

BECHTEL ASSOCIATES PROFESSIONAL CORPORATION

MIDLAND PLANT UNITS 1 & 2

JOB 7220

ADMINISTRATION BUILDING

FOUNDATION SETTLEMENTS

ALONG COLUMN LINE 0.4

Prepared by:

GEOTECHNICAL SERVICES
December, 1977.

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SB705862

INTRODUCTION

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

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

BACKGROUND

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

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

FIELD OBSERVATIONS

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

SB705863

and after the removal of the subject footings.

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

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

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

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

BORINGS

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

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

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

The boring logs are shown on Figures 3 through 7.

TESTING PROGRAM

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

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

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

The Proctor curve in Figure 8 was used to calculate the in situ percent compaction using the in situ dry density data reported by the Field. This information is compared in Figure 3 with the percent compaction previously reported. This comparison shows that the percent compaction was in all cases lower than that previously determined.

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

resulted in compactive energies of 56,000 ft-lb/ft³, 20,000 ft-lb/ft³, and 12,400 ft-lb/ft³, respectively. It is seen that the pressure values for a penetration of 0.1" at the maximum dry density reduced from 94.5 psi to 5 psi by reducing the compactive energy from 56,000 ft-lb/ft³ to 12,400 ft-lb/ft³.

CONCLUSION

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

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

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

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

<u>Column</u>	<u>Elevation</u>	<u>Settlement (ft)</u>
Pa	634.10	0.11
N _k	634.03	0.17
M _P	634.01	0.20
L _N	634.05	0.16
K _P	634.02	0.19
K _B	633.93	0.28
J _F	633.93	0.28
H _T	633.92	0.29

MIDLAND UNITS 1 & 2
 ADMINISTRATION BUILDING EXCAVATION
 UNCONFINED COMPRESSION TESTS

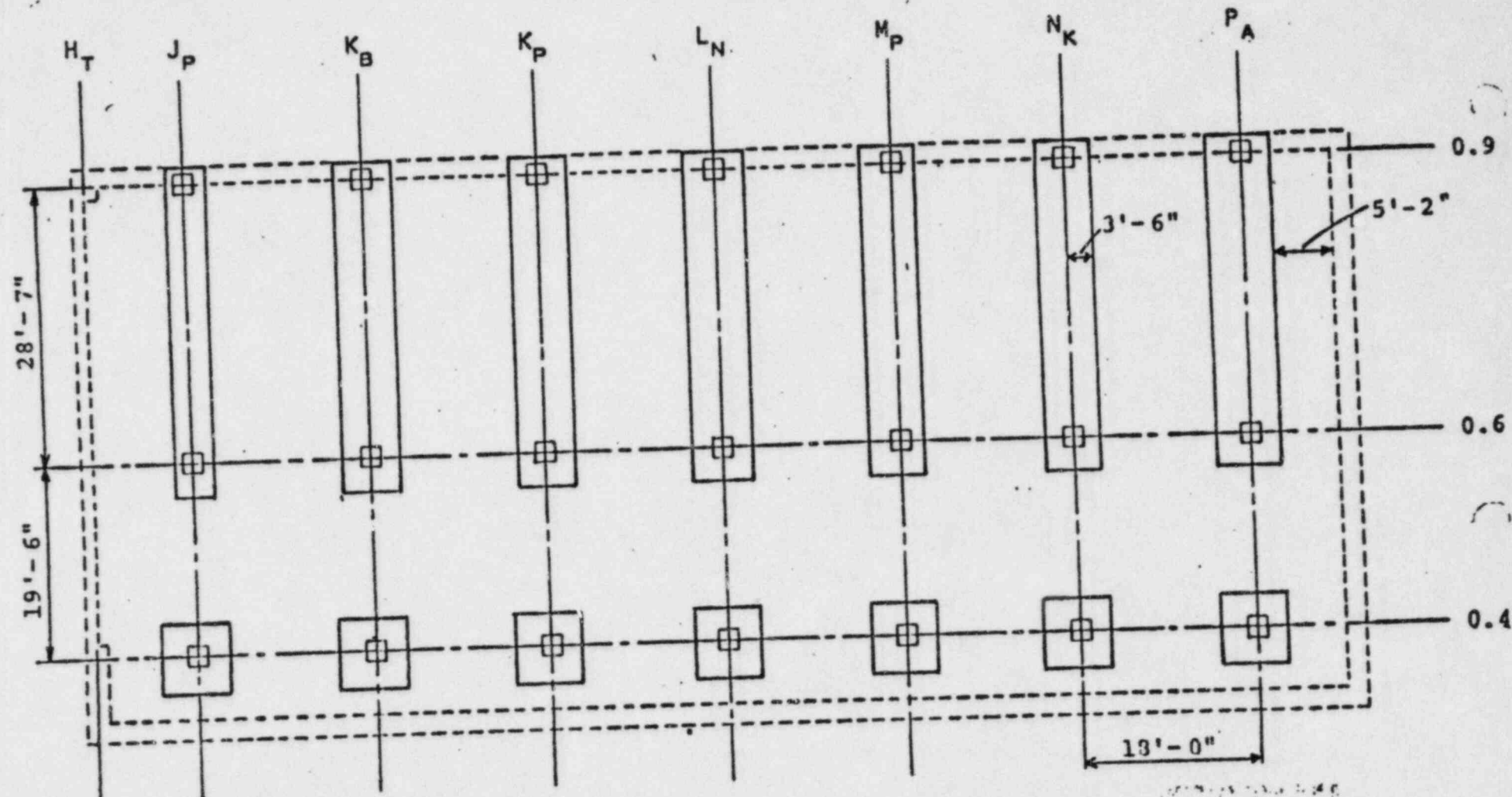
Sample No.	Sample Location	Sample Elevation	*Unconfined Compression Strength Lbs Per Sq Ft	**Allowable Bearing Value Lbs Per Sq Ft	Percent Strain	Remarks
1	PA - .0'	622.0	730	625	20.0	
2	PA - .04	621.0	487	420	20.0	
A	PA - .04	612.0	1984	1709	6.7	
B	PA - .04	611.0	633	546	20.0	
3	LN - .04	622.0	9.4	788	12.0	
4	LN - .04	621.0	2081	1792	5.0	
ST-1	Boring LN	617.5	4241	3653	10.3	
ST-2	Boring LN	615.5	2145	1849	20.0	
ST-3	Boring LN	603.0	5945	5123	9.1	
ST-4	Boring LN	597.5	3137	2704	20.0	
ST-5	Boring LN	588.0	2837	2423	20.0	

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

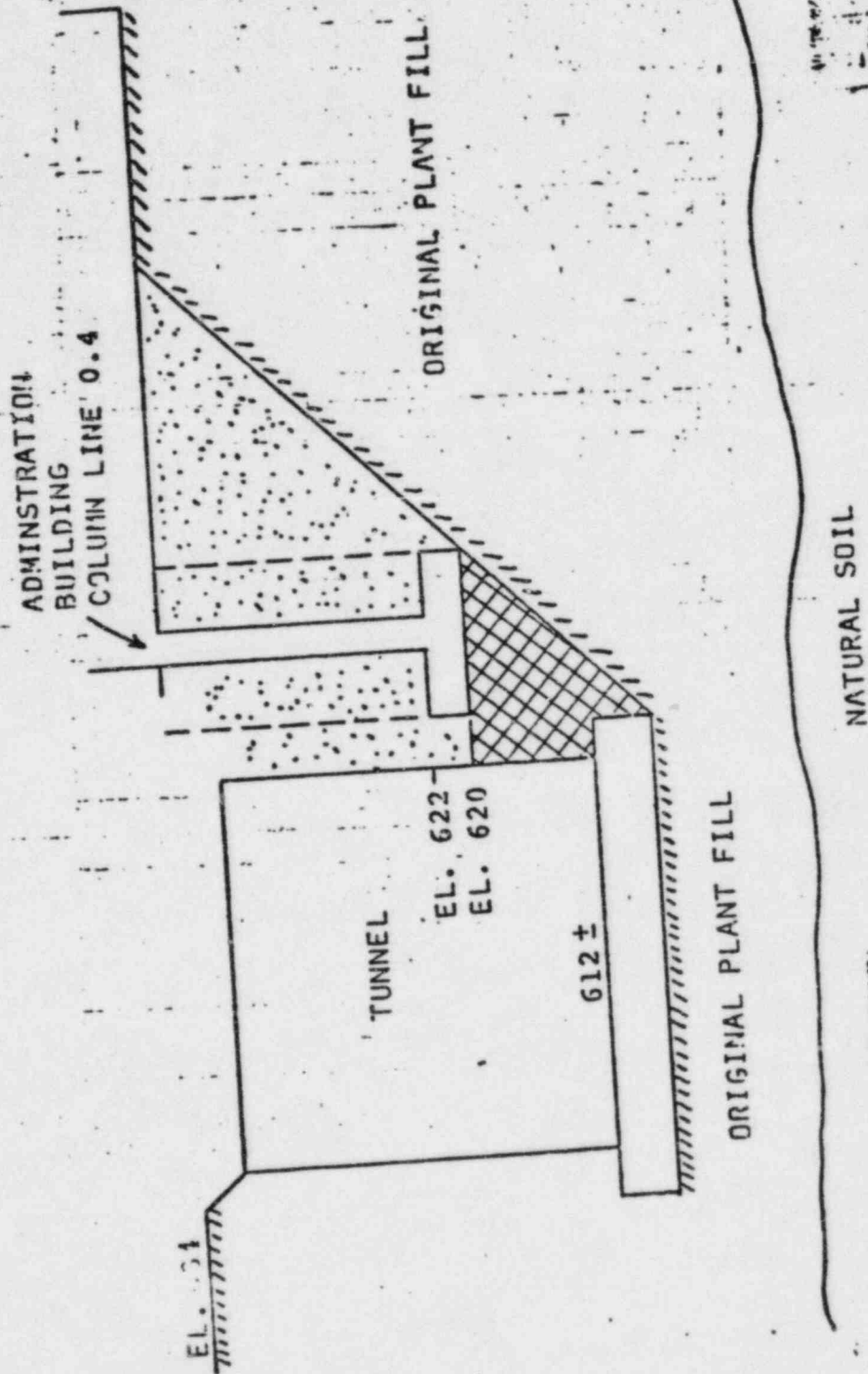
Figure 1

FOUNDATION LOCATION PLAN
ADMINISTRATION BUILDING
MIDLAND NUCLEAR UNITS 1 & 2



SF 05369

Figure 2



SB705870

BORING LOG

PROJECT: MIDLAND NUCLEAR PLANT 7220 SHEET NO. 1-1 HOLE NO. LN

SITE: ADMINISTRATION BLDG. COORDINATES: APPROX. 2' E OF FOOTING @ 0.4-LN ANGLE FROM HORIZ. BEARING: 90°

START: 9/27/77 COMPLETED: 9/29/77 DRILLER: SINGLETON (ABEL DRILL.) DRILL MAKE AND MODEL: CME-550 HOLE SIZE: 5" OVERBURDEN (FT.): — ROCK (FT.): — TOTAL DEPTH: 43.5'

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

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

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLER RECOVERY CORE RECOVERY	SAMPLER BLOW "N"	PENETRATION BLOWS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON WATER LEVEL, WATER RETURN, CHARACTER OF DRILLING, ETC.
				1ST 5"	IND 5"	3RD 5"						
							622					
							620			1	0-2' SILTY SAND, TAN, LOOSE (BACKFILL)	5" AUGER TO 8.5'; SET 5" CASING; DRILL W. 4" TRI-CON. ROLLER BIT IN RE-CIRCULATING WATER BELOW 8.5'
	2ST 2' 1.5'	—	—	—	—	—	619.5	2.5'		2	2.5'-27.5' GREY GRAVELLY CLAY (CL) TRAIL TO LITTLE GRAVEL, LOW TO MEDIUM PLASTICITY, HARD (CL)	
	2ST 2' 0.9'	—	—	—	—	—		4.5'		3	7'-25.5' BROWNISH GREY (FILL)	
	2SS 1.5' 1.0'	35	11	13	22			6.5'		4		
	2SS 1.5' 1.2'	37	13	17	20			8.5'		5	12' LARGE COBBLE (? BENT TUBE)	SLIGHT WATER SEEPAGE AT 2.5'
	2ST 2' 0'	—	—	—	—	—		10.5'		6	12.5' INCREASE IN SAND CONTENT	USED DEWITT GLAZING COMPOUND AND TAPING TAPE TO SEAL TUBES
	2SS 1.5' 0.8'	28	10	14	14			12.5'		7	15.5' 1" STONE	SAVED 35 SAMPLES IN JARS
	2ST 2' 1.0'	—	—	—	—	—		14.5'		8	22' STONE	#1 QP = 4.5 TS
	2SS 1.5' 0.9'	31	17	16	15			16.5'		9	22'-27.5' STIFF TO MEDIUM STIFF	#2 QP = 4.5 TS
	2ST 2' 1.7'	—	—	—	—	—		18.5'		10	22.5' DECREASE IN SAND CONTENT	#3 QP = 4.5 TS
	2SS 1.5' 0.5'	19	6	9	10			20.5'		11	25.5'-27.5' MEDIUM PLASTICITY	#4 QP = 4.5 TS
	2ST 2' 0'	—	—	—	—	—	594.5	28'		12	27.5'-31' SAND SEAM? LOOSE? (POOR RECOVERY AREA - TUBE PUSHED EASILY) (FILL)	#5 NO QP - TUBE BENT BADLY
	2SS 1.5' 0.2'	10	4	5	5		591.0	30'		13	31'-33' SANDY CLAY, GREY, STIFF TO MEDIUM STIFF (CL) (FILL)	#6 QP = 2.25 TS
	2ST 2' 1.3'	—	—	—	—	—	589.0	32'		14	33'-35' SILTY SAND, TAN W LITTLE MUSTY BROWN COLOR, FINE TO MEDIUM GRAINED, MEDIUM DENSE (SP/M) (FILL)	#7 NO QP - TUBE BENT BADLY
	2SS 1.5' 0.2'	20	8	9	11		585.0	34'		15	35'-37' TAN	#8 QP = 4.5 TS
	2SS 0.8' 0.8'	100+	71	100+	—		585.0	36'		16	37'-43.5' SILTY SAND, GREY, FINE TO MEDIUM GRAINED, VERY DENSE, MUSTY (SP/M)	#9 QP = 3.75 TS
	2SS 0.8' 0.8'	100+	8	100+	—		585.0	38'		17	38.5'-43.5' FINE GRAINED	#10 QP = 1.1 TS
	2SS 0.5' 0.2'	100+	103	—	—		578.5	43'		18		#11 NO QP - TUBE PUSHED EASILY
												#12 NO QP - NOT ENOUGH RECOVERY (ABOUT 2 TS)
												#13 - #15 NO QP (SAND)
												WATER LEVEL 5.9' AFTER CASING PULL
												HOLE BACKFILLED WITH SOIL AT COMPLETION

SS = SPLIT SPOON; ST = SHOULDER TUBE; B = BENNETT; P = PITCHER; O = OTHER

SITE: ADMINISTRATION BLDG. SR7C5871 LN

BELOW

BORING LOG		PROJECT MIDLAND NUCLEAR PLANT	JOB NO. 7220	SHEET NO. 100 1	HOLE NO. LNA
SITE ADMINISTRATION BLDG.		COORDINATES 2' NORTH OF LN		ANGLE FROM HORIZ. 90°	BEARING —
BEGUN 9/20/77	COMPLETED 9/28/77	DRILLER SINGLETON (ABEL DRIL.)	DRILL MAKE AND MODEL CME-550	HOLE SIZE 5"	OVERBURDEN (FT.) —
CORE RECOVERY (FT.%) —		CORE LOSS (FT.) —	EL. TOP OF CASING —	GROUND EL. 622	DEPTH/EL. GROUND WATER (SEE HOLE "LN")
SAMPLE NUMBER WEIGHT/FALL N/A		CASING LEFT IN HOLE: DIA./LENGTH NONE		LOGGED BY: JERRY B. GIVENS	

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLER RECOVERY CORE RECOVERY	SAMPLER BLOWS "N"	PERCENT CORE RECOVERY	PENETRATION BLOWS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVEL, WATER RETURN, CHARACTER OF DRILLING, ETC.
					1ST 8"	2ND 8"	3RD 8"						
								622					
	2.5'	2.5'	—	—	—	—	619.5	2.5				0'-2.5' SAND BACKFILL	5" AUGER TO 5'; TOOK BULK SAMPLE FOR COMPACT. TEST FROM 2.5'-5' AND COMBINED IT WITH BULK SAMPLE FROM HOLE LNB HOLE BACKFILL WITH SOIL AFTER COMPLETION REFER TO BORING LOG "LN" FOR MORE INFO. CONCERNING SOIL PROFILE
							617	5				2.5'-5' COMPACTED CLAY	
												TOTAL DEPTH = 5' EL. BOTTOM = 617	

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SS = SPLIT SPIN; ST = SHELBY TUBE
 B = BENNISON; P = PITCHER; O = OTHER

SITE
ADMINISTRATION BLDG.

HOLE NO.
LNA

RECORDS

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

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

SB705873

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

SITE
ADMINISTRATION BLDG.

HOLE NO.
LNB

BEGUN

<h1 style="margin: 0;">BORING LOG</h1>			PROJECT MIDLAND NUCLEAR PLANT			LOG NO. 7220	SHEET NO. 1-1	HOLE NO. HT
			COORDINATES ADMINISTRATION BLDG. AT E OF FOOTING 0.4-HT			ANGLE FROM NORTH 90°		BEARING —
DATE 9/28	COMPLETED 9/28	DRILLER SINGLETON (ABEL DRILL)	DRILL MAKE AND MODEL CME 550		HOLE SIZE 5"	OVERBURDEN (FT.) —	ROCK (FT.) —	TOTAL DEPTH 50'
CORE RECOVERY (PT%) —		CORE BOXES 10	EL TOP OF CASING —	GROUND EL. 631	DEPTH/EL. GROUND WATER (SEE NOTES COL.)		DEPTH/EL. TOP OF ROCK —	
SAMPLE HAMMER HEIGHT/FALL 140#/18"			CASING LEFT IN HOLE: DIA./LENGTH NONE			LOGGED BY: JERRY B. GIVENS		

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE (FT)	SAMPLER RECOVERY CORE RECOVERY (%)	SAMPLE BLAWS "N"	PENETRATION BLOWS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				1ST 8"	2ND 8"	3RD 8"						
							631				0'-11.5' SILTY SAND TAN (BACKFILL) (SP/SM)	5" AUGER TO 8.5' SET CASING DRILLED W/ 4" TRI-CONE ROLLER BIT USING RE-CIRCULATING H₂O
	2'33"	1.5'	0.7'	8	2	3	619.5	4.5'	1	11.5'-16' SANDY CLAY GREYISH BROWN, GRAVEL TO 1/2", SOFT TO MEDIUM STIFF, MEDIUM PLASTICITY, MOIST (CL)	#1QP = 1.5 TSF #2QP = 0.8 TSF	
	2'55"	1.5'	0.9'	5	1	2	615	13.5'	2	16'-28.5' SILTY CLAY, BROWNISH GREY, LITTLE GRAVEL, VERY STIFF TO HARD, MEDIUM PLASTICITY, MOIST (CL)	#3QP = 4.5+ TSF #4QP = 4.5+ TSF	
	2'55"	1.5'	0.9'	25	7	12		17.5'	3			
	2'55"	1.5'	1.0'	20	8	9		18.5'	4	23.2 INCREASE IN SAND CONTENT	#5QP = 3 TSF	
	2'55"	1.5'	0.5'	18	16	12		22.5'	5			
	2'55"	1.5'	0.9'	22	8	10	602.5	28.5'	6	28.5'-47' SANDY CLAY TANNISH BROWN, VERY STIFF, MEDIUM PLASTICITY, MOIST (CL) PIECE OF COAL STRAIGHT THROUGH	#6QP = 3.25 TSF (CLAY)	
	2'55"	1.5'	1.0'	30	10	15		33.5'	7	29.8'-33.5' SEAM OF GREY SILTY FINE TO MEDIUM SAND	#7QP (NONE, TOO SANDY)	
	2'55"	1.5'	1.0'	10	2	5		35.5'	8	33.5'-38.5' GREYISH BROWN, SEAMS OF SAND	#8QP = 1.75 TSF (BREAKING UP, SANDY)	
	2'55"	1.5'	0.2'	15	5	6		43.5'	9		#9 NO QP (TOO LITTLE REC.)	
							584	47.5'	10	47'-50' FINE SILTY SAND, GREY, VERY DENSE, TRACE ORGANICS, CLAYEY SILT LENSES, SLIGHT MOISTURE (SM)	#10 NO QP (SM)	
	2'55"	1.5'	1.5'	111	18	40	581	49.5'			TOTAL DEPTH = 50' EL. BOTTOM = 581'	WATER LEVEL AT 8' WHILE DRILLING, WENT TO 7.1' H₂O DRILLING COMPLETE AND CASING REMOVED. HOLE BACKFILL W/ SOIL AT COMPLETION

SB = SPLIT SPOON; ST = SHELBY TUBE;
B = BARNISON; P = PITCHER; S = STRAIN

SITE
ADMINISTRATION BLDG.

HOLE NO.
HT

SB705871

BECHTEL

BORING LOG		PROJECT MIDLAND NUCLEAR PLANT	JOB NO. 7220	SHEET NO. 1 of 1	HOLE NO. HTA
SITE ADMINISTRATION BLDG.		COORDINATES 1.0' NORTH OF HOLE HT		ANGLE FROM HORIZ. 90°	BEARING —
BEGUN 9/28/77	COMPLETED 9/28/77	DRILLER SINGLETON/ABELDRIL	DRILL MAKE AND MODEL CME-550	HOLE SIZE 5"	OVERBURDEN (FT.) —
CORE RECOVERY (PTJN) —		CORE BOXES —	SAMPLES 1	EL. TOP OF CASING —	GROUND EL. 631
SAMPLE HAMMER WEIGHT/FALL N/A		CASING LEFT IN HOLE: DIA./LENGTH NONE		LOGGED BY: JERRY B. GIVENS	
DEPTH/EL. GROUND WATER —		DEPTH/EL. TOP OF ROCK —		TOTAL DEPTH 14.5'	

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

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SS = SPLIT SPONS; ST = SHELBY TUBS;
 D = DENISON; P = PITCHER; O = OTHER

SITE
ADMINISTRATION BLDG.

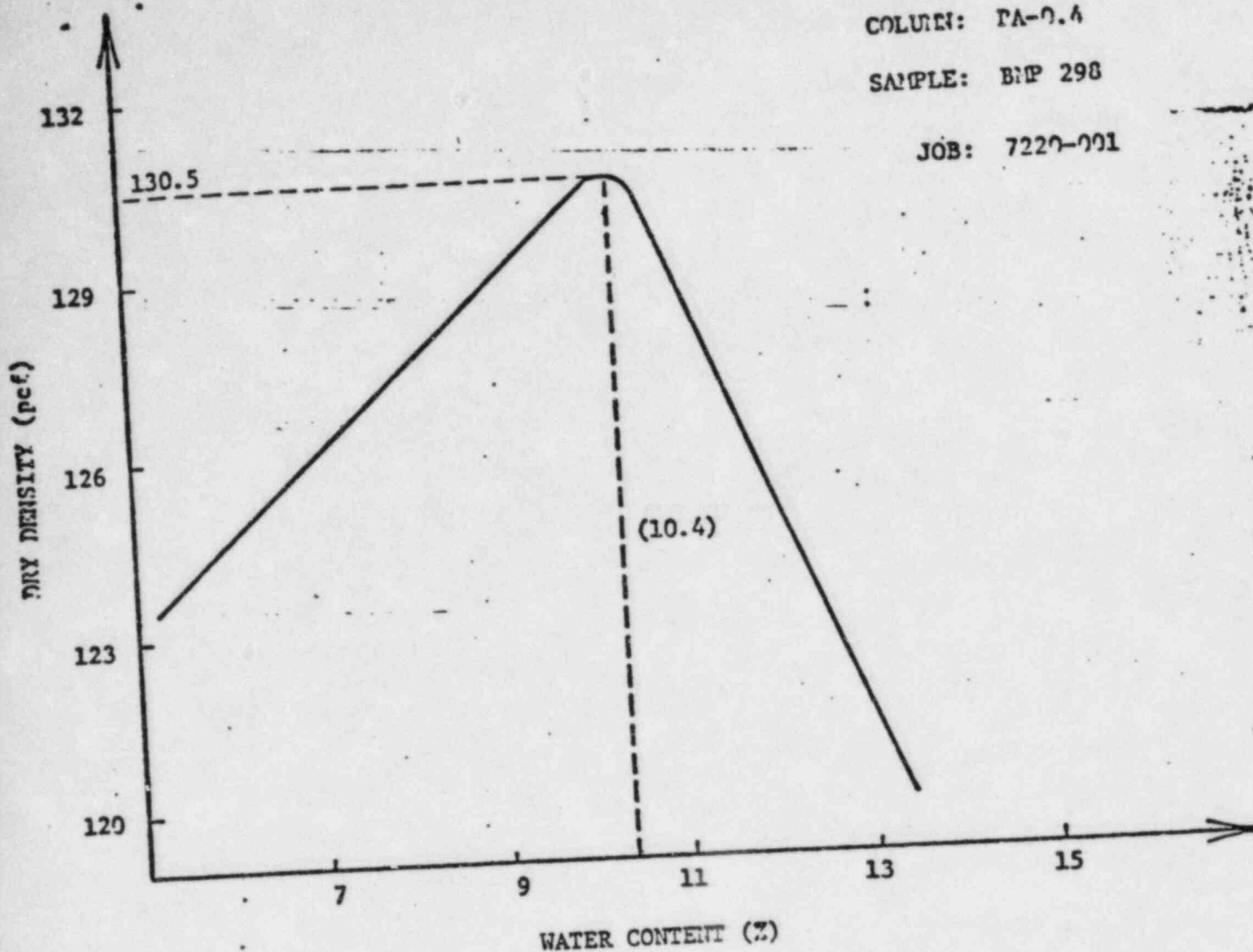
HOLE NO.
HTA

LOC. ION: Administration Building

COLUMN: PA-0.4

SAMPLE: BMP 298

JOB: 7220-001



Name	Std. Compaction Data Used		Field Data		Original	From
	$\gamma_{d(max)}$	W_o	$\gamma_{d(f)}$	W_{of}	Calculated % Compaction	Above Data % Compaction
BMP 262	123.9	11.8	117.5	17.5	94.0	90.0
			120.5	13.8	97.0	92.3
BMP 269	127.3	10.0	127.5	13.3	101.6	97.7
BMP 270	124.6	11.1	113.7	16.7	95.7	91.0
BMP 273	117.0	15.2	103.5	19.5	92.7	83.1

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

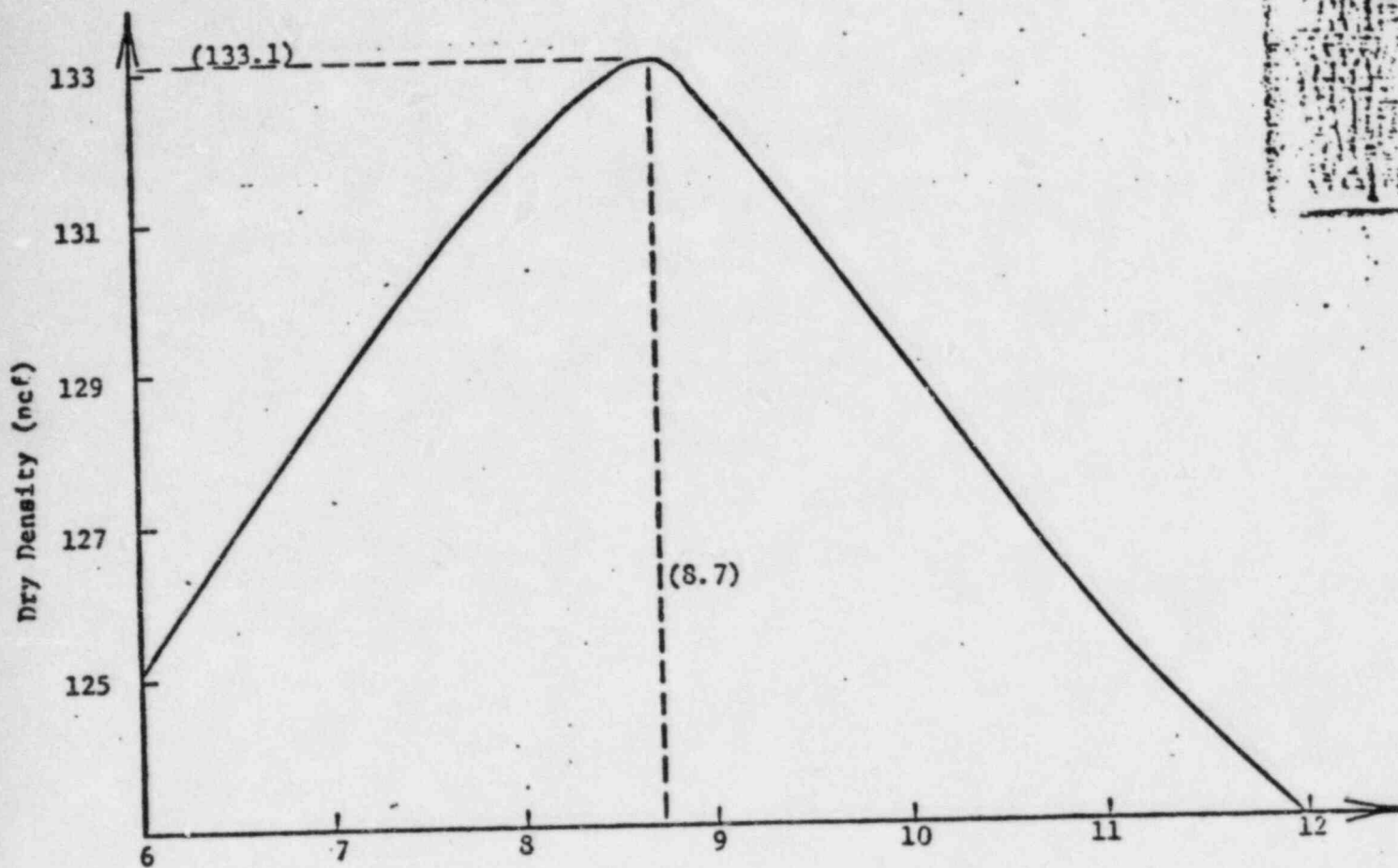
W_o = Corresponding optimum water content

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

W_{of} = Corresponding field moisture content

Fig 8

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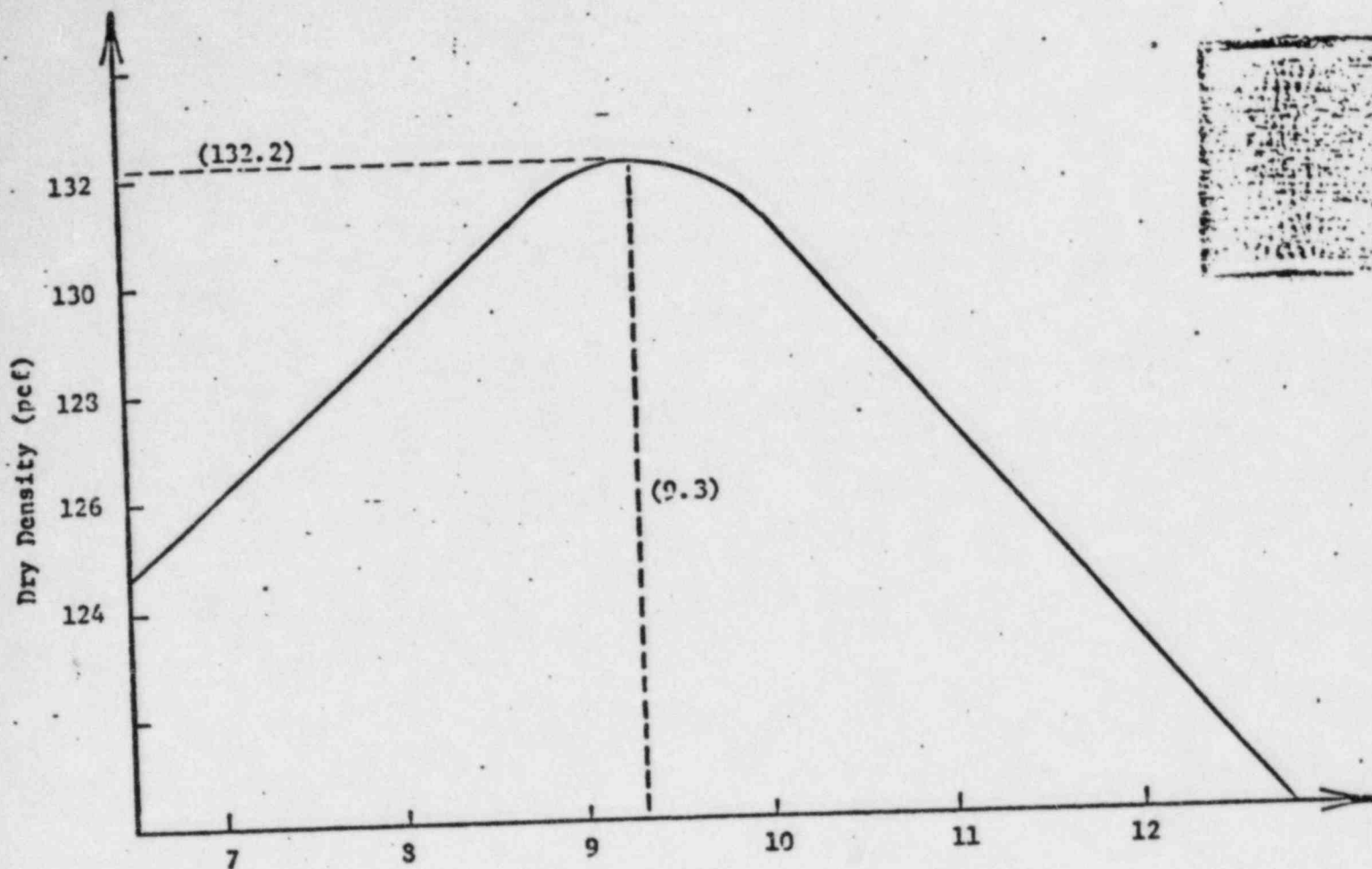
MOISTURE CONTENT %

LOCATION: Administration Building

COLUMN: LN-0.4

SAMPLE: BIF-299

JOB: 7220-001



MOISTURE CONTENT %

LOCATION: ADMINISTRATION BUILDING

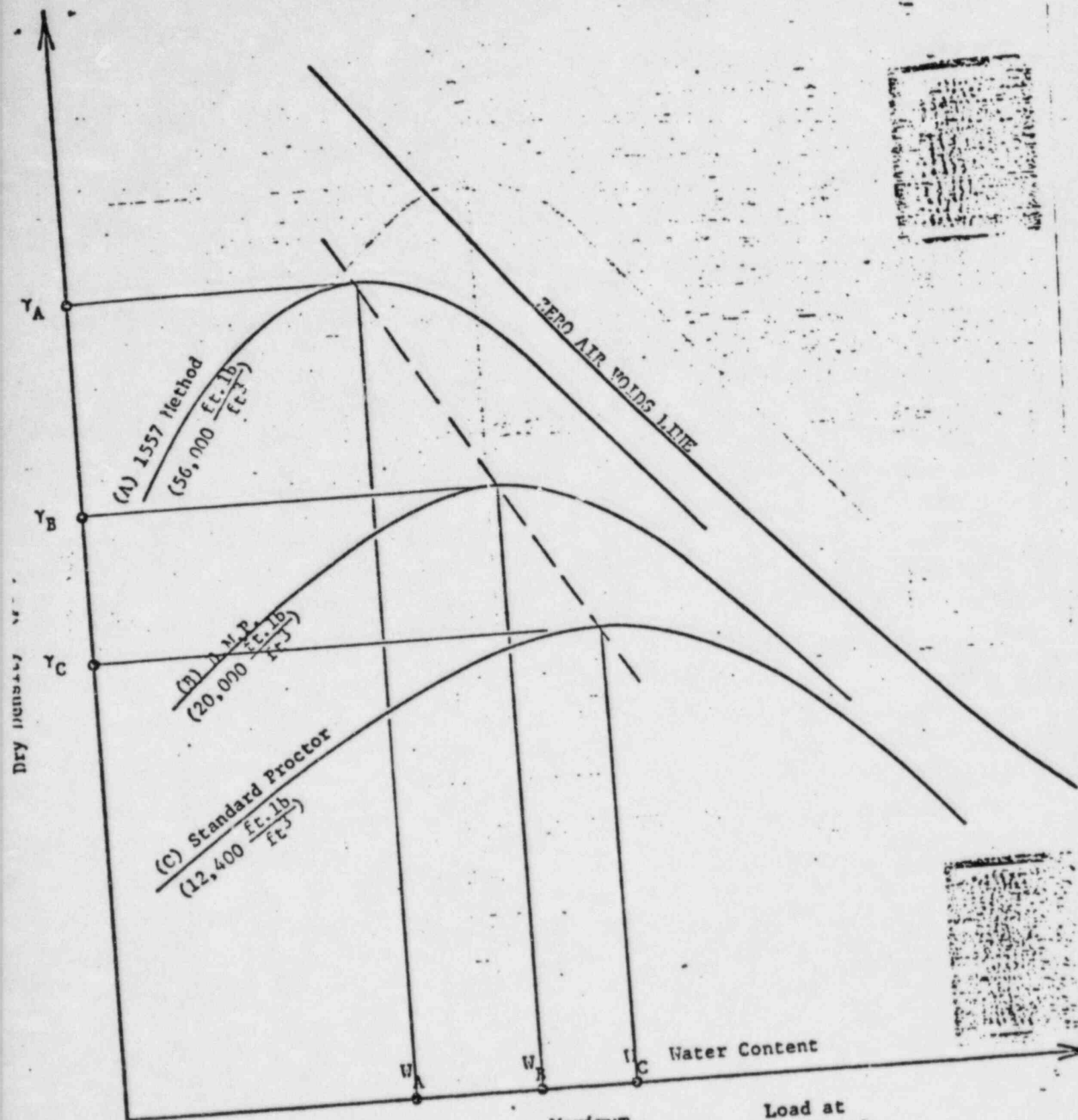
COLUMN: HT-0.4

SAMPLE: BTP-300

JOB: 7220-001

SB705678

COMPARISON OF 3 DIFFERENT STANDARDS



	<u>Optimum Water Content</u>	<u>Maximum Dry Density</u>	<u>Load at 0.1" Penetration</u>
A	12.7(%)	124.5(pcf)	94.5 (psi)
B	14.0(%)	117.0(pcf)	57.2 (psi)
C	15.0(%)	112.8(pcf)	5 (psi)

SB705879



Consumers
Power
Company

General Offices: 212 West Michigan Avenue, Jackson, MI 49201 • (517) 788-0550

LEGAL
DEPARTMENT

Lawrence B Lindemer
Vice President
and General Counsel

Judd L Bacon
Allen B Bass
O K Peterson
William E Wisner
Managing Attorneys

Robert J Byers
Howard E Clark
Bessondy E Hagen
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Lesley Daoud
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James W Dempsey
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R F Godbout
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Jon R Robinson
David R Rond
Gregory A Sanda
Jack D Shumate
Walter Scott Szpara
A T Udrys
Dennis L Viglione
Theodore J Vogel
Attorneys

J. Kane
Rec'd 9/29/81

II
~~Paton~~ / Thessin
Hodgdon / Wilcoue
Rutberg
FE

September 18, 1981

William Paton, Esq.
Counsel for NRC Staff
U. S. Nuclear Regulatory Comm.
Washington, D.C. 20555

Dear Mr. Paton:

Attached hereto are copies of the documents requested by Joseph Kane with respect to the investigation following the Administration Building grade beam settlement. Included are copies of borings "D" and "E".

I look forward to seeing you again in October.

Very truly yours,

James E. Brunner

RESERVE

BORING LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.					
DIESEL GENERATOR BLDG.				MIDLAND NUCLEAR PLANT	7220	1-1	D					
SITE				COORDINATES	ANGLE FROM NORTH, BEARING							
				S. 5136 E. 305	90°							
BEGIN	COMPLETED	DRILLER	DRILL WARE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH					
9/23/77	9/30/77	SINGLETON (ABEL DAIL)	CHE-550	5"			31.5'					
CORE RECOVERY (%/IN)		CORE BOXES, SAMPLES	EL. TOP OF CASING	END OF EL.	DEPTH, EL. GROUND WATER		DEPTH, EL. TOP OF ROCK					
		12		629.4	(SEE NOTES COL.)							
SAMPLE HAMMER WEIGHT/FALL			CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:							
140 F/13"			NONE		JERRY B. GIVENS							
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH COR. IN	SAMPLER RECOVERY CORE RECOVERY	SAMPLE BLOWS	PENETRATION BLOWS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				1ST 8"	2ND 8"	3RD 8"						
							629.4					
	255 1.5' 0.9'	21	17	10	11		624.9	3.5'		1	0'-2.5' SILTY TO SANDY CLAY, GREY, SLIGHT TO LOW PLASTICITY (CL)	5" AUGER TO 20.5' 3 FT CASING, BEGAN DRILLING WITH 4" TRI-CONE ROLLER BIT AND RECIRCULATION WATER
	255 1.2' 1.2	34	10	10	24		622	6.5'		2	2.5'-7.4' SAND, TAN, MEDIUM DENSE, SLIGHTLY MOIST (SAND) (SP)	
	255 1.5' 0.5'	16	5	5	11		621.4	8.0'		3	7.4'-8' CONCRETE PADMA	
	255 1.5' 0.5'	31	16	17	14			10.5'		4	8'-25.5' SILTY TO SANDY CLAY, GREY, LITTLE GRAVEL, LOW MOIST., LOW PLASTICITY, VERY STIFF TO HARD (CL)	Qp#1 = 4.5 TSE
	255 1.5' 0.6'	26	10	10	16			13.0'		5		Qp#2 = (SAND)
	255 1.5' 0.9'	47	10	22	25			15.5'		6		Qp#3 = SAMPLE BREAKS UP AT 3.5 TSE
	255 1.5' 1.2'	65	15	29	36			18.5'		7		Qp#4 = 4.5 TSE
	255 1.5' 1.0'	57	16	25	32			20.5'		8		Qp#5 = SAMPLE CRUMBLES, LOW MOISTURE
	255 1.5' 1.0'	53	20	33	25			22.5'		9		Qp#6 = 4.5 TSE
	255 1.5' 0.9'	107	30	42	63		603.9	23.0'		10	23'-24.2' SEAM OF CLAYEY SAND, TAN TRACE ORGANICS, GREYISH BROWN, 2.2' TAN MEDIUM SAND 3.5 FT LONG	Qp#7 = 4.5 TSE
	255 1.5' 0.6'	113	35	49	64			24.5'		11	25.5'-31.5' SILTY SAND, BROWN, MEDIUM GRAINED, WET, VERY DENSE (SM)	Qp#8 = 4.5 TSE
	255 1.5' 0.6'	102	44	102			597.9	31.0'		12		Qp#9 = 4.5 TSE
TOTAL DEPTH = 31.5'												Qp#10 (SAND)
EL. BOTTOM = 597.9												Qp#11 (SAND)
												HOLE CAVING IN @ 23' SO USED 3/4 BAG QUICK-SET
												WATER LEVEL AT 10.4 AFTER DRILLING
												HOLE BACKFILLED WITH SOIL AFTER COMPLETION

4/26/76
 1/30/77

FILL

SS = SPLIT SPOON; ST = SHELBY TUBE;
 B = BERRISON; P = PITCHER; O = OTHER

SITE: DIESEL GENERATOR BLDG
 HOLE NO.: D

BEH

BORING LOG		PROJECT MIDLAND NUCLEAR PLANT	JOB NO. 7220	SHEET NO. 1 of 1	HOLE NO. E
TYPE EVAPORATOR AND AUX. BOILER		COORDINATES AT FOOTING 8-CA			ANGLE FROM HORIZ. BEARING 90°
DATE 9/29/79	COMPLETED 9/29/79	DRILLER SINGLETON (ASBL DRIL)	DRILL MARK AND MODEL CME-550	HOLE SIZE (OVERBURDEN) 5"	ROCK (PT.) —
CORE RECOVERY (PT.%) —		CORE BOXES/IMPLES 14	EL TOP OF CASING 633	GROUND EL. 633	DEPTH/EL. GROUND WATER (SEE NOTES COL.)
SAMPLE NUMBER WEIGHT/FALL 140 F/15"		CASING LEFT IN HOLE: DIA./LENGTH NONE		LOGGED BY: JERRY B. GIVENS	

SAMPLE TYPE AND DIAMETER	SAMPLE ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY	SAMPLE RECOVERY PERCENT	SAMPLE BLOWS	PENETRATION BLOWS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON WATER LEVEL, WATER RETURN, CHARACTER OF DRILLING, ETC.
					1ST 6"	2ND 6"	3RD 6"						
								633				5" RUGER TO 2.5' DRIVING IN TRI-CONE AND RE-CIRCULATING WATER	
								629.5				0'-3.5' SILTY SAND, TAN (BACKFILL) (SP/SM)	
								629.5				3.5'-3' CONCRETE IN DONUT	
	255	1.5'	10.7	30	15	19	11					4.5'-9.5' CLAYEY SAND TO SANDY CLAY, GREY, V. STIFF, SLIGHTLY LOW PLASTICITY, SLIGHT MOISTURE (SC/CL)	#10Q = 4.5 TSP #20Q = 4.5 TSP #30Q = 4.5 TSP
	255	1.5'	1.1	23	12	11	12					9.5'-11' 5.5'-12' CLAYEY SILT, BROWN, PEBBLES TO 1/2", RUST STAIN, L. MOIST, L. PLAST. (CL)	#40Q = 4.5 TSP
	255	1.5'	1.5	33	10	15	18	623.5				12'-15.5' SILTY CLAY BROWN W. TRACE GREY, LOW PLASTICITY, LOW MOISTURE, PEBBLES TO 3/8" HARD (CL)	#50Q = (NONE-SAND) #60Q = 4.5 TSP
	255	1.5'	1.5	30	10	15	15	621				15.5'-18' SAND, GREY MEDIUM GRAINED, MOIST TO SILTY, V. DENSE (SP)	#70Q = 4.5 TSP
	255	1.5'	1.5	52	10	21	37	617.5				18'-21' SAND, GREY, DENSE, TR. TO LITTLE ORGANICS (SM)	#80Q = 4 TSP
	255	1.5'	1.5	56	13	24	32	615				21'-22.5' SILTY CLAY, BROWN W. REDDISH TINT, V. STIFF (CL)	#90Q = 4.5 TSP
	255	1.5'	1.0	32	10	15	17	614				22'-22.5' BROWN (RODISH TINT) SAND	#100Q = 4.5 TSP
	255	1.5'	1.0	29	11	14	15	608.5				22.5'-24' SAND, CLAY TO CLAYEY, TR. TO LITTLE ORGANICS (SM)	#110Q = 4.5 TSP
	255	1.5'	1.0	43	10	21	22	607				24'-28' SILTY SAND, GREY, DENSE, TR. TO LITTLE ORGANICS (SM)	#120Q = 4.5 TSP
	255	1.5'	1.0	59	15	24	35	605				28'-31.5' SILTY CLAY, BROWN, HARD (CL)	#130Q = 4.5 TSP
	255	1.5'	1.5	55	12	13	45	601.5				31.5'-33' SANDY SILT, BROWN, HARD (CL)	#140Q = 4.5 TSP
	255	1.5'	1.0	25	6	22	—	600				33'-36.5' FINE TO MED. SAND, BROWN, V. DENSE, TRACE CLAY, LOW MOIST. (SP)	#150Q = 4.5 TSP
	255	1.5'	1.0	51	—	—	—	596.5				TOTAL DEPTH = 36.5' EL. BOTTOM = 596.5	

WATER AT 8.4' WHILE DRILLING
WATER LEVEL AT 5.1' AFTER DRILLING

WHY

* SPLIT SPOON: ST = SHELBY TUBE;
DESCRIPTION: ○ = BITCHEN; ● = OTHER

TYPE
EVAPORATOR AND AUX. BOILER BLOCS.

HOLE NO.
E



Given in 3/26/81 Deposition


UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

11/B6

MAR 17 1991

Docket Nos. 50-329/330

MEMORANDUM FOR: Frank J. Miraglia, Chief
Licensing Branch No. 3
Division of Licensing

THRU:  James P. Knight, Assistant Director
for Components and Structures Engineering
Division of Engineering

FROM: George Lear, Chief
Hydrologic and Geotechnical Engineering Branch
Division of Engineering

SUBJECT: MIDLAND - CHANGES IN REMEDIAL ACTION AS INDICATED
IN CONSUMERS FEBRUARY 27, 1981 TELECON

Plant Name: Midland Plants, Units 1 and 2
Licensing Stage: Post CP
Docket Numbers: 50-329/330
Responsible Branch: LB No. 3; D. Hood, LPM
Review Status: Continuing

The information provided in the March 13, 1981 memorandum to files on the above subject which was prepared by D. Hood is the basis for the following request by the Geotechnical Engineering Section.

- (1) To minimize the potential for future differences in the review of the Midland project, we suggest that DOL arrange a telecon between Consumers Power Co. and their consultants with the Corps of Engineers and the GES prior to Consumers beginning the explorations at the Midland site. The objectives of the call would be:
 - a. To make arrangements to have a Corps representative at the site when certain borings and sampling operations are underway.
 - b. To discuss CPCo plans for selecting the locations and depths where undisturbed samples will be taken.

In addition to the above request for arranging the telecon, DOL is also requested to have Consumers Power Co. provide one copy of the PSAR to the U.S. Army Corps of Engineers, Detroit District.

8103231078 2pp

Frank J. Miraglia

-2-

MAR 17 1981

Consumers Power Co. is also requested to provide a list of reports completed by Dames and Moore for the Midland project which have not been provided to the NRC. The intent of this request is to determine what information exists beyond that provided in Appendices 2A and 2B of the FSAR documents.

Original signed by George Lear

George Lear, Chief
Hydrologic and Geotechnical
Engineering Branch
Division of Engineering

cc: R. Vollmer
J. Knight
G. Lear
L. Heller
D. Hood
H. Levin
W. Paton
N. Gehring, COE
J. Kane

OFFICE	HGEB:DE	HGEB:DE	HGEB:DE	A/D CSE:DE		
SURNAME	JKane/mc	LHeller	GLear	JPKnight		
DATE	3/16/81	3/16/81	3/16/81	3/17/81		



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

J. Kone
Rec'd 3/13/81
Copy sent COE on
3/13/81

MAR 13 1981

Docket Nos.: 50-329/330

MEMORANDUM FOR: File

FROM: D. Hood

SUBJECT: FEBRUARY 27, 1981 TELECON REGARDING CHANGES IN REMEDIAL
ACTIONS FOR MIDLAND SOIL SETTLEMENT

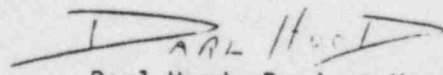
At 11:15 a.m. on February 27, 1981, Messrs. J. Cook, G. Keeley, and others of Consumers Power Company called Messrs. R. Vollmer, F. Miraglia (Acting for R. Tedesco), H. Levin, and D. Hood of NRC to report certain decisions and changes intended to expedite resolution of the soil matter on Midland Plant, Units 1 and 2.

- (1) Mr. Cook has today authorized all borings, exploration and testing requested by the Staff's letter of June 30, 1980, Request 37, as subsequently amended by R. Tedesco letter. The Staff and the Corps of Engineers will be invited to participate as requested in the staff letter. Samples will be sent to an independent laboratory and results of analyses will be provided to the Staff.
- (2) For the Diesel Generator Building, the program will measure the pre-consolidation pressure of the boring sample and this will be correlated by analysis to what the surcharge program should have done. An error analysis of the uncertainty of this empirical data associated with borings will also be provided. Consumers would appreciate an opportunity to discuss these results with the staff prior to conclusion of the staff review.
- (3) The proposed remedial action for the Service Water Building has been changed. The use of piles has been dropped and a Bin Wall concept (essentially an extension of the entire North wall down to till) will be adopted. Underpinning was found to provide little seismic margin. A conceptual design package, including seismic discussions, will be presented for the new fix the first week in April.
- (4) The fix for the Aux. Bldg. remains the same, however more caissons might possibly be added if found to be needed. Other possibilities for lateral loads are being reviewed in the event such should be needed. A potential 50.55(e) report on the Aux. Bldg. seismic analysis was issued February 20, 1981.

8103260883 12pp.

MAR 13 1981

- (5) The drilling of wells for the permanent dewatering system may prove to be a pacing schedule item if a lengthy hearing results. Mr. Cook would like to explore with the Staff the possibility that the drilling of these wells might be acceptable to the staff prior to completion of the hearing. Mr. Cook noted that wells can always be plugged if necessary at some later date.
- (6) Two reports by Weston Geophysical, one for the seismic response spectra at the original ground surface and another on the probabilistic seismic hazards study will be forwarded March 2, 1981. A third report, covering the response spectra at the top of the fill will be forwarded later. A meeting on the first two reports is requested.
- (7) A 50.55(e) report on the BWST cracks was issued February 20, 1981. Five options are being considered at this time.



Darl Hood, Project Manager
Licensing Branch No. 3
Division of Licensing

- cc: J. Kane
L. Heller
W. Paton
G. Lear
J. Knight
F. Schauer
F. Rinaldi
R. Bosnak
A. Cappucci
R. Gonzales
R. Jackson
J. Kimball
J. Gilray
R. Shewmaker
E. Gallagher
R. Knop
F. Miraglia
R. Vollmer
H. Levin
R. Tedesco

Note to Files:
Follow up w/HGEB memo to DCL

ROUTING AND TRANSMITTAL SLIP

Date 4/22/81 12/86

TO: (Name, office symbol, room number, building, agency/Post)	Initials	Date
1. L. Heller		
2. G. Lear		
3. J. Knight		
4. D. Hood		
5. W. Potor		

Action	File	Note and Return
Approval	For Clearance	Per Conversation
As Requested	For Correction	Prepare Reply
Circulate	For Your Information	See Me
Comment	Investigate	Signature
Coordination	Justify	

REMARKS

Inevitable questions arise after reading the attached memorandum.

Why wasn't NRC notified of this test pile program in April 1980?

Why wasn't this document available in the deposition papers of either Afifi, Dhar or Ferris?

Why did Dr. Davission mislead NRC in his deposition of January 14, 1981 (Pages 76 to 79)?

I think the problem in driving this pile and buckling the pile further reinforces HGEB requests to have Consultants at the site during the difficult underpinning work.

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/Post)	Room No.—Bldg.
J. Kane	Phone No.

Inter-office Memorandum

To: S. S. Afifi Date: 12 May 1980

Subject: Report of Pile Driving Operations for Service Water Test Pile April 23, 1980 From: L. A. Kendall

Copies to: S. L. Blue w/o Of: Geotechnical Services

A. Boos w/a At: Ann Arbor 10 D 5

H. H. Burke w/a

L. H. Curtis w/a

b. Dhar w/a

W. R. Ferris w/a

J. O. Wanzeck w/a

1320, 3410

INTRODUCTION

Driving operations for the test pile to be installed near the northeast corner of the Service Water Building at the Midland jobsite were scheduled to begin early in the morning of Wednesday, April 23, 1980. M. T. Davisson (consultant) and J. O. Wanzeck (Geotech) were on hand to monitor the installation. The weather was cool (50°F) and clear with a light breeze.

OPERATIONS

The pre-drilling operation was not begun until late morning (10:30 a.m.) due to a mechanical problem with the drilling crane. Once started the pre-drilling operation proceeded without incident to a depth of 30 feet. The test pile was then dropped into the approximately 16 inch diameter hole with a free fall of 31 feet. Driving began after lunch and after the cushion had been repaired (the mycarta/aluminum stack was replaced). Once started, driving continued for 5 minutes before pile damage forced an interruption. (The top of the pile bent during driving and had to be removed). Driving resumed after a 20 minute delay, and continued for 12 minutes until a sudden change in pile resistance occurred. Canonie's Supt. G. Thorne felt that the pile had been broken. Consultant M. T. Davisson wanted to be sure that it was a broken pile, and not a soft soil layer, that caused the change in resistance. Driving was therefore briefly resumed. The very low resistance encountered as well as the sound of the hammer on the pile convinced all observers that the pile was broken.

RESULT

After driving operations were stopped and the pile was cut off, the location of the top of the shear was found to be at elevation 608. Measurements

Bechtel Associates Professional Corporation

Page 2
12 May 1980
S. S. Afifi

also determined that approximately 3 feet of pipe is buckled beneath the shear. As the pipe is in a Q-area, it will be concreted and left in place.

L. A. Kendall
L. A. Kendall

LAK/nm
Attachment

STRUCTURE SW GROUP NO. TEST PILE NO. 1

GROUND ELEV. 634 FT.

CUT-OFF ELEV. 636 FT.

TIP ELEV. 590 FT.

PAY LENGTH _____ FT.

PILE TYPE 27250 x 500 LENGTH 75.25 FT

HAMMER & MANDREL VULCAN TYPE Q10

INTERNAL INSPECTION & REMARKS: _____

* PILE RENT DURING DRIVING: 19' 3/4" CUT-OFF

** PILE BROKE DURING DRIVING

PUNCH MARK ELEV. _____

DRILLING TIME

DRIVING TIME

START	FINISH	TIME
7:35 AM	11:30 PM	55
AM	AM	
PM	PM	
AM	AM	
PM	PM	

START	FINISH	TIME
1:53 AM	1:58 PM	5
2:20 AM	2:32 PM	12
2:38 AM	2:39 PM	1

TOTAL 55

TOTAL 18

LEE FALL 31 FT. PUSHED 0 RETAP INFO. _____ UPLIFT _____ BATTER _____

NO. OF BLOWS	FT.	NO. OF BLOWS	FT.	NO. OF BLOWS	FT.	NO. OF BLOWS	FT.	NO. OF BLOWS	FT.	NO. OF BLOWS	FT.	NO. OF BLOWS PER INCH							
15	42	61/10"																	
49	43	6																	
50	44	8																	
69*																			
83																			
86																			
95																			
90																			
67																			
72																			

PILE INSPECTOR L. KENDALL

ORIGINATOR LARIE KENDALL DATE 4.25.80 CALC. NO. _____ REV. NO. _____
PROJECT MIDLAND CHECKED _____ DATE _____
SUBJECT SW TEST PILE JOB NO. 7220-101 SHEET NO. _____

LOCATION OF PILE: S 4983
E 800

MEASUREMENTS

DRIVING BOOT: 1.5" x 14^{13/16}"

CUSHION: SMALL STACK (7^{3/4}" x 14")
4 MYLARIA (13^{3/4}" OD, 3" ID x 1")
3 ALUMINUM (13^{3/4}" OD, 2^{7/8}" ID x 1/2")
PENNY (2")

FIRST CUT-OFF: 19' 3^{1/4}"
FOUND TO BE 3/4" WALL AT TOP, 1/2" WALL AT BOTTOM

FINAL CUT-OFF: 10' 10" (1/2" WALL)

FINAL ELEV. OF PIPE = 636 FT.

PIPE BUCKLE ~ 3 FT.
TOP OF BUCKLE / SHEAR AT EL. 608 (28' BELOW TOP OF PIPE)

→ NOTE: HAMMER STROKE FOUND TO BE APPROXIMATELY 2"-2 1/2" LONG

ROUTING AND TRANSMITTAL SLIP

TO (Name, office symbol or location)
~~W. P. Foster, OECD~~
~~D. Flood, NRR~~
~~J. Keppeler, RUL~~
 L. Heller / J. Kane, NRR
 J. Gillray, NRR
 F. Rinzaldi, NRR
 A. Cappucci, NRR
 G. Gallagher, IE
 G. Fiorelli / K. Neidu, RUL

INITIALS	CIRCULATE
DATE	COORDINATION
INITIALS	FILE
DATE	INFORMATION
INITIALS	NOTE AND RETURN
DATE	PER CON-VERSATION
INITIALS	SEE ME
DATE	SIGNATURE

Kane Rec'd 3/24/81
 J. Kane
 13/86

REMARKS

Attached is updated listing on log of depositions related to the Midland Hrg.

Given in 3/26/81 deposition

X C:
 Brad Jones
 J. Kane
 G. Leah
 J. Kimball
 R. Gonzales

Do NOT use this form as a RECORD of approvals, concurrences, disapprovals, clearances, and similar actions.

FROM (Name, office symbol or location)

Stewmaker

DATE 3/13/81
 PHONE 27551
 5041-101

OPTIONAL FORM 41
 AUGUST 1967
 GSA FPMR (41CFR) 100-11.208

GPO 443-10-81418-1 419-018

3/13/21

MIDLAND HEARING

Prehearing Conferences

12/14/78 Prehrg. Conf. pp. 1-233

9/10/80 Prehrg. Conf. pp. 234-408

1/28/81 Prehrg. Conf. pp. 409-690

1/29/81 Prehrg. Conf. pp. 691-826

2/24/81 Corrections to Transcript of 1/28/81

<u>Depositions Of</u>	<u>Date</u>	<u>Pages</u>	<u>Exhibits</u>
G. Gallagher (NRC-IE)	11/17/80	1-116	1-8
	11/18/80	117-345	
	12/16/80	346-528	
K. Naidu (NRC-IE)	2/26/81	1-174	1
G. Fiorelli (NRC-IE)	2/17/81	1-152	1-11
J. Keppler (NRC-IE)	1/6/81	1-164	1-7
	1/16/81	165-248	8-13
R. Shewmaker (NRC-IE)	1/19/81	1-165	1-28
H. Thornburg (NRC-IE)	2/20/81	_____	_____
D. Hood (NRC-LPM)	10/7-8/80	1-314	1-21
	12/3/80	315-407	
	2/19/81	_____	25-32
Transcript Corrections	12/29/80	1-4	
Transcript Corrections	2/17/81	1-6	
L. Heller (NRC-HGEB)	10/9/80	1-139	1-6
	12/4/80	139-247	
	12/5/80	248-353	
J. Kane (NRC-HGEB)	10/14/80	Vol. I, 1-154a	1-17
	10/15/80	Vol. II, 1-209	
	10/16/80	Vol. III, 1-94	
	12/2/80	Vol. IV, 1-185	
	12/3/80	Vol. V, 186-357	
	12/4/80	Vol. VI, 358-406	
Transcript Corrections	12/5/80	1-9	
J. Simpson (USACE)	11/19/80	1-145	1-17

MIDLAND HEARING

<u>Depositions Of</u>	<u>Date</u>	<u>Pages</u>	<u>Exhibits</u>
W. Otto (USACE)	1/19/81	1-165	1-7
R. Erickson (USACE)	1/20/81	1-85	1-4
H. Singh (USACE)	12/18-19/80	Vol. I, 1-215	A, 1-6
	1/21/81	Vol. II, 216-343	
	1/22/81	← 1-209	
		← 1-100	
F. Rinaldi (NRC-SEB)	1/6/81	1-162	1-16
P. Huang (NSWC)	1/9/81	1-54	1-3
J. Matra (NSWC)	1/7/81	1-114	1-4
A. Cappucci (NRC-MEB)	1/22/81	1-114	1-14
J. Brammer (ETEC)	1/22/81	1-61	1-4
W. Chen (ETEC)	1/21/81	1-131	1-10
J. Gilray (NRC-QAB)	2/20/81	1-54	1-3
G. Keeley (CPC)	10/23/81	1-87	1 & 2
T. Cooke (CPC)	10/22/80	1-64	1-3
D. Horn (CPC)	10/21-22/80	1-174	1-3
		175-245	
T. Thiruvengadam (CPC) (formerly Bechtel)	12/11/80	1-61	1 & 2
W. Ferris (Bechtel)	12/10-11/80	1-252	

MIDLAND HEARINGS

<u>Depositions Of</u>	<u>Date</u>	<u>Pages</u>	<u>Exhibits</u>
S. Afifi (Bechtel)	10/29/80	1-123	1-6
	10/30/80	124-223	& Includes
	10/31/80	224-261	Informal
			Discovery
			Documents
B. Dhar (Bechtel)	12/17/80	1-160	Informal
			Discovery
			Documents
R. Peck (Bechtel Consult)	1/13/81	1-140	1-5
	1/14/81	141-205	
A. Hendron (Bechtel Consult)	1/27/81	1-165	1-33
	1/28/81	166-230	
M. Davisson (Bechtel Consult)	1/14/81	1-147	1-8
C. Gould (Bechtel Consult)	1/8/81	1-120	1 & 2