



# GEOTECHNICAL ENGINEERS INC.

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Rec'd 10/12/82  
8/137

October 7, 1982  
Project 81907  
File 2.0  
Ref: 81907-17

Mr. Joseph Kane  
Project Officer  
U. S. Nuclear Regulatory Commission  
Division of Engineering, M/S P-214  
Washington, D.C. 20555

Subject: Location of Data on Underpinning Dimensions  
and Load Transfer Procedures  
Midland Plant Underpinning

Dear Mr. Kane:

At your request we have compiled the enclosed Tables 1 and 2 which contain the subject information.

Due to the long period\* over which the information was provided to NRC and due to changes in design and procedures that the Applicant made during that period, the subject data have not been consolidated in a few drawings and specifications.

For the purposes of aiding NRC while following the progress of the work, we recommend that the Applicant be requested to furnish the NRC, in one submittal, the following drawings and specifications for the Auxiliary Building and for the Service Water Pump Structure:

1. Design drawings showing dimensions and locations of underpinning piers and walls
2. Specifications and/or design drawings that contain a description of the procedures that will be used to transfer the jacking loads, in stages, from the first temporary supports to the final underpinning wall

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Mr. Joseph Kane

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October 7, 1982

It would be desirable for the above information to be made available prior to or during the forthcoming site visit.

Sincerely yours,

GEOTECHNICAL ENGINEERS INC.



Steve J. Poulos  
Principal

SJP:ms

Encl.

cc w/encl. - Reuben Samuels

TABLE 1

Location of Data

on

Underpinning Dimensions and Load Transfer Procedures  
Auxiliary Building and Service Water Pump Structure

MIDLAND PLANT UNDERPINNING

Geotechnical Engineers Inc.

October 7, 1982

SERVICE WATER PUMP STRUCTURE

Dimensions of Underpinning Wall:

Bechtel Drawing 7220-C-2035 dated 11/9/81  
-2036 dated 11/9/81

Load Transfer Procedures:

Specification 7220-C-194 undated  
Testimony before ASLB  
Draft dated 12/31/81  
Sections 4.3 and 8.3

AUXILIARY BUILDING (EPA's and CT)

Dimensions of Underpinning Wall:

See Table 2

Load Transfer Procedures:

Bechtel Specification 7220-C-195 (Q) Rev. 0, Sect. 6.3  
Undated. Received July 27, 1982

Mergentime Drawing S74 dated 7/23/82  
S74a dated 7/23/82

Bechtel Drawing 7220-C-1445 (Q) dated 6/9/82  
-1445-1 (Q) dated 6/9/82

Jack stands

Bechtel Drawing 7220-C-1409-2 undated  
1409-4 undated

Drawings received July 27, 1982  
Jack supports

TABLE 1 (continued)

Bechtel Drawing 7220-C-0101 Rev. 0, undated  
Received July 27, 1982  
Construction Sequence, Plan and Logic

AUXILIARY BUILDING (FIVP)

Design of Underpinning Fill:  
See Table 2

Load Transfer Procedure:  
Specification 7220-C-195 (Q) would apply to this operation. No  
further details were provided by the Applicant.

TABLE 2

## Drawings Showing Pier Dimensions

## Electrical Penetration Areas and Control Tower

## MIDLAND PLANT UNDERPINNING

Geotechnical Engineers Inc.

October 7, 1982

Pier	Source/Date	Size (ft)	
		Column	Bell
<u>CONTROL TOWER</u>			
E-H <sub>K</sub>	Merg. S73, June 9, 1982	6 x 6	12 x 12
W-H <sub>K</sub>	Audit July 27, 1982		
CT 1,2,3, 5,6,7, 8,10,11, 12	Merg. S80, June 9, 1982 Audit July 27, 1982 Fig. AUX 35 Audit January 18-19, 1982	3 x 6	14 (North- South) 9 (East- West)
CT 13	Merg. S80, June 9, 1982	6 x 6	14 (East- West)
CT 14			
CT 15	Audit February 1-5, 1982 Calculation sheet by J. Ross, 11/23/81. Calc. DQ-50(Q) Rev. 0, Sht. 0	6 x 6	14 x 14
CT 13A,B,C 14A,B,C 15A,B,C	Audit July 27, 1982 - rough sketch and verbal	6 (E-W)	Not given
<u>EPA's</u>		<u>Size</u>	
Entire	Applicant's ASLB Testimony, Nov. 19, 1981 by Burke, Corley, Gould, Johnson, Sozen Fig. AUX 22 Audit July 27, 1982 - verbal	Concrete under prac- tically all of EPA  Small spaces not filled with concrete in AUX 22 will be filled with concrete. Thus, all of EPA supported on concrete.	

TABLE 2 (continued)

<u>FIVP's</u>		<u>Size</u>
East and West	Applicant's ASLB Testimony, Nov. 19, 1981 by Burke, Corley, Gould, Johnson, Sozen AUX 22	Backfill: 4-ft-thick concrete mat, 1-ft- thick jacking slab, and about 29 ft of com- pacted granular fill.

Stampyris Request 4-(b) -ls in Public Doc Room

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

JAN 19 1983

Docket Nos: 50-329/50-330 OM, OL

APPLICANT: Consumers Power Company

FACILITY: Midland Plant, Units 1 & 2

SUBJECT: TELEPHONE DISCUSSIONS OF JANUARY 11 & 12, 1983  
REGARDING UNDERPINNING SETTLEMENT READINGS

On January 11 and 12, 1983, the NRC and its consultant from Geotechnical Engineers, Inc. (GEI) participated in a telephone discussion with Consumers Power Company (CPC) and Bechtel. The call primarily discussed settlement records for deep-seated benchmarks associated with underpinning construction of the two Electrical Penetration Areas (EPA's) located at the southern portion of the Midland Auxiliary Building. CPC's plans for underpinning the EPA's and the Service Water Pump Structure (SWPS) are described in Supplement 2 of the Safety Evaluation Report (NUREG-0793, October 1982).

Enclosure 1 is a record of this telephone conversation.

Darl Hood, Project Manager  
Licensing Branch No. 4  
Division of Licensing

Enclosure:  
As stated

cc: See next page

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MIDLAND

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Mr. J. W. Cook

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Supplemental page to the Midland OM, OL Service List

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- 3 -

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ENCLOSURE

RECORD OF TELEPHONE CONVERSATION

DATE: January 11, 1983 @ 2:00 PM

PROJECT: Midland

RECORDED BY: Joseph D. Kane

TALKED WITH:

CPC

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J. Schaub  
T. Thiruvengadam  
K. Razdan  
R. Ramanujam

Bechtel

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R. Wheeler  
G. Murray  
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GEI

S. Poulos

NRC

R. Landsman  
J. Kane

ROUTE TO:

J. Knight  
G. Lear  
L. Heller  
D. Hood

H. Singh, COE  
S. Poulos, GEI  
R. Landsman, Region III  
J. Kane

MAIN SUBJECT OF CALL: To discuss background settlement readings -  
Auxiliary Building Underpinning

ITEMS DISCUSSED:

This call had been arranged at the request of NRC to discuss the background (underpinning had not yet started) settlement records provided to NRC for the period from 8/23/82 to 10/14/82. The records provided were for DSB-AN1, DSB-1E, DSB-2E, DSB-AS4 and DMD-3E and the ambient air temperatures for the same time frame. Region III had requested that HGEB review the background data and provide comments on the apparent upward movement of the EPA which is indicated by the settlement monitoring program.

1. CPC was asked to briefly describe the procedure that was followed to establish the uncorrected and corrected settlement curves which were provided for the deep-seated benchmarks (DSB). The uncorrected curves are based on the recorded LVDT readings. The occasional small triangles plotted on the curves are points established from the back-up dial gages. The corrected curves adjust the uncorrected curves for temperature changes measured at the deep-seated benchmarks (DSB) since the time of initial

installation. Temperature changes are measured at each DSB location at depths of 3 ft, 15 ft and 50 ft through thermocouples which were placed during installation. Minimal changes in temperature are being observed below the upper thermocouple. CPC is to provide the temperature readings with depth to support their position that temperature corrections at DSB-AN1, DSB-AN2 DSB-1E and DSB-1W are not required in the future. The plot of ambient air temperatures which was provided was not used in correcting for temperature variations.

2. During this call the following information was provided by CPC on  $\Delta_1$  values (See Drawing C-1493(Q) and prior reports for definition of differential settlement,  $\Delta_1$ ).

<u>Building Monitoring Location</u>	<u>Uncorrected Settlement</u> (in mils as of 1/11/83)	<u>Corrected Settlement</u> (in mils as of 1/11/83)
✓ DSB-AN1 (North Main Auxil.)	68	118
✓ DSB-AS4 (South Main Auxil.)	46	63
✓ DSB-2E (East EPA)	35	43
DSB-3E (Control Tower)	22	44
DSB-2W (West EPA)	27	39

Computed values of  $\Delta_1$  that were given include:

DSB-2E:  $\Delta_1 = -18$  mils

DSB-3E:  $\Delta_1 = -17$  mils

DSB-2W:  $\Delta_1 = -15$  mils

DSB-3W:  $\Delta_1 = -10$  mils

These values are based on uncorrected readings for DSB-AN1 and corrected readings for the other locations. The minus signs reflects a magnitude of settlement at the EPA and Control Towers less than the Main Auxiliary Building.

3. Additional information provided by CPC included:

<u>Building Monitoring Location</u>	<u>Actual Settlement (corrected) (in mils as of 1/3/83)</u>
DSB-2W	29
DSB-3W	38
DSB-3E	39
DSB-2E	30

Estimated bearing pressures: EPA = 4.5 ksf, Control Tower = 5.2 ksf  
and Auxil. Bldg. = 9.5 ksf

4. Possible explanations for the larger amount of settlement occurring at the north end of the Main Auxiliary Building were discussed and included:

- a. The heavier loaded Auxiliary Building which rests on glacial till may be picking up additional load from the EPA and Control Tower through cantilever action because the more compressible till beneath the EPA and Control Tower is providing little foundation support.
- b. The EPA is affected more by changes in temperature than the other structures which causes an upward expansion of the EPA. This is reflected as less settlement than the other structures.
- c. The dewatering for underpinning is causing an uneven immediate settlement over a relatively large area in the thick glacial till layer.

5. The NRC Staff and its consultant made the following recommendations for plotting of the settlement data in order to sort out the many variables affecting the settlement readings.

- a. Plot the uncorrected and corrected readings for each monitor location along one line (North Auxil. Bldg. through to Control Tower) at the noon time interval. (On 1/12/83 this was later agreed to be at the midnight interval). Two settlement history plots on standard 11" by 17" graph paper should be developed for each monitoring location. One plot would have both horizontal and vertical (suggested 1 inch = 20 or 40 mils) arithmetic scales and the other plot would graph time in days (1, 10, 100, 1000) on semi-log paper. The temperatures used to correct the data should be plotted on the same graph at the same time interval (Temperature plot needed only on settlement graph plotted to arithmetic scales).

6. CPC indicated the requested settlement plots would be furnished to NRC in about one week's time. This was noted to be acceptable and will permit staff review prior to any site visit for reviewing underpinning progress (now planned for time when pier load test of W11 is being conducted).
7. The staff and its consultant believe the relatively small settlement values and the trends of that data which have been recorded to date are a result of temperature changes. It is felt that if sufficient background data were available, where comparable temperature and seasonal conditions were repeated, that the effects of sustained temperature changes would be clearer. It is also felt that the apparent upward movement of the EPA with respect to the other structures will be quickly reversed as underpinning operations progress beneath its foundation slab. The present trend indicated by the settlement readings is favorable with respect to the settlement acceptance criteria which has been established to control underpinning operations.
8. At the request of R. Ramanujam, CPC, several other items were discussed and included:
  - a. CPC plans to explore for buried utilities in advance of drilling the SWPS dewatering wells and soldier piles by using a jet-wash type boring (3-1/2" diameter water pipe) which would be inspected by the Resident Geotechnical Engineer. R. Landsman and J. Kane, NRC, agreed that this type of boring would be acceptable for attempting to locate utilities when performed in foundation soils which would eventually be removed either in underpinning operations or in replacement of service water piping.

There is a concern when using this type of drilling that the jetting and washing action, if not properly controlled, could cause development of voids and loosening of cohesionless foundation soils. The NRC staff expressed preference for other types of exploratory drilling (e.g., augering) in areas where future foundation stability was required. W. Paris of CPC indicated that this position does give them problems. At the staff's request, CPC is to identify the specific location of proposed borings which will be located in permanent foundation soils required to remain stable. This information will be used to guide the staff in a future response on the use of the jet-wash type boring.

- b. R. Landsman indicated that his review of underpinning procedures developed by CPC has identified a problem. The procedures presently indicate that backpacking behind pit excavation lagging is not required when "neat cut" of the pit excavation is made. CPC indicated that the lagging would be essentially in direct contact with the foundation soils when neat cutting was performed. After considerable discussion the major difference became centered on the interpretation of essential and whether the entire length of lagging is required to be in contact, or if short, narrow intermittent voids were acceptable behind lagging. All parties did agree that backpacking should be required, even if neat cutting procedures were used, if sufficient voids behind lagging did exist. It was acknowledged that reasonable judgments will have to be made during construction when faced with widely differing conditions of voids that may run from several inches to several feet in length behind the lagging. It is hoped that the early planned site visit will permit the typical void conditions to be viewed where a consensus of agreement can be reached.
9. An additional call from J. Kane to R. Landsman and K. Razdan on 1/12/83 requested that settlement be plotted vertically downward in the conventional engineering manner on the settlement history plots which CPC has agreed to provide. In addition CPC agreed to provide the background readings for the extensometers and strain monitoring devices.