CPCO Ex 2 i.d.
12/18/80 (Singh)

18 NOV 1980

MCVED-T

SUBJECT: Interagency Agreement No. NRC-03-79-167, Bi-Monthly Letter

Mr. George Lear
U.S. Nuclear Regulatory Commission
Chief, Hydrologic & Geotechnical Engr. Br.
Division of Engineering
Mail Stop P-214
Washington, DC 20555

Dear Mr. Lear:

This is the sixth of the bi-monthly letters required by subject interagency agreement. The status of the tasks required by the agreement is provided in the following paragraphs.

Efforts Completed During the Period 21 September to 20 November 1980

Midland. Action was completed this period by NRC concerning the taking of additional borings. The additional 18 borings must be taken by the applicant. Some relief was granted by eliminating the SET's for some of the borings. The locations of the borings to be taken at the cooling pond dikes are being revised. Taking of district employee depositions for the ASLB hearings was scheduled for October but due to delays in taking NRC staff depositions, these will be rescheduled. Interrogatories have been prepared to be asked of the applicant and its consultants during the taking of depositions. All this information will be used to complete subtask 2 by preparing the Safety Evaluation Report (SER) and preparing the testimony of the ASLB hearings in March/April 1981. This work is preparatory to completing subtasks 2, 3, & 4 of the interagency agreement.

Bailly. There has been no activity by the applicant to get this project moving. An ASLB hearing will be held to discuss whether or not the construction permit should be extended. The pile issue may be brought up at the hearing. Work is continuing on preparing the draft SER and preparing additional geotechnical questions not related to the pile issue. Mr. John Grendstron the lead reviewer for the Bailly Plant has now become a permanent employee within the Geotechnical Engineering Section. NRC is preparing an interagency agreement modification to include a full time pile driving expert on site during the pile driving activity. The personnel to handle this work is to be provided by the Chicago District due to the Detroit District's limited staff.

28 NOV 1980

NCSLD-T

SUBJECT: Interagency Agreement No. NRC-03-79-167, Bi-Monthly Letter

Amount of Funds Expended

Site	From 1 Sep 80 to 31 Oct 80	Cumulative
Midland	$ 15,863.76	$ 94,255.00
Bailly	8,617.50	61,699.96
	$ 24,481.50 .	$155,954.96

Total costs through FY 80 are Midland $88,066.12, Bailly $58,953.50, total $147,019.62. Modification No. 2, increasing funds to $204,000 was received on 25 Sep 80.

Problems Encountered or Anticipated

The four NRC spaces allotted to the District are good only thru FY 81. Recruitment of highly qualified personnel for only one year, or less, is nearly impossible. The work will then likely be completed with the present district staff. For the Midland project, an SER is to be completed by the end of February 1981. In terms of meeting the interagency agreement requirements, this document will be more than a draft but less than a final SER. With the document to be completed in February 1981, the draft will be considered to be complete and a significant portion of the final SER will be considered complete.

Progress Summary

Midland. Subtask No. 1 letter report is considered complete. Work on subtask 2, 3, and 4 to prepare the draft and final SER and prepare ASLB testimony is underway.

Bailly. Subtask No. 1 letter report is considered complete. Work on subtask 2, preparation of the draft SER is underway.

Plans for the Next Reporting Period 21 November 80 - 20 January 81

Midland. Interrogatories will continue to be prepared to be asked during the taking of depositions from the applicant and its consultants in preparation for the ASLB hearings resulting from the 6 December 79 show cause order. All depositions are to be completed by 23 January 1981. The District will hear key depositions as they are taken. The District will be preparing part of the testimony for the ASLB hearings. The content of the testimony is primarily the same as the content of the SER. The District will be working toward completion of a SER during this period too. The SER is to be complete by the end of February 1981.

28 NOV 1980

NCLED-T
SUBJECT: Interagency Agreement No. NRC-03-79-167, Bi-Monthly Letter

Bailly. Submit additional questions on geotechnical concerns other than the foundation pile issue. After an appropriate response is received from the applicant, work on the draft SER will continue.

General. By letter dated 2 October 1980, the District requested that all mail from NRC be directed to Mr. Neal A. Gehring in lieu of Mr. Lawhead. Mr. Lawhead is no longer directly involved in the NRC work efforts. By making this change, all correspondence will be handled faster.

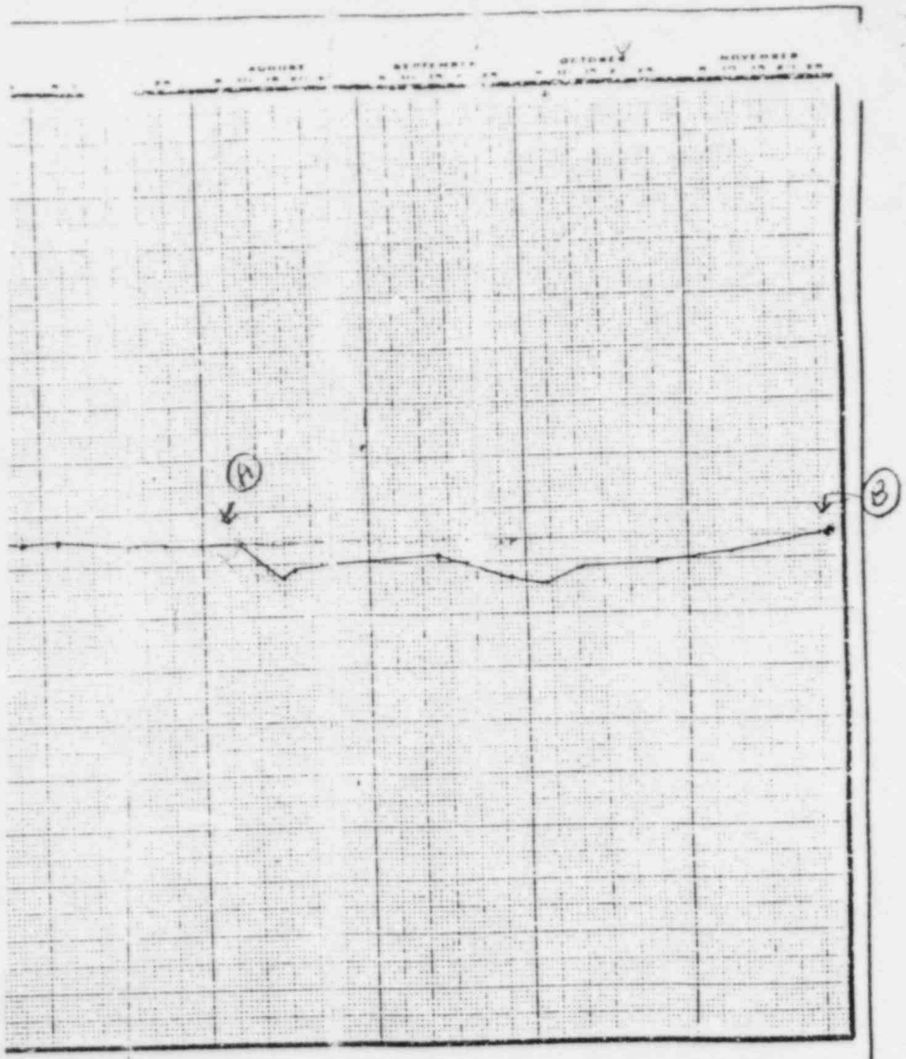
Sincerely,

for P. McCALLISTER
Chief, Engineering Division

Copy furnished:

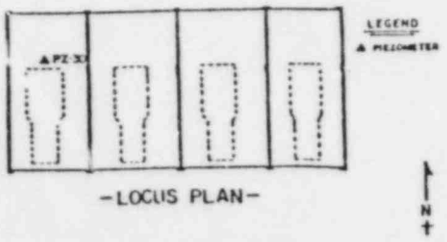
U.S Nuclear Regulatory Commission, Director, Division of Systems Safety, Washington, DC 20555, ATTN: D. L. Grenier

NCDED-G
Tech Br
Tech Br (GEHRING)
Tech Br (Geotech)



RATOR BUILDING

s TIME —



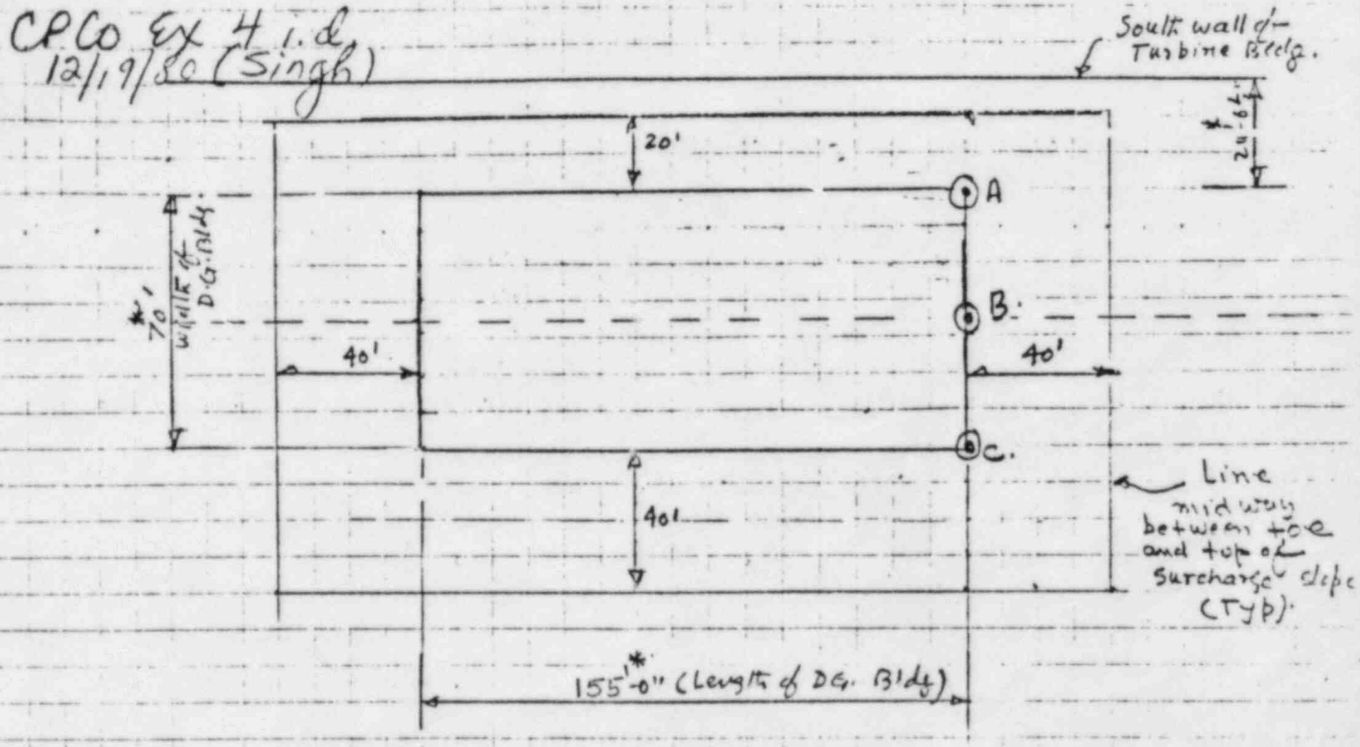
NOTE: PIEZOMETER ELEVATIONS ARE INITIAL ELEVATION OF CENTER OF OTTAWA SAND ZONE

PZ-30

CONSUMERS POWER C

[Hira Singh FE, checked by J Sreedharan 9-9-80 (corp' file) ①
Date - 9-8-80

CPCo Ex 4 i.d.
12/19/80 (Singh)

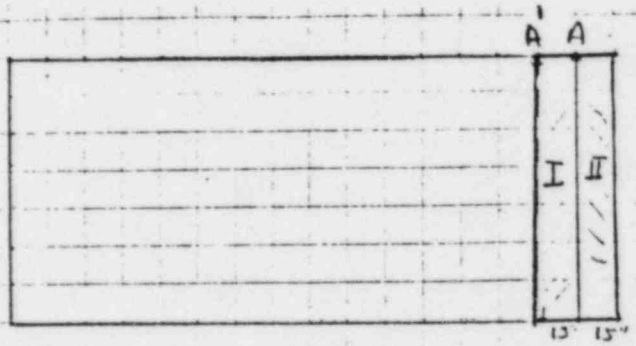


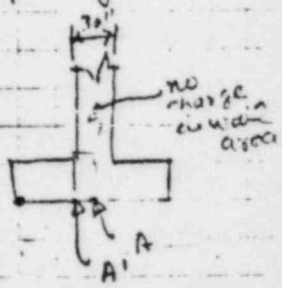
*- Dimensions for Length and breadth of D.G. Bldg and its distance from turbine building have been taken from Fig. 3.8-55 FSAR.

Determination of Pressure along the

By H.N. Singh PE, Checked by [illegible]
Date 9/8/80 9-9-80

Deduction due to wall thickness (no surcharge load in the areas occupied by walls)



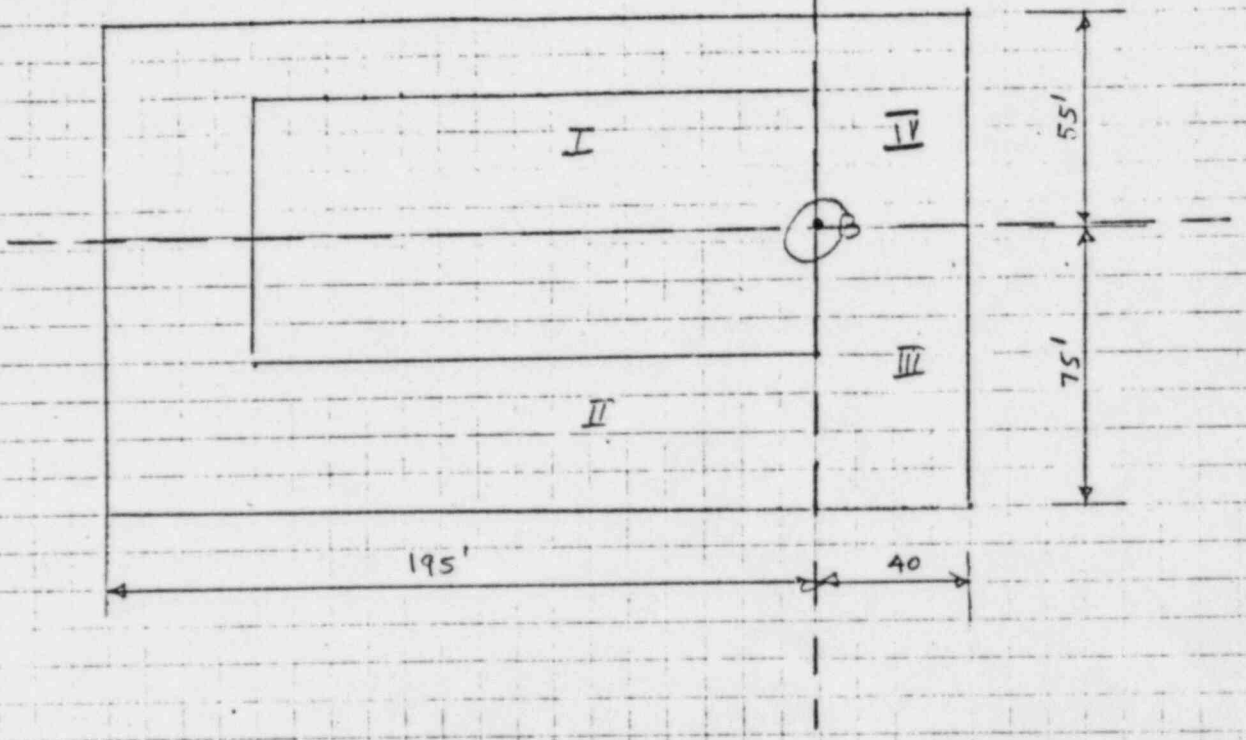


For I & II,
A = 70', B = 1.25'

H	m	n	C	Stress	Total for I & II
5'	14	.25	.076	0.17	- 0.34
10'	7	.175	.040	0.088	- 0.176
15'	4.67	.08	.032	0.071	- 0.142
20	3.5	.06	—	—	—
25	2.8	.05	—	—	—
28	2.5	.045	—	—	—

By H.H. Singh, P.E., Checked By - H.N.S.
Date - 9/5/80

Determine stresses at Point B.



for Region I
A = 195', B = 55'

H	m	n	Coeff	Stress
5'	39	11	0.25	0.55
10'	19.5	5.5	0.249	0.55

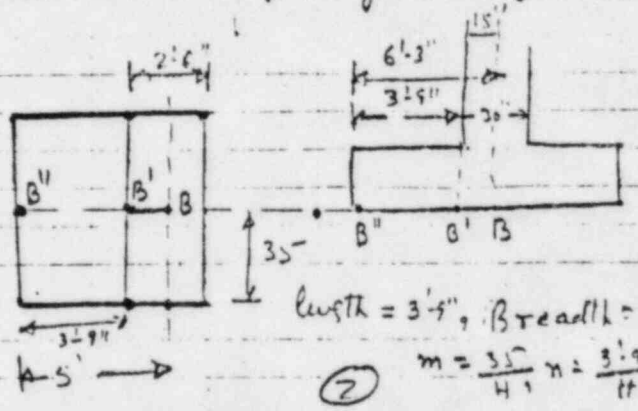
for Region III A = 40, B = 75

H	m	n	C	Stress
5	8	15	.25	0.55
10	4	7.5	.247	0.55

Date 9/5/60

Stresses at the toe of footing:-

There will be practically no change in stresses along the depth of fill below points located at mid point of and edge of footing due to surcharge load of 2.2 K.s.f. However, there will be considerable difference in duction for area of walls which is not occupied by surcharge.



length = 6'-3", Breadth = 35"

$m = \frac{35}{H}$, $n = \frac{6.25}{H}$

(1)

H	m	n	c	stress	2 x stress
5	7	1.25	.22	.48	.96
10	3.5	.625	.156	.34	.68
15	2.33	.42	.115	.25	.50
20	1.75	.31	.089	.20	.40
25	1.40	.25	.075	.165	.33
28	1.25	.22	.057	.125	.25

length = 3'-3", Breadth = 35"

$m = \frac{35}{H}$, $n = \frac{3'-9"}{H}$

(2)

H	m	n	c	stress	2 x st.
5'	7	.75	.178	.39	.78
10'	3.5	.375	.108	.24	.48
15'	2.33	.25	.076	.167	.33
20'	1.75	.19	.060	.132	.26
25'	1.40	.15	.045	.10	.20
28	1.25	.13	.038	.078	.154

net deduction

(1) − (2) = 5 = .18

10 = .20

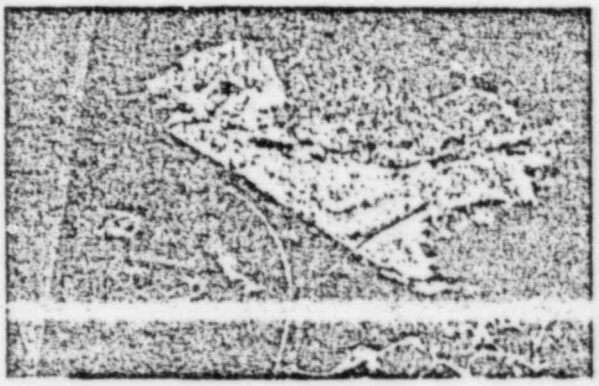
Runway extension at Mayport, Fla., grown up out of soft mud and muck of a reedy salt marsh.

Sand Over Muck

By CDR Richard L. Mann, CEC, USN

How 800,000 cubic yards of hydraulic fill, placed as a temporary surcharge to ten feet above final design grade, speeded up consolidation of a poor bearing soil underlying a runway extension at the Naval Auxiliary Landing Field, Mayport, Fla.

Mayport Auxiliary Landing Field, on the Atlantic Coast at the mouth of the St. Johns River, is a seaport satellite of the Naval Air Station, Jacksonville, Fla. Berthing facilities are under construction for CV-B class carriers, whose air groups will fly in and taxi to aprons at ship-side for loading aboard. As part of the scheme, BuAer requires that one of the old 4,150-foot runways be lengthened to 8,000 feet and strengthened to accommodate jet aircraft. The runway extension posed a problem, for the only practicable location was in a salt marsh covered with reeds and sedge and containing meandering tributaries of a tidal estuary. Beneath the vegetation was soft mud or muck to a depth of about ten feet. Because of this poor foundation condition, it was decided to conduct a careful investigation with the assistance of BuDock's Soil Mechanics Section.



Aerial shows early stages of hydraulic filling in the surcharge area

A plan view of the runway extension is shown on figure 1. Borings were taken by an engineering service contract, and undisturbed samples

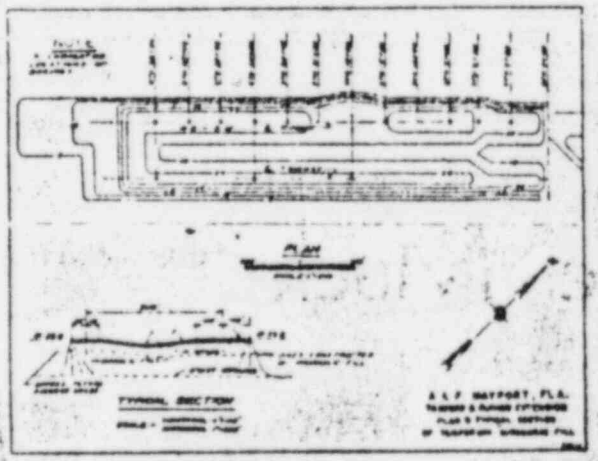
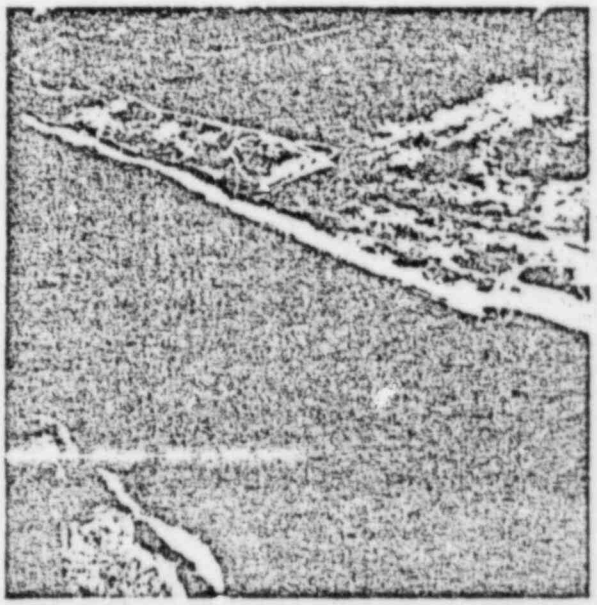


Figure 1.—Plan and typical section of temporary hydraulic fill to speed up consolidation.

were shipped to the Bureau for analysis and recommendations. As shown by the soil profile (fig. 2), the muck layer extended to a maximum depth of 14 feet below mean low water and was underlain for the most part by a good bearing stratum of silty sand and shell. The profile also shows an old dredge spoil area near the middle of the runway extension, which had already depressed the original marsh surface as much as 5 feet.

Laboratory examination of the soil samples disclosed that the material was a relatively homo-



Double-duty pipeline dredge clears carrier turning basin and at same time supplies fill for surcharge.

geneous OH organic clay (Casagrande classification) having high compressibility, an average in-place wet unit weight of 83 pounds per cubic foot and an average moisture content of 142 percent. In its natural state, it has negligible bearing value.

Consolidometer tests of the samples gave the settlement-time curves of figure 3, which were based on loading equivalent to that of the proposed permanent fill for the runway and taxiway extension. As is typical of all fine-grained, rela-

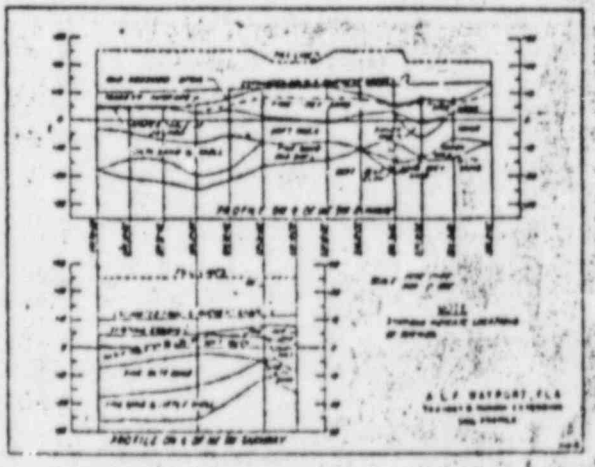


Figure 2.—Profile on center line of runway shows stable stratum of sand and shell under muck.

tively impervious soils, it took time to reach an equilibrium between the soil and an applied load. Initially, the excess load is carried by the water in the voids of the soil. The excess hydrostatic or "pore" pressure causes the pore water to flow away from the stressed zone. Gradually, the load is transferred to the soil grains, and consolidation takes place. Equilibrium is reached when all of the load is carried on the soil grains and none by pore pressure. The volume reduction is equal to the volume of water that escapes from the saturated soil.

It will be noted that the curves of figure 3 indicate a serious and fairly rapid settlement, reaching up to 14 inches and to about 50 percent of total settlement, in one year. After that, the curves tend to flatten out.

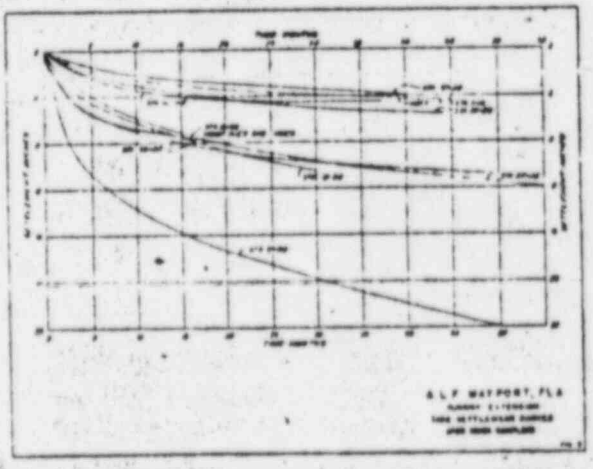


Figure 3.—Time-settlement curves for muck under proposed permanent fill show fairly rapid settlement of about 50 percent in first 12 months.

Several schemes for reducing or accelerating the settlement were studied. The Bureau first recommended reducing the settlement by excavating about half the depth of muck, thereafter allowing from 2 to 3 months for consolidation of the remainder under the load of the fill to be placed before constructing any pavement. Inasmuch as the speed of consolidation is inversely proportional to the square of the thickness of the layer undergoing consolidation, removal of half the thickness of muck would have increased the speed of settlement fourfold, and the flat part of the curve would have been reached in about 3 months.

A system of sand drain wells also undoubtedly would have reduced the settlement time satisfactorily. But in view of the relatively high unit cost of drilling and filling sand drains in a thin stratum, this method did not appear economical. The use of sand drains would have entailed a considerable delay because of the time required to prepare a new contract and mobilize the necessary specialized equipment. Furthermore, as a contract for dredging the nearby carrier turning basin had already been started under an earlier appropriation, it was desired to place all the available hydraulic fill in the runway extension area without interruption and payment of stand-by time for the dredge during installation of sand drains.

The Director of the Paving Inspection and Testing Division, Sixth Naval District Public Works Office, proposed that consideration be given to accelerating the consolidation of the muck layer by temporarily increasing the height of fill to be placed upon it. Studies indicated enough good material could be pumped in from the dredging project to provide the necessary permanent fill for the runway and taxiway extension, including shoulders, end zone, and a circumferential patrol road. By placing as much as possible of the available sand over the areas to be paved, a surcharge about ten feet above final design grade would be created. As the marsh elevation averaged about +4.5 feet above mean low water, and finished subgrade was to be about +15.0 feet, this scheme involved building a 20-foot fill (to elevation +25 feet) which would be graded back down to runway and taxiway elevation after consolidation. The surcharge would roughly double the pressure on the underlying muck, as compared with the load of the lower, permanent fill. This would almost double the settlement taking place within a given increment of time.

As an example, the curves plotted on figure 4 show the conditions for Station 6+50. Without the surcharge, the predicted settlement was 5½ inches at 5 months. With twice the load, 5½ inches of settlement would occur in only 1¼ months. Thus, by overloading with excess fill, the muck would become overconsolidated, with respect to the load of the final fill, within less than 3 months. At 2½ months, the accelerated curve

indicates a settlement of 8 inches, which is about the same as the ultimate settlement on the normal curve. Thus, if the surcharge were removed after 2½ months, bringing the area at this station to finished grade and paving, the muck thereafter would be fully consolidated and no further settlement would take place.

The success of the surcharge method would depend largely on the perviousness of the fill, in order that water expelled from the muck by the increased pore pressure might drain out readily. The fill material, consisting principally of fine and medium sand with varying proportions of shell, was sufficiently pervious to permit the drainage as intended. Considerable drainage would also be expected from the lower surface of the muck into the underlying sandy strata.

Comparative cost and time studies for the several methods indicated that consolidation by surcharge would prove the least expensive, not consume too much time, and would use the spoil materials to best advantage. Results of these studies were as follows:

(*a*) The scheme of removing half the muck, which at first appeared to offer the best solution, would have cost about $600,000, and taken 9 months' time before paving could begin.

(*b*) An alternate of the above scheme was considered whereby the suction dredge would suspend operations in the turning basin, cut its way up the slough, and pump out the muck. To retain flotation, the dredge would have had to remove all the muck, but on the other hand could do the job, including backfilling with sand from the river, in 4 to 5 months. Additional fill up to pavement subgrade could have been placed in another 3 months, and paving could have been started about 7 months after commencing operations. However, this procedure would have cost about $750,000.

(*c*) Sand drains would have cost in the neighborhood of $550,000 and taken 6 months for design, award of contract, and completion; 4 to 6 months more would have been consumed in final filling, waiting for settlement, and grading preparatory to paving.

(*d*) The estimated cost of consolidation by surcharge amounted to $107,000 for additional higher dikes to confine the fill to a more limited area, and $320,000 for the unloading or grading-down operation, a total of $427,000. Timewise, this method would require about 3 months to complete the fill, about 4 months for the settlement rate to reach a satisfactory value, and 2 months for unloading and grading to runway elevation; 9 months in all.

The Officer-in-Charge of Construction, Capt. W. T. Eckberg, CEC, USN, DPWO of the Sixth Naval District, directed that the surcharge method be employed, and a notice to proceed with the additional diking and increased height of fill over the runway and taxiway extension area was issued on 11 July 1951 to the Standard Dredging Co. as a change order under Contract NOy 23817 for dredging the carrier turning basin.

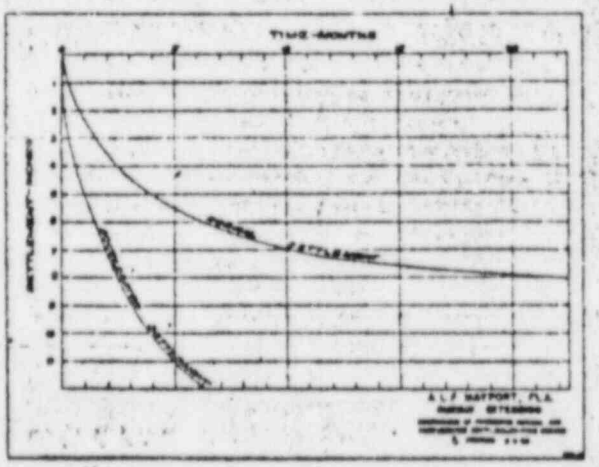


Figure 4.—Comparison of normal and accelerated settlement-time curves shows how surcharge would overconsolidate muck in less than 5 months.

The surcharge was completed on 30 September 1951. Settlement markers, consisting of 12-foot lengths of 1-inch pipe were driven into the fill at 12 locations. The tops of the pipe markers were set at elevation +26.0 feet. Survey crews were assigned to take periodic levels on the pipe markers, resulting in the actual settlement-time curves of figure 5.

Shortly after completion of the fill, many springs and rivulets developed at intervals along the toe of the slope on both sides. At some points the water "bleeding" out of the fill was dark brown or reddish in color, and gave forth an offensive odor. This seemed good evidence that water was

being expelled from the organic muck, as intended. There was no noticeable heaving or lateral displacement of the muck from beneath the edges of the fill.

By early January 1952, the springs at the toe of the slope had markedly diminished, and by the end of February they had ceased flowing altogether. According to level readings, the rate of subsidence had lessened considerably, and settlements had been reached which were in excess of the final settlements that would have occurred under the permanent load as shown in figure 3. As a check, additional borings were made and undisturbed samples sent to the Bureau's Soils Laboratory.

The boring logs disclosed that the muck layer had been compressed to roughly half its original thickness. The average wet unit weight had increased to 102 pounds per cubic foot and the moisture decreased to 67 percent.

The combined results of the changes in soil strata as disclosed by the final borings, and the changes in soil characteristics as computed from consolidometer tests, are illustrated for a typical location by figure 6, which was taken from the report prepared by the Bureau's Soil Mechanics Section. The comparison of the before-and-after borings clearly indicates the decrease in thickness of the muck stratum due to consolidation.

The right-hand portion of figure 6 shows the computed pressures within the soil as a function of depth for the surcharge condition and for the permanent load after removal of the surcharge. The circled "X" represents the "preconsolidation pressure" of the undisturbed sample taken at this station. The preconsolidation pressure is that pressure with which the soil sample has reached equilibrium, with the result that no pore pressure exists with the preconsolidation pressure acting. This pressure is estimated closely from voids—ratio vs. pressure curves plotted in the laboratory. In the case of this sample, the preconsolidation pressure is in excess of the pressure which will result from the completed runway fill. Therefore, no pore pressure would exist, no more water would be squeezed out of the voids, and the soil will carry the load without further consolidation.

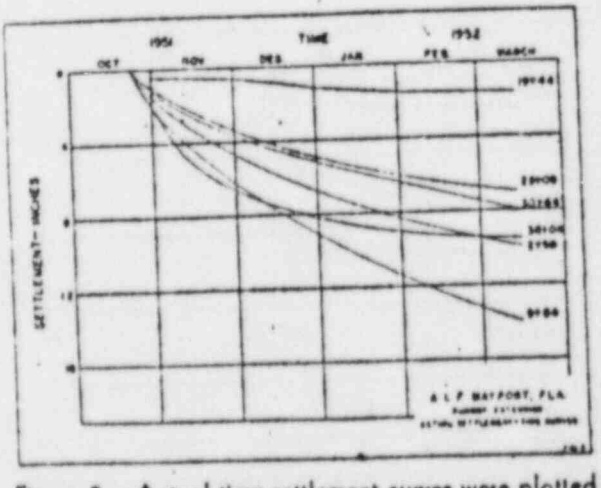


Figure 5.—Actual time-settlement curves were plotted from level readings on pipe markers.

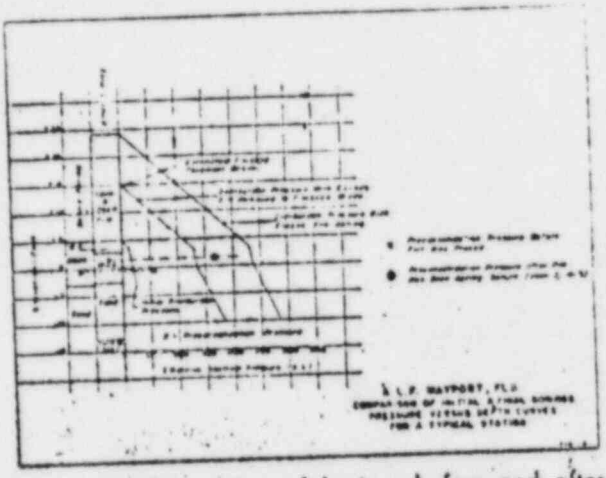


Figure 6.—Comparison of borings before and after filling shows decrease in muck thickness due to consolidation.

As the results of tests on the other samples were similar, it was definitely concluded by the Bureau that accelerated consolidation by means of the surcharge had taken place as predicted, and that it was safe to proceed with final grading and paving without danger of settlement and consequent pavement failure.

The foregoing is a good example of the successful application of soil mechanics to an unusual foundation problem arising in the field, and demonstrates that such problems may often be solved with facility if the Officer-in-Charge calls upon the services of the Bureau's Soil Mechanics Section.

FORMS DOCUMENT

CPCo Ex 6 id
12/19/80 (Singh)

CF Erickson/Otto
Singh

Attachment 3

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555
301-492-7000

FACSIMILE SERVICE REQUEST

DATE: 5/29/80

MESSAGE TO: Mr. Neil Gehring

TELECOPY NUMBER: 226-6412

AUTOMATIC: (Yes) No

VERIFICATION NUMBER 226-6413

NO. OF PAGES 4 PLUS INSTRUCTION SHEET

STATE & CITY Mich., Detroit

MESSAGE FROM: J. D. Kane

TELECOPY NUMBER 492-8110 RAPIFAX AUTOMATIC

492-7617 2M VRC AUTOMATIC

VERIFICATION NUMBER 492-7371

5/29/80
Kane

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

DRAFT

MEMORANDUM FOR: A. Schwencer, Acting Chief
Licensing Branch No. 3, DL

FROM: George Lear, Chief
Hydrologic and Geotechnical Engineering Branch, DE

SUBJECT: REQUEST FOR ADDITIONAL FIELD EXPLORATIONS AND INFORMATION

PLANT NAME: Midland Plants, Units 1 and 2
LICENSING STAGE: Post CP
DOCKET NUMBERS: 50-329/330
RESPONSIBLE BRANCH: LB No. 3; D. Hood, PM
REQUESTED COMPLETION DATE: N/A
REVIEW STATUS: Continuing

The Consultant to NRC Geotechnical Engineering Section, the U. S. Army Corps of Engineers, Detroit District, has requested additional borings and soil data to permit verification of Consumers Power Company (CPCo) computations and conclusions concerning the plant fill settlement problem and foundation design. This request was initially submitted by P. McCallister, Chief, Engineering Division to Dr. Robert E. Jackson, DSS, by letter dated 27 March 1980 and later revised in letter of 16 April 1980. We have enclosed a copy of this later letter as Enclosure 2.

We have modified the Corps request for information since several of the items have been provided in more recent submittals from CPCo. In addition, we have attempted to condense the Corps request into the customary format used by NRC in identifying and asking questions and taking staff positions since this procedure has definite advantages in evaluating the applicant's responses. The contents of Enclosure 1 have been coordinated with and concurred in by the Corps.

We request that Enclosure 1 be submitted now to CPCo to permit their planning of the required subsurface exploration program. We recommend that the explorations do not physically begin until CPCo has received and absorbed an Interim Report from the Corps. Receipt of this Interim Report from the Corps is expected by June 6, 1980. This report will detail the required geotechnical engineering studies that are to be based on the field and laboratory test results on soil samples to be recovered in the requested exploration program.

This memorandum and Enclosure 1 was prepared by J. D. Kane, GES, HGEB, DE.

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

cc: See next page.

MIDLAND PLANT - UNITS 1 AND 2
CONSUMERS POWER COMPANY
DOCKET NO. 50-329/330
QUESTIONS AND POSITIONS-GEOTECHNICAL ENGINEERING
PREPARED BY: J. D. Kane, GES, HGEB
from the review comments of
the U. S. Army Corps of Engineers,
Detroit District

362.18 (Quest. 24) Provide the boring logs for the following explorations:

a. Pull down holes PD-1 thru PD-27 (35 holes that include 8A, 20A, 20B, 20C, 15A, 15B, 15C, and 27A)
b. LOW-1 thru LOW-13 (13 holes)
c. TW-1 thru TW-3 and PZ-1 thru PZ-48 (53 holes)
d. OW-1 thru OW-3 (3 holes)
e. TEW-1 thru TEW-7 Q-1 thru Q-12 (19 holes)

The logs should include date and method of drilling, the type and location of samples attempted. Also please provide the locations, boring logs and available test data of any exploration completed in 1979 and 1980 but has not yet been submitted.

362.19 (RSP) (Quest. 5 & 35) The refusal of the Applicant in previous responses to Questions 5 and 35 to complete additional explorations, sampling and laboratory testing following the preload program is unacceptable to the staff. We require that CPCo complete as a minimum, the exploration and testing program indicated on Table Q 362.19-1. Several reasons for not accepting the Applicant's previous responses include:

a. We do not agree that the preload program as completed on the heterogeneous materials which were placed as structural fill is an improvement or would necessarily produce foundation soils of more uniform engineering properties than if the material had been properly compacted to the original requirement established in the PSAR.

b. We feel it is prudent to independently verify the predictions of future settlement and the conclusions of the preload program which was complicated by the simultaneous raising of the cooling pond reservoir. In addition, an estimate of total and differential settlement is still required for involved structures following drawdown under the proposed permanent dewatering system.

362.20 Provide a discussion that addresses whether there are seismic safety-related piping and conduit connections with other structures such as the Radwaste Building and Turbine Building which have also been constructed on the plant fill now experiencing the settlement problem.

Encl. 1

Tabel Q 362.19-1

Request for Additional Explorations, Sampling and Testing

Location [1]	Depth [2]	Sampling [3]	Lab Testing [4]	Anticipated Geotechnical Engineering Studies to be Required [6]
Diesel Generator Building	Thru fill and a minimum of 5' into natural glacial till soils	Classify samples according to Unified Soils Classification System	For cohesive soils C-D (Consolidated-Drained) C-U (Consolidated-Undrained) Consolidation [5] For sands Drained Direct Shear on both loose & dense specimens Relative Density	Bearing Capacity Settlement
ervice Water Pump tructure and Retaining Walls xiliary Building	Same as above	Same as above	Same as above except consolidation testing would be limited to samples in retaining wall foundation.	Pile and Caisson Foundation Design (Vertical and Lateral Load Support) Retaining Wall Stability & Settlement.
Cooling Pond Embankments	Extend thru fill and a minimum of 5' into natural residual soils except hole no. 5 which should extend to bottom elevation of cooling pond.	Same as above	For cohesive soils C-D (Consolidated-Drained) C-U (Consolidated-Undrained)	Slope Stability

NOTES: See next page.

NOTES:

1/ See attached Fig. Q 362.19-1 for approximate boring location. Holes to be accurately located in the field to avoid obstructions, underground piping and conduits and slurry trench area.

2/ No boring is to be terminated in loose or soft soils.

3/ Continuous split spoon sampling using SPT is required. Holes are to be held open ~~while sampling~~ using either casing or hollow stem auger. Additional borings to obtain representative undisturbed samples for detailed laboratory testing should be located at the completion and evaluation of the split spoon sampling program. The groundwater level should be recorded at the completion of drilling in all borings once the level has stabilized.

4/ Normal classification (e.g., gradation, Atterberg Limits) unit weight and moisture content testing to be performed on representative samples from each significant foundation layer. This column pertains to lab testing in addition to the above mentioned tests. It is requested that at least one week notice be provided to the NRC before opening undisturbed samples to permit on site visual observation by Corps of Engineer representative.

5/ The maximum load should be great enough to establish the straight-line portion of the void ratio-pressure curve.

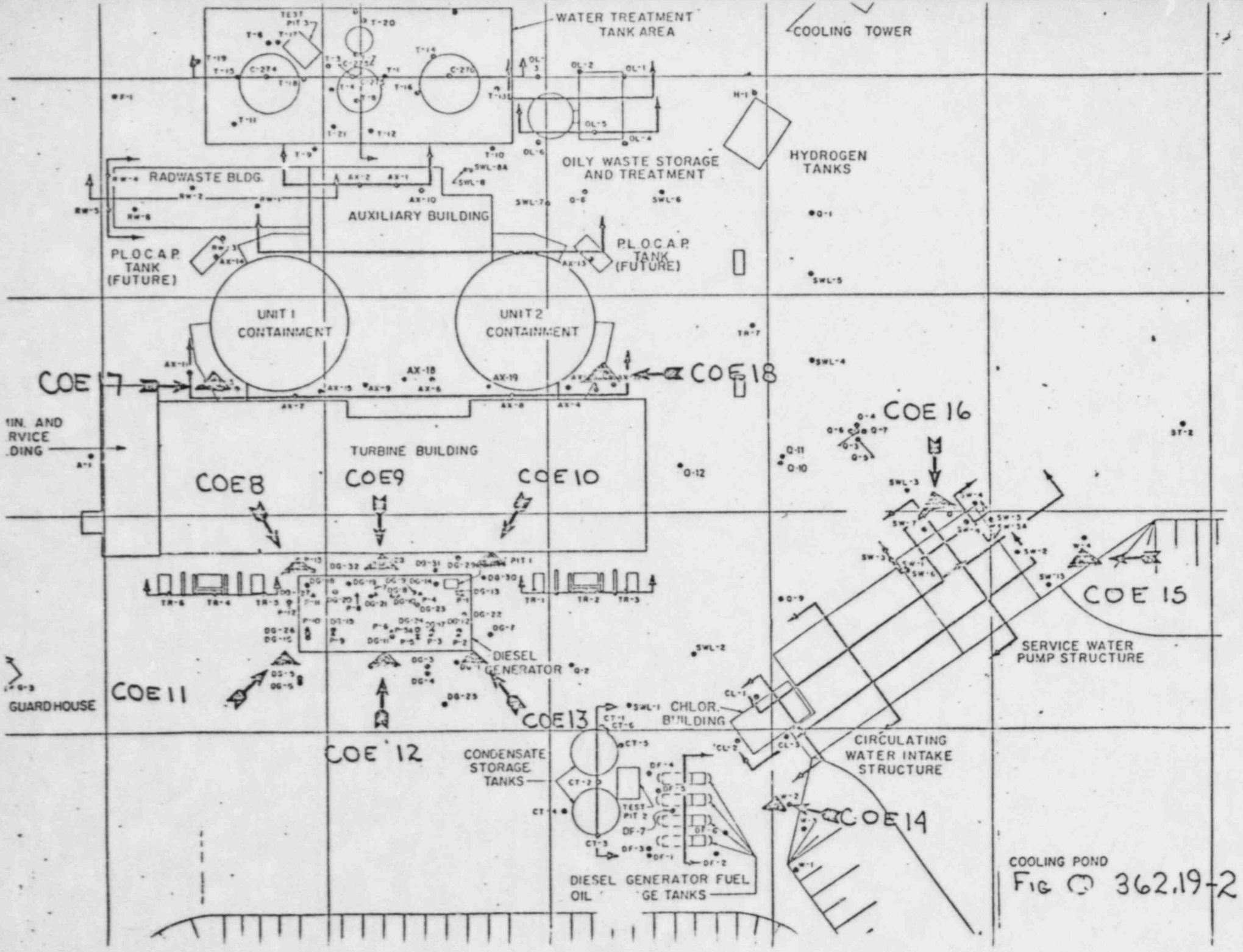

WATER TREATMENT TANK AREA
COOLING TOWER
OILY WASTE STORAGE AND TREATMENT
HYDROGEN TANKS
RADWASTE BLDG.
AUXILIARY BUILDING
PLOCAP TANK (FUTURE)
PLOCAP TANK (FUTURE)
UNIT 1 CONTAINMENT
UNIT 2 CONTAINMENT
COE 7
COE 18
COE 16
TURBINE BUILDING
COE 8
COE 9
COE 10
COE 15
SERVICE WATER PUMP STRUCTURE
DIESEL GENERATOR
COE 11
GUARD HOUSE
COE 13
CHLOR. BUILDING
COE 12
CONDENSATE STORAGE TANKS
CIRCULATING WATER INTAKE STRUCTURE
COE 14
DIESEL GENERATOR FUEL OIL GE TANKS
COOLING POND

FIG 362.19-2

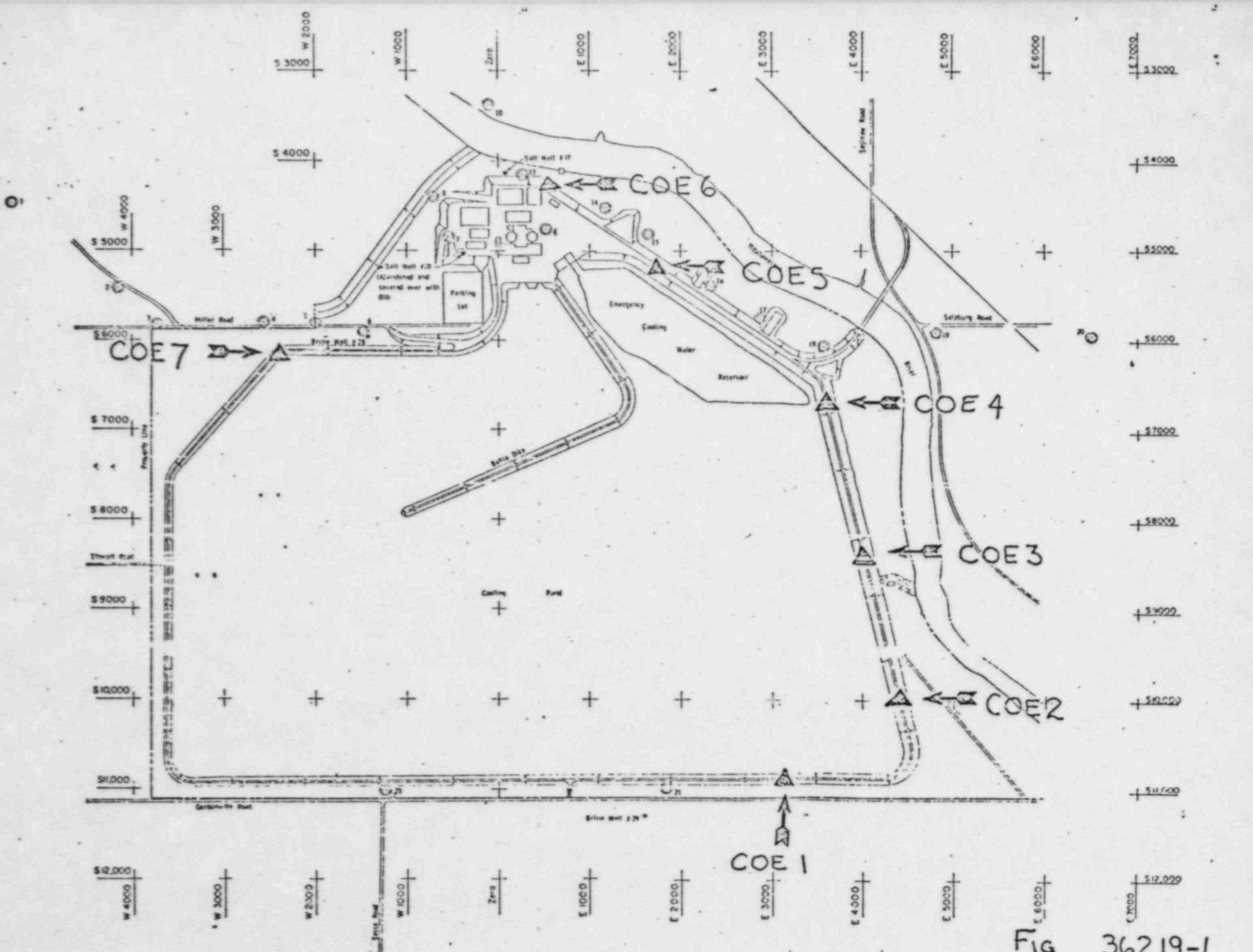

COE 6
COE 5
COE 4
COE 3
COE 2
COE 1
COE 7
Miller Road
Salt Well #17
Salt Well #10 (Cordoned and covered over with fill)
Parking Lot
Emergency Cooling Water Reservoir
Baffle Dike
Cooling Pond
Saginaw Road
Salzburg Road
Property Line
Gordonville Road
Brine Well #23
Brine Well #29
Stuart Road
Zero
W 1000
W 2000
W 3000
W 4000
E 1000
E 2000
E 3000
E 4000
E 5000
E 6000
E 7000
S 3000
S 4000
S 5000
S 6000
S 7000
S 8000
S 9000
S 10,000
S 11,000
S 12,000

Fig 362.19-1

NCEED-T

SUBJECT: NRC Midland Project, Request for Additional Borings and Existing Soil Data - Revision No. 1

U.S. Nuclear Regulatory Commission
Dr. Robert L. Jackson
Division of Systems Safety
Mail Stop P-314
Washington, D.C. 20555

Dear Dr. Jackson:

Inclosure 1 to our letter of 27 March 1980 has been revised and attached hereto. The two maps provided indicating boring locations remain unchanged.

FOR THE DISTRICT ENGINEER

1 Incl
As stated

Copy furnished:
NCDED-G

INCLOSURE 1

1. It is requested that the applicant furnish the boring logs listed below indicating when and how these were taken, the type of sampling, and samples taken:

Pull down holes PD-1 thru PD-27* (35 holes)
LOW-1 thru LOW-13 & W-1 thru W-4 (18 Holes)
TW-1 thru TW-5 & PZ-1 thru PZ-48 (53 holes)
OW-1 thru OW-3 & CL-1 thru CL-6 (8 holes)
TEW-1 thru TEW-7 & Q-1 thru Q-12 (19 holes)
*Includes 6A, 20A, 20B, 20C, 15A, 15B, 15C, & 27A.

what document do Appear in Request. will

2. Locations, boring logs and test data from any other drill holes taken in 1979 and 1980 are also requested.

3. Dutch cone penetrometer data from holes P-1 thru P-13 must also be provided. lookup what doc in later

4. Information is requested on all piezometers that were installed to monitor problems related to plant fill. The information should include the number and location, the time of installation, the type of filter around the piezometer, the installed depth, and the type of piezometer. Maybe have in Rev 6 4&5

5. All piezometer readings for each installation with dates and times are required.

6. The data and information requested in paragraphs 1 thru 5 above is needed to verify the applicant's computations and conclusions and to make any needed computations for the dewatering analysis, the seismic analysis and the settlement analysis.

7. A need exists for additional borings, since random exploratory borings throughout the plant site have revealed pockets of soft clay subject to settlement and or consolidation and loose sands subject to liquefaction. A need also exists to check the results of the proposed remedial measures of surcharge loading at the Diesel Generator Building and the dewatering plan.

a. In the case of the Diesel Generator Building, check borings must be made in the vicinity of borings which identified low "N" values in the clay and sand fill. The proposed borings shall be carried into the glacial till and all samples, including those in the glacial till, treated as indicated below.

will go with ... analysis

(2) what ... when get results

2517

(1) N. Borings. After surcharge? — will look later

of NRC question. look #5 & 35

The boring locations are as indicated on the attached map. All soil for the full depth of the borings shall be classified according to the Unified Soil Classification System. Any tests necessary to classify the soil shall be accomplished. Unit weight and moisture content of all samples should also be determined. The samples obtained from any cohesive strata shall be tested. The tests for cohesive material shall be a consolidation drained and undrained triaxial shear tests (R&S) and a consolidation test with restraining-load equal to the load in-place at the strata depth the sample represents. The sands shall be tested in direct shear for a loose and dense condition and the relative density of the sand in situ determined.

b. Where piling or caissons are proposed to underpin the Service Water Building and Auxiliary Building - feed water valve pits which are located on fill, the load bearing capacity of the bearing strata must be determined. The capability to resist lateral shearing stresses that could be induced in low "N" value soil subjected to seismic action must also be determined. The same tests required for soil samples obtained from the new borings at the Diesel Generator Building shall also be made on soil samples from new borings for these buildings.

c. The questionable site area fill may have a counterpart in the cooling pond embankment which was constructed contemporaneously with the site fill. It is requested that exploratory continuous drive borings be taken at a number of points along the north and east embankments, omitting the slurry trench cutoff areas which are positively sealed. The approximate boring locations are as indicated on the attached map of the cooling pond. Upon completion of drive boring a second undisturbed boring shall be made adjacent to the disturbed boring to sample cohesive soils. The tests on the soil samples obtained from the borings in the embankments shall include the following tests, consolidated, drained triaxial shear tests, (cohesive samples) Atterberg limits and all soils classified according to the Unified Soil Classification System. The drive borings shall be continuously sampled using a standard split spoon sampler. The hole shall be held open using a hollow stem auger or casing. Particular attention shall be paid to ground water conditions during and after completion of drilling. In the case of Hole 5, the boring should be drilled to the depth of the cooling pond bottom while the remaining borings need penetrate only 5 feet into underlying residual soils unless soft ground indicates a need for further hole penetration.

8. Summary of Requested Drilling

a. Diesel Generator Building - 4-6 holes around the perimeter of the building. Samples of all strata from ground surface into the glacial till (holes 8-13). Include downhole, crosshole and surface geophysical tests to establish insitu compression and shear moduli for floor response spectra design check mentioned on pg. 10 & VII-4 of Interim SER.

b. Auxiliary Building - Take two borings around the proposed support piling or caisson for remedial grouting of loose sands and soft clays adjacent to pile or caisson to stiffen piles and adjoining ground against lateral loading. Borings need to penetrate to glacial till. (see attached map for boring locations - Holes 4 & 5.)

c. Service Water Building - A boring (hole 16) shall be made as indicated on the attached map to and into the glacial till. All samples obtained shall be classified according to the Unified Soil Classification System also consolidation, drained and undrained triaxial compression tests made on cohesive soil samples and direct shears for a loose and dense condition shall be made on all granular soil samples, as specified in paragraph 7a.

d. Plant Area Borings - If feasible some borings should be taken under the Radwaste and Turbine Buildings to determine if unwatered pockets exist or persist. Suggested boring locations would be as indicated on the attached map. Further investigation could be needed after the results of these borings are obtained. No borings presently exist in these areas. The borings should be cased or hollow stem auger borings with drive samples every 2-1/2 feet through the fill. The holes should be converted to dewatering holes or used for piezometers (Holes 1, 2, 3, 6 & 7).

e. The site visit of 27 or 28 February 1980 turned up two differential settlement points on the retaining wall adjacent to the Service Water Pump Structure. Two borings, Holes 14 and 15 as indicated on the attached map shall be taken to investigate this problem. Tests required are consolidation tests, triaxial compression tests, Atterberg limits and gradation tests made on cohesive soils, and direct shear for loose and dense conditions and gradation tests made on granular soils.

f. In all new borings made, the water table shall be determined.

R

Staff Ex = 1 12-17-80

BECHTEL POWER CORPORATION - PERSONAL RESUME

NAME BIMALENDU (BIMAL) DHAR DATE August 1979

CLASSIFICATION Engineering Supervisor (Group Supervisor)

ORGANIZATION & LOCATION SFPD

Ann Arbor BIRTH DATE 8/19/36

ORIGINAL BECHTEL EMPLOYMENT DATE 7/2/73

RE-EMPLOYMENT DATE(S) N/A

NAME OF SPOUSE Gita

CHILDREN'S BIRTH DATES N/A

PHOTO DATE _____ MILITARY SERVICE & RANK None

PROFESSIONAL LICENSES AND SOCIETIES

Registered Professional Engineer, State of Michigan
Member, Institution of Civil Engineers, London

EDUCATION AND PERSONNEL DEVELOPMENT PROGRAMS

DEGREE, CERTIFICATE, ETC.	SCHOOL	MAJOR (OR SUBJECT)	DATE
	University of Calcutta, India	Civil Engineering	1958
Post Graduate	University of Leeds, England	Concrete & Structures	1963
—	Bechtel	BMC	Currently Enrolled

OTHER SIGNIFICANT INFORMATION

PERSONAL & FAMILY:

SPECIAL INTERESTS:

LANGUAGE CAPABILITY:

ACHIEVEMENTS:

ASPIRATIONS:

MEMBERSHIPS:

Task Force member for preparation of Design Guide C-2.35 - Support for RCS systems (Initial Issue)

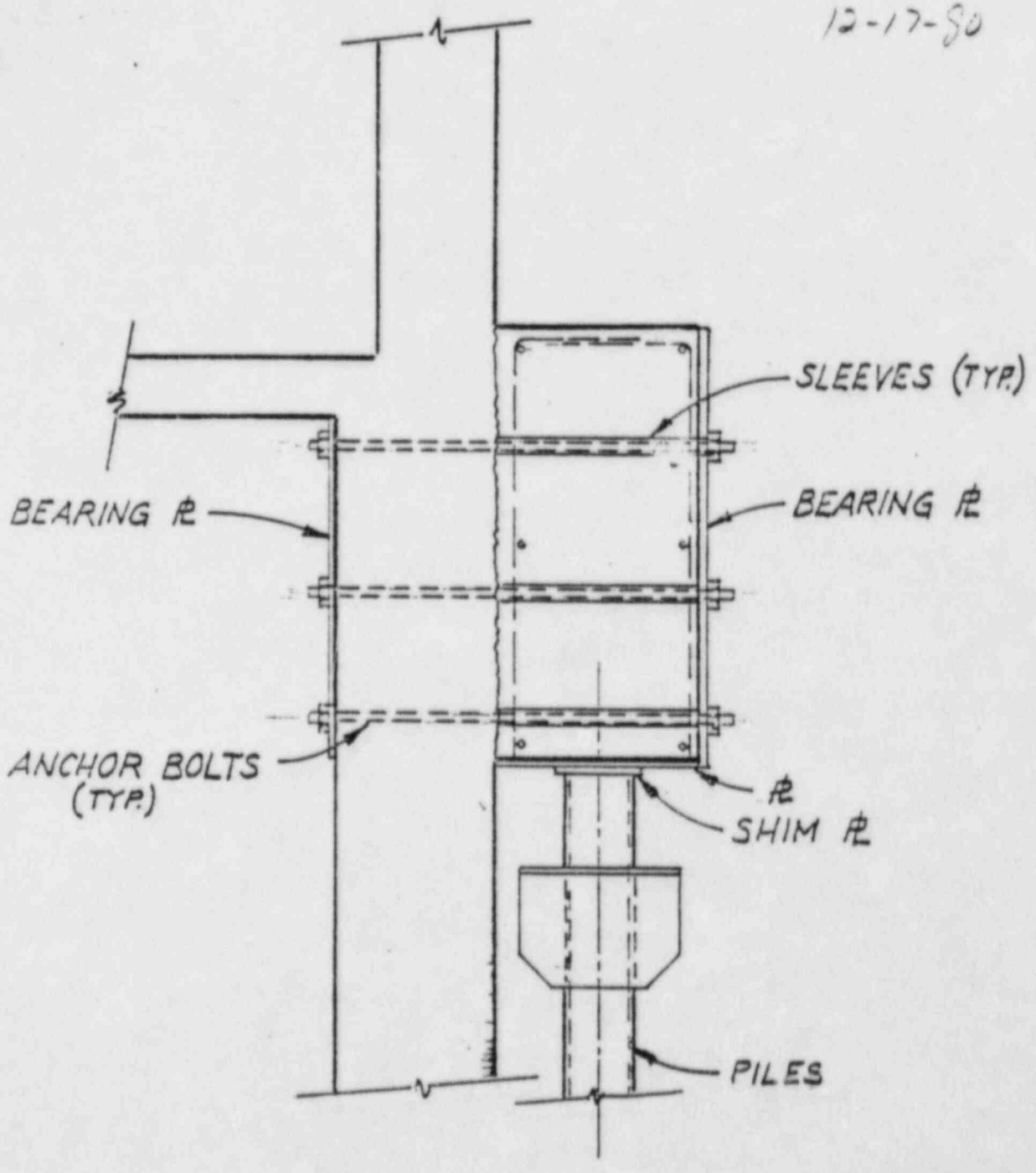
Containment Committee Member - 1977 and 1978

WORK HISTORY

DATES FROM	TO	COMPANY, DIVISION, OR DEPARTMENT: LOCATION AND SUPERIOR	POSITION HELD, SUMMARY OF RESPONSIBILITIES, AND SIGNIFICANT ACCOMPLISHMENTS
1/67	12/70	Engineers India Ltd. New Delhi, India S.K.N.S. Dixit	Senior Engineer: analysis and design of structures for a lube oil plant from initial stages till completion.
3/71	6/73	Sargent & Lundy Structural Eng. Dept. Chicago, Ill H. H. Shah	Engineer: analysis of structures for normal and abnormal load. Remedial action to coal bunkers to correct local failures in their components. Report evaluating effect of aircraft impact and pipe break o/s containment on category I structures for Zion Nuclear Station. Report evaluating the forces due to seismic event for LaSalle & Bailly Nuclear Stations. Assisted in preparing design guides for coal bunkers.
7/73	10/74	Bechtel Power Corporation Ann Arbor, MI J. Isted	Senior Engineer: responsible for design of containment internal structures for Quanicasse and later Midland plant. Checking calculations of base slab for containment - Grand Gulf Nuclear Station. Preparation of Design Guide C-2.35.
11/74	5/75	J. Hink	
6/75	11/75	Bechtel Power Corporation San Francisco, CA M. Lin	Senior Engineer: responsible for the design of pipe anchors for FFTF project.
11/75	10/76	Bechtel Power Corporation Ann Arbor, MI G. Tuveson	Senior Engineer: responsible for restraints and jet barriers for RCS piping for Midland plant.
11/76	7/78	" "	Engineering Supervisor: group leader for containment building, Midland plant. Responsible for pipe whip restraints, NSSS re-analysis and coordination of internal structures and construction support. During this period significant part of containment exterior and interior structures were constructed and NSSS were set.
8/78	6/79	" "	Engineering Supervisor: deputy group supervisor and civil task force member for resolution of soil compaction problems for Midland plant. Took part in investigation and definition of problem, development of remedial actions. Interfacing with client, consultants and NRC for technical discussion and presentation. Helped group supervisor by performing specific assignments to resolve problems.
7/79	Present	R.L.Castleberry/L.Curtis	Engineering Supervisor: group supervisor (Civil), responsible for Civil/Structural work for the Midland plant.

REDUCE CAPACITY OF A-540 BOLTS (T.S.=165^{K}) BY 25% TO ACCOUNT FOR STEEL RELAXING, CONCRETE CREEP AND ELASTIC SHORTENING.

D.L.S. D.A.H.C
12-17-80



DETAIL (1)

From Applicant Inspection Documents

Teletype Message

TYPE DOUBLE SPACE · BE BRIEF

10/19/79

2X3 2HAR-12=D S)

MESSAGE NUMBER	OPR. INL.	DATE/TIME

DBG	TELTEX	TWX	TELEX	OTHER

CHECK APPROPRIATE BOX: Night Ltr: | Full Rate: | Report Delivery: YES | NO

CHARGE ACCT. CODE: 7220-001

NUMBER TO BE CALLED 810-266-9497

MESSAGE ADDRESSED TO

ADDRESSEE	ADDRESS	LOCATION (CITY, STATE OR COUNTRY)
BECHTEL POWER CORP	3500 E. MILLER ROAD	MIDLAND, MI 48640
ATTN: L.E. DAVIS		

GEOTECH ANN ARBOR DISTRIBUTION

	BISC	ACT	INFO	W/A	W/T
MGR			1		
ADMIN					
DAFT					
SOILS			2		
CAW			3		
DRS			4		
[redacted]					
Proj Mgr					
Proj Engr					
JOB 7220 FILE 3410					
REC'D					

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

Page 1

BEBC- 3344

SUBJECT: CPCO/MIDLAND PLANT - JOB 7220

DIESEL GENERATOR BUILDING WORK RESUMPTION

FILE: 0274, C-2645

RE: 1) BCBE-2493R, 8/29/79

2) DRAWING M-167

IN CONJUNCTION WITH THE EXCAVATION BETWEEN THE TURBINE BUILDING AND THE DIESEL GENERATOR BUILDING TO REMOVE THE TEMPORARY TIE RODS, THE BURIED PIPE APPROXIMATELY 2 FEET BELOW THE TIE RODS SHOULD BE REBEDDED AND THE CONDENSATE LINES SHOULD BE REWELDED.

1) THE RESULTS OF THE YARD PIPE ANALYSIS HAVE NOT BEEN FINALIZED BUT BECAUSE THE EXCAVATION WILL BE MADE, THE LARGE (21-INCH) DEVIATION FROM THE DESIGN ELEVATION SHOULD BE CORRECTED. THE FOLLOWING PIPES SHALL BE REBEDDED:

8"-1HBC-81	FROM S 5062/E 210	TO S 5044/E 349
8"-1HBC-82	FROM S 5062/E 212	TO S 5055/E 344
10"-0HBC-28	FROM S 5055/E 344	TO S 5104/E 370
4"-0JBD-739	FROM S 5046/E 226	TO S 5060/E 347

COPIES TO:

SIGNATURE	LOCATION & EXT:	ORGANIZATION CODE:

AQ-17-1

ORIGINAL TO TELETYPE

8501337

Ann Arbor Area Office

Teletype Message

TYPE DOUBLE SPACE • BE BRIEF

TELETYPE USE ONLY				
MESSAGE NUMBER		OPR. INL.		DATE/L
CBG	TELTEX	TWX	TELEX	OTHER

CHECK APPROPRIATE BOX: Night Ltr: | Full Rate: | Report Delivery: YES | NO

CHARGE ACCT. CODE:

NUMBER TO BE CALLED

MESSAGE ADDRESSED TO	ADDRESSEE	ADDRESS	LOCATION (CITY, STATE OR COUNTRY)
	Page 2 of 3		

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

LINES 8"-1HBC-81 AND 8"-1HBC-82 SHALL BE REBEDDED TO PASS THROUGH THE CENTER OF THE EXISTING DIESEL GENERATOR BUILDING PENETRATIONS AND HAVE CONSTANT SLOPES ALONG THEIR LENGTHS TO THE EXISTING ELEVATIONS OF THE OTHER END POINTS SPECIFIED ABOVE. LINES 10"-0HBC-28 AND 4"-0JBD-739 SHALL BE REBEDDED WITH A CONSTANT SLOPE BETWEEN THE EXISTING ELEVATIONS OF THE POINTS SPECIFIED ABOVE.

LINES 3"-2JDD-537 AND 8"-2HBC-311 SHALL BE CUT FREE FROM THE ABOVE PIPES TO RELIEVE STRESS AND SHALL BE REWELDED AFTER THE LINES ARE REBEDDED.

THE ABOVE LINES SHALL BE SURVEYED BY OPTICAL MEANS BY RECORDING THE TOP OF PIPE ELEVATIONS AT 10-FOOT INTERVALS PRIOR TO DISTURBING THE LINES AND AGAIN AFTER THE LINES ARE REBEDDED. PROVISIONS SHALL BE MADE TO ALLOW RESURVEYING OF 8"-1HBC-81 AT 20'C/C (SEE DRAWING C-1146, NOTE 2). READINGS SHALL BE TAKEN AT 2-WEEK INTERVALS DURING DEWATERING.

REFERENCE 2 WILL BE REVISED TO REFLECT AS-BUILT CONDITIONS.

TO:

DATE	SIGNATURE	LOCATION & EXT:	ORGANIZATION CODE:
			SB 01338

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)
	Page 3 of 3		

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

2) IN ADDITION TO THE ABOVE, THE FOLLOWING CONDENSATE LINES WHICH WERE CUT PREVIOUSLY SHALL BE REWELDED AT THE TURBINE BUILDING:

6"-1HCD-513 20"-1HCD-169

6"-2HCD-513 20"-2HCD-169

L.H. CURTIS

DR
DR/sg

COPIES TO: S. AFIFI, J. BUTTS (FIELD), A. BOOS (FIELD), L. CURTIS, J. DARBY (FIELD), R. DHAR, R.C. MCCONNELL, R. TULLOCH, COM LOG

DATE	SIGNATURE	LOCATION & EXT:	ORGANIZATION CODE
10/19/79	for L.H. CURTIS	6A 2320	38-01339

SX 4 DFTR
12-17-80

CALCULATION COVER SHEET

PROJECT Midland Plant JOB NO. 7220 DISCIPLINE Civil

SUBJECT Calculation of Subgrade Modulus for Long Buried Structures FILE NO. 1-5

CALC NO. Q-105-A

ORIGINATOR D. Reeves DATE 12-11-80

CHECKER _____ DATE _____ NO. OF SHEETS 5

RECORD OF ISSUES

NO.	DESCRIPTION	BY	DATE	CHKD	DATE	APPRD	DATE	DATE FILMED
1	Issued for Verification of Technique by Geotech	DR	12-11-80					

PRELIMINARY CALC ☐ COMMITTED PRELIMINARY DESIGN CALC ☐
SUPERSEDED CALC ☐ FINAL CALC ☒

COMPUTER PROGRAM

NUMBER N/A

ACRONYM _____

VERSION _____

VERIFIED Yes ☐ No ☐

If no, separate verification attached ☐

References:

1. Iqbal, M.A., and Goodling, E.C., Jr, "Seismic Design of Buried Piping," 2nd ASCE specialty Conference on Structural Design of Nuclear Plant Facilities, at New Orleans, Louisiana, Dec 8-10, 1975.
2. Seed, H.B., and Idriss, I.M., "Soil Moduli and Damping Factors for Dynamic Response Analyses," Report No. EERC 70-10, University of California, Earthquake Engineering Research Center, Berkeley, Dec. 1970.
3. Civil Calc Q-102, Rev 0
4. BC-TOP-4A, Rev 3 and BC-TOP-4, Rev 4
5. Civil Design Criteria, Standard C-501, Rev 11

CALCULATION SHEET

CALC. NO. 0-105-A REV. NO. 0

ORIGINATOR D. Reeves DATE 12-11-80 CHECKED _____ DATE _____

PROJECT Midland JOB NO. 7220

SUBJECT Subgrade Modulus SHEET NO. 1

Calculation of Modulus of Subgrade Reaction for Long Buried Structures

The subgrade modulus for a buried pipe or duct bank to be used in the seismic analysis as described in BC-TOP-4, Section 6.0 is calculated by the method presented in Reference 1.

$G_o = \rho C_s^2$ — G_o = Soil shear modulus at low shear strain ($\gamma_o = 10^{-4}$ %)

ρ = soil density

C_s = Shear wave velocity of soil layer under consideration

Reference 1 - "Seismic Design of Buried Piping", M. Avub Iqbal, Evans C. Goodling, Jr., Paper presented at the 2nd ASCE Specialty Conference on Structural Design of Nuclear Plant Facilities at New Orleans, Louisiana, Dec 8-10, 1975

CALCULATION SHEET

ORIGINATOR D. Reeves DATE 12-11-80 CALC. NO. Q-105-A REV. NO. 0

CHECKED _____ DATE _____

PROJECT Midland JOB NO. 7220

SUBJECT Subgrade Modulus SHEET NO. 2

$$\gamma = \frac{\Delta}{6B}(1+\mu)\,100$$

γ = soil shear strain in percent

Δ = deflection of structure

B = width of structure

μ = Poisson's ratio

$$G_\gamma = G_o\,(\text{ratio}_\gamma)$$

G_γ = soil shear modulus at shear strain γ

ratio_γ = ratio of soil shear modulus at shear strain γ to shear modulus at shear strain γ_o

$$E_s = 2G_\gamma(1+\mu)$$

E_s = Young's modulus of the soil

$$k = 0.65\sqrt[12]{\frac{E_s B^4}{E I}}\left(\frac{E_s}{1-\mu^2}\right)$$

E = Young's Modulus of structure

I = Moment of Inertia of structure

k = subgrade modulus
$k = B k_s$ as used in BC-TOP-4
units = force/(length)^2

CALCULATION SHEET

CALC. NO. Q-105-A REV. NO. 0

ORIGINATOR D. Reeves DATE 12-11-80 CHECKED _____ DATE _____

OJECT Midland JOB NO. 7220

UBJECT Subgrade Modulus SHEET NO. 3

Sample Calc

26" ϕ Pipe

$B = 26$ in
$I = 2478$ in^4
$\mu = .4$
$\gamma_{soil} = 130$ lbs/ft^3
$C_s = 500$ ft/sec
$\Delta = .229$ in
$E = 29 \cdot 10^6$ psi

$$\rho = \frac{\gamma_{soil}}{g} = \frac{130}{32.2} = 4.037 \frac{\text{lbs sec}^2}{\text{ft}^4}$$

$$G_o = \rho C_s^2 = 4.037(500)^2 \frac{1}{144} = 7009.14 \text{ psi}$$

$$\gamma = \frac{\Delta}{6B}(1+\mu)100 = \frac{.229}{6(26)}(1+.4)100 = .20551\ \%$$

$\text{ratio}_\gamma = .23564$ From eqn $\text{ratio} = .090707244\,\gamma^{(-.603361517)}$

$$G_\gamma = G_o(\text{ratio}_\gamma) = 7009.14(.23564) = 1651.63 \text{ psi}$$

$$E_s = 2G_\gamma(1+\mu) = 2(1651.63)(1+.4) = 4624.57 \text{ psi}$$

$$k = 0.65\sqrt[12]{\frac{E_s B^4}{EI}}\left(\frac{E_s}{1-\mu^2}\right) = 0.65\sqrt[12]{\frac{462457(26)^4}{29\cdot10^6(2478)}}\left(\frac{4624.57}{1-.4^2}\right)$$

$k = \underline{\underline{2667.34 \text{ psi}}}$

ORIGINATOR D. Reeves DATE 7-31-80
CALC. NO. Q-102 REV. NO. 0
CHECKED [illegible] DATE 7-24-80
JOB NO. 7220
SHEET NO. FILE NO. 130

...per bound of shear modulus for ...ds
Taken from Seed, H.B., and Idriss, I.M., "Soil Moduli and Damping Factors for Dynamic Response Analyses," Report No. EERC 70-10, University of California, Earthquake Engineering Research Center, Berkeley, Dec. 1970.

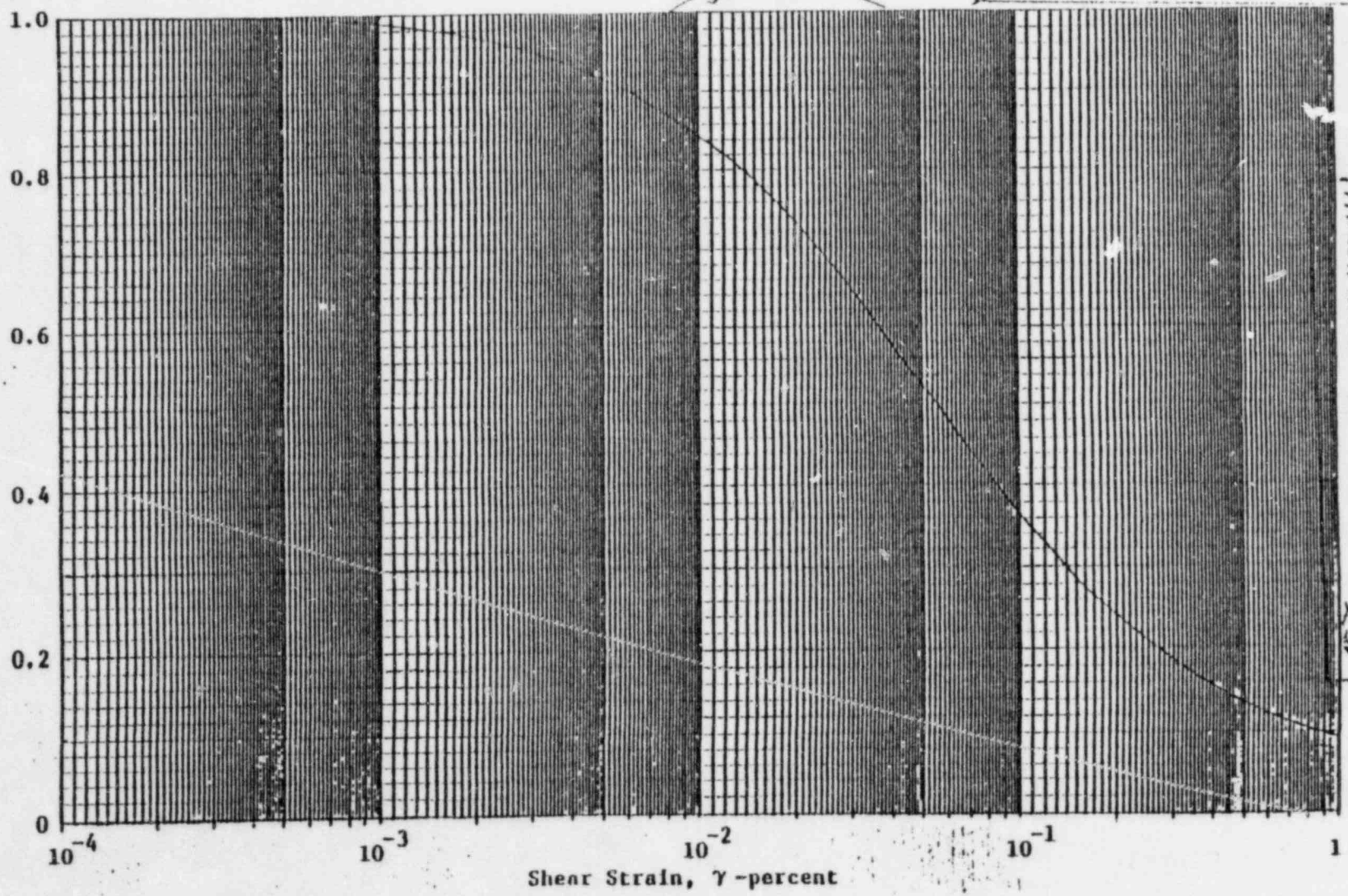


Fig. 1 VARIATION OF SHEAR MODULUS WITH SHEAR STRAIN FOR SANDS.

ORIGINATOR N/A DATE
CALC. NO. Q-105-A REV. NO. 0
CHECKED N/A DATE
JOB NO. 7220
SHEET NO. 4 FILE NO.
Attachment A

Sheet 4

Sheet 5

CALCULATION SHEET

CALC. NO. Q-102 REV. NO. 0

ORIGINATOR D. Reeves DATE 7-21-80 CHECKED KLL DATE 7-25-80

SUBJECT Midland JOB NO. 7220

SUBJECT D.G. Fuel Lines SHEET NO. 131

Appendix E
Shear Modulus
Page 3 of 6

ORIGINATOR N/A DATE

CALC. NO. Q-105-A REV. NO. 0

CHECKED N/A DATE

JOB NO. 7220

SHEET NO. 5 FILE NO.

Attachment A

Range of γ (percent)	Value of ratio $\frac{G}{G_o}$
$\gamma < .0003477683$	1.0
$.0003477683 \leq \gamma < .007798716$	$1.00644281 e^{(-18.04944476)\gamma}$
$.007798716 \leq \gamma < .035$	$.9969579476 e^{(-13.65174279)\gamma}$
$.035 \leq \gamma < .07999999$	$1.487189988 + .2273314588\gamma$
$.07999999 \leq \gamma < 1.231440415$	$.9907072441 (-.6033615117)\gamma$
$1.231440415 \leq \gamma$	.08

Table I
Variation of Shear Modulus
with Shear Strain for Sands

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

5C

CPC DEP. EX NO. 1
FOR ID. AS OF 1-6-81
(Keppler)

March 12, 1979

MEMORANDUM FOR: H. D. Thornburg, Director, Division of Reactor Construction Inspection
Office of Inspection and Enforcement

FROM: James G. Keppler, Director

SUBJECT: MIDLAND DIESEL GENERATOR BUILDING AND PLANT AREA FILL

Meetings on this subject were held on February 23, 1979 and March 5, 1979, between Consumers Power Company, Bechtel Corporation and NRC. These meetings were a continuation of the investigation conducted by our inspectors during December 11-13, 18-20, 1978 and January 4-5, 9-11, 22-25, 1979.

During the February 23, 1979 meeting we presented to Consumers Power Company our preliminary investigation findings, a copy of which was previously forwarded to you.

During the March 5, 1979 meeting Consumers Power Company provided their responses to those findings, copies of which are enclosed.

Our summary findings with regard to this matter are as follows:

1. The quality assurance program for obtaining proper soil compaction of the Midland site was deficient in a number of areas.

2. Soil of the type used in the foundation of the diesel generator building is also located, to varying degrees, under other Class I structures. Whereas excessive settlement has been observed with the diesel generator building, the settlement of other Class I structures has not exceeded predicted values.

3. Several incorrect statements are contained in the FSAR with respect to the soil foundation.

In addition to these findings, we have compiled a list of technical questions which bear on the resolution of this problem. These are enclosed for your use in working with NRR.

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As previously discussed with you, one of our concerns is related to why construction activities at the Midland site, which could be affected by a Class I structure settlement should be continued while the total cause of the diesel generator settlement has not yet been determined. During the meeting on March 5, 1979, this question was posed to the licensee. Their response was that continuing scheduled construction work would not compromise the committed evaluations or remedial actions nor make irrevocable any conditions which do not fully satisfy FSAR or licensing requirements. Based on this, they are willing to accept the risk of continued construction.

In that we have questioned the licensee's intent to continue construction, we consider that the matter also warrants examination by HQ. This examination we feel also involves NRR for the following reasons:

1. If one assumes the foundation settlement placement was in accordance with design, then the matter of design adequacy becomes questionable.

2. If one assumes foundation placement did not meet design specification, one must question acceptability of the soils condition under the affected structures. It should be pointed out again, that the type of soils placed under the diesel generator building were also the type placed under other Class I structures and associated pipes and utility lines.

3. In light of items a and b above, the matter of seismic design also becomes one of concern.

4. Because of the licensee's total evaluation of the specific cause for the diesel generator and plant area fill settlement is not yet complete, the question of FSAR design review and its acceptability may warrant further attention by NRR.

As an alternate approach to the issue, consideration should be given to an NRC Directive or Show Cause Order which could expedite the licensee's confirmation to the NRC that continued construction will not compromise the design function of the involved structures for the life-time of the plant. It may also expedite the licensee's investigation into the basic cause of the diesel generator settlement and its relationship (or absence) to other Class I structures.

We will continue to followup on this matter and keep you informed of new information.

for James G. Keppler
Director

Enclosures:
As stated

MIDLAND QUESTIONS

1. The licensee has stated that the fill has settled under its own weight. What assurance is provided that the fill has not settled locally under:

   a. Structures with rigid mat foundations as portions of the auxiliary building or service water pump structure.

   b. Class I piping in the fill resulting in lack of continuous support causing additional stress not accounted for in design.

2. How has the lack of compaction and the increase in soil compressibility affected the seismic response spectra used in design and therefore, the soil-structure interaction during seismic loading?

3. After current preloading material is removed will additional borings be taken to ascertain that the material has been compacted to the original requirements set forth in the PSAR and construction license application?

4. Since the foundation material is variable as described in 50.55(e) interim report number 4, how can long term differential settlement be predicted to assure reliable startup of the D/G in the event of emergency?

5. What tolerance does the D/G manufacturer require on the alignment of the D/G for reliable operation and startup?

6. Preliminary information indicates that the piping in fill under and in the vicinity of the D/G building have gross deformations induced either prior to or during the preload program. What is the extent of the deformation. Is this deformation beyond predicted? If so, what plans are being taken to correct the condition?

7. The borated water storage tanks and diesel fuel oil tanks have not yet been constructed and are to be located in questionable plant fill of varying quality. Why should those Class I structures be constructed prior to assuring the foundation material is capable of supporting such structures for the plant life?

MIDLAND QUESTIONS

8. FSAR Figure 2.5-48 shows estimated ultimate settlements which indicate a differential settlement across individual mat foundation and within individual structures. Was this differential accounted for in the original design of the mat foundation and in the design of structural member within the structure. If not, what effect does this differential settlement have on additional stresses induced in the mat or in structure members such as slab-beam-column connections?

9. Based on the information provided in CPCo interim report number 4, it appears that the tests performed on the exploratory borings indicate soil properties that do not meet the original compaction criteria set forth in the PSAR and specification for soils work. What assurance is there that the soil under other Class I structures not accessible to exploratory boring meet the control compaction requirements?

NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

OFFICE OF THE COMMISSIONER

CRC0 DEP. EX. NO. ____ December 29, 1980

FOR ID., AS OF 1/6/81

DOCKET NUMBER
PROD. & UTIL. FAC. 50-329OM
3300M

MEMO TO: Samuel J. Chilk
Secretary

FROM: Thomas R. Gibbon
Legal Assistant
to Commissioner Bradford

SUBJECT: POSSIBLE EX PARTE CONTACT IN MIDLAND PROCEEDING, DOCKET # 50-329OM AND # 50-3300M

On July 30, 1980, I had extensive discussions with James G. Keppler, Director of Region III, and other Region III personnel on general NRC enforcement issues. During the course of these general discussions, we touched briefly upon the Midland case. I have recently reviewed my notes of these conversations and have now realized that the Midland conversation could be considered an ex parte contact. Accordingly, I request that pursuant to 10 CFR 2.780, you serve a copy of this memo and the attached summary of discussion upon all the parties in the Midland proceeding and also place these documents in the PDR. With regard to the summary of the discussion, Mr. Keppler notes that while there are some technical inaccuracies, the substance of the discussion is portrayed correctly.

Attachment:
As stated

cc: James G. Keppler

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Keppler also stated that the Commissioners needed to express in one form or another the philosophy that once something is found wrong at the construction site, construction will stop in that area until the item was resolved. He gave the example of Midland where I&E found that the diesel generator building had settled excessively. They also found that there was no Q/A program of any substance related to the basic foundation of the site. He said there really wasn't a Q/A program in this area. In response to this, the NRC issued an order which said that this should be remedied or work would be stopped in 30 days. The company requested a hearing and, therefore, stayed the order. Midland is continuing work today which will make resolution of the settlement problem much more difficult. Keppler said that the staff had not yet made up their minds on whether the fix proposed by Midland is acceptable. Therefore, the project continues to be built and the problem gets worse. He wanted the work stopped until the problem is solved.