and he was prepared to come to Washington to resolve this issue with Denton.

Contd on Page 3

January 17, 1980

8:15 AM

D Hood indicated that he concurred with the CP Co approach on submittal of the responses and advised us not to overreact on this issue at this time. He indicated that he would discuss this subject with his management and call us back.

J J Zabritski/cg
1/18/80

12-19-79

Mtg w/ Wiedner Bailey Blue et al
re: Dewater meeting of 12-18-79
and Tom Cooke's phone call to Curtis
12-19-79

Wiedner — no more "informal" meetings
ZB
- brainstorming in ~~for~~ morning
- formal agenda type meeting in afternoon

Karl's concerns
- agrees w/ Cooke Wheeler about confusion
- soils and hydrogolists not in agreement
- full site or partial dewatering?
- get the design rolling

QA prob w/ fines monitoring still an impediment to further testing

Paris needs another test well to develop recharge data but could do without - there is supposed to be a geotech memo to project on this

MOR to follow up

Project to send TWX

SB 23678

(c)

Curtis says Dhar hasn't time to function effectively as dewatering ~~lead~~ task force leader because of press of other business

Wiedner says must have:

- coordination between soils and hydrology (Blue to handle) ie extent & elevation of dewater must be estab
- coordination between geotech and project
- meetings limit to working group w/ managers and client in for summary
- more publication of results of our work
- get design parameters/criteria published

Karl's basic point:

dewater everywhere where fill supports Catagory I structures

Karl says push test well — or backup test

Paris concerned w/ QC/QA hold (Wheeler pushing)

- need letter ex USTesting accepting our comments on level 3 approval
- need QC training on fines monitoring (Barkley)
- Wheeler review of any CPC QA hang ups

SB 23679

test needed to establish recharge time which is a major design criterion

Karl says run tempo dewatering for ~~one~~ month or so and then turn off and measure recharge rate as only way to establish recharge rate. Analysis don't do it

broken line syndrome must be addressed

Action:

- LTC issue memo designating Wanzeck permane dewatering task group leader (see Dhar memo designating task group members)
- establish design criteria schedule Wan act including: 1) extent (area & elev) of dewatering elevation
  - how deep
  - plant shutdown elev at 0.12g & 0.2g
  - recharge suppression provisions
  2) ~~#~~ active wells and redundancy
  3) well details
  4) power ~~sup~~ supply requirements
  5) monitoring (ie observation wells)

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GSK wants assurance that Q's 4 & 14 answers will be forwarded to CPCo by 1-2-~~81~~ 80

Q4 Geotech complete by 12-21
Project review week of 12-26 to 28
mtg of Geotech/Project/(Kliedner)
12/26 or 12/27

Q14 Proj civil group responsibility must be completed on same schedule as Q4 above

rest of 50.54f questions
kick out to CPCo ASAP but no later than 2-1-80

get back to CPCo week of 1-7-80
for progress/status rept
and present design criteria
draft mtg notice and agenda for mtg by 12-21-79
propose 1-8-80
workers only no observers

call ~~Foote~~ Cooke 3 $^{00}_{P}$

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