Bernie Thompson & Roger Smith
NRC Interviews of 1-22-79 & 1-23-79
Same day - validity was established?!

Q.) Was it difficult to determine what proctor value to use by comparison to the jar samples?
A.) No

Q.) Who gave you the locations and elevations for the tests?
A.) Generally the labor foreman or sometimes the laborers.

Q.) Who selected the site for the test?
A.) The laborers would prepare the site of the test where the foreman selected most of the time. In some instances we would select the exact site in the general area for which the test was requested.

Q.) How often were either Q.C., or Engineering present at the time of the test?
A.) Very seldom.

Q.) Did Q.C. do surveillance on your test activities in the field on a regular basis?
A.) No, not that we were aware of.

Q.) How often did they observe you doing the tests?
A.) Very seldom.

Q.) Do you know what their requirements are for surveillance of soils?
A.) No. I have not had access to that information.

Q.) Were they short of people to do this work?
A.) I cannot answer that question.

Q.) Did they have qualified people for this work?
A.) I cannot answer that question.

Q.) Who was in charge of soils for Q.C.?
A.) Primarily, Daryl Osborn.

Q.) Did he have other responsibilities besides soil work?
A.) Yes. To the best of my knowledge, he had other areas of responsibility.

Q.) Were there grade stakes available for elevations?
A.) Very seldom.

Q.) How were elevations determined?
A.) Mostly from nearby buildings where elevations were written on the walls.

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Q.) Were locations established by the use accurate measuring devices?
A.) No. They were usually by walking off from a wall or just eyeballing the distance.

Q.) Were lift thicknesses measured?
A.) Not in my presence.

Q.) Were the areas free of debris prior to the placement of fill material?
A.) I cannot answer that question.

Q.) Did Q.C. make sure that areas were free of debris before placement?
A.) I cannot answer that question.

Q.) How were retests done? Did they (Bechtel) supply you with a sample?
A.) Retests were taken by a technician as close to the original test as possible at the request of Bechtel when they felt the area was ready for a retest. No, Bechtel did not supply us with a sample.

Q.) Was special attention given to test areas?
A.) Yes, although not a common occurance, I did feel that special attention was given to test areas on certain occasions.

Q.) Can you recall such occasions?
A.) Yes.

Q.) Would you discribe such instances?
A.) Roger spoke of a test on the 30" SWI discharge line. Bernie mentioned a test in the same area.

Q.) Did the foreman asking for the tests know the requirements for the frequency of tests?
A.) I cannot answer that question.

Q.) Were lift thicknesses reasonable or were they excessive?
A.) Generally yes, however there were occasions that they were not.

Q.) How was the moisture controlled prior to placement?
A.) Prior to August of 1977, there was no control of moisture prior to placement. After that date until the spring of 1978, one moisture was taken in the morning from the stockpile.

Q.) How was the moisture reported?
A.) The moisture was given to Q.C. and Engineering.

Q.) Was the moisture associated with a proctor value?
A.) No, it was not at this time.

Q.) Were there more than one proctor used during a days production?
A.) Yes.

Q.) Were additional moistures taken for these proctors?
A.) No, not at first. Later the conditions changed.

Q.) What happened after the spring of 1978?
A.) A number of changes transpired in the moisture control via letters from Bechtel personnel. The last letter for direction to U.S.T. was from Rao in the spring of 1978. Most of this correspondence was generated from questions we presented to Bechtel concerning the moisture control.

Q.) Do you have a copy of this letter?
A.) Yes.

Q.) Can we see this letter tomorrow?
A.) Yes.

Q.) Did you feel there were similar problems with soils concerning the Administration Building.
A.) Yes.

Q.) At that time did you feel there were problems with other buildings on the site?
A.) I would say no, based on the fact that most of the other major structures were done or well under construction and there was no other similar circumstances of settling of structures known at that time.

Q.) Was there a difference between Bechtel and Canonie operations?
A.) Yes.

Q.) What were these differences?
A.) Canonie Q.C. Engineer, Gene DeGeer, gave locations by coordinates paced off from grade stakes and elevations by use of a hand level and regineers rule from grade stakes. Canonie also had much heavier equipment to work with.

Q.) Was placed material ever removed and placed at another location?
A.) Yes.

Q.) Who did you report test failures to?
A.) Primarly to Bechtel labor foreman until the use of the test failure stamp was started in the fall of 1977, then they were reported to Engineering and Q.C.

Q.) Who did you interface with in Q.C. and Engineering?
A.) In Q.C., it was Daryl Osborn and Steve Gilnett. In Engineering, Jerry Morris and Gary Coaster.

Q.) Who were the Bechtel foremen?
A.) Barney J., Mike Davis, Roger Ott, Scott Hancy.

Wollongo's Review

ITEMS TO BE RESOLVED

I. General

A. When and where was the first settlement reading taken?

B. When was settlement questionable?

C. Was accuracy of survey notes checked? (Closure)

D. When was settlement felt excessive?

E. When was NCR documented?

F. When was it determined to be reportable?

1. For what reason(s) is it reportable?

F. When was it determined to be reportable (Contd)

2. When was it reported to the NRC?

G. When was MCAR issued?

H. When were the footings poured? (Between dates)

I. When were the D/G pedestals poured?

J. When was fill material in area placed?

II. If excessive settlement, were the following factors considered to determine cause?

A. Freeze thaw cycles?

II. <u>If excessive settlement, were the following factors considered to determine cause?</u> (Contd)

B. Results of backfill test data reviewed.

1. No. of test in area.

2. Location of test.

3. Elevation of test.

4. Results of test.

5. Failing tests cleared.

6. Adequate classification of material.

7. Calculations. checked?

8. Moisture content.

II. (Contd)

B. Results of backfill test data reviewed (Contd)

9. Were tests on original ground satisfactory prior to backfill placement?

10. Were all tests performed by the same method?

C. Effects of other excavation in area.

1. Dates and locations of adjacent excavations.

2. Depth of excavations.

3. Tests taken on backfill.

4. How was material replaced?

5. Was sand used as backfill for other underground facilities between the pond and D/G Building?

II. (Contd)

D. Effects of brine well extraction.

E. Was temporary fill placed and not removed?

How handled?

F. Was backfill in area trackwalked or sheepsfooted?

G. Were original specs deviated from (DCN's - letters)?

III. Status of Area

A. Being evaluated.

B. Not being evaluated

IV. Possible Corrections to be Taken for D/G

A. No corrective action to be taken(BLC-6578)

B. Modify the present strip foundations for the walls to a continuous mat foundation for the entire building (BLC-6578)

C. Preload and consolidate the soil under the building (BLC-6578)

D. Combination of B and C above (BLC-6578)

E. Underpin the building to transmit loads directly to the undisturbed soil layer (BLC-6578)

F. Remove and replace the building and fill material and reconstruct (BLC-6578)

V. Settlement Investigation

A. The Foundation Date Survey Program (Specification C-76), has been expanded to include additional settlement data locations as well as monitoring these data locations more frequently. Building time rate of settlement curves are being developed based on this datum for a better understanding of the problem (MCAR #24, Interim #1)

V. (Contd)

A. (Contd)

1. Where was original settlement being monitored?

2. Where are the additional settlement data locations?

3. How often were the original readings?

4. How often are the more frequent readings?

5. What are the results of the time rate of settlement curves?

B. A boring program has been initiated to provide better definition of the fill conditions under the building and to obtain soil samples for laboratory tests. (MCAR #24, Interim #1)

1. When did borings start?

2. Where are these borings located?

V. (Contd)

B. (Contd)

3. How many in the confines of the D/G area?

4. How many in the other areas?

C. Dutch cone penetration tests are also being performed under the building area to better define the variable strength properties of the fill material (MCAR #24, Interim #1)

1. When did dutch cone penetration tests start?

2. Where are these located?

3. How many in the confines of the D/G area?

4. How many in other areas?

V. (Contd)

D. Laboratory tests being performed are: (MCAR #24, Interim #1) Who - Q-program

1. Shear strength tests to determine fill characteristic for bearing capacity evaluation

   a. What do the results indicate?

2. Consolidation tests to predict building settlement for the present fill material

   a. What do the results indicate?

3. Soil classifications

   a. What do the results indicate?

4. Minerology tests to evaluate the swelling potential of the fill material

   a. What do the results indicate?

5. By whom are these tests to be performed?

V. (Contd)

E. An independent soils consultant has been retained to help in the data evaluation and feasibility of the corrective actions. (MCAR #24, Interim #1)

1. Who is the soils consultant?

2. Will other consultants be retained?

F. Placement of the soil and underground utility instrumentation will be done. (Interim #2)

1. What type(s) of instrumentation will be used?

a. Where will it be located?

b. How many instruments will be used?

c. What frequencies will readings be taken?

V. (contd)

G. Separation of the electrical duct banks penetrating or otherwise restricting the equalized settlement of the building from the footing to allow unrestricted settlements to occur (Interim #2)

1. Will any monitoring of structures and utilities be made during this separation?

2. When did this begin?

3. When was it complete?

H. Grout any remaining separations between the building footings. Any separations between building footing and supporting fill will be grouted. (Interim #2)

1. When did this begin?

2. When was it completed?

V. (Contd)

I. Raise the cooling pond water level from elevation 622'-0" to its design height of elevation 627'-0", which will bring the water table in the building area to its operation level. (Interim #2)

When did raising of pond level start (from 622'0)? from 605?

1. Will monitoring of water level in plant fill be made in conjunction with pond elevation?

2. If so, how often?

J. Visual monitoring and a survey of the diesel generator building and appropriate utilities under the building will be performed before, during, and after separation of duct banks (Interim #2)

1. What are the appropriate utilities?

2. How were they determined?

VI. CPCo/Bechtel/Consultants Meetings

A. September 28, 1978 Meeting at Midland Jobsite.
Dr. Ralph Peck stated:

1. Make test pits at a number of locations and carve large size samples for density and Proctor testing.

2. Look carefully at test pit walls. Take pocket penetrometer readings along the sides of the test pits on a grid pattern.

Results?

3. Plot settlement of the building at different times and show contours of equal settlement to see if the building is equalizing. This will indicate how stiff the building is. Add settlement points if necessary.

4. Settlement may not be related to applied loads. It will be helpful to monitor light structures on the fill near pond.

What structures

5. Regional subsidence.

   a. Make sure external benchmarks are satisfactory.

   b. Obtain the Dow records of settlement.

of what?

VI. (Contd)

A. (Contd)

6. Install borros settlement gages at several depths to determine rate and seat of settlement.

7. Install observation wells around the fill in the plant area.

8. Have the above been implemented?

9. Any significant conclusions?

B. November 7, 1978 Meeting (Meeting Notes #882) in Champaign, Illinois. Consultants stated:

1. The preload height should be about 20'-0", approximately equal to the depth of the material to be consolidated.

2. The preload rate is not critical and even distribution would be adequate.

3. The preload should be stopped at 10 feet for about a week to watch the monitoring, and then increased to 15 and 20 feet as necessary.

VI. (Contd)

B. (Contd)

4. It was suggested that a 20-foot berm with a 30 degree slope be used around the building where possible.

5. Frost protection for the area to be preloaded was considered appropriate if required by weather conditions.

6. There are some sand materials under the north side of the diesel generator building. The boring blow counts in some isolated zones indicate that the potential for liquefaction would have to be evaluated. Vibroflotation is a possible solution for liquefaction problems if they exist. Project Engineering was to look into this.

7. The structure, including the generator pedestals, would be monitored by survey. Areas covered by preload would have rods encased by sleeves extending to a visible point.

8. Four of the existing cracks in the concrete structure will be monitored by electronic strain gages.

VI. (Contd)

B. (Contd)

9. a. The existing fill will be monitored by 50 borros anchors. The anchors will be placed at three levels within the fill.

   b. There will also be some anchors placed outside of the preloaded area as settlement control. The borros anchors should be initially monitored on a daily basis.

10. Settlement platforms will be used through the preload to monitor the top of the ground.

11. The pore water pressure will be monitored by 20 piezometers at approximately the same three levels, except that the sand length is to be shortened to approximately 2 feet.

12. The utilities under the structure (condensate and service water pipes) would be monitored by drag through settlement devices. The accuracy of data is anticipated to be $\pm 1/4$ inch and a series of readings would have to be made to develop a base line.

13. The consultants suggested that grating be used inside the building instead of the compacted fill and slab to eliminate material placed above the foundation. The feasibility was to be investigated by Bechtel.

VI. (Contd)

B. (Contd)

14. The other structures founded on plant fill will be discussed following the December 4, 1978 meeting with the NRC.

15. That underpinning may be required after, and only after, preloading.

16. Bechtel would grout any gaps between footing and soil after the preload had been removed.

17. If bearing capacity justification tests were required, test pits could be dug to determine the in situ bearing capacity of the soil

18. Construction could continue in the diesel generator.

C. November 15, 1978 Meeting (Trip Report - Serial: CSC-3621) in Urbana, Illinois. Consultants stated;

1. Only one or two piezometers be placed in the natural sands under the D/G.

VI. (Contd)

C. (Contd)

2. Consultant should be brought up to date on the instrumentation program and be given a chance to make additions if felt necessary.

3. He agreed with stacking the 48,000 lb. concrete blocks between the diesel generator building and the turbine building then preloading between the blocks and the diesel generator building with sand. The turbine building wall will have to be braced. 20 feet of the wall can be braced off the turbine building structural steel by jacking against the concrete wall to remove all slack in the steel. After the slack is removed, the wall is to be moved outward (a distance arrived at by Bechtel Engineering) and then shims are to be placed between the steel and the wall until the preload is removed. This should equalize the stress on the wall. The rest of the wall will have to be held in place with approximately 20 threaded #18 rebar spaced on 20 ft. centers through holes drilled through the turbine and diesel generator building walls.

4. More areas and slabs around the diesel generator building should be surveyed to get an idea of the entent of the settling east, south and west of the building.

VI. (Contd)

C. (Contd)

5. The consultant did not feel that there was any problem with liquefaction on this area and that the building was desinged so that there would be no problem with such a small area. He said that this sand could be pressure grouted or hydroflotation could be used as stated in their last meeting (November 7, 1978). Bechtel should do further studies to be sure of their decision. Afifi should make a stress diagram (pressure distribution graph) for each loading scheme for the engineers.

D. December 8, 1978 Meeting (Trip Report)

VII. Inspections by the NRC

A. Gene Gallagher inspection of October 24-27, 1978, Report No. 50-329/78-12 and 50-330/78-12

1. Activities in Progress

   a. Foundation Data Survey Program has been expanded to include additional data locations and to increase the frequency of monitoring these locations to a weekly basis rather than the previous 60 day basis.

   b. A Boring program has been initiated to provide better definition of the compacted fill conditions supporting the diesel generator building as well as other plant structures, e.g., Class 1 tanks, transformer foundations and plant fill area. Soil samples have been recovered for laboratory tests. Details of these tests are provided in later sections of this report.

2. Planned Activities for Future Work

   a. Extend bench mark monitors for settlement study.

   b. Install inclinometers.

   c. Preload diesel generator building and foundations; both inside and around the building with 20 to 22 feet of sand for approximately 5 to 7 months.

   d. Build retaining wall to separate preload material from turbine building on the north side.

   e. Check calculation to see if turbine building can carry effect of preload surcharge.

   f. Monitor condensate lines under diesel generator building.

   g. Monitor soil movement during preload.

   h. Provide freeze protection around diesel generator area during winter.

i. Monitor concrete cracks using stain gauges.

j. Monitor pore water pressure in soil.

k. Cut loose the four electrical duct banks which run under the building and project vertically becoming an integral part of the structure.

l. Continue filling pond from elevation 622' to 627'.

m. Identify item effected by the structure, i.e., plant safety, operations and layout.

3. <u>Other Activities to be Planned</u>

a. Possible core borings in cooling pond dike area to verify integrity of dikes.

b. Continue visual inspection of dikes for movement.

4. <u>Other Structures Being Monitored for Settlement</u>

a. Borated water storage tank foundations.

b. C.W. intake structure.

c. Condensate storage tanks.

d. Service water valve pits.

e. Chlorination building

f. Radwaste building.

g. Cooling towers.

5. Discrepancies Between FSAR Commitments Versus Site Implementing Procedures

a. FSAR Table 2.5-14 (Summary of Foundations Supporting Seismic Category I and II Structures) identifies the supporting soil material under the diesel generator building as being, "controlled compacted cohesive soils". In addition, FSAR Table 2.5-9 (Minimum Compaction Criteria) identifies soil type and function. Under "support of structures" the soil type is identified as clay which is a cohesive soil.

However, construction detail drawings C-109 R2 and C-117 R6 identify the material in this area as "zone 2" material. Zone 2 material is identified in FSAR Table 2.5-10 as "Random Fill," described as any material free of organic or other deleterious material. In the field a varity of material has been used for the diesel generator building, e.g., sands, clay, silty sand, clayey sand and lean concrete. A review of the records indicate sands have been used between elevations 594' to 608', areas of elevation 611' to 613' and areas between 616' and 628'. Lean concrete was permitted to be used indiscriminately throughout. This indicates the extent of the variability of the material used under the diesel generator building foundation.

b. FSAR Table 2.5-21 (Summary of Compaction Requirements) identifies "random fill" to require a compaction effort of a minimum of 4 passes with specified equipment. This requirement of 4 passes was not an imposed criteria in Bechtel specification C-210 R6 nor was it an inspection requirement of Bechtel Quality Control Instruction for Backfill, C-1.02. In addition, FSAR section 2.5.4.5.3 (fill) states, "the four passes were required for each substitute roller".

Discussion with QC field personnel indicated that documentaty evidence was not available to determine that the required number of passes were performed. However, it was commented that at times more than 4 passes were required in order to attain the minimum compaction.

c. The FSAR states that during operation, settlement readings will be taken every 90 days. Because of the diesel generator settlement problem, this frequency should be re-evaluated for adequacy. (Not in Report)

d. FSAR Section 3.8.5.5 states, that "settlements of shallow spread footings founded on compacted fill are estimated to be on the order of 1/2 inch or less". The site survey program has identified settlements in the diesel generator foundation and building to range from 0.55 inches to 2.30 inches and in excess of 3.0 inches for the diesel generator pedestal, as of September 1978.

e. FSAR Figure 2.5-47 indicates the foundation of the diesel generator building is at elevation 634'; however, design drawing C-1001(Q) R5 indicates the spread footing and pedestal are at elevation 628' and locally lowered to elevation 625' in the sump areas. Since the ground water elevation will be raised to 627', a hydrostatic pressure will reduce the net effective structure load on the foundation material. This should be reflected in table accompanying FSAR figure 2.5-47.

6. Conflict in Specifications for Site Soils Activities

a. Specification C-210, Section 13.7.1 requires all cohesive backfill in the plant area to be compacted to not less than 95% maximum density, as determined by ASTM D-1557, Method D which requires an effective compactive effort of 56,000 ft-lbs of energy per cubic foot of soil. However, Section 13.4 (testing) of the specification requires testing of materials placed in the plant area to be performed in accordance with tests listed in Section 12.4. This section, in particular Section 12.4.5.1 (cohesive soils), requires lab maximum densities to be determined using ASTM D-1557, Method D provided a compactive energy equal to 20,000 foot pounds per cubic foot is applied (Bechtel Modified Proctor Density). To date, the Bechtel modified proctor density for determining maximum proctor density versus optimum moisture content has been utilized, as committed to in FSAR Table 2.5-9. Furthermore, Bechtel Quality Control Instruction C-1.02, Section 2.4 (testing) references the applicable inspection criteria, including both Sections 13.7 and 12.4 of specification C-210 which includes the discrepancy described above.

As a result of this conflict, the actual in-place compaction would be less using the Bechtel modified proctor than using the standard ASTM D-1557, Method D. This is due to the fact that the compactive energy exerted using the Bechtel modified method is less than that using the standard ASTM method (i.e., 20,000 ft-lbs versus 56,000 ft-lbs of energy).

During a review of the specifications, the inspector was informed that Bechtel had contracted Dames and Moore to perform the original site soils and backfill study, as documented in a report dated March 15, 1969. On page 16 of this report the compaction criteria for support of structures is recommended to be 100% of the maximum density using a compactive effort of 20,000 ft-lbs (similar to Bechtel Modified Proctor Density). However, this 100% of maximum density using 20,000 ft-lbs of compactive effort corresponds to 95% compaction using the standard ASTM D-1557, Method D. As previously described, specification C-210 did not incorporate the Dames and Moore recommendation.

b. Furthermore, Dames and Moore report (page 15) states that, "all fill and backfill materials should be placed at or near optimum moisture content in nearly horizontal lifts approximately 6 to 8 inches in loose thickness". This recommendation was not adopted by Bechtel, in that specification C-210, Section 12.5.3 permits an uncompacted lift thickness of 12 inches.

c. A further review of specification C-210, Section 12.6 (moisture control) indicates that zone 2 material, known as "random fill," was permitted to have a moisture content tolerance of "not more than 2 percentage points below optimum moisture and not more than 2 percentage points above optimum moisture". A review of the moisture-density curves for the material (random fill) placed in the diesel generator area indicates steep, sloped moisture-density curves, and therefore, a $\pm$ 2% range for moisture control can significantly effect the in-place density of the material used.

7. Review of NRC Question No, 362,2 on FSAR Section 2.5.4.5.1

a. This question concerns whether a natural sand layer near elevation 600', as identified in FSAR Figure 2.5-21, had been removed during construction or if the sand tested out to be greater than 75% relative density. The licensee had not responded to this question as of the date of this inspection.

An internal Consumers Power Company memorandum from B. H. Peck to J. L. Corley indicates that a review had not yielded any verification that the sands were removed or that tests were performed to confirm the in-place density of the natural sands. The current boring program will also be used as a data base for confirming the in-place condition of the natural sand layer identified in FSAR Section 2.5.4.5.1. The licensee informed the inspector that the results of this survey will provide the basis for their answer to NRC Question No. 362.2.

8. Cracks in Concrete Structural Wall and Footing in the Diesel Generator Building

Discussions with Bechtel design staff personnel at the site indicate that the crack is being evaluated along with the settlement survey and will continue to be monitored during preload of the structure.

ACI 318-71 (Commentary) Section 10.6.4 limits flexural cracks to 0.013 inches (13 mils) when exposed to the outside elements. The crack was observed to be larger than the ACI limit for flexure. The licensee is committed to this standard in FSAR Section 3.8.6.2.

9. Diesel Generator Building and Pedestal Foundation Details

Of significance is that the original ground water level prior to plant construction was approximately at elevation 601'. Subsequent to construction of the cooling water pond, the ground water table has risen to elevation 622', and it is planned to be raised to its maximum elevation of 627'. This increased ground water level has stabilized in the compacted fill beneath the diesel generator building at elevation 622'. The licensee is evaluating the effects of this increase in ground water level on the 35 feet of compacted fill material in the plant fill area.

10. Piping, condensate lines, duct banks, and other utilities under the diesel generator building may also be affected and must be evaluated. (Not in Report)

11. Mr. Gallagher stated he was leaving not having seen bearing capacity calculations and will be discussing design calculations, assumptions made, and conflicts with the FSAR with Licensing. (Not in Report)

12. Calculations should be evaluated on the increase and the rate of increase of the pond fill and the effects of the water in other areas. (Not in Report)

13. Seismic loading calculations should be determined for the type of material existing in its present condition. (Not in Report)

B. Darl Hood/Gene Gallagher (only 12-4-78)/Daniel Gillen/Lyman Heller/Ron Cook inspection of December 3-4, 1978

1. We need to identify backup documentation for inclusion in 50.55(e) reports. NRC asked that we provide the data which was specifically presented in today's meeting.

2. Give to Ron Cook data on specific equipment used for compaction between elevation 618-628.

3. Heller asked how we will know when job is done. Dr Peck said judgments can only be made from settlement trends and other data from the instrumentation.

4. The consultant made the statement that the cause is not relevant to the fix. Gallagher stated that the cause was of concern to the NRC.

5. Gallagher wants us to look at direct effect of surcharge load on utilities.

6. We need to specifically address the other Class 1 structures. It was left open for the need for any corrective action in these areas.

7. We agreed to send a separate letter to address the items in the Gallagher Inspection Report. A timetable was not committed to but I asked P A Martinez to shoot for a draft in three weeks.

8. We need to develop a comprehensive presentation with conclusive evidence of the effect of the specification requirement of $\pm$ 2% on optimum moisture - which curve, variability of materials, etc.

9. Heller - We must demonstrate that actual material placed met compaction requirements.

10. Include calculation of stresses in structure due to settling.

11. Heller - Summary of Staff View

The NRC is not completely confident on the plan and results available to demonstrate the achievement of the consolidation program. We must rely on interpretation of data that may not be all that clear. We proceed at our own risk although the NRC does not see any other viable option other than starting over.

The NRC reviewer who read the PSAR approved the criteria contained therein. There is a need for more absolute evidence that the compaction criteria was met. They expect the compaction resulting from our consolidation program to meet or exceed the criteria. The NRC will do another review in six months. If we go ahead we will need to prove the criteria of the construction permit are met. Additional analyses are required to demonstrate the structures meet the FSAR criteria (response to seismic, etc.).

12. Hood - Expect this matter to be addressed heavily in hearings (ACRS - Operating Permit).

13. Note from 11/30 Meeting - Action Item to come up with operating limit criteria for structural settlement.

C. Gene Gallagher/Jerry Phillip inspection of December 11-13, 1978 @ Midland Jobsite and December 18-20, 1978 @ Ann Arbor.

VIII. CPCo/Bechtel Meetings

A. November 2, 1978 in Ann Arbor - Discussed "Inconsistencies Discovered to Date"

1. References:

   a. Dames & Moore Report (Page 15)

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

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

   Bechtel Field did not have a Soils Engineer on site.

2. References:

   a. Dames & Moore Report (Page 14)

   b. Bechtel Specs C-210 and C-211

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

VIII. (Contd)

A. (Contd)

2. (Contd)

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

Obviously, these two requirements conflict

3. References

a. Dames & Moore Report (Page 15)

b. Bechtel Spec C-211

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

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

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

VIII. (Contd)

A. (Contd)

4. References:

a. Bechtel Design Standard C-501

b. Bechtel Spec C-211

Bechtel Design Standard - Table of Minimum Compaction Criteria

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

Bechtel Spec C-211, Section 5.5.1 - "Cohesionless (sand) material shall be compacted to not less than 80% relative density....by ASTM D2049"

Spec and Design Standard conflict.

5. References:

a. Dames & Moore Report (Page 14)

b. FSAR, Page 2-7

c. Drawing C-44

C

VIII. (Contd)

A. (Contd)

5. (Contd)

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

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

Bechtel Drawing C-44, Note #4 - "Within the excavation area shown, all loose surficial sands with relative density less than 75% shall be removed." (Note #4 added to this drawing 8/23/75)

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

6. We question the method used to select the proctors. Errors in reported compaction probably resulted from selection of lower maximum density proctors. See Bechtel letter to U. S. Testing dated 2-1-78.

Work on D/G Continuing August 23, 1978 (MCAR #24, Interim #1)

A. One concrete pour was made to finish the structure to a common elevation of 662'-0" and to allow removal of formwork (MCAR #24, Interim #2)

DOCUMENTATION AND MEETINGS RELATIVE TO SOILS

3/13/73	Hunt/Hanson (Rogn 33-73)	C-210 comments
9/19/74	CAHunt comment on C-210 compaction of plant area - Hunt 110-74	
8/25/77	Grade beam failure - See also BCCC (see below 2794), 3010 Bechtel - UST memo of 2/1/78	
9/ 8/77	TCCooke Serial 2538 to Newgen on Article 9	
9/23/77	BCCC-2794 Newgen acknowledgment	
2/ 1/78	Newgen to US Testing	
8/22/78	Verbal discussion with RCCook by WRB & JLC on settlement (78-13) also 8/24 Cook exit	
8/25/78	Article 9, TCC/JFN - See also CSC-3797, Loose sands, Serial 3478	
8/31/78	SHH/GSK/RCB/JJZ	NRC meeting in Washington
[redacted]	50.55(e) telecon report to NRC on settlement - WRB and JLC to RCCook	
9/ 8-Exit & 9/10-29/78	RCook	78-14
9/14/78	GSK (GSK handwritten notes) (where are meeting notes?)	Meet with Bechtel at site on foundation settlement
9/22/78	MCAR 24, Interim Report No 1, BLC-6578	
9/26/78	PAM - GSK telecon	Question on removal of natural sands
9/28/78	Dr Peck on soils at site	
9/29/78	WUOKKO to CAH/GSK and WUOKKO CAH to GSK	Review of settlement
9/29/78	Siple/Cheek note	Tests on fill
[redacted]	50.55(e) Report	

GSKeeley/cg
1/4/80

Oct 78	R Cook	78-21
10/ 4/78	GSK/DBM/TCC	Discuss earthwork specs
10/ 8/78	Dr Hendron site visit	
10/ 9/78	Afifi to Peck	Transmitted Vol IV of FSAR
10/ 9/78	Afifi to Hendron	Transmitted Vol IV of FSAR
10/ 9/78	RMW - 11/1/78 - settlement status - A^2	
10/10/78	TCC/JFN Serial 3487	Dike borings
10/11/78	GSK (RMW & TCC asked to review conditions)	Soils discussion on site
10/12/78	Field - A^2 telecon	Dike borings
10/12/78	Afifi to Peck	Transmitted settlement contours for DGB SK-C-620
10/12/78	Afifi to Hendron	Transmitted settlement contours for DGB SK-C-620
10/17/78	GSK/CAH (Discussed RMW inconsistency notes)	Visit site on foundations
10/18/78	Dunnicliff	Site visit
10/18/78	Afifi to Peck	Meeting in Urbana
10/20/78	Pond fill & D/S Settlement A^2	
10/23/78	Hendron to Afifi	Comments on site visit
10/23/78	JFN/TCC (also plan mtg w/GSK)	Dike borings
10/24-27/78	Region III site inspection 78-12	NRC notes dated 11/17/78 also 280 FQA78 (DEH)
10/25/78	GSK (handwritten notes) (where are official meeting notes?) BLC-6747	D/G settlement meeting at site
10/26/78	Afifi to Hendron	Transmitted data 1. Boring logs 2. Consolidation tests 3. Updated settlement data

10/26/78	Afifi to Peck	Transmitted data 1. Boring logs 2. Consolidation tests 3. Updated settlement data
10/27/78	Draft TCC/JFN	Activities prior to preload also NRC exit that date
10/30/78	WRB/RMW/DEH (where are notes?)	MCAR discussion on settlement Bechtel-A2
10/31/78	Draft NRC exit (GSK)	
Nov 78	RCook 78-22	
11/ 1/78	Keppler memo to Thornburg asking NRC Staff to take over responsibility	
11/ 1/78	PAM/GSK - BLC-6747	Continuation of D/G work
11/ 2/78	Afifi to Hendron	Transmitted 10/8/78 meeting notes
11/ 2/78	GSK/RMW/DBM/TCC/DES (see material assembled by RMW 11/1/78)	Meet w/Bechtel on settlement Bechtel-AA (GSK meeting notes 12/4/78)
11/ 6/78 or 11/7/78	Champaign, IL Mtg	Handwritten (CAH notes)
11/ 6/78	Afifi to Peck	Transmitted Dunnicliff's site visit recommendations
11/ 6/78	Afifi to Hendron	Transmitted Dunnicliff's site visit recommendations
11/ 6/78	MCAR 24, Interim Report No 2	BLC-6767
11/ 6/78	Afifi to Hendron	Transmitted Dr Wood Dutch cone data
[redacted]	50.55(e) (Tentatively planned to have review meeting last two weeks in November and NRC will be invited.)	
11/ 7/78	TCC/DES/RMW/CAH/DEH - CSC-3674 and Bechtel minutes	Meet with Dr Peck and Hendron on settlement at Urbana, IL
11/10/78	Afifi to Hendron	Telecon: Recommendations on preload prior to NRC meeting
[redacted]	NRC notified meeting at site for 12/3 and 12/4/78	

11/15/78	Meeting with consultants at Urbana (Bruce Peck's notes 11/21/78)	
11/16/78	DBM CSM-0050 to PAM	Continue construction of building
11/16/78	Urbana Meeting	CSC-3621 also Bechtel minutes
11/16/78	Ohmstead to ASLB including Keppler to Thornburg 11/1/78 memo and CP Co 9/24/78 50.55(e)	
11/17/78	Hendron to Afifi	Comments and conclusions to 11/7/78 meeting notes
11/17/78	Inspection Report (Gallagher 10/24-27/78 inspection on site)	
11/18/78	Meeting in Urbana w/Hendron ?	
11/20/78	Cherry memo to Keppler (Is attached to 12/14/78 Keppler reply to Cherry)	
11/21/78	GSK	Meet w/RCY, PAT by NRC?
11/27/78	Afifi to Peck	Transmitted 9/27/78 meeting notes
11/27/78	Afifi to Hendron	Transmitted 9/27/78 meeting notes
11/28/78	Afifi to Hendron w/Peck	Instrumentation and cross-sections for DGB. Cage for vertical pressure
11/30/78	GSK/RMW	Meet w/Bechtel on preparation for NRC site visit on settlement
12/ 3-4/78	TCC, CSC-3663 to PAM BLC-7233 & Bechtel minutes; Hood's Mtg notice of 11/14/78	NRC on site for settlement issue. DHood/WLayman/DGillen/Bechtel/CP Co/ Dr Peck
[redacted]	JLC/DEH Gallagher Telecon	Roller Passes
12/ 8/78	Met w/consultant (where are meeting notes? CSC-3699 & Bechtel minutes	(BPeck CSC-3712 refers to it)
12/11-13/78	NRC 78-20 Soils	AA, Site, Jackson
12/11/78	Ferris to Peck	NRC letter dated 11/17/78
12/13/78	Gray to GZD (Schultz) w/GeoT	Minerology of soil
12/13/78	GZD to QF	Qualification of people

12/14/78	Met with [illegible]ntel to discuss 12/8/78 meeting with consultants and concerns of CP Co - CPC-3663. (BPeck CSC-3712 dated 12/20/78)	
12/21/78	Between the lines	
12/21/78	50.55(e) that preload is corrective action to be taken	Site task group
12/27/78	Afifi to Hendron	Telecon: Preload sequence for DGB
12/27/78	Afifi to Hendron	Telecon: DGB preload defrosting requirements
12/28/78	Ferris to Hendron	Transmitted backfill Spec C-210 & 211 and SK-C-355
12/28/78	Ferris to Peck	Transmitted backfill Spec C-210 & 211 and SK-C-355
[redacted]	MCAR 24, Interim Report No 3	BLC-6949
12/29/78	GZD to GeoT	Personnel Qualifications
12/29/78	Afifi to Peck	Transmitted sketch SK-C-620, SK-C-623 and settlement vs time for pedestals plus copy of NRC questions
12/29/78	Afifi to Hendron	Transmitted sketch SK-C-620, SK-C-623 and settlement vs time for pedestals plus copy of NRC questions
12/78-1/79	RCook 78-20	
1/ 3/79	Newburry/TCC	Newsletter on soil compaction
1/ 4/79	A^2 meeting task group	
1/ 4/79	Revision to MCAR 24, Interim Report No 3 - BLC-6971	
[redacted]	50.55(e) Report	
1/10/79	GZD to Castleberry w/GeoT	Transmitting inspection and reading procedure
1/12/79	NRC investigation US testing allegations (no notes)	
1/15/79	Afifi to Castleberry w/Peck	Next meeting February 4, 1979
1/15/79	Afifi to Peck w/Hendron	Transmitting 12/8/78 meeting notes

1/17/79	Afifi to Hendron	Transmitted meeting notes for November 7 and 18, 1978
1/17/79	Afifi to Dunnicliff	Transmitted meeting notes for November 7, 1978
1/18/79	Afifi to Peck	Transmitted meeting notes for November 7 and 18, 1978
1/23/79	Site	Task Group
1/30/79	Afifi to Dunnicliff	Discussing TSA
1/31/79	Afifi to Hendron	Transmitted FSAR Question 362.13 w/draft answer
2/1-3/79	Code 79-09; also 1/2-31/79	
2/ 5/79	GZD to Castleberry	Supplemental QA Manual
2/ 5/79	GZD to Castleberry	TSA
2/ 7/79	GSK/DBM (where are official meeting notes?)	Meet w/JKeppler at Site (GSK notes)
2/15-16/79	GSK/WRB/CAH/TRT/TCC/RMW (where are meeting notes?) A^2 handouts & handwritten notes	Status of diesel generator building foundation - Bechtel-A^2 (See GSK notes)
2/16/79	MCAR 24, Interim Report No 4	BLC-7179
2/20/79	TCC memo CSC-3852 to CAH commenting on DRW 12-78 & 13-78	
2/21/79	RCB/CAH & GSK discussion (GSK notes) also Hunt 29-79	
2/23/79	Met with Region 3 at Glen Ellyn	
[redacted]	50.55(e)	
2/23/79	Afifi to Peck	Location of Class I piping and profiles by GZD
2/24/79	Afifi to Peck	Telecon: Effective saturation of compacted fill
3/ 1/79	Hand notes - A^2 meeting, I think	
3/ 5/79	SHH/GSK/TCC/DEH	Meet with Region 3 in Glen Ellyn. At end of this meeting requested NRC for technical meeting.

3/ 5/79	Draft cause memo by TCC	
3/ 6/79	NRC visited site to review preload. NRC documented 3/20/79	Also planning meeting on site
3/ 8/79	Meeting w/Bechtel (no formal notes)	Planning K/T analysis
[redacted]	SHH memo to Keppler	Asked for reply on scheduling technical meeting.
3/12/79	Task Force meeting	Jobsite
3/14/79	Prof N Newmark	Urbanna
3/15/79	NRC meeting notes of 2/23/79 & 3/5/79 meeting in Glen Ellyn	
3/19/79	RCB Eng SU request	Subsidence/settlement check
3/20/79	TCC/DES/GSK	Meet with Dr Peck on settlement at Bechtel-A^2, BLC-8093
3/21/79	GSK	Received NRC's 50.54(f) questions on settlement
3/22/79	Keppler to SHH	Results of investigation by Phillip, Gallagher and Maxwell 12/11, 18/78 & 1/4, 9, 22/79
3/22/79	Afifi to Peck	Transmitted copy of 10 CFR 50.54(f) question (22 questions)
3/22/79	Afifi to Hendron	Transmitted copy of 10 CFR 50.54(f) question (22 questions)
3/23/79	Review 50.54 (A^2)	
3/23/79	Between the lines	
3/23/79	Afifi to Peck	Transmitted: 1. Liquefaction potential study; 2. Field cyclical stress ratio; 3. Earthquake induced settlement

3/23/79	Afifi to Hendron	Transmitted: 1. Liquefaction potential study; 2. Field cyclical stress ratio; 3. Earthquake induced settlement
3/27/79	GSK response to letter on soils	Review 50.54(f) question with Bechtel in A^2
3/28/79	Afifi to Peck	Transmitted Dr Woods report on Dutch cone data
3/28/79	Afifi to Hendron	Transmitted Dr Woods report on Dutch cone data
3/28-29/79	Gallagher inspection on Site (JLC memo 3/29/79 111FCA79 & NRC report 4/9/79)	79-06
3/29/79	Gould - A^2 meeting	
[redacted]	50.55(e)	
4/ 4/79	Underpinning	A^2 Spencer White & Prenti~~ce~~ss ?
4/ 4/79	Afifi to Hendron	Update of March 23, 1979 letter
4/ 9/79	BWM & DEH & Bechtel meeting at US Testing. (Meeting notes on 4/25/79 memo)	
4/10/79	Davidsson, Loughney, Gould	Site Tour
4/12/79	Afifi to Davidsson	Transmitting: boring logs; location plan of areas being considered for underpinning; Midland FSAR soils section
4/17/79	MCAR 24 coordination	
4/19/79	GSK	Review answers to NRC
4/23-24/79	Site meetings on data & Q-List fill	
[redacted]	SHH	Respond to NRC's 50.54(f) settlement issues
4/24/79	Resumption of Q-List backfill BCDC 3995	
4/24/79	Soil & Rock to Castleberry	Field data April 3 to 10 pipe profiles
4/25/79	MCAR 24, Interim Report No 5	BLC-7505

4/26/79	Task Group	
4/26/79	Castleberry to Intrusion prepack	Grouting of sand
4/27/79	Castleberry to Loughney	Transmittal for underpinning 12 drawings; 17 figures; boring logs
4/27/79	Afifi to Hendron	Transmitting 17 figures showing response of instrumentation to surcharge
4/27/79	Afifi to Peck	Transmitting 17 figures showing response of instrumentation to surcharge
4/27/79	Dunnicliff to Chen	Received soil samples
5/ 1/79	Afifi to Peck	Transmitted responses to NRC questions
5/ 1/79	Afifi to Hendron	Transmitted responses to NRC questions
[redacted]	2 telecons with Hood	Settlement issue is broad. NRC Staff too tied up with TMI-2 to meet
5/10/79	RMW	Meet with D/G consultants at Bechtel-A^2
5/11/79	GSK	NRC Exit Interview at Bechtel-A^2
5/11/79	GSK/TCC - BLC-7830	Meet with Bechtel on proposed fixes to structures
5/16/79	Task Group	Site
5/17/79	TCC memo CSC-4066 to Newgen on air line leak in tank farm	Also NRC Exit
5/17/79	NRC 79-10 & 170FGA79	Site
5/21/79	Afifi to Loughney	Transmitted C-88 for review
5/22/79	Afifi to Davisson w/Peck, w/Dunn; w/Hendron	Transmitted May 10, 1979 meeting summary
5/22/79	Davisson - Afifi	May 10 meeting in A^2 summary

5/24/79	Afifi to Davisson w/Gould	Transmitted Spec C-95 for review
5/24/79	Afifi to Hendron w/Davisson	C Gould participation with Davidsson
5/25/79	Afifi to Davisson	Transmitted C-94 for review
5/29/79	Davisson to Afifi	Response to May 10, 1979 meeting summary
5/30/79	D/G Task Group, BLC-8051	A^2
5/31/79	Loughney, Woods, DES	A^2 dewatering
[redacted]	[redacted]	Rev 1 to 50.54(f)
6/79	Review of UST	
6/ 1/79	NRC Notice of Test Pit Visit - 6/7/79	
6/ 5/79	RLC/TCC	Prospective Bidding
6/ 6/79	Afifi to Hendron	Liquefication potential of railroad bay
6/ 7/79	TCC, CSC-4138	NRC site visit to observe test pits (TCC memo 6/13/79, CSC-4138 and NRC Report dated 6/21/79)
6/11/79	DES (where are minutes?)	Meet at Bechtel to discuss diesel gen MCAR
6/12/79	Afifi to Hendron	Update of borings, cross-sections & other information
6/12/79	Afifi to Peck	Update of borings, cross-sections & other information
6/12/79	Afifi to Woods	Update of borings, cross-sections & other information
6/12/79	Afifi to Davisson	Update of borings, cross-sections & other information
6/12/79	Afifi to Gould	Update of borings, cross-sections & other information
6/12/79	Afifi to Peck	Copy of the NRC 10 CFR 50.54(f) questions dated 4/24/79 and Rev 1 dated 5/31/79

6/12/79	Afifi to Hendron	Copy of the NRC 10 CFR 50.54(f) questions dated 4/24/79 and Rev 1 dated 5/31/79
6/12/79	Afifi to Davisson	Copy of the NRC 10 CFR 50.54(f) questions dated 4/24/79 and Rev 1 dated 5/31/79
6/12/79	Afifi to Gould	Copy of the NRC 10 CFR 50.54(f) questions dated 4/24/79 and Rev 1 dated 5/31/79
6/13/79	Chen to Hendron	Telecon - Interim Report #6 to MCAR 24 - questions on liquefaction of control tower
6/15/79	MCAR, Interim Report No 6	BLC-7749
6/18/79	SHH/GSK/JJZ/RFG	Meet with NRC on Licensing Schedule in Washington, DC
6/18-19/79	DES	Meet with consultants at Bechtel-A^2 (TCC memo CSC-4297 dated 8/8/79)
6/20/79	CP Co motion for separate hearings on environmental and soils	
6/22/79	GSK/BWM/WRB/DEH, CSC-4297	Meet at Bechtel to discuss upcoming NRC meeting
[redacted]		
6/25/79	DES - D/G Task Group	A^2 BLC-7944
6/27-28/79	Meeting with consultants in Denver (TCC memo CSC-4306 dated 8/10/79 and CSC-4274 dated 8/7/79)	
[redacted]		CP Co response to noncompliance on prestressing - soils also inspected on 5/14-17
6/29/79	Afifi to Peck	Interim Report #6 to MCAR 24
6/29/79	Afifi to Davidsson	Interim Report #6 to MCAR 24
6/29/79	Afifi to Hendron	Interim Report #6 to MCAR 24
6/29/79	Afifi to Loughney	Interim Report #6 to MCAR 24
6/29/79	Afifi to Gould	Interim Report #6 to MCAR 24

6/29/79	Afifi to Peck	Report by D Gray dated 5/7/79
6/29/79	Afifi to Hendron	Report by D Gray dated 5/7/79
6/29/79	Afifi to Dunnicliff	Peck's suggestion on temperature correction for DGB Instrumentation
7/ 2/79	Gould, Davisson, Loughney, Peck to Afifi	Transmitting Denver meeting notes signed by the senders
7/ 3/79	TCC telecon with NRC Lipinski	
7/ 3/79	GSK/PAM, BLC-7827	Arrangements for 7/18/79 meeting (Washington)
7/ 3/79	Newgen/Cooke	Resumption of Q-List fill
7/ 3/79	Afifi to Ferris w/Hendron	Settlement during earthquake
[redacted]	Telecon SHH to Boyd	Concern on need for continuing activity on settlement
7/ 7/79	Afifi to Loughney	Meeting notice
7/ 7/79	Afifi to Gould	Meeting notice
7/ 7/79	Afifi to Peck	Meeting notice
[redacted]		Send in Rev 2 to 10 CFR 50.54(f)
7/10/79	Denton reply to SHH	TWX says they will continue reviews of soils
7/10/79	DNR - Hittle	Draining Pond to correct D/G
7/10/79	NRC Staff reply to CP Co 6/20/79 motion	
7/10/79	DNR - Hittle	Draining pond to correct D/G
7/10/79	TRT/DEH/GSK/TCC	Pre-7/18 meeting
7/17/79	Review Monitoring w/Loughney	A^2
7/17-18/79	GSK/TCC/TRT	Premeeting with consultants in Washington, DC. Meet with NRC on settlement in Washington, DC 50.55(e) dated 8/10/79 documented meeting
7/18/79	Hood issued meeting notes of 7/18/79 meeting on 10/16/79	

7/18/79	Meeting Submittal	
7/18/79	Afifi to Gould	Transmitting Rev 2 of 50.54(f) questions
7/18/79	Afifi to Davisson	Transmitting Rev 2 of 50.54(f) questions
7/18/79	Afifi to Hendron	Transmitting Rev 2 of 50.54(f) questions
7/18/79	Afifi to Peck	Transmitting Rev 2 of 50.54(f) questions
7/18/79	Afifi to Loughney	Transmitting Rev 2 of 50.54(f) questions
7/23/79	Gould to Afifi	Summary of presentation made to the NRC 7/18-19, 1979
7/23/79	Peck to Afifi	Summary of Presentation made to the NRC July 18-19, 1979
7/25/79	Afifi to Davisson	Transmitted meeting notes of 6/18-19/79
7/25/79	Afifi to Loughney	Transmitted meeting notes of 6/18-19/79
7/25/79	Afifi to Dunnicliff	Transmitted meeting notes of 6/18-19/79
7/25/79	Afifi to Peck	Transmitted meeting notes of 6/18-19/79
7/25/79	Afifi to Hendron	Transmitted meeting notes of 6/18-19/79
7/25/79	Afifi to Gould	Transmitted meeting notes of 6/18-19/79
7/25/79	Loughney to Afifi	Summary of presentation made to the NRC July 18-19, 1979
7/26/79	Meeting with SHH & Bechtel on Lessons Learned. (BWM meeting notes 7/26/79, BWM 101-79)	
[redacted]	[redacted]	Discussion on documenting 7/18/79 meeting. Hood stated that Staff said positive aspects of meeting were proposed design fixes.
8/ 1/79	Task Force, BLC-8092	
8/ 2/79	Chen to Peck	Data for settlement evaluation of DGB

8/ 2/79	Chen to Hendron	Data for settlement evaluation of DGB
8/3/79	Gould to Afifi	Remedial Measures
8/ 3/79	Telecon with Miller	Update on 7/18/79 soils meeting and Bechtel Mgmt Meetings
8/ 6/79	Fobes to JSS/RLB	Dewatering info request
[redacted]		Meeting notes of 7/18/79 meeting with NRC Staff
8/10/79	Afifi to Woods	DGB settlement Dutch cone data pipe profiles
8/10/79	Afifi to Peck	DGB settlement Dutch cone data pipe profiles
8/10/79	Afifi to Hendron	DGB settlement Dutch cone data pipe profiles
8/10/79	Afifi to Davisson	DGB settlement Dutch cone data pipe profiles
8/10/79	Afifi to Gould	DGB settlement Dutch cone data pipe profiles
8/10/79	Woods to Afifi	Pile stiffness report on service water structure
8/13/79	Afifi to Castleberry w/Peck, w/Hendron	Telecon: Reference w/Peck & Hendron on removing the surcharge
8/14/79	Newgen/Castleberry TWX	Release to remove surcharge
8/15/79	PAM to GSK, BLC-8021	Justification for removing preload
8/16/79	Chen to Hendron & Dunnicliff	Telecon: Settlement monitoring during surcharge removal
8/24/79	Dewatering (A^2)	
8/24/79	MCAR 24, Interim Report 7	BLC-8073
8/28/79	Afifi to Loughney	Interim Report No 7
8/28/79	Afifi to Peck	Interim Report No 7
8/28/79	Afifi to Hendron	Interim Report No 7
8/28/79	Afifi to Davisson	Interim Report No 7
8/28/79	Afifi to Gould	Interim Report No 7
[redacted]		Question 1 meeting

8/31/79	JJZ/WRB	Held preplanning meeting for NRC QA settlement meeting at Bechtel-AA
9/ 4/79	Revision to MCAR 24, Interim Report No 7	BLC-8088
9/ 5/79	Darl Hood meeting notes	Meet with NRC on QA settlement (Q-23)
9/ 5/79	50.55(e) & RMW A^2 dewatering?	
9/ 6/79	Dewatering CSC-4376	
9/ 7/79	Dewatering A^2	
9/10/79	Afifi to Loughney	Interim Report No 7
9/10/79	Afifi to Peck	Interim Report No 7
9/10/79	Afifi to Hendron	Interim Report No 7
9/10/79	Afifi to Davisson	Interim Report No 7
9/10/79	Afifi to Gould	Interim Report No 7
[redacted]		NRC sent letter on QA settlement issue (Question 23)
9/11/79	Testing & monitoring A^2	
9/12/79	GSK/BWM/WRB/JJZ	Meet on QA settlement in Jackson
[redacted]		Rev 3 to 50.54(f)
9/13/79	RMW/Dunnicliff CSC-4405	Task Group A^2
9/17/79	Chen to Hendron	Telecon: monitoring of only selected borres anchors
9/18/79	Afifi to Curtis w/Woods	Insitu shear wave measurements & additional borings
9/18-19/79	Case Load Forecast Panel Site Visit. Serial 7759. Agenda Item 6. Discussed work schedules and completion of investigation and saw no schedule effects.	
9/27/79	SHH/GSK/JJZ/TJS - Serial 7921	NRC Management Meeting in Washington, DC. Rubenstein stated he had trouble getting Tech Staff to review soils.

10/ 1/79	Bechtel	Tank Farm Investigation Report
10/ 1/79	UST-Bechtel	Response to Bechtel review
10/ 9/79	GSK/BWM/WRB/JJZ	Meet on 50.54(f) (Question 23) in Jackson
10/ 9/79	TCC/DES/DEH/TRT (CSC-4504-below) also BLC-8439	D/G Task Group A^2
10/11/79	GSK	Meet with TRT to prepare for Bechtel dewatering meeting (Jackson)
10/12/79	GSK	Meet at Bechtel-A^2 all day?
10/15/79	Gray to Schultz	Dispersive soil test data
10/15/79	Schultz to Afifi	Dispersive soil test data
10/16/79	JJZ	NRC notification that Corps of Engineers is helping on geo-technical reviews so asked that 50.55(e) and 50.54(f) be sent to them
10/16/79	D Hood - 7/18/79 minutes	
10/16/79	TCC to Curtis CSC-4504	Comments on dewatering RG
10/19/79	Dunnicliff to Afifi	DGB settlement
[redacted]		Transmittal of draft RG on dewatering systems
10/25/79	SHH/BWM/GSK (tendon meeting?)	Meet with NRC Region III in Chicago
10/25/79	TCC/DES (where are meeting notes?)	Meeting with consultants Gould & Hendron at Bechtel-A^2
10/25/79	Mtg Notes (Hendron, Gould)	Plant Area Fill
10/29/79	MCAR 24, Interim Report No 8	BLC-8370
10/30/79	TCC/DES (where are meeting notes?) BLC-8474, 11/19/79 Curtis-TCC	Dewatering meeting with consultants Bechtel-A^2
10/31/79	Afifi to Loughney	Interim Report No 8
10/31/79	Afifi to Peck	Interim Report No 8
10/31/79	Afifi to Hendron	Interim Report No 8
10/31/79	AFIFI TO DAVISSON	Interim Report No 8
10/31/79	Afifi to Gould	Interim Report No 8

11/ 1/79	TCC - Curtis	Pond dewatering requirements
[redacted]		8th Interim report
11/ 9/79	Curtis to DBM, BLC-8441	Need for pond dewatering
11/ 9/79	JAR to GSK	Suggested 50.54(f) Question 23 include commitment to review previous 50.55(e) reports.
11/12/79	Afifi to Hendron	Review of DG Calc
11/12/79	Afifi to Peck	Review of DG Calc
[redacted]		Submitted Rev 4 to 10 CFR 50.54(f) relative to QA (Question 23)
11/14/79	TCC (where are meeting notes?) I have, but not published	D Hood w/Corps of Engineers visits site (NRC meeting notes dated 12/6/79)
11/15/79	CP testing telecon Bechtel-A^2	Settlement/vibration question
11/15/79	WRB - Dreisbach	QC commitments on 50.54(f) questions
11/16/79	Bechtel/Consultants	Vibration Meeting, Bechtel-AA
11/19/79	Supplemental 50.54(f) Questions 23-35	
11/19/79	Listing of commo w/consultants	
11/20/79	TCC (where are meeting notes?) Not published yet (A^2)	Dewatering task force meeting at Bechtel
11/21/79	Curtis - Cooke pono dewatering	Technical aspects
11/21/79	Cooke - Fobes	Pond dewatering reasons/method
11/27/79	Afifi to Peck	Transmit October 25, 1979 Notes
11/27/79	Afifi to Gould	Transmit October 25, 1979 Notes
11/27/79	Afifi to Hendron	Transmit October 25, 1979 Notes
11/27/79	GLD to Castleberry	Transmit Test Pit and Plate Load Test
11/29/79	Afifi to Hendron	Transmit October 30, 1979 Notes on Dewatering
11/29/79	Afifi to Gould	Transmit October 30, 1979 Notes on Dewatering

11/29/79	Afifi to Loughney	Transmit October 30, 1979 Notes on Dewatering
11/29/79	TCC/Starr Eby MDN Telecon	Other Bldg Settlement
11/30/79	Afifi to Woods	Transmit Additional Information on DG Pedestal Vibration
11/30/79	Afifi to Peck	Transmit Supplemental 50.54 Questions
11/30/79	Afifi to Hendron	Transmit Supplemental 50.54 Questions
11/30/79	RLT memo to Bechtel PE	Data for new settlement problems
11/30/79	Fiorelli to SHH	IR 50-329/79-20, 50-330 cons methods/spec rev (inadvertent)
11/30/79	JBPost - TCC	Mengentime bid question
12/1-28/79	R Cook 78-23	
12/ 3/79	GSK (no meeting notes)	Meet with Bechtel at site on 50.54(f) Questions 24-35
12/ 3/79	Curtis to Davis memo	Dewatering work responsibilities
12/ 3/79	Fobes - to distribution	Response to TCC 11/21 memo on draining pond
12/ 4/79	GSK to JAR Serial 8021	Answer to JAR memo to GSK on QA commitments
12/ 4/79	Fobes - Lansing	Draining pond
12/ 4/79	Fobes - TCC	Permission to drain
12/ 5/79	Pond dewatering	Final preparations for dewatering
12/ 5/79	New 50.54(f) Questions	Planning session
12/ 5/79	Meeting at Site to discuss additional 50.54(f) soils questions - TCC memo 12/11/79, CSC-4660	
12/ 6/79	Underpinning meeting in A^2	Pre-award
12/ 6/79	NRC issues Order modifying Construction Permit	
[redacted]		

12/ 6/79	Dreisbach NCR response to JLCorley	Dewatering fine sampling
12/ 7/79	TCC memo to Fobes	Miscellaneous dewatering info
[redacted]	Telecon with Hood on interpretation of Order between 50.54(f) and Order	
12/12/79	NRC Order of December 6, 1979	Investigate work activities which may not proceed under Order
[redacted]	Telecon with Hood on follow-up of 12/11/79 telecon	
[redacted]	Telecon with Hood on not getting Questions 4 and 14 on 50.54(f) in until Mid-January and that some of 11/19/79 50.54(f) questions are pertinent to amendment	
[redacted]	CP Co/NRC telecon on future meeting	
12/18/79	Dewatering Meeting in Ann Arbor	
[redacted]	Amendment 72 referencing 50.55(e) and 50.54(f) material	
12/19/79	Telecon Cook/Weidner - Planning FR release on Order	
[redacted]	SHH memo submitting amendment	
12/20/79	MOR to RCB (BLC-8165)	Vibratory Settlement of the D/G Pedestals
12/20/79	Bechtel/Consultants (BLC-8615)	Vibration Meeting, Bech-AA Meeting Notes No 1085
12/20/79	GZD to Afifi	Transmit Settlement Marker Calc
[redacted]		NRC Region III - CP Co Mgmt Meeting - 1/11/80
12/26/79	MIMiller to EGCase & VStello	Request for Hearing
12/26/79	JAR to GSK (BLC-8622)	Modification of Midland Construction Permit - Schedule Analysis on Impact of Order

12/26/79	QAR - Question 23, Item 1	
12/26/79	Fobes/Cooke Memo on Pond Dewatering	
12/28/79	BLC-8630, LHC to RCB	Responses to 10 CFR 50.54(f) Questions on Plant Fill
1/ /80	NRC Letter to Nila Najawicz	Response to her letter of January 19, 1980 regarding Soils Settlement
1/ 2/80	NRC Meeting Notice	
1/ 3/80	QA telecon on Number of Infractions	
1/ 4/80	GeoTech/Hendron Dewatering Mtg	
1/ 4/80	Memo to File from BHP/RMW	12/18/79 Mtg in Ann Arbor - Permanent Dewatering
1/ 7/80	Bechtel/Loughney/Hendron/McClure/Ferril	Dewatering Meeting
1/ 8/80	CP Co/Bechtel Meeting - Ann Arbor	Dewatering & Questions #4 and #14
1/ 8/80	Woods to Afifi	Transmit Cross-Hole Test Report
1/ 9/80	Woods to Afifi	Evaluation of DG Pedestal Vibratory Settlement
1/ 9/80	Bechtel/Mergentime	Suspend Bid
1/10/80	Dreisbach/Corley	Fines Monitoring
1/14/80	CP Co/Bechtel - Ann Arbor	Preparation for NRC Mtg - 1/16/80
1/14/80	BLC-8692 - JAR to GSK	50.54(f) Question 23 Actions - December Status Report
1/16/80	CP Co/Bechtel	NRC Meeting in Bethesda on 50.54(f) questions and update on soils corrective action technical items
1/17/80	Telecon with Hood, JJZ, GSK	On Soils
1/17/80	Memo From MIMiller to GSK & SHH	On NRC Soils Reporting Requirements
1/17/80	Telecon Between D Hood and J J Zabritski	Soils Issue

1/23/80	Cooke/Rothwell Telecon	50.54(f) Questions
1/23/80	Fobes/District Engineer	Dewatering Discharge to Pond
1/25/80	TCC Memo to MRothwell, CSC-4763	Answers to 50.54(f) questions based on NRC meeting of 1/16/80
1/25/80	Horn/Gallagher	Lean Concrete Backfill
2/ 4/80	Telecon Record, JJZ and DHood	Future Meeting on Soils Settlement Issue
2/ 4/80	NRC to CP Co (SHH)	1/16/80 Mtg on Supplemental Requests regarding Plant Fill
2/5/80	Cooper/Wheeler	Insurance Coverage
2/ 6/80	QA Dept Oral Communications Record - WRB, JJZ, LJRichards with Dick Knop, NRC	50.55(e) letter transferring D/G Foundations and Bldg Settlement Problem to Licensing
[redacted]	[redacted]	Closing out 50.55(e)
2/ 7/80	Probably no Minutes	50.54(f) Questions Response Review Meeting - A^2
2/ 8/80	Dunnicliff to Afifi	Review of DG Bldg Settlement
2/ 8/80	Telecon Record, JJZ and DHood	Soils Mtg on Site for Consultants
2/11/80	SHH to DVassallo, Howe 39-80, Serial 8333	Reference Material for Amendment 72
2/11/80	NRC, R M Diggs to S H Howell	Additional Fee for Licensing on Soils
2/12/80	Afifi to Gould	Transmit Updated Spec C-95 and C-88 for Review
2/12/80	Probably no Minutes	50.54(f) Questions Response Review Meeting - A^2
2/13/80	Telecon Record, D Hood and J Nowak	NRC Mtg on Soils at the Midland Site
2/14/80	BLC-8827, JAR to GSK	50.54(f) January Status Report
2/14/80	Draft Agenda	Feb 27, 28 Mtg w/NRC
2/14/80	NRC letter to SHH	Termination of 50.54(f) Context for Further Responses on Midland Soils Settlement
2/14/80	NRC - LSRubenstein from DHood	Notice of Initial Site Visit for NRC Consultants to Observe Midland Soils Settlement and Effects

2/14/80	Woods to Afifi	Correction for Cross-Hole Test Report (1/8/30)
2/14/80	Draft Agenda	Feb 27-28 Mtg W/NRC
2/15/80	BLC-8833 - MDR to RCB	Meeting Notes No 1115 of January 8 and 14, 1980 meetings in Ann Arbor - 10 CFR 50.54(f) Questions on Plant Fill
2/15/80	BLC-8833	Minutes for 1/8 and 1/14 Mtg
[redacted]	[redacted]	Rebutting 2/11/80 Memo Requesting Additional Fee on Licensing
2/21/80	Curtis to Gould	Request to Attend Feb 28, 1979 Mtg
2/22/80	Woods to Afifi	Recommending Shear Wave Profile in DG Bldg and Tank Farm
2/22/80	Woods to Afifi	Revise Report
2/25/80	Memo From NRC, G Fiorelli to SHH	Acknowledging 2/7/80 50.55(e) Report as Final Report
2/26/80	NRC, LSR to SHH	Request that Naval Surface Weapons Center receive Soils Info
2/27/80	Afifi to Hendron	Transmit Dr Wood's Cross-Hole Test Report
2/27-28/80	Mtg With NRC and Consultants at Site	
2/27/80	Afifi to Peck	Transmit Dr Wood's Cross-Hole Test Report
[redacted]	[redacted]	Transmittal of Amendment 74 to FSAR Answer to 50.54(f) Questions 24-37, Rev
2/29/80	Memo From NRC, LSR to SHH	Use of Energy Tech Engg Center for Mech Engg Review for Soils and Operating License
[redacted]	[redacted]	U date and Questions 24-35
3/ 3/80	NRC Memo	Gallagher Inspection 2/12 and 2/14
3/10/80	BLC-8955, JAR to GSK	50.54(f) Soils Status Report
3/10/80	Zabritski/Curtis Added FSAR and Fill Distribution	Serial 8486

3/13/80	TCC to File 0485.16	Mtg W/NRC on Fill Status and Resolution - 2/27-28/80
3/14/80	Board notice of hearing	Notice of Hearing held before ASLB
3/17/80	Afifi to Dunnicliff	Meeting Notes 2/20/80
3/18/80	Soils Documents to Misc Parties	Serial 8509
3/20/80	BLC-9021 LHC to RCB (Doc Rev - 3/25/80)	10 CRF 50.54(f): Core Drilling for Crack Depth Investigation
3/25/80	Afifi to Davisson	Transmitting C-94 Spec for Comment on Test Pile
3/27/80	GSK to JAR Serial 8548	50.54(f) Monthly Status Reports - Soils
3/31/80	DSH, NRC to SHH	Summary of 2/27-28/80 Mtg and Site Tour With Consultants to Review Soil Settlement
~~4/ 1/80~~	~~SHH to DVassallo, NRC,~~ Serial 8570 (Howe 72-80)	Amendment No 76
4/ 1/80	BLC-9069, LHC to RCB	Mtg Notes 1131, 10 CFR 5054(f) Requests Mtg January 16, 1980
4/ 1/80	LSR, NRC, to SHH	Req for Reports, Dwg and Other Info Regarding Plant Fill Settlement and Effects
4/ 2/80	Mtg W/IL&B, DEH, GSK and TCC	
4/15/80	Telecon, D Hood, NRC and G E Clyde	Re: LSR ltr to SHH dated 4/1/80. "Request for Reports, Dwg, & Other Info Regarding Plant Fill Settlement & Effects"
4/16/80	IL&B reply to Board Notice of Hearing	
4/17/80	BLC-9140, LHC to RCB	Vibratory Settlement of the Diesel Generator Pedestals
4/30/80	NRC Staff Motion for Issuance of Amended Notice of Hearing	
~~5/5/80~~	~~JWC to Vassallo~~	Amendment [illegible] on Additional Documentation and Updated List of FSAR Sections No Longer Applicable

~~5/7/80~~	~~JWC/SHH to J G Keppler, NRC~~ (Howe-84-80; Serial 8803)	IE Bulletin No 79-02
5/12-13/80	Oral Com Record, WRB 51-80	D/G Settlement Program 50.54(f) Commitments on Equipment Qualification
5/16/80	Serial CSC-5043, TCC to LHC	Open Items - Soils
5/21/80	BLC-9289, JAR to JWC	Soils Settlement Schedules
5/21/80	CP Co Answer to NRC Staff Motion	Issuance of Amended Notice of Hearing
5/22/80	BLC-9305, JAR to JWC	Responses to NRC Questions on Plant Fill
5/27/80	ILAB to CP Co attaching Motion to ASLB	Motion to Partial Consolidation of soils & operating license hearing
5/28/80	JLB to CP Co (JBF/SHH/LBL/JWC/RFG/GSK/MGK)	Regulation - Federal - NRC -Constr Permit Modification -Correspondence
5/30/80	NRC, A Schwencer to SHH	Display ad re: Hearing on Order For Mod of Constr Permit
6/5/80	Note to File: RMW-CSC-5084	Mtg with Bechtel on Action Items For Soils Issues
6/13/80	Met With Staff on Licensing and Indicated Need to SER on Soils	
6/16/80	JAR to JWC	50.54(f) May Status Report
6/16/80	ASLB from NRC Staff	NRC Staff Response to CP Co Motion for Partial Consolidation and Staff Motion to Postpone Further Response
6/16/80	Carol Gilbert to NRC	Petition to Intervene
6/23/80	Wm A Thibodeau to NRC	Petition to Intervene
6/24/80	George Wilson to NRC	Petition to Intervene
6/25/80	Patrick Race to NRC	Petition to Intervene
6/25/80	Michael Race to NRC	Petition to Intervene
6/25/80	Terry Miller to NRC	Petition to Intervene
6/26/80	Sandra Reist to NRC	Petition to Intervene
6/26/80	Sharoon Warrent to NRC	Petition to Intervene

6/27/80	Ivan Smith, Chairman ASLB	ASLB Memo and order granting NRC Staff's request to postpone responses on motion to consolidate issues
6/27/80	Barbara Stamiris to NRC	Petition to Intervene
6/30/80	Memo from Schwencer to JWC	On Requests for Additional Information Regarding Plant Fill (Additional borings Questions 36,37, 38)
7/ 1/80	Answer to CP Co to Petition to Leave to Intervene of Thibodeau, Miller, Race, Stamiris and Gilbert	
7/ 7/80	NRC Staff to ASLB	Staff Answer to Petition for Leave to Intervene signed by Carol Gilbert
7/ 8/80	From IL&B to ASLB	Answers to CP Co to Petitions to Intervene of Race, Wilson, Reist and Warren.
7/14/80	Telecon Record - GSK/TJS/TRT/JEB to D Hood	Request by Corps of Engineers for Additional Information Regarding Plant Fill
7/14/80	NRC Staff Order	To Petition for Leave to Intervene Filed by Wendell H Marshall
7/21/80	Hood Notice of Mtg on 7/31/80	
7/24/80	Memo to L Curtis From T Cooke	Expediting Soils Placement
7/24/80	NRC - Memo and Order	Ruling Upon Standing to Intervene
7/24/80	NRC - Order	Ruling on Mapleton Intervenors 6/30/80 Petition to the Board
7/24/80	NRC - Order and Notice	Prehearing Conference
7/24/80	Memo and Order	Ruling Upon Standing to Intervene
7/24/80	Order and Notice	Prehearing Conference
7/25/80	Telecon Record - DHood/GSK/DMB	Discussion on Forthcoming NRC Corps of Engineers Mtg on Soils
7/30/80	Wendell Marshall memo to ASLB	Answering CP Co Motion for consolidation and includes move for stop of construction.
7/31/80	Met w/Staff & Corps of Eng on Adequacy of Our Fixes	

8/ 4/80	Schwencer to JWC on Corps of Eng Report Question 39 - 48	
8/ 7/80	Meet w/Bechtel to Plan Responses to Corps of Eng Questions from 7/31/80 NRC mtg	
8/11,20, 22,25/80	Amended Petition by Stamairis	
8/12/80	'arol Gilbert to NRC	Statement Concerning Contentions
8/12/80	Memo to ASchwencer from DHood	Notice of Mtg to Appeal Staff Position Requiring Add'l Explorations & Testing of Midland Plant Fill
8/12/80	Hood Notice of Appeals Mtg on 8/29/80	
8/12/80	Notice of Mtg to Appeal Staff Position Requiring Add'l Exploration & Testing of Midland Plant Fill	
8/13/80	Marshall Attorney Mewitt to ASLB Withdrawal	
8/14/80	Supplement to Petition to Intervene by Sharon Warren	
8/14/80	Correspondence from J E Brunner	Construction Permit Modification
~~8/15/80~~	~~To D Vassable from GSHowell~~	Amendment No 80 on Update of Committments on QA Answers to 23 and Test Report on Compaction Equip Qualification
8/15 & 25/80	Supplement to Petition to Intervene by Barbara Stamiris	
8/18/80	JLB to JWC/JEB/GFH/LHH/GSK	Contracts - Bechtel - Subcontracts: US Testing Company
8/20/80	Wheeler Notes on Mtg with Bechtel on Answering Corps of Engineers Questions on Additional Borings.	

8/27/80	Tedesco to JWC.	Request for additional info regarding dewatering (Question 49 - 53)
8/27/80	Wendell Marshall to ASLB on NEPA not evaluating Class 9 accidents.	
9/9/80	Supplement to Warren Petition to Intervene & Amended Supplement to Stamaris Petition to Intervene	
~~9/12/80~~	~~JWC to Bieschut Amendement 81~~	1. Discussion of Applicants Position on need for additional borings. 2. Settlement Update 3. Answer to Question 36 & 38 & borings for Figure 35-3
~~9/16/80~~	~~JWC to Vollmer on~~ General Discussion on Applicant's Position on Need for Additional Borings & including Item 1 From Amendment 81.	
No date	Statement of CPCo with respect to supplement to Warren Petition & Amended Stamaris Supplement	
9/19/80	Notice of Replacement of Ivan Smith by Charles Bechhoefer	

x

Consumers Power Company

ORAL COMMUNICATIONS RECORD

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT

QA5-0

CHRON. FILE NO WRB 51-80

PAGE 1 OF 2

DATE OF COMMUNICATION 5/12/80 & 5/13/80 QA-PE&C PERSONNEL PARTICIPATING WRBird (DHorn 5/13/80 only)

TIME OF COMMUNICATION ________ OTHER PARTY(S) G Gallagher, NRC

PREPARED BY WRBird

PROJECTS AND/OR SUBJECTS DISCUSSED

DIESEL GENERATOR SETTLEMENT PROBLEM - 50.54(f) COMMITMENTS ON EQUIPMENT QUALIFICATION

SUMMARY OF CONVERSATION

5/12/80 - Mr Gallagher asked my assistance in obtaining compaction equipment qualifications. NRC had asked for their submittal. The latest 50.54(f) response did not submit the data. He said he had talked to D Horn several times over the last weeks about the NRC concerns that the qualification records were not available. The following three points were made: 1) Qualifications are considered a permanent "Quality Record." 2) If they don't exist how can CPCo justify old work or justify continuing work? 3) Letters stating equipment is qualified is not good enough - a qualification report is needed.

I stated that I would investigate the situation and take appropriate action. Mr Gallagher stated that he would ask to see report on his next visit, and that there are other vehicles to accomplish their needs.

/13/80 - We called Mr Gallagher back to give him a status of what my investigation evealed and what specific actions we had directed:

) Bechtel will release an official design disclosure (most likely SCN to Specification C-211) which will list the equipment qualifications and the limits of the qualification.

(OVER)

21

1/2

BECHTEL

Telephone call

BY R. Grote OF B Midland ROUTE Valenzano
TO R. Rixford OF B.A.A.O. Church
DATE Sept. 18, 74 TIME 2:15 P.M. File C-210
SUBJECT Compaction Requirements in Q-list Fills JOB NO. 7220

I called R. Rixford concerning compaction requirements for specification C-210. He was in agreement with the following summarization of compaction requirements:

Non-Q Dikes (method spec)

Compaction ~~is~~ acceptance is based on moisture conditioning and 4 passes with a 50-ton rubber tired roller (or equivalent roller)

Q-list Plant Area Fill ("end product" spec)

Compaction acceptance is based on meeting an "end product" requirement, i.e. 95% of maximum density only. No method of acheiving this "end product" is specified or is required. The Subcontractor can use any equipment he chooses as long as he acheives 95% maximum density.

Rixford fully agrees with the above summarization.

R. Grote
9/18/74

(continued)

0046 (12-67)

BECHTEL

Telephone call

ROUTE Valenzano
Church
File C-210

BY ____ OF ____

TO ____ OF ____

DATE ____ 19 ____ TIME ____

SUBJECT ____ JOB NO. ____

I made an analogy (an exaggeration admittedly, but applicable) that if the compaction could be acheived with a herd of mules walking over the fill it would be acceptable as long as we got the required 95% compaction. Rixford agreed.

R. Broto
9/18/74

Bechtel Associates Professional Corporation

Inter-office Memorandum

Gr... [illegible]
J[illegible]
Hudson

BEBC - 104

To E. E. Felton

Date November 7, 1973

Subject Midland Plant Units 1 & 2
Job No. 7220
Earthwork Moisture Content
File: C-210, C-208, 0274

From P. A. Martinez

Of Engineering

At Ann Arbor

Copies to J. H. Allen
J. C. Hink
R. L. Rixford
L. F. Wilcox

Reference: a) FCR-C-18 dated November 2, 1973

In response to your FCR (ref. a) and based on laboratory test data, compaction data, and location of the material being placed, specification C-210 can be relaxed with the following stipulations:

The optimum moisture content range can be specified as 2% dry to 5% wet of optimum provided that if the moisture content exceeds 2% wet of optimum the fill shall be placed with a compactive effort equal to at least 95% of the Bechtel modified proctor test result (20,000 foot pounds effort). This will be done at no additional cost to Bechtel. This also applies only to zone 2 material which is placed in the Bullock Creek area and in other selected areas of the dike as specified by the Bechtel representative. The moisture control specifications originally written for zone 1 material still apply to zone 1 material. That is, zone 1 material must be placed within a moisture content range of 2% dry to 2% wet.

The above change in allowable range of optimum moisture content for the zone 2 material may result in more than four passes of compaction equipment. However, as pointed out above, this additional effort will not be at the expense of Bechtel since it is being done to allow construction to continue and give the contractor the best utilization of his equipment and people.

P. A. Martinez

RLR/rc

Teletype Message

TYPE DOUBLE SPACE • BE BRIEF

CHECK APPROPRIATE BOX

MESSAGE ADDRESSED TO	ADDRESSEE	ADDRESS	LOCATION/CITY, STATE
	Bechtel Power corporation	3500 E. Miller Road	Midland, Michigan
	Attn: K. E. Felton		

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

March 22, 1974

BEMC - 249

Subject: Midland Plant Units 1 & 2, Job No. 7220

Soil Boring Program

File: C-210, C-203, 0274

Reference: 1) BEMC-238 attach. Sht. 1

In response to telecon request from R. Grote on 3/20/74, this is to clarify that the "W-tests" referred to in ref. 1) consist of moisture content determination (ASTM D 2216) and dry density.

The dry density is to be determined by the following procedure:

Samples will be extracted in Shelby tubes. A representative four to six inch sample shall be cut from the Shelby tube. The cuts must be uniform and perpendicular to the axis of the tube. The sample should then be carefully extruded from the cut portion of the Shelby tube, using a jack with a diameter equal to the inside diameter of the Shelby tube. The extrusion should be

COPIES TO: R. Grote, J. H. Allen, S. S. Afifi

RLR/pjf

DATE

3/22/74

P.A. Martinez, Project Engineer

LOCATION

Building 'A' - 202

ORIGINATOR

7PE-2113

Teletype Message

TYPE DOUBLE SPACE • BE BRIEF

CHECK APPROPRIATE BOX:

Night Ltr.	Full Rate	Report Delivery YES / NO	CHARGE ACCT. OR NUMBER TO BE CALLED

MESSAGE ADDRESSED TO

ADDRESSEE	ADDRESS	LOCATION (CITY, STATE OR COU...)

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

made vertically with care taken to assure an undeformed sample.

The inside diameter of the Shelby Tube will be used to express the sample diameter and the volume of the sample computed from the cross-sectional of area and the average of four height measurements.

The wet density is the ratio between the weight of the extruded sample and the calculated volume of the sample.

The dry density is the ratio between the weight after oven drying of at 105°C for 24 hours and the calculated volume of the sample.

Extreme care is required in handling these samples between the boring location and the laboratory to assure obtaining an undeformed sample. The extrusion and weight and height measurements should be made by a qualified technician under the supervision of the engineer.

COPIES TO:

DATE	SIGNATURE	LOCATION & EXT.	ORIGINATURE CO.

04605

Teletype Message

TYPE DOUBLE SPACE • BE BRIEF

MESSAGE NUMBER	CHG. IND.	

DSG	TELTEX	TWX	TELEX

CHECK APPROPRIATE BOX:

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

MESSAGE ADDRESSED TO	ADDRESSEE	ADDRESS	LOCATION (CITY, STATE & COUNTRY)

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

Weight measurements are to be to the nearest 0.1gm and dimensions to the nearest 0.01 inch.

WU INFOMASTER

BECHTEL MIDL

003468C364 0937EST
2071 MIDLAND, MI 12/30/77

TLX 12-6493 U.S. TESTING HBKN
ATTN: DAVE EDLEY

SUBJECT: JOB 7220 MIDLAND PROJECT
SUBCONTRACT 7220-C-208
FAILURE OF ADMINISTRATION
BUILDING GRADE BEAM AT 0.4 LINE
C-208-B-283

ON AUGUST 23, 1977 WE NOTED A FAILURE OF THE SOIL SUPPORTING THE SUBJECT GRADE BEAM. THIS GRADE BEAM WAS PLACED ON FILL FOR WHICH U.S. TESTING PROVIDED SOIL COMPACTION TESTING DURING THE INSTALLATION PERIOD. OUR ENGINEERING ANALYSIS INDICATES THAT THERE MAY HAVE BEEN AN ERROR ON THE PART OF U.S. TESTING COMPANY IN THE SELECTION OF THE PROCTOR FOR THIS WORK. WE ARE EVALUATING ALL OF THE CIRCUMSTANCES (INCLUDING SUBSEQUENT TESTS THAT HAVE BEEN PERFORMED) AND WILL ADVISE YOU IN THE NEAR FUTURE AS TO ANY LIABILITY WE FEEL U.S. TESTING COMPANY MAY HAVE PER ARTICLE 14, "INDEMNITY" OF EXHIBIT "A", "GENERAL TERMS AND CONDITIONS" OF TECHNICAL SUBCONTRACT 7220-C-208.

QUESTIONS ON THIS MATTER SHOULD BE REFERRED TO MR. J. C. CHURCH, FIELD CONTRACTS ADMINISTOR.

J. F. NEWGEN
BECHTEL MIDL.

JFN/JCC/AJB/KM

CC: JOHN SPELTS, UST CO
P. A. MARTINEZ
R. HERMESTON
P. A. BECNEL, SFHO
J. C. CHURCH

ACCEPTED
02071

1-PC

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

February 28, 1978

Consumers Power Company
P.O. Box 1963
Midland, MI. 48640

Attention: T. C. Cooke

Job 7220 Midland Project
Non-Q Dike Soils Test
BCCC-3128

Dear Mr. Cooke:

In order to evaluate the non-Q portion of the cooling pond dike for turnover, Bechtel field engineering has performed an audit of the soils tests on the dike. Out of a total of approximately 4,400 non-Q soils tests, 458 were reviewed. These tests were randomly selected from all sections of the dike. Attached is a copy of the tests reviewed.

Of the 458 tests reviewed, no compaction failing tests were found. The failing tests indicated on the attached list were due solely to high moisture content. As can be seen, in each case, except one, a retest was found or another test was found in the same vicinity to close out the failing test.

In the case where a retest was not indicated, the moisture content reported was so high that it made the report questionable. In this case, we believe that either the test was erroneous or the soil was replaced and not noted.

From this audit, we conclude that the documentation for the non-Q portion of the cooling pond dike is acceptable and the dike is ready for turnover.

Very truly yours,

J. F. Newgen

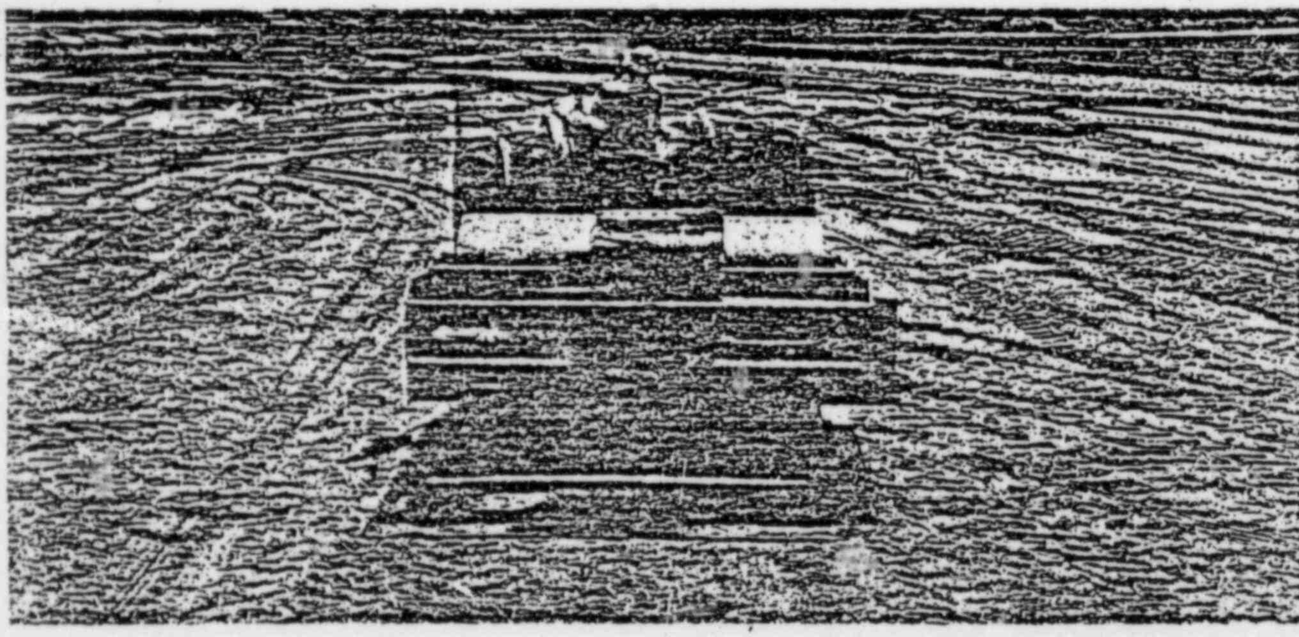
JFN/JRD/mrb

Attachments

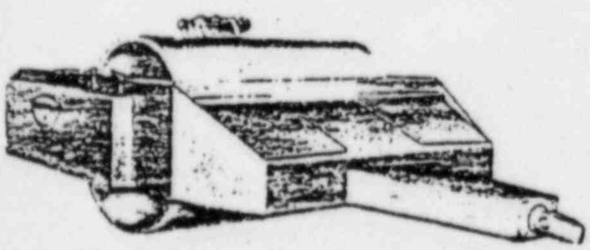
DYNAPAC®

VIBRATORY COMPACTORS

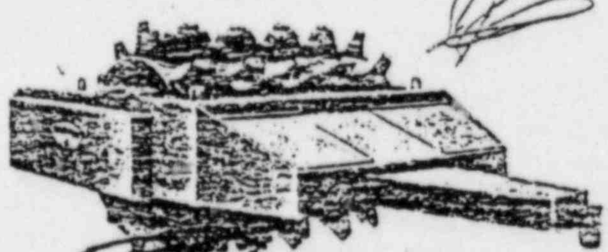
Model 3
Model 4



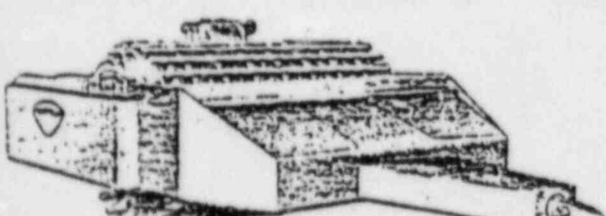
Deeper, Faster Compaction in Fewer Passes!



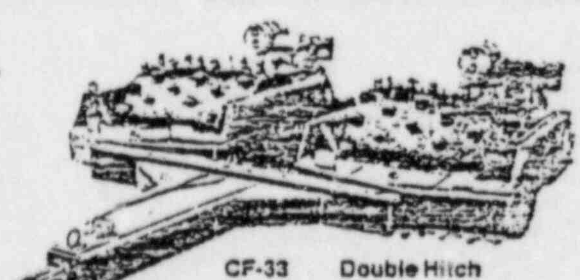
CH-43 CH-33 Smooth Drum



CF-43 CF-33 Sheepsfoot



CHG-43 Grid-Type



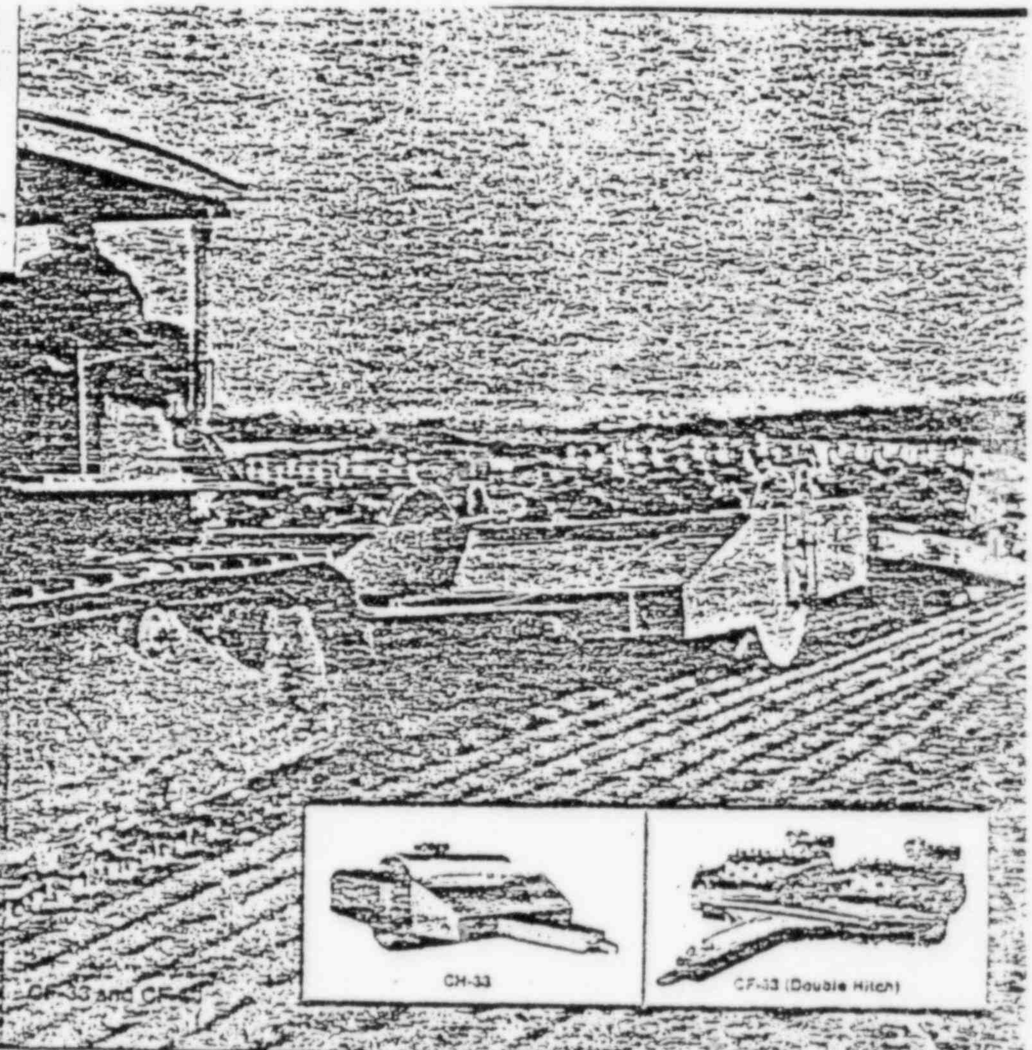
CF-33 Double Hitch

VIBRO-PLUS PRODUCTS!

STANHOPE, NEW JERSEY

Model 33 Options

CH-33 • CF-33



The Vibro-Plus CH-33 is essentially the same as the CH-43 except for its narrower (57" wide) drum. This multi-purpose roller weighs 4 tons and features the same engine options as the CH-43. A day-to-day cost saver in all types of material, the CH-33 is effective in base and sub-base work on sand, gravel, crushed stone and cohesive soils. Particularly suited to multiple-hitch roller operation, the CH-33 smooth drum roller is interchangeable with a sheepsfoot roller.

CH-33

CF-33 (Double Hitch)

Well-Balanced and *Right for the Job!*

THE RIGHT ROLLER FOR THE JOB To meet a particular job requirement with vibration, it is necessary to have the proper combination of *applied force* (per inch of drum width), frequency, amplitude and shell thickness.

The compaction effect of a vibratory roller is properly expressed as total applied force (per lineal inch of roller width). Total applied force must, however, be specified at a given frequency since it may be obtained with *high* frequency and *low* amplitude or *low* frequency and *high* amplitude.

This is particularly important in cohesive soils where high amplitude *and* heavy impact are desirable for depth compaction. In granular materials, satisfactory compaction is possible over a wider range of frequencies with less emphasis on amplitude. Therefore, the Model 43 and Model 33 with their finely balanced design provide the widest range of applications in different soils.

Vibro-Plus' ***heavy shell thicknesses*** are engineered to prevent energy-absorbing deflections and the damaging effects of point-loadings.

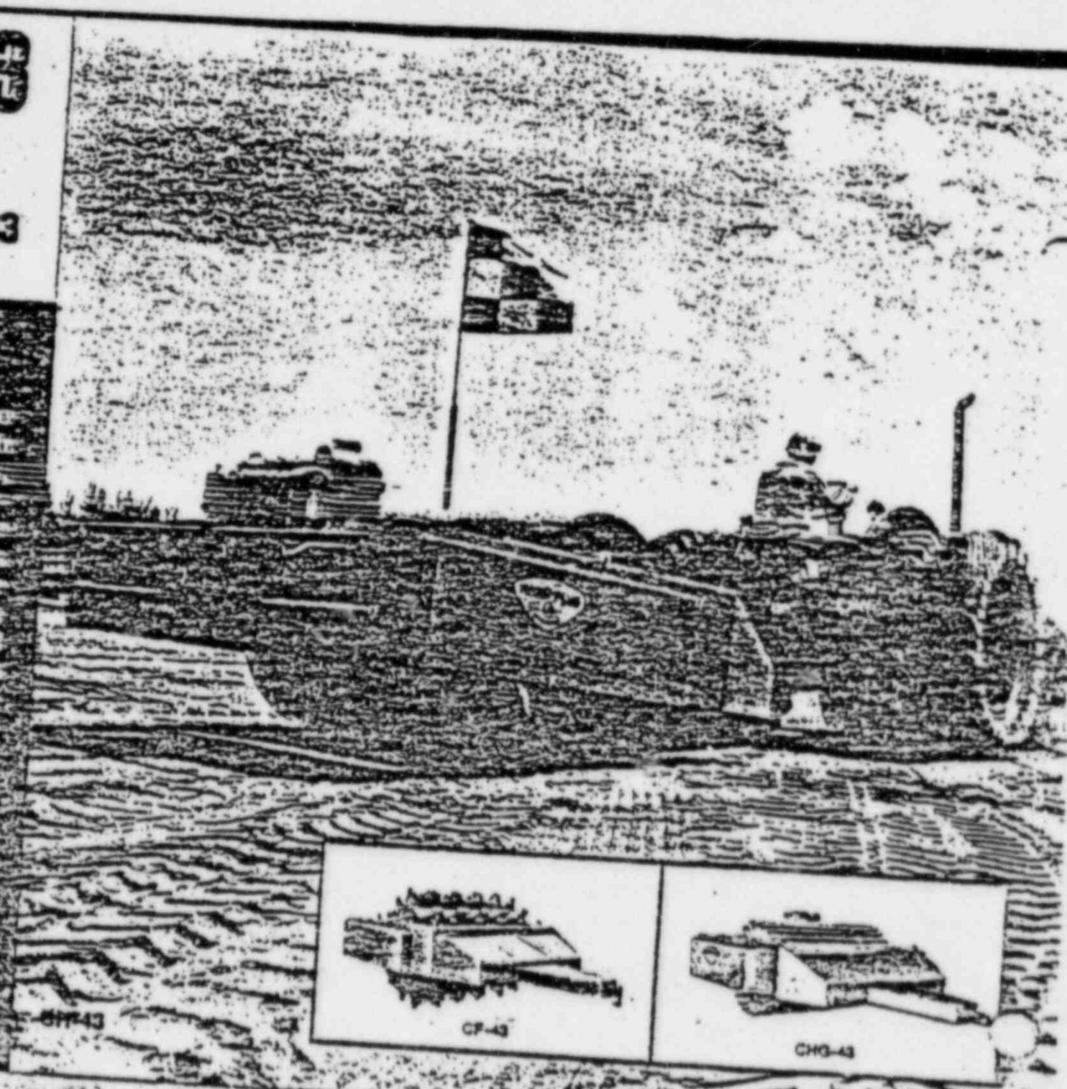
Loads per in./Drum Width			No. Sheepsfeet	Contact Area, Sq. In.	Total Applied Ground Pressure (PSI)
Static	Centr.	Total Appl'd			
140	316	456	—	—	—
—	—	—	98	20.7	1,520
133	307	440	—	—	—
—	—	—	128	26.7	1,310

*for GM add 600 lbs.

Model 43 / Options

-43 • CF-43 • CHG-43

popular vibratory rollers in the
-Plus line, the CH-43 smooth
roller assures steady profits,
fter job. Its proven construc-
features and wide effective
age (75" drum width) — plus
rsatility (interchangeable
sfoot and grid-type rollers)
it ideal for all general and
construction requirements
nular and cohesive compac-
vailable with either a water-
d GM 2-53 or air-cooled
3 FL-812 engine, the Model
also be furnished with a
ulic motor for use with a
emover and PTO pump
ng. For increased output,
del 43 is available in double
s-hitch combinations.



Use the Vibratory Roller that's *Dependable*,

DEPENDABLE *Patented ball and race design... superior suspension... dependable engines.*

In addition to the popular air-cooled Deutz 3 FL-812 engine, the Model 43 and Model 33 are now available with the highly effective long-life, water-cooled GM 2-53. Either of these fine engines provide optimum performance through a long, trouble-free life.

The patented Vibro-Plus Ball and Race design, coupled with a superior spring and rubber shock absorber combination mean minimum downtime — longest possible roller life (see back page).

PERFECTLY BALANCED Balanced design consists of two major considerations: (A) Balance of static and dynamic forces and (B) Balance of weight distribution.

A. In Vibro-Plus rollers, the fine balance between the vibrating mass and stationary masses is factory-engineered with infinite care for the most effective utilization of vibratory forces.

B. The E-Z Lift frame permits easy hook-up and utilizes static weight most efficiently for compaction. Check the E-Z Lift frame on the Model 43 or Model 33. Lift it with *one hand* . . . you'll *feel* the balance!

SPECIFICATIONS

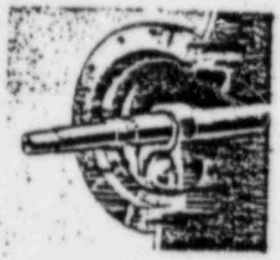
Model		Static Weight*	Centr. Force @ 1600 VPM	Total Appl'd Load* @ 1600 VPM
33	CH	8,000 Lbs.	9 Tons	26,000 Lbs.
	CF	9,500 Lbs.	11 Tons	31,500 Lbs.
43	CH	10,000 Lbs.	11.5 Tons	33,000 Lbs.
	CF	12,000 Lbs.	11.5 Tons	35,000 Lbs.

Vibration Frequency: 1400-1600 VPM
Engines: 3 cyl., Air-cooled Deutz, Model 3 FL-812, 30 HP.
2 cyl., Water-cooled GM, Model 2-53, 35 HP.

Model 33 Model 43

DYNAPAC®

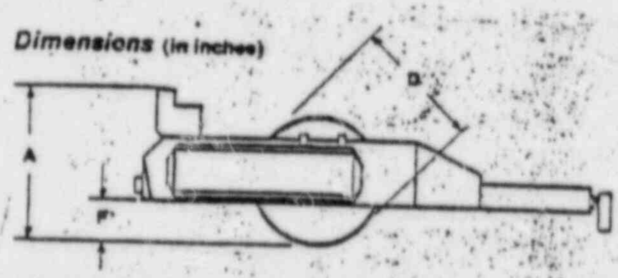
VIBRATORY COMPACTORS

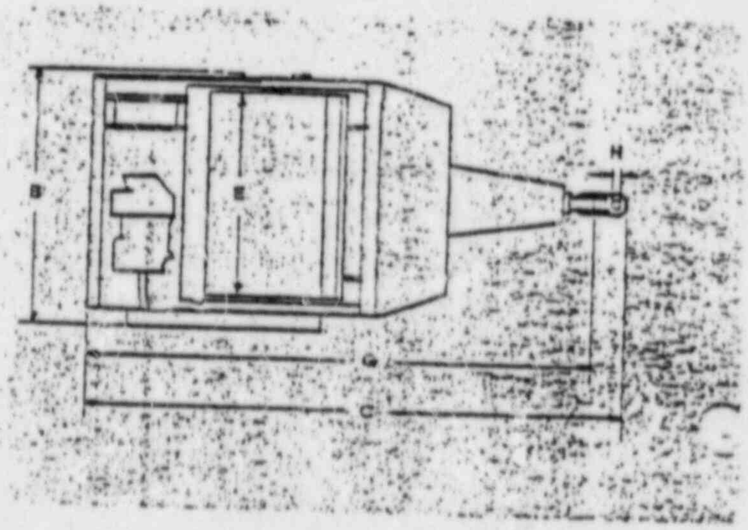


Patented Ball and Race Design

In this exclusive Vibro-Plus design, the rotating balls transmit their compaction forces directly into the drum head and then into the soil, providing ample impact yet leaving the drum bearings virtually unloaded for longer maintenance-free service.

Dimensions (in inches)





Model		D	E	B	C	A Deutz	A GM	F	G	H
33	CH	47¼	57	73½	156½	53¼	59	14	161½	2¼
	CF	63	57	73½	186½	63	67	22	161½	2¼
43	CH	47¼	75	[illegible]½	183	53¼	59	14	178	2¼
	CF	63	75	[illegible]½	[illegible]	63	67	22	178	2¼

How to determine output in cubic yards/hr. for the Model 43

1. On Chart A (Coverage Factor) First determine *Coverage Factor* by reading across from "MPH" and down from the "Number of Passes" (Note: Coverage Factor is speed divided by number of passes.)

2. Then, On Chart B (Output) From the determined *Coverage Factor*, read across to the specified "lift thickness" to determine *Output in Cubic Yards/Hr.*

(Note: Output depends on coverage in sq. yards per hr., compacted lift thickness and operating efficiency.)

(Chart A)
COVERAGE FACTOR

VELOCITY	Number of Passes 1	2	3	4	5	6
1.0 MPH	1.0	.50	.33	.25	.20	.17
1.5 MPH	1.5	.75	.50	.38	.30	.25
2.0 MPH	2.0	1.00	.67	.50	.40	.33
2.5 MPH	2.5	1.25	.83	.63	.50	.42
3.0 MPH	3.0	1.50	1.00	.75	.60	.50
3.5 MPH	3.5	1.75	1.17	.88	.70	.58
4.0 MPH	4.0	2.00	1.33	1.00	.80	.67

Most job conditions will fall within the shaded area, with proper moisture control.

(Chart B)
OUTPUT IN CUBIC YDS. PER HR. FOR COMPACTED LIFT THICKNESS @ 80% OPERATING EFFICIENCY

COVERAGE FACTOR	Specified Lift Thickness 6"	9"	12"	18"	24"	30"
	Cohesive and Granular Material			Granular Material Only		
.20	90	140	185	275	365	460
.30	140	205	275	415	550	690
.40	185	275	365	550	735	920
.50	230	345	460	690	920	1150
.60	275	415	550	825	1100	1375
.70	320	480	640	964	1285	1605
.80	365	550	735	1100	1470	
.90	415	620	825	1240		
1.00	460	690	920	1375		
1.50	690	1035	1370			
2.00	920	1380	1835			
2.50	1150	1725	2205			
3.00	1375	2065				
4.00	1835					

Example: *For a coverage factor of 1.0 and a job efficiency of 80% and a 12" compacted lift thickness the Model 43 produces:*

$\frac{1 \times 75"}{36 \text{ in/yd}} \times 1.0 \text{ Coverage Factor } \frac{1760 \text{ yd/mi}}{\text{Passes}} \times \frac{12"}{36 \text{ in/yd}} \times 80\% = \frac{920}{\text{cyd/hr}}$

(Model 33 output is 75% of Model 43 output)

VIBRO-PLUS PRODUCTS STANHOPE, NEW JERSEY

DISTRIBUTOR

Printed in U.S.A.

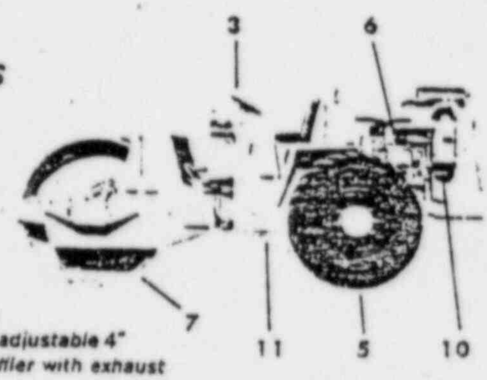
4510-987

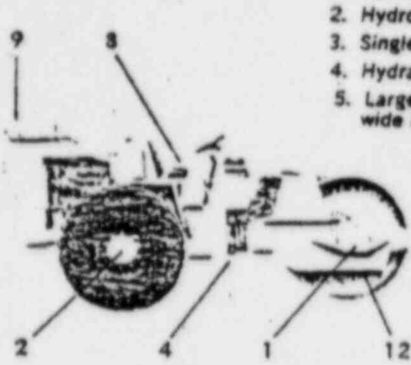
SPECIFICATIONS

RayGo RASCALS SELF-PROPELLED VIBRATING ROLLERS

THE RAYGO RASCALS OFFER THESE OUTSTANDING FEATURES

1. Hydraulically-driven Vibra-Drum
2. Hydrostatic wheel drive — Dynapower
3. Single lever forward-reverse/speed control
4. Hydraulic full power steering — Articulated
5. Large floatation or super hard, rock lug, wide base tires





6. Diesel engine (standard)
7. Large diameter steel drum
8. Large, soft bucket seat — adjustable 4"
9. Extra-quiet Donaldson muffler with exhaust extension
10. Dry type Donaldson air cleaner
11. Heavy welded (unitized) steel frame
12. High curb clearance — Tires track inside drum tread

		DYNAMIC 400	SUPER 600
PHYSICAL DIMENSIONS	Overall Length	16' 11½"	17' 0"
	Width	*8' 8" (Shog. 7' 11")	9' 11¾"
	Height (including muffler)	7' 2"	7' 4"
	Shipping Weight (approx.)	*17,900 lbs.	28,800 lbs.
	Drum Diameter	59"	60"
	Drum Length	*84"	100"
	Turning Radius	16' 10"	17' 0"
	Wheelbase	9' 0"	9' 1½"
	Curb Clearance	15½"	16"
VIBRATION SYSTEM	Hydraulic Direct Drive (no belts, no chains)	Vibra-Drum	Vibra-Drum
	Dynamic Force	*27,000 lbs.	*45,000 lbs.
	Frequency	1100 to 1500 V.P.M.	1100 to 1500 V.P.M.
	Total Applied Force	*44,900 lbs.	*73,800 lbs.
PROPULSION SYSTEM	Traction Wheel Drive	"Dynapower" Hydrostatic Drive with "Torque Selector" Control	
	Controls	Single Lever for Forward-Reverse Travel Speed Control and Dynamic Braking	
	Steering System	Hydraulic Full-Power Steering — "Articulated" Type	
	Braking	1. Dynamic on Drive 2. Hydraulic Service in Wheels 3. Hand Parking	
	Speed	0-15 M.P.H.	0-15 M.P.H.
	Tires (standard)	23.1 x 26 — 8 Ply Flotation type	*28.1 x 26 — 10 Ply Flotation type
POWER UNIT	Engine (Standard)	GM 3-53 Detroit Diesel 80 H.P. @ 2300 R.P.M.	GM 4-53/4 Valve Detroit Diesel 120 H.P. @ 2400 R.P.M.
	Electrical System	12-Volt	12-Volt
	Muffler	Donaldson Heavy Duty	Donaldson Heavy Duty
	Air Cleaner	Donaldson Heavy Duty Dry Type	Donaldson Heavy Duty Dry Type
	Fuel Tank	50 Gal.	50 Gal.
	Engine Disconnect Clutch	Yes	Yes
	Hour Meter	Yes	Yes
OPTIONS AND ACCESSORIES (available on special order at extra cost)	Tires — *20.5 x 25 — 12 Ply S.H. Rock Lug	No	Yes
	Driving Lights — Front and Rear	Yes	Yes
	Umbrella	Yes	Yes
	Cab with wiper	Yes	Yes
	Heater	Yes	Yes
	Air Conditioner	Yes	Yes

* Change from previously published specifications

RayGo®

13500 County Road 6
Minneapolis Industrial Park • Minneapolis, Minnesota 55427

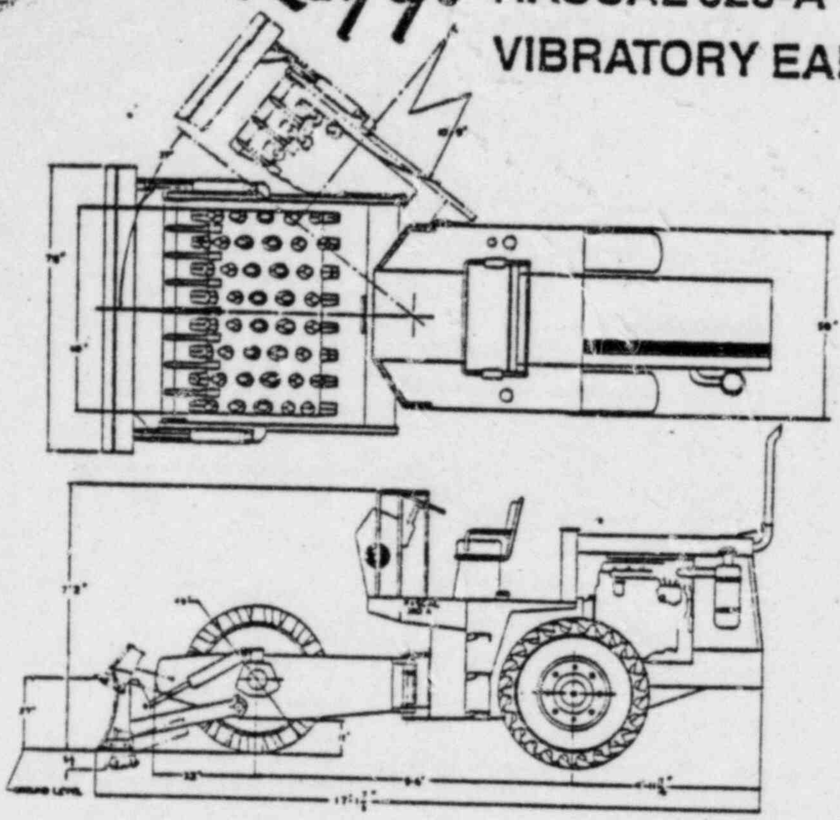
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE OR OBLIGATION.
RASCAL AND RAYGO ARE REGISTERED TRADEMARKS OF RAYGO, INC.

PATENTS PENDING — U.S. AND FOREIGN

FORM R.G. 105 (2-69) (SUPERSEDES R.G. 105, 11-67)

PRINTED IN U.S.A.

RayGo® RASCAL 320-A VIBRATORY EARTH COMPACTOR



SPECIFICATIONS: RAYGO RASCAL 320-A

PHYSICAL DIMENSIONS

Overall Length (with blade) .... 17'-11" (5.46 m.)

Overall Width (with blade) .. 6'-6" (1.98 m.)

Height (over steering wheel) .. 7'-2" (2.18 m.)

Weight (with blade) ... 14,340 lbs. (6505 kg.)

Wheelbase .... 8'-6" (2.59 m.)

Turning radius (inside edge of drum) ..... 10'9" (3.28 m.)

Curb clearance, height .... 11" (.28 m.)

Articulation angle .... ±37°

Oscillation angle .... ±16°

COMPACTION DRUM

Drum Diameter (over drum) .. 41" (1.04 m.)

Drum Diameter (over pads) .. 48" (1.22 m.)

Drum Width .... 60" (1.52 m.)

Number of Pads 96

Pad Height .... 3½" (.09 m.)

Pad face area .... 14.34 sq. in. (92.52 sq. cm.)

No. of Pads per Chevron 8

No. of Chevrons 12

Pad type .... Replaceable

POWER UNIT

Engine .... Ford 256D Diesel 89 HP @ 2500 RPM

Fuel Capacity...... 38 gallons (143.8 liters)

Electrical .... 12 volt

Engine Disconnect .... Clutch, hand lever

PROPULSION SYSTEM

Traction Wheel and Drum Drive .... Hydrostatic with two speed transmission

Speeds – Forward & Reverse
1st Gear .. 0 to 3.9 mph (0 to 6.28 km./hr.)
2nd Gear .. 0 to 6.2 mph (0 to 9.98 km./hr.)

Gradeability, Gross* 50%

Traction Wheel Axle .. Planetary w/no-spin differential

Propulsion Control ... Single lever, infinitely variable, forward and reverse.

Steering System ... Hydraulic full power with center-point articulation

Braking System ... Dynamic braking on propulsion drive; hydraulic service braking on wheels; hand operated parking brake.

Tires .... 14.9 x 26—6 PR, R-1

VIBRATION SYSTEM

Vibratory Drive ... Hydraulic, direct drive

Frequency .... 1100 to 1500 vpm

Dynamic Force ... 18,000 lbs. (at 1500 vpm) (7258 kg.)

Total Applied Force .... 30,340 lbs. (13762 kg.)

*Dependant on soil & surface conditions

INSTRUMENTATION

Vibra-Tach

Ammeter

Hydraulic Oil Temp.

Engine Water Temp.

Engine Oil Pressure

Hour Meter

OTHER CONSOLE MOUNTED CONTROLS:

Directional control lever

Throttle lever

Vibratory on-off switch

Key Switch

Starter Button

Engine Shut-off

Horn Button

OPTIONAL EQUIPMENT

Lights, 2 front & 2 rear

Cab w/safety glass & electric wiper

Heater & Defroster

Air Conditioner

Back-Up Alarm

RayGo® inc.
13500 COUNTY RD. 6
MINNEAPOLIS, MINN. 55441 U.S.A.
Telephone: 612/544-3321

RGS-256

RayGo RASCALS SPECIFICATIONS

	400-A	410-A WITH DRUM DRIVE	420-A WITH DRUM DRIVE AND PAD	500-A	600-A	700-A
PHYSICAL DIMENSIONS						
Overall Length	17' 3"	17' 3"	17' 3"	17' 3½"	17' 3½"	20' 6½"
Width (overall and shipping)	7' 11½"	8' 8"	8' 8"	7' 9½"	9' 4"	9' 4"
Height (including muffler)	7' 2"	7' 2"	7' 2"	7' 2"	7' 4"	8' 7"
Shipping Weight (approx.)	20,000 lbs.	21,400 lbs.	23,500 lbs.	31,000 lbs.	28,500 lbs.	45,500 lbs.
Drum Diameter	59"	59"	55***	60"	60"	60"
Drum Length	84"	84"	84"	80"	100"	100"
Turning Radius (outside edge of drum)	20' 5"	20' 5"	20' 5"	20' 3"	21' 1"	18' 6½"
Wheelbase	9'	9'	9'	9' 1½"	9' 1½"	10' 3½"
Curb Clearance (height)	16"	16"	16"	16"	16"	16"
PROPULSION SYSTEM						
Traction Wheel Drive	Hydrostatic Drive with 3 Speed Transmission* →					
Controls	Single Lever for Forward-Reverse Travel, Speed Control and Dynamic Braking →					
Steering System	Hydraulic Power Steering—Articulated Type →					
Braking	(1) Dynamic on hydrostatic drive		(2) Hyd. disc brake on axle input. †		(3) Hand parking brake →	
Speed—1st gear (F & R)	0 to 4.6	0 to 4.1	0 to 4.1	0 to 4.6	0 to 4.6	0 to 3
2nd gear (F & R)	0 to 9.0	0 to 6.2	0 to 6.2	0 to 9.0	0 to 9.0	0 to 7
3rd gear (F & R)	0 to 17.0	0 to 8.0	0 to 8.0	0 to 17.5	0 to 17.5	0 to 12
Tires	23.1 x 26 8-ply	23.1 x 26 8-ply	23.1 x 26 8-ply	20.5 x 25 Rock Lug L-3	28.1 x 26 10-ply	26.5 x 25 14-ply L-3
VIBRATION SYSTEM						
Hydraulic Direct Drive (no belts, no chains) Vibra Drum	Yes	Yes	Yes	Yes	Yes	Yes
Dynamic Force	27,000 lbs.	27,000 lbs.	32,000 lbs.	45,000 lbs.	45,000 lbs.	50,000 lbs.
Variable Frequency	1100 to 1500 V.P.M.	1100 to 1500 V.P.M.	1100 to 1500 V.P.M.	1100 to 1500 V.P.M.	1100 to 1500 V.P.M.	1100 to 1500 V.P.M.
Total Applied Force	47,000 lbs.	48,400 lbs.	55,500 lbs.	76,000 lbs.	63,000 lbs.	105,500 lbs.
Dead Stop Vibration Control	Yes	Yes	Yes	Yes	Yes	N.A.
Reed Type Vibration Tachometer	Yes	Yes	Yes	Yes	Yes	Yes
POWER UNIT						
Engine—Detroit Diesel	GM 3-53 (4-V) 88 h.p. at 2500 R.P.M.	GM 3-53 (4-V) 88 h.p. at 2500 R.P.M.	GM 3-53 (4-V) 88 h.p. at 2500 R.P.M.	GM 4-53 (4-V) 119 h.p. at 2500 R.P.M.	GM 4-53 (4-V) 119 h.p. at 2500 R.P.M.	GM 6V-53N 178 h.p. at 2350 R.P.M.
Electrical System	12 Volt	12 Volt	12 Volt	12 Volt	12 Volt	12 Volt
Muffler	Donaldson H.D.	Donaldson H.D.	Donaldson H.D.	Donaldson H.D.	Donaldson H.D.	Dual Nelson
Air Cleaner	Donaldson H.D., Dry Type	Donaldson H.D., Dry Type	Donaldson H.D., Dry Type	Donaldson H.D., Dry Type	Donaldson H.D., Dry Type	Donaldson H.D., Dry Type
Fuel Tank	50 Gallons	50 Gallons	50 Gallons	50 Gallons	50 Gallons	85 Gallons
Engine Disconnect Clutch	Yes	Yes	Yes	Yes	Yes	Yes
Hour Meter	Yes	Yes	Yes	Yes	Yes	Yes

*Plex drum drive on 410-A and 420-A.
**Pad drum 60" dia over pads.
†Except drum type in wheels on 500 & 600.

OPTIONS AND ACCESSORIES: Driving Lights (front and rear), Umbrella, Cab with Wiper, Heater, Air Conditioner, R.O.P.S. per U.S. Corps of Engineers. Cold weather starting kit.

WE HAVE A THING ON SOLVING YOUR COMPACTION PROBLEMS.

If you have compaction problems, call Archie Williamson on the RayGo Compaction Action Hot Line. He's a recognized specialist in the field of compaction. He'll answer your questions and give you fast action. Just dial 612/544-9321.

FINISHES 1 ST EVERY TIME

RayGo®

In the interest of continuous product improvement, specifications are subject to change without notice.

MINNEAPOLIS INDUSTRIAL PARK
MINNEAPOLIS, MINN. 55441 U.S.A.
Telephone: 612/544-9321

X

Bechtel Associates Professional Corporation

Inter-office Memorandum

To L. H. Curtis

Date 19 September 1979

Subject Midland Units 1 & 2-Job 7220-001
Equipment Qualification

From S. S. Afifi

Of Geotechnical Services

At Ann Arbor 10 D 5
7220-79-195

Copies to S. L. Blue
B. Dhar
G. Krzisnik
~~J. O. Wanzeck~~
K. Wiedner
1320, 3410

REFERENCES: 1. IOM, S. S. Afifi to R. L. Castleberry, 27 July 1979
2. IOM, S. S. Afifi to L. H. Curtis, 4 September 1979

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

A. STRUCTURAL AND RANDOM SANDS

1. ("POGO STICK") Rammer Type Compactor (RV 4B)

   a. all areas requiring 85% RD
   b. all areas requiring 80% RD
   c. all areas 4" lift, 8 passes

B. CLAYS

1. ("POGO STICK") Rammer Type Compactor (RV 4B)

   a. all areas requiring 95% (ASTM D 1557)
   b. all areas requiring 90% (ASTM D 1557)
   c. all areas 4" lift, 8 passes

This equipment is in addition to that which has previously been qualified in references 1 and 2.

JoWanzeck For/SSA
S. S. Afifi

Jow JOW/nm

BECHTEL

Teletype Message

TYPE DOUBLE SPACE · BE BRIEF

MESSAGE NUMBER	OPR. INL.	DATEL		
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: J.F. NEWGEN		

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

GEOTECH ANN ARBOR DISTRIBUTION

DISC	ACT	INFO	W/A	INIT
MGR				
ADMIN				
DRFT				
SOILS				
GEOL				
H&H				
Proj Mgr				
Proj Engl				
JOB		FILE		
REC'D OCT 2 1979				

BEBC- 3301

SUBJECT: CPCO/MIDLAND PLANT - JOB 7220

SOILS WORK COMPACTION

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

REFERENCE: QUALITY ASSURANCE STOP WORK REPORT 6

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

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

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

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

SR/js

L.H. CURTIS

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

W. BARCLAY

DATE	SIGNATURE	LOCATION & EXT:	ORGANIZATION CODE:
9-28-79	for L.H. CURTIS	6A 7220	7PE-2113

AO-17-1

ORIGINAL TO TELETYPE

X

BECHTEL ARB
TWX 5283 8/7/79 14:03

RECEIVED
AUG 7 1979

ATTN: J.F. NEWGEN

BEBC-3162
SUBJECT: CPCO/MIDLAND PLANT JOB 7220
QUALIFICATION OF COMPACTION EQUIPMENT
FILE: 0274, C-211-PR

THIS TWX LISTS WHICH EQUIPMENT IS QUALIFIED FOR Q-LISTED AND NON-Q-LISTED FILL PLACEMENT, AS REQUIRED.

EQUIPMENT TYPE	APPLICABLE MATERIAL	REQUIRED PASSES & THICK-NESS
"J" FOOT WACKER (MODEL GVR 220 V)	STRUCTURAL AND RANDOM RANDOM SAND	4" LIFT, 6 PASSES
M-B-W VIBROTARY (MODEL GD 7000)	STRUCTURAL AND RANDOM SAND	4" LIFT, 6 PASSES
VIBRO PLUS SELF-PROPELLED (MODEL CA-25D)	STRUCTURAL AND RANDOM SAND	6" LIFT, 10 PASSES

THE ABOVE EQUIPMENT WAS QUALIFIED ON TEST STRIPS AND BY ACTUAL USE IN NON-Q-LISTED AREAS.

RL CASTLEBERRY
ANN ARBOR/7PE2118/7220-001/ER

BECHTEL MIDL

Bill Barclay

Bechtel Associates Professional Corporatio

Inter-office Memorandum

To	L. H. Curtis	Date	4 September 1979
Subject	Midland Units 1&2 - Job 7220-001 Compaction Equipment	From	S. S. Afifi
		Of	Geotechnical Services
Copies to	S. L. Blue B. Dhar J. O. Wanzeck ~~J. Newgen~~ J. Betts K. D. Bailey 1320, 3410	At	Ann Arbor 10 D 5 7220-79-180

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SEP 1 1979
BECHTEL POWER CORP
JOB 7220
PER 32110 0220

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

A. Structural and Random Sands

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

B. Clays

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

2. Wacker 1 foot tamper (model GVR 2204)
   (a) all areas requiring 90% compaction
   (b) 4" lifts and 6 passes per lift
   (c) this equipment is capable of getting 95% 1557, but with additional compactive effort.

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

4. Wacker vibratory plate with 8" out riggers (model DVU 3001)
   (a) all areas requiring 90% compaction
   (b) 4" lifts and 6 passes per lift

QC 07220	
PFQCE	
A. PFQCE	
CIVIL	
ELECT.	
PIPING	
MECH.	
WELDING	
DOC.	
RECEIVING	
ADM ASST	SC
Matls. Test Lab Super.	
E. Newman	
OPEN LOOP	
YES NO	
DATE........	

JOB 7220 ROUTING	
Site Mgr.	
Proj. Supt.	
Sen. Supt.	
P.F. Engr.	
APF Eng. 1	
APF Eng. 2	
S.U. Turnover	
Cost-Sched.	
Inst. Engr.	
Civ. Sup	
Civ. Eng	X
Mech. Sup	
Mech. Eng.	
Elec. Sup.	
Elec. Eng	
Wld. Cont	
Cl. Adm.	
F & A	X
Q.C.	
Purch.	
Sub-Con.	
Doc. Con	

RECEIVED

SEP 12 1979

QUALITY CONTROL
BECHTEL JOB 7220
SIGNATURE

This equipment is in addition to that which has already been transmitted on July 27, 1979. (See IOM S. S. Afifi to R. L. Castleberry, dated July 27, 1979).

If there are any questions, please call J. O. Wanzeck of this office.

JOWanzeck / For SSA
S. S. Afifi

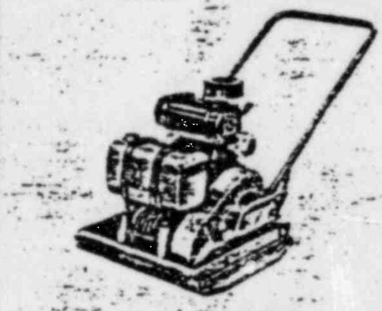
JOW
JOW/nm

If you have to pound ground do it with THE M-B-W

GROUND POUNDER®

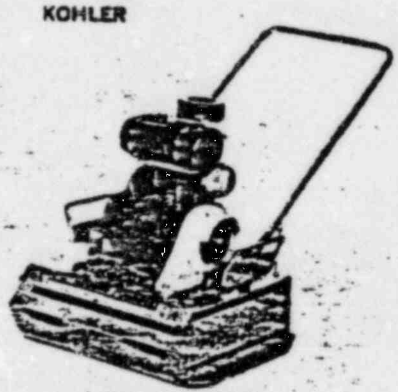
CP 1000
CRETE POUNDER
BRIGGS & STRATTON

AP 2000
ASPHALT POUNDER
BRIGGS & STRATTON
KOHLER



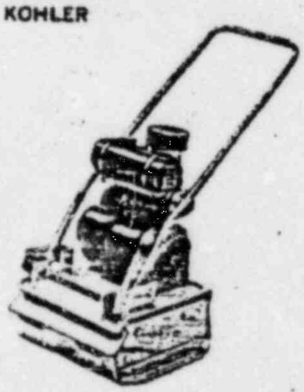
17" x 19" PLATE

GP 3000
KOHLER



20" x 22" PLATE

GP 3000-15
KOHLER



15" x 20" PLATE

GP 5000
KOHLER
WISCONSIN

24" x 24" PLATE

GP 7000
KOHLER
WISCONSIN
HATZ DIESEL

26" x 30" PLATE

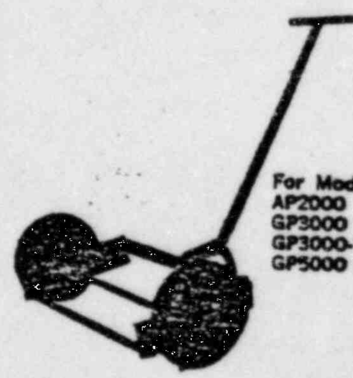
R-11
CHRYSLER
2 CYCLE

11" x 15" RAMMING SHOE

R-14
CHRYSLER
2 CYCLE

14" x 16" RAMMING SHOE

UNIVERSAL LOADING CART # 134



For Models
AP2000
GP3000
GP3000-15
GP5000

M-B-W, INC.

P. O. Box 378
SLINGER, WISCONSIN 53086
Tel. (414) 644-5234

2065 Bunnell Road
WARRINGTON, PA. 18976
Tel. (215) 343-3636

WACKER

RAMMERS

it has all these outstanding features, it can only be a WACKER

nerally, the first piece of confined area com- tion equipment a contractor purchases is a mmer. Further, more than nine out of ten spec- WACKER. The reasons are sound.

le Operating Range

primary compacting force of a Rammer is a aring action delivered by low frequency, high pact blows. This action is necessary in clay, m and other cohesive soils. WACKER Rammers o produce a vibratory action which broadens ir range to include granular soils.

ength and Quality

ntractors have learned to rely on WACKER de- ndability. Few will compromise on a lesser ma- ne simply to save a few original investment lars, for even an hour's downtime can cost ny times the price of the Rammer.

WACKER Rammers are tested and rated per ustry standards, CIMA-LEMB Standard #1.

Handle Doubles as a Guard. A special-design, ck-mounted handle forms a protective ring und the engine and serves as a mounting for variable-speed throttle control.

Spark Arrestor Silencer easily meets OSHA reg- tions for noise control . . . is approved by U.S. est Service for use in national parks.

Centrifugal Clutch permits free-wheeling idle easy no-load starts.

Crack-Resistant Shoe. Laminated hardwood or ecial compound high-impact shoes used on all cker Rammers resist cracking common to all- el shoes.

Gear and Spring System completely enclosed protected by continuous lubrication.

Two Cycle Engine with all-position carburetor ot affected by the machine's ramming motion.

Fully Filtered Fuel System keeps abrasive dirt of vital moving engine parts.

Specifications

MODEL	OPER. Wt (lb)	SHOE SIZE (in)	H P (SAE)	FT LB/ BLOW	BLOWS/ MIN	LB/ BLOW	LIFT (in)	SQ FT/ HR
GVR 75Y	87*	8 x 13*	3.3*	23.2*	800*	1120*	10	1710*
GVR 100	125*	11 x 13*	5*	33.0*	630*	1590*	10	2915*
GVR 151Y	134*	11 x 13*	5*	54.3*	620*	2610*	17	3080*
GVR 220Y	204*	16 x 15*	6*	73.1	580*	3510	20	3520*
EVR 150Y	145*	11 x 13*	2.2*	54.3*	630*	2610*	17	2250*

*Rated per CIMA-LEMB Standard #1.

WACKER

VIBRO-PLATES

f it has all these outstanding features, it can only be a WACKER

ligh frequency vibration sets granular particles in notion causing them to sift down, fill voids and nprove key seating of the soil. Easy one-man andling and low cost relationship to compacting fficiency make WACKER Vibro Plates a solid fav-rite among contractors, municipalities and other sers. Some models also offer gravity fed sprin-ling system for hot or cold mix asphalt compac-on.

eatures which help set WACKER Vibro Plates part include:

. **Guiding Handle** is shockmounted and reversible r operator ease and comfort.

. **Centrifugal Clutch** is fully throttle controlled. ngine free-wheels at idle for easy, no-load start-g. Clutch engages smoothly as rpm's increase.

. **Belts and Pulleys** concealed and protected for ouble free in-service operation and operator afety.

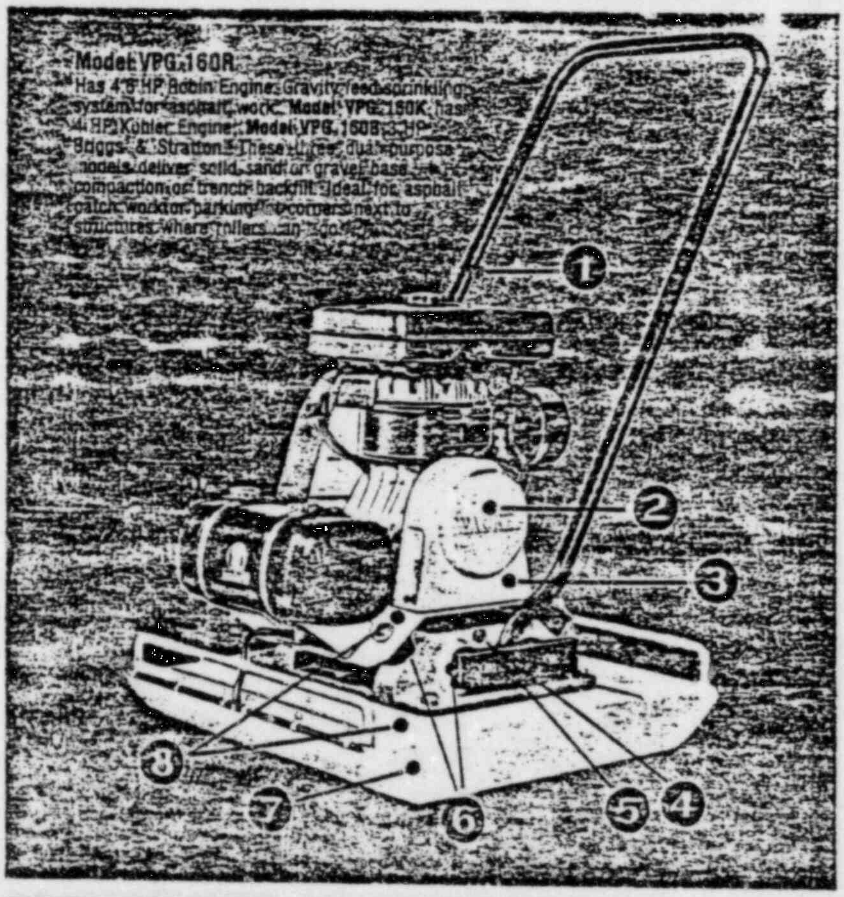
. **Heavy Duty Roller Bearings** specially designed withstand vibration shockload and to transmit ll compaction energy through base plate.

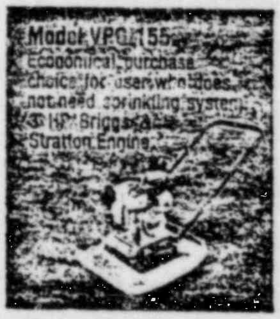
. **Sealed Lubrication System.** Oil bath or grease brication system provides exciter and roller bear-gs with constant supply of clean lubricant.

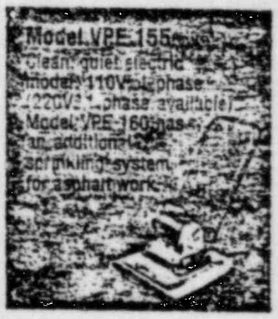
. **Shock Mounted Engine.** Special resilient shocks re "tuned" to isolate plate vibrations from engine nd guiding handle.

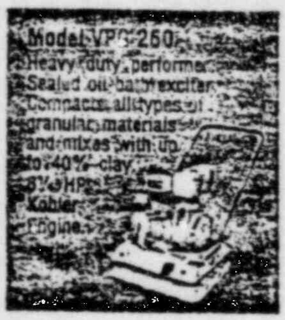
. **High Strength Steel Base Plate** with preformed olding edges for smooth turns.

. **Two Mass Vibratory System** — a WACKER ad-antage. Two separate "masses" are concentrated rectly above soil area to be compacted. Lower ass consists of base plate and exciter to pro-uce vibration. Upper mass consists of shock ounted engine to power the vibration system.









Specifications: Gasoline Models

MODEL	OPER. WT (lb)	PLATE SIZE (in)	H P (SAE)	CENT. FORCE (lb)	EXCITER RPM	SPEED FT/MIN	LIFT (in)	SQ FT/ HR
VPG 155	168*	21 x 24*	3*	2350*	5700*	59*	10	5810*
VPG 160R	185*	21 x 24*	4.6*	2500*	5850*	52*	10	5100*
VPG 160B	166*	21 x 24*†	3*	2350*	5700*	55*	10	5420*
VPG 160K	183*	21 x 24*†	4*	2850*	6250*	66*	10	6500*
VPG 310	254*	20 x 28*	4.6*	4600*	5300*	75*	13	7440*
VPG 260	257*	21 x 22*	6.25*	4660*	5000*	100*	13	10250*
VPG 600	625*	24 x 34*	9.2*	6100*	2800*	73*	20	8700*
Electric Models								
VPE 155	168*	19 x 24*	1.5*	2275*	5600*	45*	10	4275*
VPE 160	182*	21 x 24*	1.5*	2275*	5600*	43*	10	4500*

*Rated per CIMA-LEMB Standard #2. †Optional 17" x 24" plate available on special order.

WACKER

DIESEL VIBRO-PLATES

If it has all these outstanding features, it can only be a WACKER

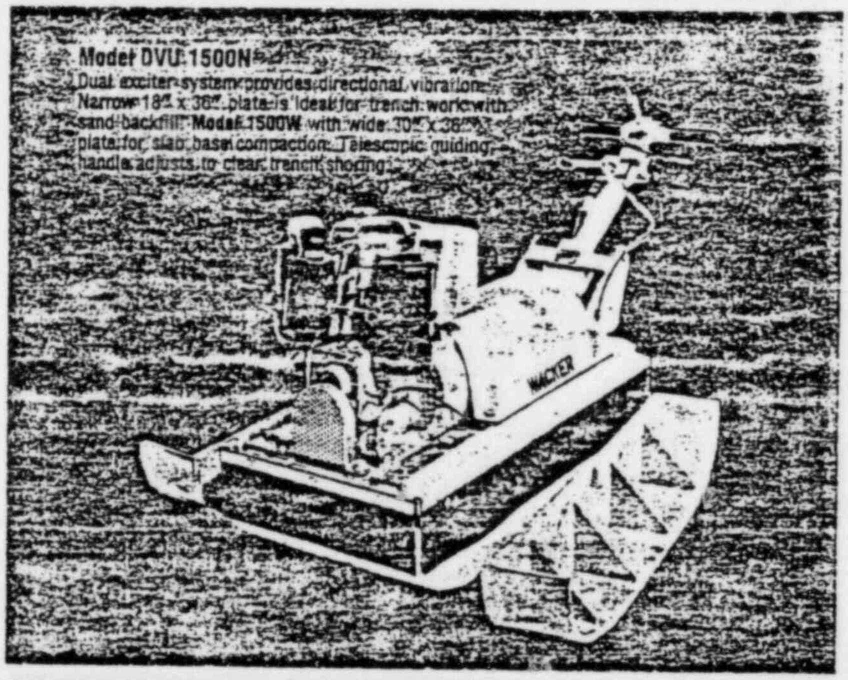
WACKER Diesel Vibro Plates combine the highly effective vibratory action for compacting granular and mixed soils with the efficiency and durability of diesel power. Ideal for large area compaction on parking lots, dams, around bridge abutments, along railroad beds, highway shoulders, etc. Also popular for confined area compaction around tanks, forms, columns, footings, under concrete slabs, base preparation basements and soil bases inside buildings.

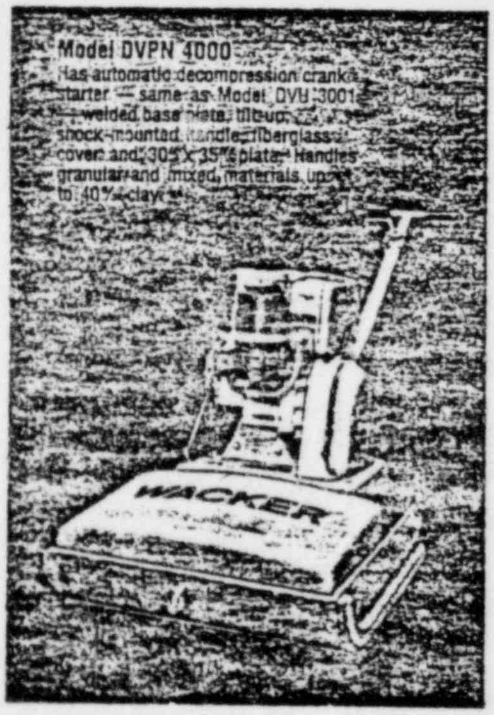
Shock Mounted Guide Handle reduces operator fatigue.

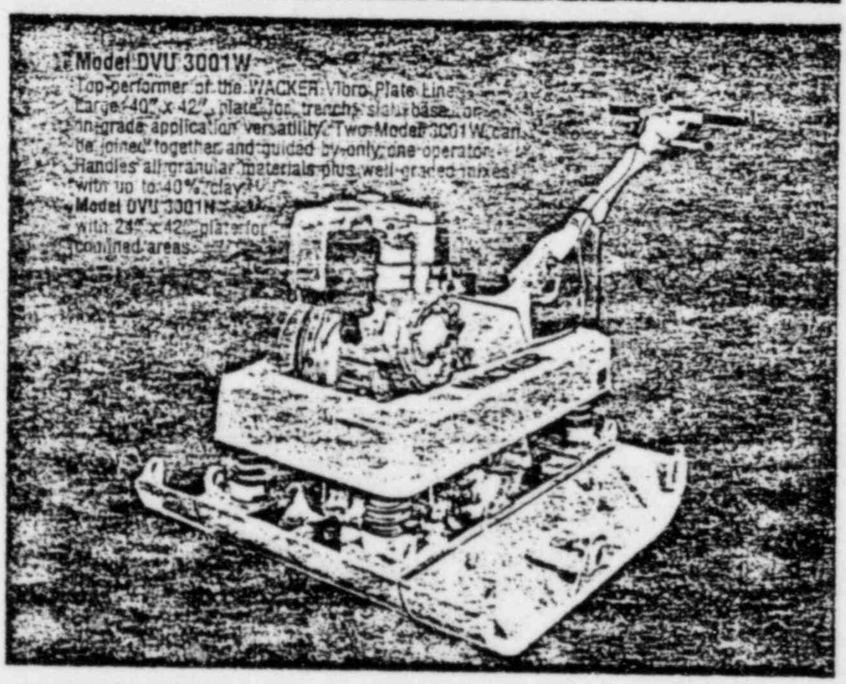
Oil Bath Air Cleaner. Efficient, easy to service, can account for many additional hours of engine life on dusty construction jobs.

Sealed Oil Bath Exciter System with special design self-aligning roller bearings.

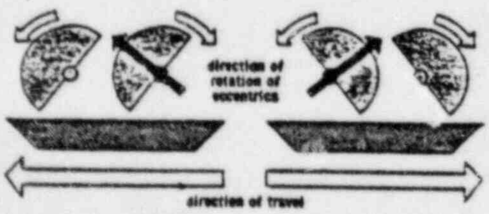
Transport Wheels. Standard accessory for models DVPN 4000 and DVU 1500 N/W.







INSTANT FORWARD-REVERSE



Models DVU 1500N/W and DVU 3001N/W feature a system of two exciters placed symmetrically at center of base plate. To change direction of travel, operator turns one eccentric 180 degrees by simply pulling control lever on guide handle.

Specifications

MODEL	OPER. WT (lb)	PLATE SIZE (in)	H P (SAE)	CENT. FORCE (lb)	EXCITER RPM	SPEED FT/MIN	(LIFT) (in)	SQ FT/ HR
DVPN 4000	815*	30 x 35*	10.8*	9200*	2800*	80*	28	12000*
DVU 1500N	660*	18 x 36*	6*	3700*	1620*	35*	20	3150*
DVU 1500W	785*	30 x 36*	6*	3700*	1620*	27*	18	4050*
DVU 3001N	1190*	24 x 42*	8*	7800*	1880*	50*	32	6000*
DVU 3001W	1350*	40 x 42*	8*	7800*	1880*	35*	24	7000*

*Rated per CIMA-LEMB Standard #2.

WACKER

VIBRATORY ROLLERS

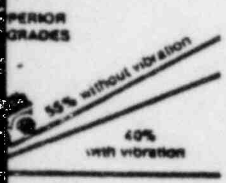
t has all these outstanding features, it can only be a WACKER

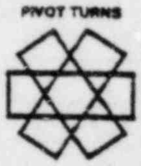
tive on wide range of soils. Vibratory rollers de effective compaction in all types of soils sands and gravels to mixes with high clay nt. Used extensively by utility construction maintenance crews and by contractors for action in trenches, construction of road beds ther base preparation. Versatile Model W 74 s used for hot or cold mix asphalt compac- WACKER Rollers feature low center of gravity ork on uneven terrain; choice of vibration o: operation.

Engine Power. The construction industry's popular engine. Selected for the tough jobs unmatched durability and efficiency.

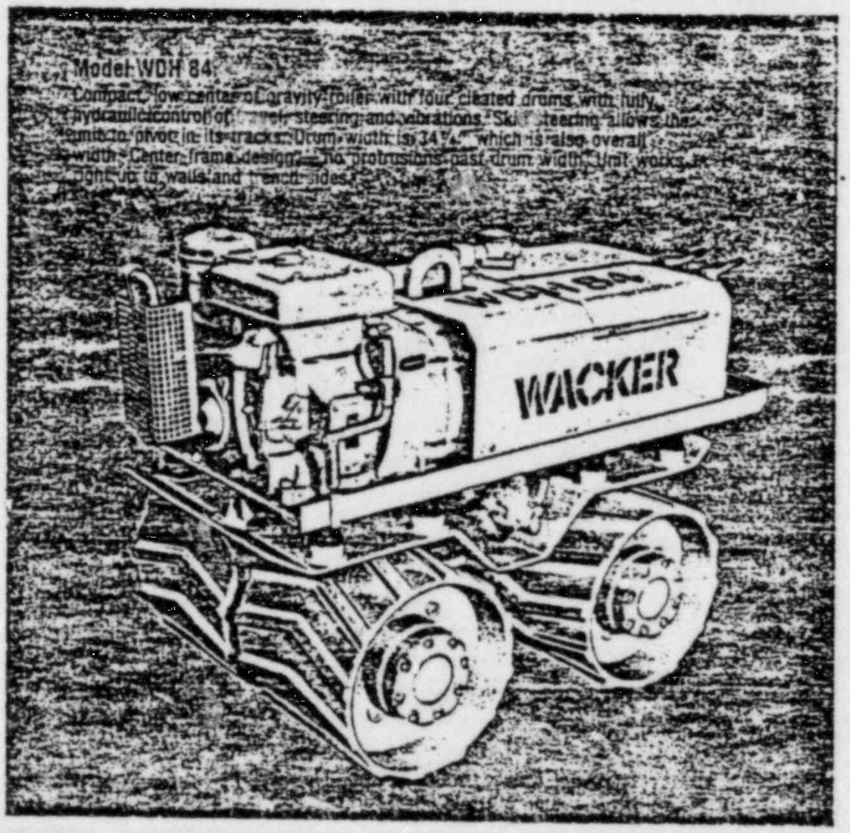
nent Lubrication. Only the engine needs dic attention.

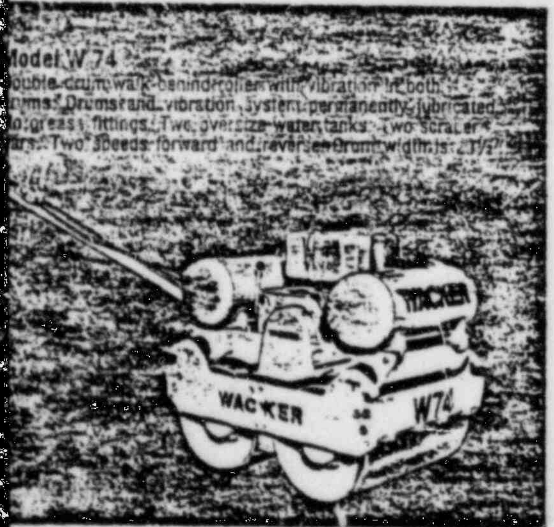
ion Multiplies Effectiveness. Vibrating drums r the compaction effect of a static roller times the weight. For example, the static pressure of Model W74 is 31.4 lb./in. mic lineal force (with vibration) is 153 lb./in. increase of almost 400 percent.

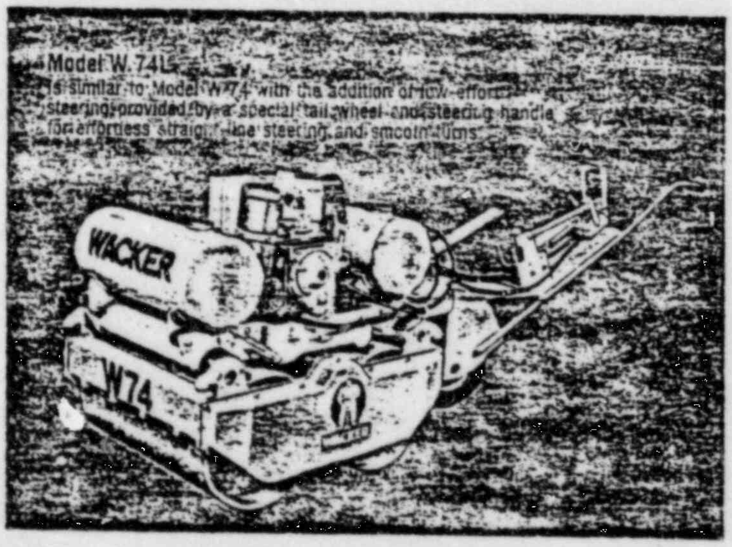




WDH 84 with its low center of gravity is or on grades . . . 55% without vibration . . . with vibration.







Specifications

MODEL	WT (lb)	DRUM WIDTH (in)	H P (SAE)	CENT. FORCE (lb)	EXCITER RPM	SPEEDS FT/MIN F or R	LIFT, IN		LIN. PRES. lb/in		VOLUME CAPACITY CU YD/HR	* AREA CAPACITY SQ FT/HR
							SOIL	ASPHALT	STAT	DYN		
W 55	1606	21.7	8.5	6750	2800	77/132	18	7	37	155.5	465/800	8350/14350
W 74	1850	29½	8.5	9000	3000	82/142	18	18	31.4	15.3	675/1170	12100/21000
W 74L	2095	29½	8.5	9000	3000	82/142	18		35.5	15.3	675/1170	12100/21000
WDH 84	2730	34¼	11	9000	3000	55/110	24		42.5	140	700/1400	9500/19000

Don torn 61

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

BECHTEL

Don - will any of these things not be covered by present QCIs

November 1, 1979

BLC- 8397

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

RECEIVED
NOV 7 1979
QUALITY ASSURANCE

Attention: Mr. R.C. Bauman

Subject: Consumers Power Company
Midland Plant - Job 7220
Diesel Generator Building
Settlement Investigation
File: 0270, 0279, C-1700,
C-2645

Gentlemen:

Attached is a copy of Meeting Notes No. 866 which addresses the diesel generator settlement investigations and filling of the cooling pond.

Very truly yours,

for [signature]
L.H. Curtis
Project Engineer

BCM/js
10/24/13

cc: D.B. Miller
T.J. Sullivan

CONSUMERS POWER COMPANY
RECEIVED
NOV 9 1979
FIELD QUALITY ASSURANCE
MIDLAND, MICHIGAN

61

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

MEETING NOTES NO. 866

MIDLAND PLANT UNITS 1 AND 2

CONSUMERS POWER COMPANY

BECHTEL JOB 7220

DATE: Friday, October 20, 1978

PLACE: Ann Arbor, Michigan

SUBJECT: Filling Of Cooling Pond And Diesel Generator Settlement Investigation Status

FILE: 0279, C-0280, C-2640

ATTENDEES:

Midland Project	Geotech	Staff	Construction
P. Martinez	S. Blue	K. Wiedner	A. Boos
M. Rothwell	J. Wanzeck	N. Swanberg	J. Betts
G. Tuveson	A. Marshall		
C. McConnel			
J. Simpson			
W. Moring			
G. Butler			
S. Godwin			

PURPOSE: Coordination of activities regarding filling of the Midland cooling pond and diesel generator building settlement investigation.

Were any more borings needed to clear up ucKO

ITEMS DISCUSSED:

The following points regarding filling of the cooling pond were discussed.

1. CPCo has withdrawn its request for additional borings in the dike pending further review of the Bechtel position.

2. W. Ferris of geotechnical services and the consultants, Dr. Peck and Dr. Hendron, recommended filling the pond.

3. A. Marshall has made a preliminary inspection of the dike and will complete a final inspection by October 27, 1978. (A. Marshall action)

61 61

4. A. Boos stated that the pond could be filled using temporary facilities in a period of 2 weeks with approximately 4 weeks total time required including setup time. The field will present to CPCo the Bechtel recommendation to fill the pond with a target completion of November 30, 1978. (A. Boos action)

The status of the settlement investigation for the diesel generator building was reviewed. The following points were discussed.

1. The consultant's recommendation to preload the building is still firm.

2. A meeting will be held in Urbana, Illinois on November 6, 1978, with Dr. Peck and Dr. Hendron. W. Ferris and CPCo representatives will also attend.

3. The soils laboratory is currently working at maximum capacity to analyze the samples taken at the site. Current scheduled completion of testing is November 6, 1978.

4. Upgraded material is available for the preload fill. The field will explore the availability of frost protection material if it should be needed. (A. Boos action)

5. The instrumentation needed to monitor consolidation of underlying soil was reviewed, geotechnical services will develop a cost estimate for installation of this instrumentation. (Geotech action)

6. A specification will be needed to cover monitoring of the building and underlying soil during preloading. It was suggested that a similar specification from the Quanicassee Project be used as a model. (N. Swanberg action)

7. The feasibility of underpinning the structure should continue to be pursued. The feasibility of the removal of existing underlying material should be explored. (N. Swanberg action)

8. The option of installing a mat type foundation was discussed. Currently five methods are being evaluated on the basis of cost and schedule. The most favorable from a cost standpoint is to attach the mat to the building walls only, and leave the generator foundations free. The most favorable from a schedule standpoint is to remove the existing generator foundations and place a monolithic mat which attaches to the existing walls by drilled-in dowels.

9. The status of the fill and structures on the rest of the site was reviewed. Geotechnical services will provide a progress report on the entire site by November 24, 1978. (Geotech action) The frequency of settlement measurements on selected buildings will be increased based on direction from engineering. (G. Tuveson action)

77

Bechtel Associates Professional Corporation

Inter-office Memorandum

BMAC- 1336

To	J. F. Haugen	Date	May 20, 1977
Subject	Midland Plant Units 1 & 2 Job 7220 Class I Fill Material Areas File: 0274, C-208, C-210	From	R. L. Castleberry
		Of	Engineering
Copies to	D. A. Grote J. J. Donnelly V. Rao S. Afifi	At	Ann Arbor

RECEIVED

MAY 23 1977

BECHTEL POWER CORP.
JOB 7220

PER

The Emergency Diesel Fuel Storage Area has been moved Southeast, away from the Condensate Storage Tanks.

The "Class I" fill area required for Emergency Diesel Fuel Storage must also move Southeast as shown on Enclosure 2. We understand that there is presently about 7 feet of "Non-Class I" fill in this area. Therefore, Engineering recommends that borings be taken to evaluate the in-place density, moisture content, compaction, grain size and specific gravity of soil in the area designated for emergency diesel fuel tanks, as shown on Enclosure 1. All tests should conform to Specification 7220-C-208, Rev. 9 and be administered by the quality assurance program of Specification 7220-G-22 (Appendix A to Specification 7220-C-208).

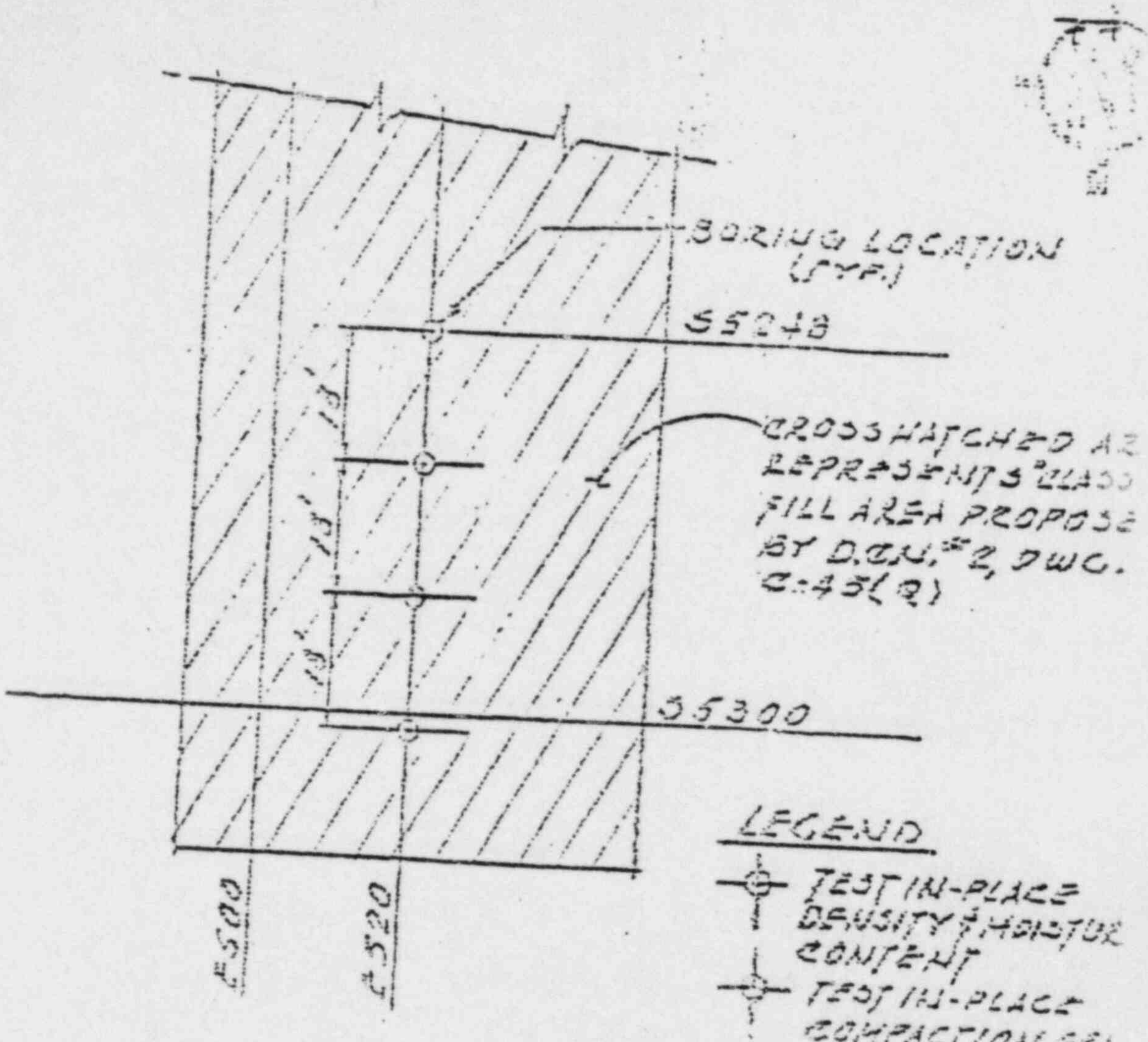
Please submit all results of these tests to Engineering by June 30, 1977.

In the future all soils placed in this area (see Enclosure 2) shall be "Class I" as indicated on Dwg. C-45 (Q).

JEH for R. L. Castleberry

RLC/sg

Enclosures: 1) SK. 7220-C-541, Rev. A
2) UTN No. 2, Dwg. C-45(Q)



NOTES:

1- BORINGS SHALL BE MADE IN LOCATIONS SHOWN
2- MATERIALS FROM BORINGS SHALL BE TESTED IN ACCORDANCE WITH SPEC. 7220-C-208
3- TESTS SHALL BE ADMINISTERED IN ACCORDANCE WITH THE QUALITY ASSURANCE PROGRAM SPEC. 7220-G-22

NO.	DATE	REVISIONS	BY	CHK'D	GROUP LEAD	GROUP SUPV	PROJ ENGR	PROJ ENGR
	3-29-77	ISSUED FOR INFORMATION	LRG.	TJP	RAW	EAH	RLC/JK	

DESIGNED

DRAWN

MIDLAND PLANT - UNITS 1 & 2
CONSUMERS POWER CO.
EMERGENCY DIESEL FUEL TANK AREA - TEST BORING ARRANGEMENT

JOB NO. 7220

DRAWING NO. SK-C-541

REV. A

POWER AND INDUSTRIAL DIVISION

DRAWING CHANGE NOTICE

JOB NO.	DRAWING NO.	REV.
7220	C-45(Q)	1

DCN No. 2 Page 1 of 1

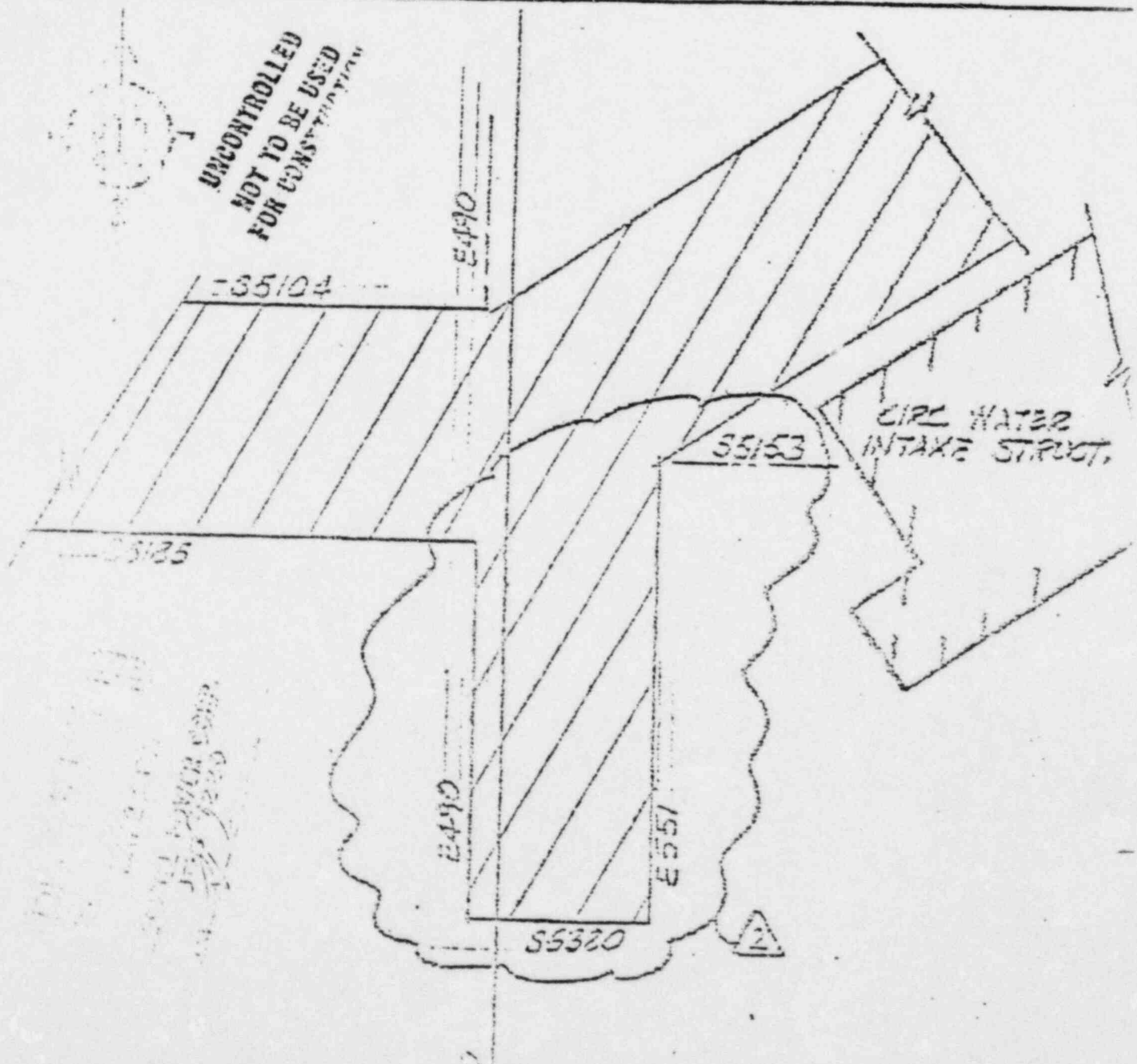
DATE: 5-20-77 BY:

APPROVAL:

Reason for change: DESIGN MODIFICATION

The following Requisitions are affected by this change: NONE

They have / have not been revised in accordance with this DCN: NOT REQ'D.



72

Bechtel Associates Professional Corporation

Inter-office Memorandum

To	R. L. Castleberry	Date	27 November 1978
Subject	Midland Units 1 & 2-Job 7220-101 Meeting Notes	From	S. S. Afifi
		Of	Geotechnical Services
Copies to	S. L. Blue, J. Betts, A. J. Boos, B. J. Cheek, W. R. Ferris, O. H. Holman, 1320, 3130, T. Johnson, G. T. LeFevre, B. C. McConnel, G. A. Tuveson, K. Wiedner, A. S. Marshall, A. J. Hendron, Jr./R. B. Peck	At	Ann Arbor 10(D)5 7220-78-110

RECEIVED
DEC 4 1978
BECHTEL POWER CORP
JOB 7220
PER (I)20357 C384

Attached are the notes for the meeting with Dr. R. B. Peck at the site on September 28, 1978 regarding the diesel generator building.

Sheif8Tob

S. S. Afifi

SSA/lap
Attachment

72

Bechtel Associates Professional Corporation

Inter-office Memorandum

To	R. L. Castleberry	Date	27 November 1978
Subject	Midland Units 1 & 2-Job 7220-101 Meeting Notes	From	S. S. Afifi
		Of	Geotechnical Services
Copies to	S. L. Blue, J. Betts, A. J. Boos, B. J. Cheek, W. R. Ferris, O. H. Holman, 1320, 3130, T. Johnson, G. T. LeFevre, B. C. McConnel, G. A. Tuveson, K. Wiedner, A. S. Marshall, A. J. Hendron, Jr./R. B. Peck	At	Ann Arbor 10(D)5 7220-78-110

RECEIVED
DEC 4 1978
BECHTEL POWER CORP
JOB 7220
PER (E)30257 C284

Attached are the notes for the meeting with Dr. R. B. Peck at the site on September 28, 1978 regarding the diesel generator building.

S. S. Afifi

SSA/lap
Attachment

Midland Units 1 & 2
Job 7220-101

MEETING NOTES

DATE: 28 September 1978

LOCATION: Midland Jobsite
Midland, Michigan

SUBJECT: Settlement Observations Some Fill Supported Structures

ATTENDEES:

CPCo.	Bechtel	Consultant
T. C. Cooke	S. S. Afifi	Dr. R. B. Peck
D. E. Horn	J. Betts	
A. S. Pratt	A. J. Boos	
O. E. Sibbald	R. Castleberry	
R. M. Wheeler	B. J. Cheek	
	W. R. Ferris	
	O. H. Holman	
	T. Johnson	
	B. T. LeFevre	
	B. C. McConnel	
	G. Tuveson	
	K. Wiedner	
	A. S. Marshall	

DISCUSSION:

Purpose

The meeting was held to discuss settlements of structures south of the turbine building which are founded on fill. Dr. R. B. Peck was met by W. R. Ferris, S. S. Afifi and G. T. LeFevre on Thursday morning and all drove to the site. Enroute, Dr. Peck was briefed on the general site conditions, settlement observations and preliminary findings of the exploration and testing program. Upon arrival at the site, Dr. Peck was further briefed by client and Bechtel personnel. All parties then toured the site and inspected the buildings where settlements have been reported.

General

1. The reference benchmark for the plant is located outside the plant area and has been checked every six months since 1977.

2. Salt wells in the area are completely capped and monitored. Brine production started in the early 1900's. The salt is located at about 4000 ft. depth.

3. The major settlements noted to date are in structures founded on the fill south of the turbine building. These settlements are based on measurements made on construction scribe marks as reference which should be accurate within 1/4 inch.

a. The diesel building settlements were first noted in July 1978. They now range between 1/2 and 3 inches.

b. The southwest corner of the turbine building has settled 3/4" since May 1977. It may have been influenced by the adjacent excavation for the administration building.

c. West transformer pads settled 2-1/4 inches. Since this measurement was made about 5 feet of crushed stone was placed in the large area surrounding the pads and no settlement of the pads was noted.

d. The service water valve pits (added weight near zero) have settled about 2 inches (1-7/8" and 1-3/8"). No settlement of these pits occurred in the past month.

4. No long term records of ground water table are available for the Midland site.

5. The sand layer below the clay till is located at 150 ft. depth and has a piezometric pressure at elevation 605±. Original ground water surface was assumed at the same elevation.

6. The pond operating level will be between 618 and 627. The pond was filled in March 1978 to about elevation 622. Now the water table in the vicinity of the diesel generator building is at elevation 622.

7. Circulating water lines buried in the plant fill are backfilled with sand and permit water table to rise to pond level in the plant area.

Diesel Generator Building

1. Building dimensions are 70' x 155'. The present foundation pressure is about 2 ksf except under the pads where the pressure is 1 ksf. The expected maximum pressure is 4 ksf static, 5.5 ksf dynamic.

2. Backfill under the building was done during the latter months of 1975 and 1977. Most fill was placed in 1977 which was a dry year (starting in May - latest placed in October). Most fill was placed with rolling equipment. The material was brought in by trucks, spread by a dozer and compacted with a vibratory sheepsfoot roller. Duct banks were put into the fill by digging trenches and backfilling.

3. Construction scribe marks were used to check settlement. Dates when these marks were set is not precisely known. However, the concrete was poured in the period March-May 1978, first pour in October 1977. The settlement was first noted in July 1978. Initial values are referred to the initial elevation of construction

scribe marks which are accurate within $\pm 1/4''$. The monitoring is being continued.

4. At the east end of the building, there are places where the foundation is separating from the mud mat below. This indicates that the building may be arching over hard spots or the fill may be settling under its own weight.

5. A trench along the east end of the building was excavated to a level below the foundation to install electrical duct bank.

6. The clay fill under the building came from the pond and the sand fill around the piping is imported. No on-site sand was used. The clay fill is random with varying sand content. It came from a stock pile that was used between 1975 and 1977.

7. The first footing was placed in October 1977. It was covered and heated.

Exploration and Testing

1. The exploration program consists of borings to conduct standard penetration tests, obtain Shelby tube samples (3" to 5" diameter), and obtain information on ground water table. Also Dutch cone measurements are being made to correlate with test samples.

2. The laboratory testing consists of unconfined compression tests, unconsolidated-undrained triaxial tests, consolidation tests, classification tests, Atterberg limit and grain size tests, and clay mineral analyses. Compaction tests will also be made to develop Proctor curves and conduct strength and consolidation tests on samples dry and wet of optimum. Samples prepared dry of optimum will also be tested for strength and consolidation after saturation. Consolidation samples will be first loaded to 1 ksf without water, then they will be flooded to determine the corresponding settlement.

3. Test pits will be made to determine in-situ density, obtain sufficient samples for Proctor tests and conduct pocket penetrometer tests.

Comments by Dr. Peck

1. Make test pits at a number of locations and carve large size samples for density and Proctor testing.

2. Look carefully at test pit walls. Take pocket penetrometer readings along the sides of the test pits on a grid pattern.

3. Plot settlement of the building at different times and show contours of equal settlement to see if the building is equalizing. This will indicate how stiff the building is. Add settlement points if necessary.

4. The fill is probably settling under its own weight in combination with settlement due to the building weight. The till material may have been placed in dry chunks with some voids. When the material is dry the top will get well compacted and the bottom will not. Following this, a small change in moisture will probably result in increased compressibility.

6. Settlement may not be related to applied loads. It will be helpful to monitor light structures on the fill near pond.

7. Regional subsidence.

    a. Make sure external benchmarks are satisfactory.

    b. Obtain the Dow records of settlement.

8. Install borros settlement gages at several depths to determine rate and seat of settlement.

9. Install observation wells around the fill in the plant area.

Dr. Peck said that it was too early to discuss a fix as all of the exploration testing and observational data were not yet available. He also said that he will read and digest the preliminary data given to him and may have some additional comments to make on the investigation.

S. S. Afifi

SSA/lap

Check on Public

commitment

RESPONSE TO QUESTIONS ASKED BY THE NRC DURING THE 7/18/79 PRESENTATION

71

References to: "Question" are the NRC 50.54(f) Questions
"Item" are the items in this list

Item 1 Agenda Item 2 - Is it possible that the condensate line or other utilities are still providing support to the Diesel Generator Building? (Lyman Heller, Darl Hood)

Response: No, the settlement data and drawing clearly show the building has settled in all areas. However, the differential settlement of the building does seem to have been exaggerated by the presence of either the condensate line and the concrete encasement around the condensate line or the concrete back fill in the area.

Item 2 Agenda Item 3 - Have provisions been made for the train bay tracks loading effect on the borated storage tank lines? (Darl Hood)

Response: Considered irrelevant to MCAR scope, but it was addressed in BLC-8370, 10/29/79, which transmitted Interim Report #8 to Consumers Power Company

Item 3 How does dewatering tie into the load test of the borated water storage tanks (time frame)? (Lyman Heller)

Response: Adequate settlement data can be acquired by the load test whether it is done prior to or after dewatering. Therefore, the dewatering and load test are considered to be independent items.

Item 4 How much settlement of the borated water storage tanks is acceptable? (Lyman Heller)

Response: Original plans outlined in BLC-8370, 10/29/79, were suspended upon receipt of Question 31 from NRC.

Item 5 Has any concrete pipe been profiled? (Ron Lipinski)
It was noted at this time that there is no Class I concrete pipe in the fill.

Response: No, the response during meeting is correct.

Item 6a What is the limiting factor in the design of the concrete duct banks? (Lyman Heller)

Response: The design of buried utilities was described in the response to Question 13 with additional specifics for the Aux. to DGB duct in the response to Question 30.

Item 6b What is the basis for the assumption that no further remedial action is required for the duct banks? (Ron Lipinski)

Bechtel responded that settlement monitoring would continue probably through cable pulling.

Ron Lipinski noted that duct banks are a Category I structure the same as any other structure on the site.

Response: Basis is that the ducts are not pressure boundaries, and have been evaluated for Category I seismic effects. The integrity of the ducts due to plant area fill settlement will be determined by techniques described in the response to Question 12, Table 12-1, Note 2. Additional discussion is in the response to Questions 7 and 30.

Item 6c Did we analyze the load associated with a large crane parked over the duct bank which may have a void below it? (Lyman Heller)

Carl Wiedner discussed the flexibility of the electrical duct bank and the structural analysis.

Response: Irrelevant to the MCAR. It was not a design load combination and was not analyzed. Additional discussion is in the response to Question 34.

Item 7 Is there any corrosion protection for stainless steel Class I pipes? (Darl Hood)

Response: Irrelevant to the MCAR.

Item 8 Chuck Goulds Presentation - Question concerning the valve pit caissons going through construction pads and reinforcement of caissons for transfer of horizontal loads. (Ron Lipinski)

Item 8 Cont. It was noted that various tools would be used for demolition which would deliver about 1,000 foot pounds per blow and that this would not damage any of the other structures. It was also noted that the valve pit crane pad was about 2½ feet thick.

Response: Response made in meeting addresses caissons going through the construction pads. Caissons will not provide for transfer of horizontal loads. (refer to MCAR 24, Interim Report 7, page 5)

Item 9a Sherif Afifi's Presentation - With ½" to 1" as the upper limit for seismic settlement, would there be no effects on other structures due to dewatering? (Lyman Heller)

It was noted to be a small general settlement to be evaluated by Sherif.

Response: Refer to the response to Question 27.

Item 9b Why do we feel that a 1.5 factor of safety is adequate? (Darl Hood)

It was noted that primarily this was due to the fact that 7.5 earthquake value was too large.

Response: Answer during meeting considered adequate assuming the factor of safety against liquefaction was the one being questioned.

Item 10 Where exactly are the Liquefaction potential problem areas? (Lyman Heller)

Sherif respouded that the small zone in the railroad bay was not a problem.

The borated water storage tank line was not a problem.

We have not analyzed all areas yet; however, this is in reality a hypothetical question since dewatering will answer the potential liquefaction questions in any area in the power block.

Response: Permanent site dewatering will handle all potential liquefaction problem areas.

Item 11a Dick Loughney's Presentation - Would the Service Water Building be outside the perimeter of the dewatering system? (Lyman Heller) 71

Response: Yes. MCAR 24 Interim Report #6 addresses soil conditions and corrective actions for this structure.

Item 11b When would the clay dike cutoff in front of power block be in place? (Lyman Heller)

Response: Design of dewatering system does not assume any cutoff system.

Item 11c Will this comply with the new Reg. Guides? (Ron Lipinski)

Response: Yes. Refer to the response to Question 24.

Item 11d What will be the systems discharge rate? (Gene Gallagher) It was noted that it would be less than 400 GPM.

Response: Refer to the response to Question 24.

Item 12 General Question on electrical blackout. It was noted that it would be low since the horsepower requirements for the pumps are small. (D. Hayes)

Response: Irrelevant to the MCAR, no discussion of diesel backup.

Item 13 Expressed a general interest on getting test pit information. (Gillan)

Response: MCAR 24, Interim Report 8 addressed test pit information.

Item 14 Ted Johnson's Presentation. Please comment on ACI 349 which includes settlement with dead load and wind, earthquake, etc. (Gene Gallagher) Bechtel noted that they had done a similar consideration. They also noted thay they would probably seal all cracks greater than 15 mils because of potential corrosion problems and that they were still pursuing an analysis in this area.

Response: The response to Question 15 addresses this, as will the study in response to Question 28.

Item 15 Exactly what all will the caissons support? (Henderson)

It was noted that Bechtel had not completed the horizontal support analysis in this area.

Response: Assuming the reference is to the Auxiliary Building caissons, refer to MCAR 24, Interim Report 7 (page 4).

Item 16a Sherif Afifi's Presentation - Will the Diesel Generator sand surcharge be removed prior to dewatering? (Lyman Heller)

Response: Yes, Surcharge removal discussed in MCAR 24, Interim Report 8 (page 2).

Item 16b How much lower than the construction water would dewatering operation go? (Lyman Heller)

It was noted that it would be a minimum elevation of 600 feet (existing till), and that it was still under evaluation.

Response: Refer to the response to Question 24.

Item 17 Are we confident that the material below the borated water storage tank is acceptable? (Lyman Heller)

It was noted that it is mainly clay and with minimal amounts of sand.

Response: Refer to MCAR 24, Interim Report 7 (page 11) and response to Question 31.

Item 18 Considering the settlement to the southeast side of the Diesel Generator Building, what accounts for this impact?

There also appears to be some concerns on conduit supporting the building.

It was noted that there is more sand on the north side of the building. (Lyman Heller)

Response: Refer to response to Item 1 above.

Item 19 Interim Report #6 to the MCAR 24 (50/553 Report) stated that we would be removing the top 3-4 ft. of soil. Why? (Gene Gallagher) 71

It was noted that this was to take care of weathering that the soil ahd experienced and also possible the bubbling of air through that portion of the soil.

Response: Refer to response to Item 17 above.

Item 20 The PLOCAP location (?) shown on the drawings as a dotted line is no longer part of the design. (Darl Hood)

The control room pressurizer is in the location proposed, but how will it be determined that the soil will be acceptable for any new Class I structures? (Darl Hood)

Response: Borings have been done (MCAR 24, Figure 67)

Item 21 Since we have eliminated chemical grout what about the control tower area void? (Gillan)

Sharif responded that this was an insignificant area and would still probably be pressure grouted.

Response: Refer to the response to Question 12, Table 12-1, Item A.1

Item 22 Dr. Peck Presentation - How would the Diesel Generator surcharge improve the bearing capacity of the fill? (Lyman Heller)

It was noted that long term bearing capacity was based on the friction of the material, and the load has increased the settlement capacity.

Response: Refer to the response to Questions 27 and 35.

Item 23 Why are we testing the caissons at 1.5 times the working load? (Lyman Heller)

It was noted that this was to avoid any unanticipated settlement in the adjacent areas.

Response: Response during meeting considered adequate (MCAR 24, Interim Report 7, pg. 5)

Item 24 TCCooke Presentation on Schedule - When will the cutoff wall be established? It was noted that there would be not cutoff wall the south end of the power block area, since the rate of flow of water to the sands and/or clays was expected to be minimal. However, if necessary, a slurry trench or chemical grout could be utilized in this area.

Response: Refer to the response to Question 24

Item 25 Phil Martinez's Presentation - If there is too much reliance on testing during the plant area fill what did the dike people rely on? (Ron Lipinski)

Response: Refer to the response to Question 23

Item 26 Why do you say re-excavation was not a cause? (Lyman Heller)

Response: Refer to the response to Question 23

Item 27 How can you possibly say there was not a problem with people qualifications?

Response: Refer to the response to Question 23

Item 28 Can you say that there was a bona fide soils engineers on site? (Gene Gallagher)

Response: Refer to the response to Question 23

Item 29 How can you possibly say that you have achieved correction action with no "yes" on personnel as a cause?

How can you say there are bad test procedures when personnel was not involved as a cause?

The NRC disagrees with qualifications of eprsonnel as not being a cause. (Gene Gallagher)

Response: Refer to the response to Question 23

Item 30 How can you say the procedures were not bad?

Response: Refer to the response to Question 23

Item 31 Why was the Spec not included as a cause? (Gene Gallagher)

Response: Refer to the response to Question 23

Item 32 D. Hayes also disagrees with the QC people not being a cause. If the people were qualified, many of the five most probable causes would have been eliminated. (Gene Gallagher)

Response: Refer to the response to Question 23.

Item 33 How come in some areas QC identified probl ms, but nothing happened? (D. Hayes)

Response: Refer to the response to Question 23

Item 34 He commented that there were also problems with moisture density relationship Phil said that moisture did not cause the problem.

Response: Refer to the response to Question 23

Item 35 Does the applicant endorse the most probable causes? (Darl Hood)
Yes - Per GSKeeley after checking with Don Horn.

Response: Refer to the response to Question 23.

Item 36 How then do people enter into the analysis? (Darl Hood)
It was noted that Don Horn's presentation would cover this.

Response: Refer to the response to Question 23.

Item 37 Don Horn's Presentation - Why are we no longer using the Nuclear Denseometer? (Gene Gallagher)
It was noted that because of moisture problems found in the sand and clay.

Response: Response during meeting considered adequate.

Item 38 What does generic mean? (D. Hayes)

It was noted that this means U. S. Testing in some cases.

Response: Irrelevant to MCAR

Item 39 What was the source of the air bubbles at the tank farm at elevation 611' and bubbles at 627'? (Lyman Heller)

Response: Refer to MCAR 24, Interim Report 7 (page 11)

Item 40 Has the tank farm test pit (inspection pit 20 X 20) confirmed boring information? (Lyman Heller)

It was noted that it has not been compared yet, but the material appeared good below the top four feet.

Was there clay in both pits or was there sand? (Lyman Heller)

Response: Refer to MCAR 24, Interim Report 7 (page 11)

Item 41 What other plant improvements will be made as a result of the soils experience?

Will there be a topical report? (Lyman Heller)

Response: Refer to the response to Question 23

Item 42 Who pays the on-site GEOTECH Man? (Lyman Heller)

Response: Irrelevant to MCAR

Item 43 Is QC separate and does it have authority to stop work? (Lyman Heller)

Response: Yes, per SF/PSP G-1.1, Section 3.5

Item 44 What is the criteria for acceptability of the borated storage tank ring foundation?

Response: See Item 4 above.

Item 45a Lyman Heller was concerned with the flexure of the ring beam.

It was noted that the tank bottom transfers load to the soil.

Response: Irrelevant to MCAR

Item 45b Lyman also seemed concerned about the fact that the borated storage tank had no baffles. He was really looking for a measurement on membrane stretching.

Darl Hood noted that this was the basis for 50.54(f) questions.

Response: Irrelevant to MCAR

Item 46a Since air bubbles may have travelled horizontally, how can borings confirm that there are not problems?

Dr. Peck noted that in all likelihood the air passages were already there and that the only evidence of air leaking was the bubbling at the surface.

Response: MCAR 24, Interim Report 7 (page 11)

Item 46b Will the fact that the air line condition existed two months be part of the decision on what to do with the tank farm soil? (Gene Callagher)

Dr. Peck noted that you could expect some surface disturbance, but he believes there would be little damage to the underlying soil.

TCCooke then noted that the piezometers could have provided paths for the air bubbles leaking to the surface.

Response: MCAR 24, Interim Report 7 (page 11)

Item 47 Has Consumers Power Company applied lessons to other sites? (D. Hayes)

Response: (Consumers Power Company)

Item 48 How are the procedures now reviewed? (D. Hayes)

Response: (Consumers Power Company)

Item 49 Question on structural mat vs. spread footing - It was noted that it would have to be rechecked to see that the design would have to be satisfactory.

The 50.54(f) response was confusing to Ron Lipinski.

It was noted that this was a settlement calculation only.

Response: Refer to the response to Question 27

Item 50a What load or elevation will the underpinning be made to? (Lyman Heller)

Response: Elevation for underpinning of valve pit will be determined by the use of dutch cone penetration tests. (no longer applicable for Aux. Bldg.)

Item 50b How will we decide what load has to be applied to each pile during jacking? It was noted that we would calculate the theoretical reactions.

Response: Exact techniques will be developed by underpinning subcontractor. But it will be based on a combination of structure weight and movement during jacking.

Item 50c How will we transfer load from the jacks to the structure? (Ron Lipinski)

Response: This is a subcontractor design and will be included in procedures he will develop.

Item 51 What about earthquake vibration? (Ron Lipinski)

Response: Seismic laods will be carried by the fill under the Main Feedwater Valve pit. Refer to MCAR 24, Interim Report 7, (page 4).

Item 52 Who runs the show on underpinning? (Lyman Heller)

It was noted that Bechtel would do the design with Chuck Gould acting as a consultant.

Consumers Power would then review it.

Response: Subcontractor after Bechtel, Gould, and Consumers Power review of procedures.

Item 53 GSKeeley's Presentation - Darl Hood noted that the staff was aware of the confusion they may have created by attacking the soil problem from several directions, and were trying to compensate for same.

Response: (NRC) Irrelevant to the MCAR

Item 54 Darl Hood wanted Keeley statement on his confidence that the deficiencies were sufficiently understood and the corrective actions taken to preclude repetitions in this area.

Response: (Consumers Power Company - See response to Question 23)

Item 55 Darl Hood also wanted to know whether all problems have been understood prior to remedial action. That is, the problems should not again show up during the remedial activities. For example, flooding was noted to have been removed from the specification by Rev. 7.

Response: The remedial actions for each structure do have a sound basis.

Item 56 Will all remedial action be accomplished by the Consumers Power Quality Assurance Program? (Gene Gallagher)

Response: All remedial action performed upon the Q-listed portions of the backfill will be accomplished under the QA program.

Item 57 Will dewatering be part of the Qualtiy System? This has to be responded in accordance with criteria 2. (Gene Gallagher)
The NRC is reviewing the standard review plan and we will look for compliance. (Darl Hood)

Response: Refer to the response to Question 24.

Item 58 Documentation is needed. (Jim Knight)

It was noted that there is more information in existing reports and that the narrative of today's discussions will take approximately two weeks to prepare for Mr. Knight.

He also noted that there appeared to be much positive progress in the Diesel Generator and he would appreciate having the documentation very quickly. (Jim Knight)

Response: Documentation of presentation provided to NRC via HOWE-218-79, dated August 10, 1979.

To CAllunt, P-24-209B

From DRWuokko, P-13-407 DRW

Date September 29, 1978

Subject SETTLEMENT OF THE MIDLAND DIESEL GENERATOR BUILDING

Consumers Power Company
DRW-13-78
INTERNAL CORRESPONDENCE

TCC

CC Burke / Leventhal

See P. 2

This study concerns the settlement of the Diesel Generator Building (DGB) at the Midland Project. Settlement of the DGB has exceeded that anticipated by Bechtel. Bechtel has taken action by expansion of its Foundation Data Survey Program, initiating a soils boring program in the area, and retaining an independent soils consultant.

Estimated ultimate settlement, currently available soil boring information, and compaction density reports are briefly discussed below.

Estimated Ultimate Settlements for Diesel Generator Building

Dames and Moore on page 20 of their "Supplement to Report - Foundation Investigation and Preliminary Explorations for Borrow Materials" (See Appendix A) state as follows:

> "Settlement of conventional spread foundations, established on an appreciable thickness of controlled compacted granular fill will occur essentially as the load is applied to the foundation."

FSAR Figure 2.5 - 48 (See Appendix A) shows the estimated ultimate settlements for the DGB established on conventional footings over approximately 30 feet of controlled compacted granular fill. These estimated settlements are greater than those experienced to-date (See Appendix A - Figure 1, page 5, MCAR Interim Report 1).

The rate-of-settlement of the DGB and also the rate-of-loading (construction) need to be compared for any direct relationships indicating that such settlement experienced to-date is to be expected.

Examination of Available Soil Borings in DGB Area

Bechtel soil borings and Dames and Moore probe borings contained in FSAR Volume 5 were examined - these are reproduced in Appendix B. Due to the limited depth of these borings and no boring information on the compacted fill, it is felt that any further study should wait until new boring data has been secured.

RECEIVED
OCT 03 1978
MIDLAND PROJECT
MANAGEMENT

Compacted Fill Density Tests

The attached Bechtel Corporation Weekly Compacted Fill Density Reports (See Appendix C) provide dates, location, and results for tests performed on compacted fill in or near the DGB area. Plotted test locations have been transferred onto overlays (see attachment) to give a composite drawing of where the tests were taken. As can be seen, the north-side center and northeast corner of the DGB fill had a concentration of tests, while the southeast, southwest, and northwest corners had very few tests. These latter three corners, as of September 19, 1978, are the location of greatest DGB foundation settlement and are areas of greatest concern. The composite drawing also indicates few tests were taken in the area of the eastern DG pedestal which has shown considerable settlement.

By determining the plan fill area surrounding the DGB and the fill depth, the approximate fill amount was computed. FSAR Table 2.5 - 11 lists the frequency of fill testing. Dividing the fill amount by the frequency indicates that a deficient number of field density tests may have been conducted. EMW

This study should be pursued by obtaining fill records to better establish fill amount and verification that these tests were the only tests conducted. Test locations should also be verified.

Comments

The following comments are presented:

1. What is the reliability of the density test information? E.g., is the 7/9/76 test of 125.0% compaction equal to or above the zero air-voids curve (theoretical maximum compaction)? no
2. Were any other density tests conducted besides those attached? no
3. Were density tests conducted specifically at areas of concern (DGB concerns) during fill and compaction? yes
4. Were the frequency and location of density tests deficient? ?
5. The method of test, personnel experience, and computation should be examined. yes
6. Boring records from the current program underway should be examined. yes
7. The DGB should be checked and monitored for any detrimental effects as a result of differential settlement. yes
8. How does the settlement rate compare with respect to its loading rate and other structure settlements in the area? not well
9. What settlements had Bechtel expected to occur to-date? ?

Conclusions

A definition of the condition of the fill will be provided by the current boring program. Laboratory tests will provide fill material characteristics. These studies should indicate if compaction was deficient. Continued monitoring of any settlement will provide information if the DGB is settling at the same rate without additional loading.

Cause for excessive settlement may be established by this information. Possible methods of resolving these settlement conditions, if necessary, will depend upon the results of these borings and tests.

DRW

To GSKeeley, P-14-408B

From CAHunt/DEWuokko, P-24-209B DRW

Date September 29, 1978

Subject MIDLAND PLANT - ORIGINAL BASIS FOR SETTLEMENT OF STRUCTURES

TCC

Consumers Power Company

DRW-12-78

Internal Correspondence

cc

This package contains those pertinent sections of the Midland Plant PSAR, PSAR Amendments, Dames and Moore "Supplement to Report - Foundation Investigation and Preliminary Explorations for Borrow Materials," and Midland 1 & 2 FSAR regarding estimated maximum settlement values for the Midland Plant diesel generator building.

The Dames and Moore report (dated February 28, 1969) is the source of settlement values listed in the PSAR and subsequent Amendments. It also contains information on recommended minimum compaction criteria, soil bearing capacities, factors of safety, and time-rates of settlement.

Appendix 5A, PSAR Volume I states the design bases for the diesel generator building - a Class 1 structure.

Amendment 1, PSAR Volume II presents the summarized results of foundation investigation studies at Midland. Amendments 2 and 5 concern fill material, foundation design, and settlement.

The answer to AEC question 8.0 of PSAR Amendment #5 and #6 provides information and calculations in support of settlement values presented in the Dames and Moore Supplement Report. The method of computing settlements is discussed.

Volume 4, Midland 1 & 2 FSAR presents information in subsection 2.5.4 regarding site conditions, excavation, and fill. Subsection 2.5.4.10 concerns settlements, subsurface conditions, soil parameters, groundwater conditions, and design criteria. Also presented herein is information on minimum compaction, frequency of fill testing, and soil pressures.

Volume 7, Midland FSAR 1 & 2 furnishes diesel generator building foundation design information.

This comprises the information currently available from our files regarding the original basis for settlement of structures at the Midland Plant.

Dale Wuokko

RECEIVED
OCT 03 1978
MIDLAND PROJECT
MANAGEMENT

FILE:
Midland 1700
FOUNDATION INVESTIGATION

SUPPLEMENT TO REPORT

FOUNDATION INVESTIGATION AND
PRELIMINARY EXPLORATIONS FOR BORROW MATERIALS
PROPOSED NUCLEAR POWER PLANT
MIDLAND, MICHIGAN

FOR

CONSUMERS POWER COMPANY

Job 5697-004-07

Feb 25 1969

banks of excavations will occur due to drying and shrinking of the banks and also due to the presence of discontinuous lenses and pockets of silt in the cohesive soils.

Filling and Backfilling - Fills up to approximately 35 feet in thickness will be required in the attainment of the final plant grade elevation 634. In addition, fills and backfills will be required below and adjacent to structures.

It is recommended that all areas in which the final grade will be raised by the placement of fill be stripped of all topsoil and other unsuitable soil if any, and be thoroughly proof-rolled. The proof-rolling operations are required to detect any localized zones of soft or loose soils and to compact the exposed soils. Zones of soft or loose soils which cannot be compacted should be removed and replaced with controlled compacted fill.

Sand Lens area?

All fill and backfill materials should be placed at or near the optimum moisture content in nearly horizontal lifts approximately six to eight inches in loose thickness. Each lift should be compacted in accordance with the following criteria for the construction of controlled compacted fill and backfill.

Spec? 8

In Spec?

PURPOSE OF FILL	RECOMMENDED MINIMUM COMPACTION CRITERIA PERCENT OF MAXIMUM DENSITY* ON-SITE COHESIVE SOILS	ON-SITE GRANULAR SOILS
Support of Critical Structures	95	100 - 80% R.D.
Support of Non-Critical Structures	90	95
Adjacent to Structures	90	95
Areal Fill (Not supporting or adjacent to structures)	85	90

*Maximum dry density and optimum moisture content should be determined by the Standard Bechtel Method of Compaction.

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

Slopes of excavations cut into compacted fill materials should be the same as the recommended slopes provided for excavations into natural soils.

Filling operations should be performed under the continuous technical supervision of a qulaified soils engineer who would perform in-place density tests in the compacted fill to verify that all materials are placed and compacted in accordance with the recommended criteria.

FOUNDATION DESIGN DATA

General - Foundation design data presented in this section assumes that individual building areas will be prepared in the manner previously recommended. It is our opinion that the major plant structures may be satisfactorily supported on mat foundations established at the presently planned elevations. Similarly, shallow spread foundations founded on controlled compacted fill soils will provide satisfactory support for the appurtenant structures.

Mat Foundations - The ultimate bearing capacity of the supporting soils underlying each of the major structures has been re-evaluated to reflect modified foundation elevations. The results of these analyses are tabulated below:

UNIT	SUPPORTING SOILS	FOUNDATION ELEVATION (FEET)	ULTIMATE BEARING CAPACITY LBS./SQ. FT.
Reactor Building	Very stiff to hard natural cohesive soils	582.5	45,000
Auxiliary Building	Very stiff to hard natural cohesive soils	562.0	50,000
		580.0	45,000
	Controlled compacted fill	610.0	30,000
Turbine Building	Controlled compacted fill	610.0	30,000
Turbine-Generators	Controlled compacted fill	610.0	30,000

The above tabulation assumes that fill soils will be cohesive; if granular fill is used the ultimate bearing capacities listed above will be greater than the tabulated values. The tabulated ultimate bearing pressures are gross values. The effects of overburden to elevation 634, and the effects of ground water at elevation 627 have been considered in the bearing capacity analysis.

The following tabulation presents a summary of the factors of safety revised to relfect the modified loading conditions and ultimate bearing capacities for the various units:

UNIT	FACTOR OF SAFETY DEAD AND LIVE LOADS	DEAD, LIVE AND SEISMIC LOADS
Reactor Buildings	5.6	2.8
Auxiliary Building		
@ Elevation 562.0	7.7	3.8
@ Elevation 580	9.0	4.5
@ Elevation 610	8.6	4.3
Turbine Building	10.0	6.0
Turbine-Generators	6.7	3.3

effect?

Shallow Spread Foundations

The recommended bearing pressures for shallow spread foundations have been recalculated assuming the ground water level to be at elevation 627, and assuming that the supporting compacted fill materials may be either cohesive or granular soils.

C Hunt

FOUNDATION WIDTH	ALLOWABLE NET BEARING PRESSURES (POUNDS PER SQUARE FOOT) COHESIVE SOILS	GRANULAR SOILS
2	7,500	2,800
4	7,500	3,100
8	7,500	3,700
12	7,500	4,300

The factor of safety and allowable increase for seismic loads are he same as previously recommended.

SETTLEMENT

General - Settlement analyses are based on the results of consolidation tests performed on undisturbed and recompacted soil samples. Consolidation test data are presented in the Appendix of this report. The consolidation tests performed in connection with the supplemental investigation confirm that the very stiff to hard cohesive soils have been preconsolidated under overburden pressures of at least 15,000 to 20,000 pounds per square foot.

The settlement analyses consider the effects of lowering the ground water level, excavating, placement of areal fill, subsequent raising of ground water level and the associated time considerations.

Mat Foundations

The results of our settlement analyses for structures supported on mat foundations are tabulated below:

UNIT	ESTIMATED MAXIMUM SETTLEMENT INCHES	ESTIMATED MAXIMUM DIFFERENTIAL SETTLEMENT INCHES
Reactor Buildings	$1 - 1\frac{1}{2}$	$\frac{1}{4} - \frac{1}{2}$
Auxiliary Building		
@ Elevation 562	$\frac{1}{2} - 1$	$\frac{1}{4} - \frac{1}{2}$
@ Elevation 580	$\frac{1}{2} - 1$	$\frac{1}{4} - \frac{1}{2}$
@ Elevation 610	$1\frac{1}{2} - 2$	$\frac{1}{4} - \frac{1}{2}$
Turbine Building	$1\frac{1}{2} - 2$	$\frac{1}{4} - \frac{1}{2}$
Turbine-Generator Mats	$1\frac{1}{2} - 2$	$\frac{1}{4} - \frac{1}{2}$

It has been further estimated that the maximum differential settlement which will occur between adjacent structures will be as follows:

ADJACENT UNITS	ESTIMATED MAXIMUM DIFFERENTIAL SETTLEMENTS BETWEEN STRUCTURES INCHES
Auxiliary @ Elevation 562 and @ Elevation 580	1/2
Auxiliary @ Elevation 562 and Elevation 610	1
Auxiliary @ Elevation 580 and Reactor	1/2
Auxiliary @ Elevation 610 and Reactor	3/4
Auxiliary @ Elevation 610 and Turbine Building	1/2
Turbine Building and Turbine Mat	1/2

The results of the dynamic settlement analysis presented in the initial report are considered applicable to the revised plant design and final location. Additional settlement under dynamic loading should not exceed one-quarter inch.

Appurtenant Structures - The total and differential settlements of buildings supported on shallow-spread foundations will depend on (1) the surface settlement of the areal fill and (2) the settlement caused by the individual foundations imposing bearing pressures on the order of the allowable bearing pressures previously recommended.

Neither building locations nor the individual column loads have been made available to us at this time. Analysis shows that the areal fill will undergo long term settlements on the order of $1\frac{1}{2}$ to 2 inches. It is estimated that shallow spread foundations supporting a total design load of up to 30,000 pounds and proportioned utilizing the bearing pressures presented above will undergo settlement on the order of one-half inch or less.

If necessary, the long term total and differential settlement of each appurtenant structure will be analyzed when the locations and structural loads of these structures are known.

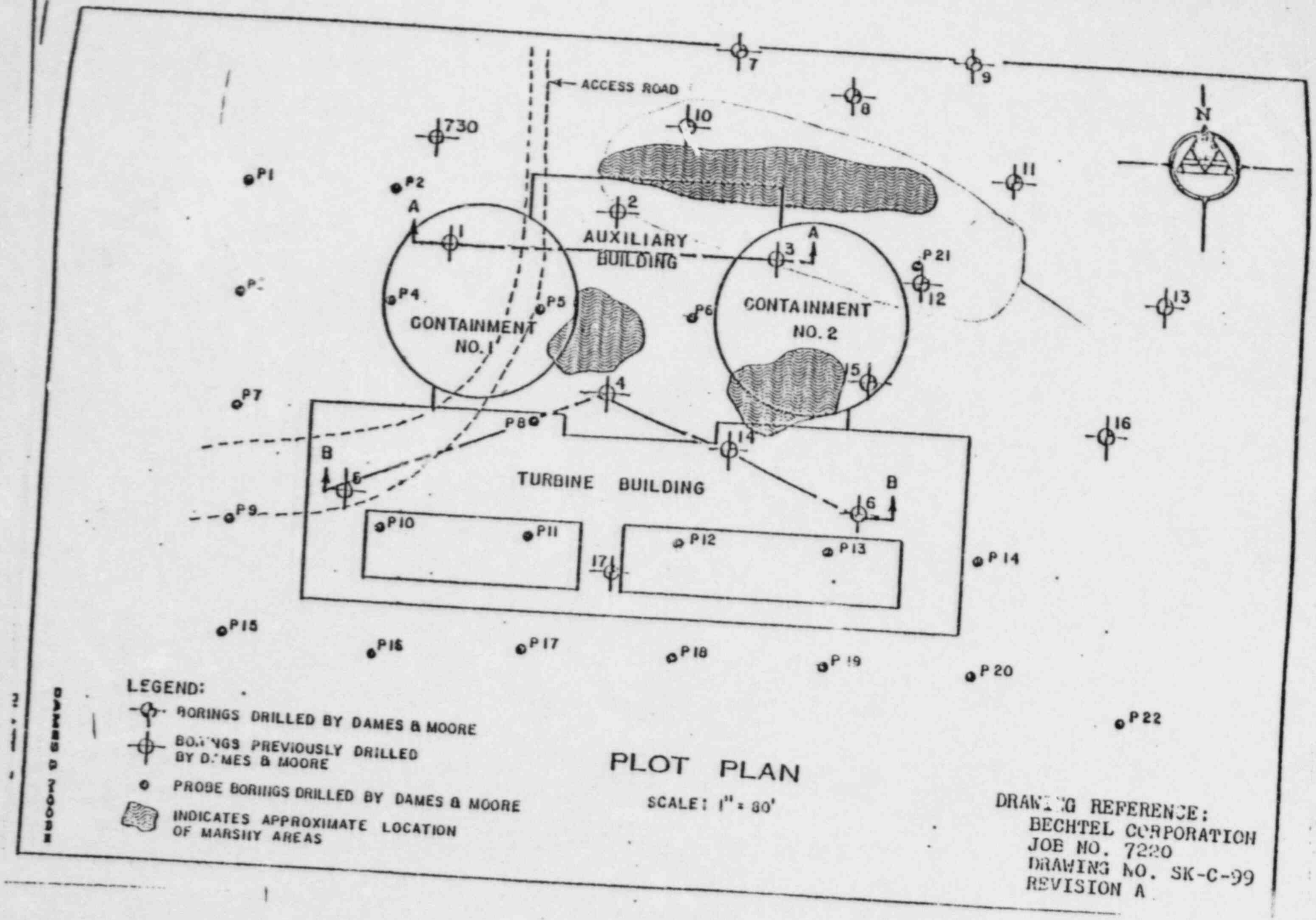
Time-Rate of Settlement - The time rate of settlement for each supported mat foundations underlain by very stiff to hard cohesive soils has been estimated based on analysis of the consolidation test data. The approximate percent of the total settlement of a mat foundation which will have occurred at various times after the full bearing pressure has been applied to the supporting soils has been estimated and is summarized below.

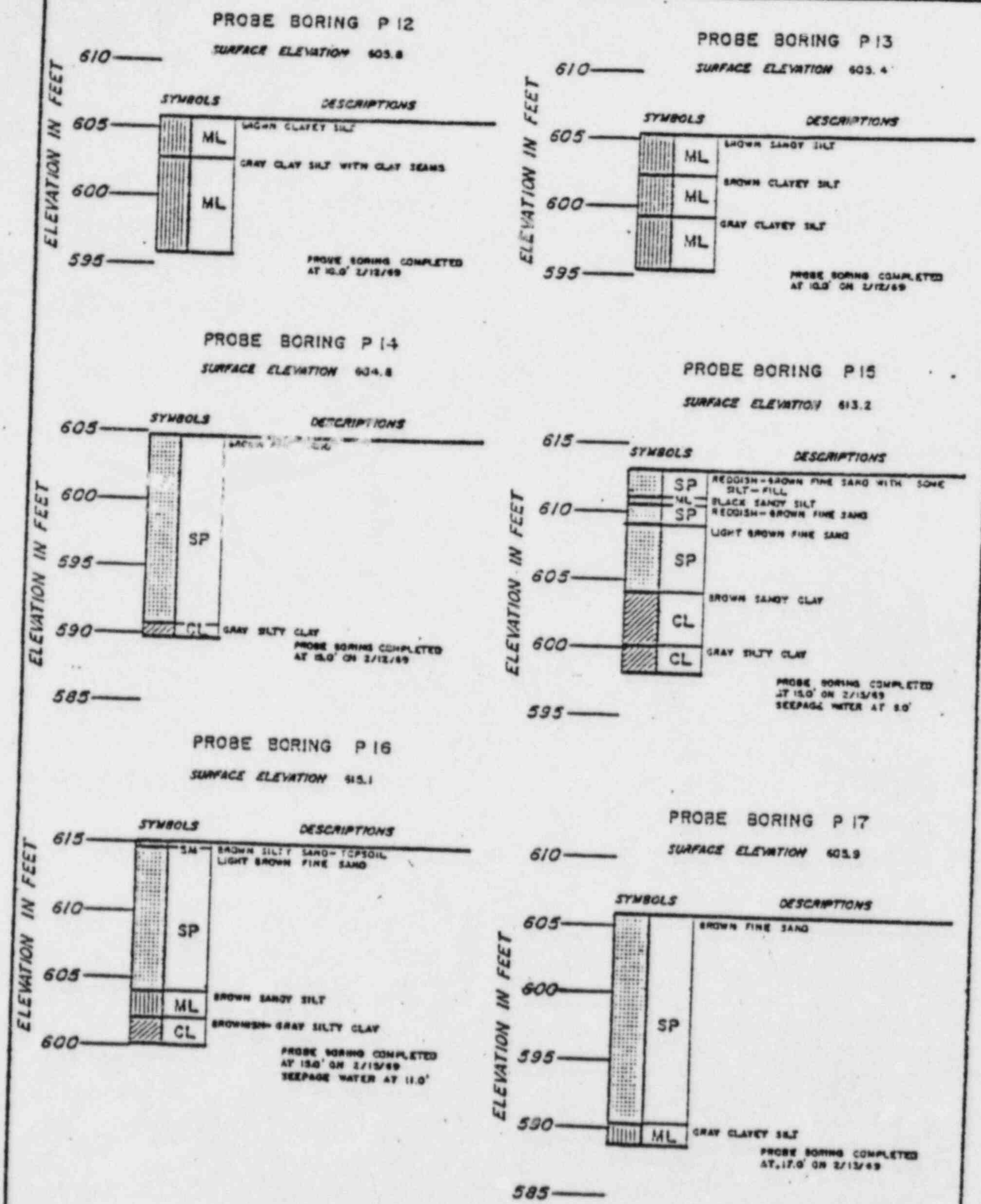
APPROXIMATE PERCENT OF TOTAL SETTLEMENT	TIME YEARS
20	2
50	10
90	60

Settlement of conventional spread foundations, established on an appreciable thickness of controlled compacted granular fill will occur essentially as the load is applied to the foundation.

LATERAL PRESSURES

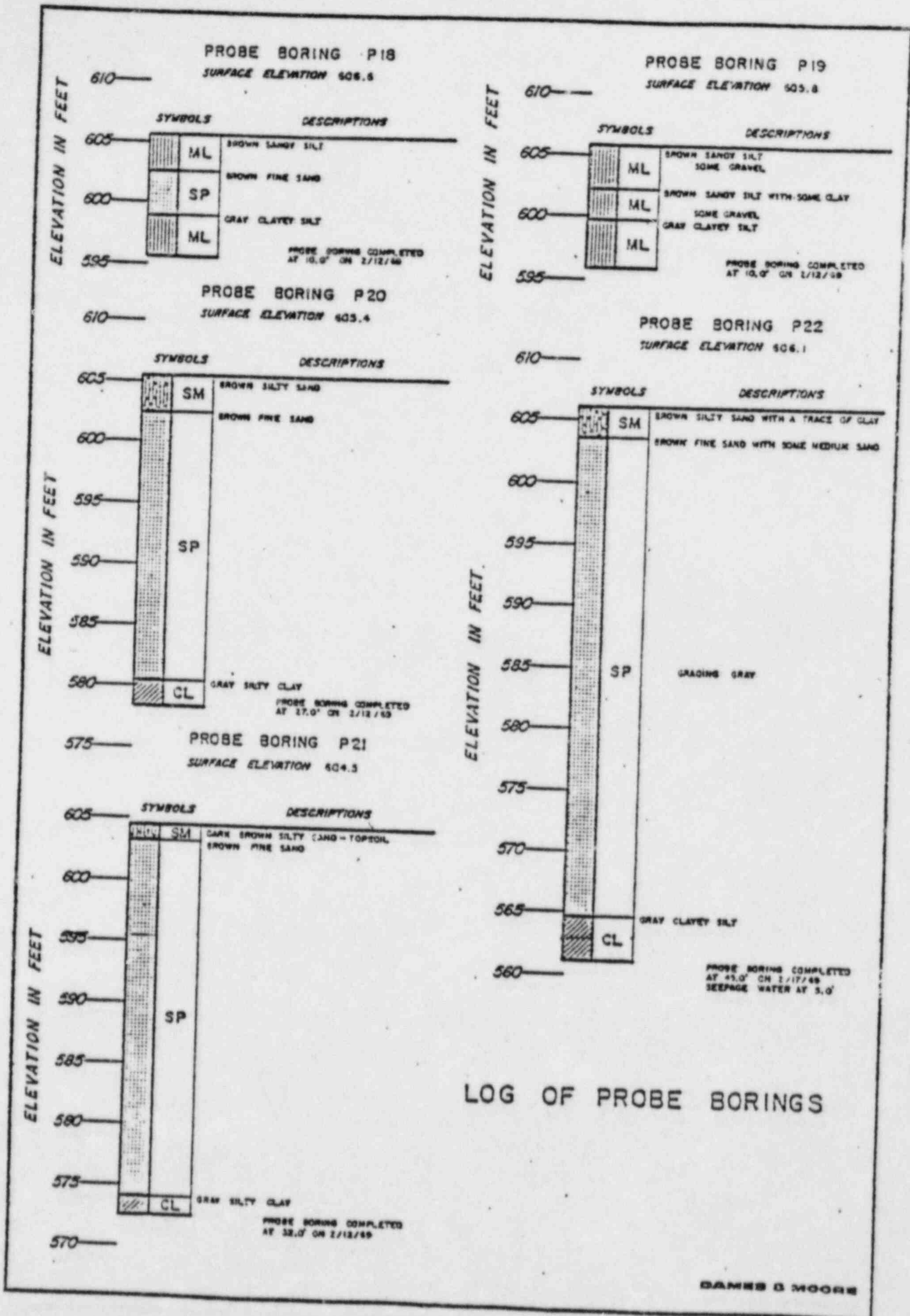
The walls of structures below final plant grade, elevation 634, will be subjected to horizontal loads imposed by backfill materials, hydrostatic pressures, and the horizontal components of adjacent foundation loads. Excluding the horizontal components of adjacent foundation loads, it is recommended that lateral pressures against rigid walls be computed using the equivalent fluid unit weights as tabulated below:


ACCESS ROAD
730
7
9
8
10
11
N
P1
P2
2
A
1
AUXILIARY BUILDING
3
A
P 21
12
13
P4
P5
P6
CONTAINMENT NO. 1
CONTAINMENT NO. 2
15
4
P7
P8
14
16
B
B
TURBINE BUILDING
6
P9
P10
P11
P12
P13
P 14
17
P15
P16
P17
P18
P 19
P 20
P 22
LEGEND:
BORINGS DRILLED BY DAMES & MOORE
BORINGS PREVIOUSLY DRILLED BY DAMES & MOORE
PROBE BORINGS DRILLED BY DAMES & MOORE
INDICATES APPROXIMATE LOCATION OF MARSHY AREAS
PLOT PLAN
SCALE: 1" = 80'
DRAWING REFERENCE:
BECHTEL CORPORATION
JOB NO. 7220
DRAWING NO. SK-C-99
REVISION A
DAMES & MOORE



LOG OF PROBE BORINGS

DAMES & MOORE



LOG OF PROBE BORINGS

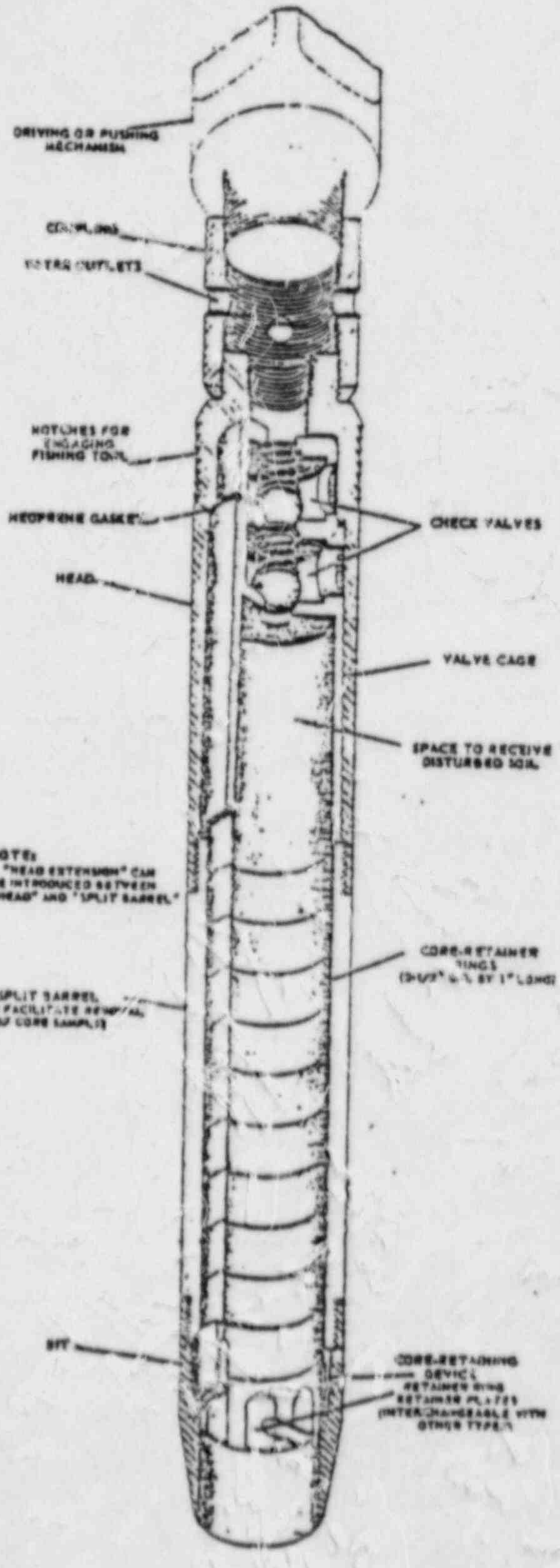
DAMES & MOORE

PLATE A-17

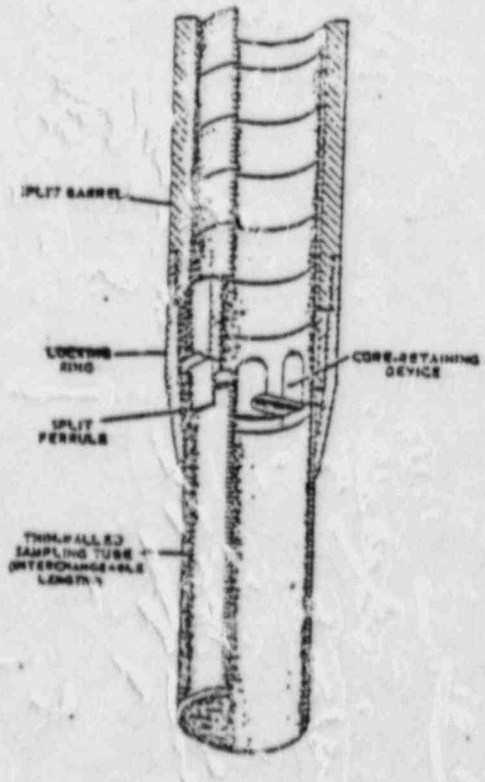
CHECKED BY ______ DATE ______ COPY TO GO ______ FILE ______

SOIL SAMPLER TYPE U

FOR SOILS DIFFICULT TO RETAIN IN SAMPLER
U. S. PATENT NO. 2,318,062



ALTERNATE ATTACHMENTS



DAMES & MOORE
APPLIED EARTH SCIENCES

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
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				GP	[illegible]
	[illegible]	[illegible]		GM	[illegible]
				GC	[illegible]
[illegible]	[illegible]	[illegible]		SW	[illegible]
				SP	[illegible]
	[illegible]	[illegible]		SM	[illegible]
				SC	[illegible]
[illegible]	[illegible]	[illegible]		ML	[illegible]
				CL	[illegible]
				OL	[illegible]
[illegible]	[illegible]	[illegible]		MH	[illegible]
				CH	[illegible]
				OH	[illegible]
[illegible]				PT	[illegible]

[illegible]

SOIL CLASSIFICATION CHART

DIRECT SHEAR AND FRICTION TESTS

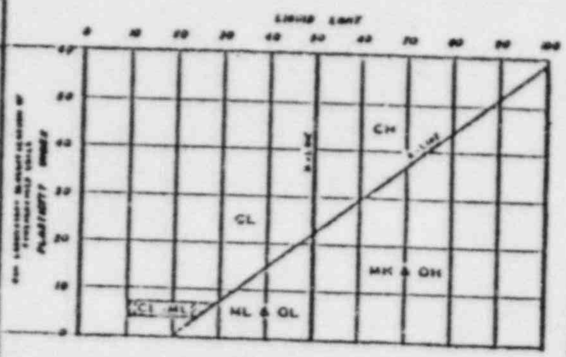
UNCONFINED COMPRESSION TESTS

TRIAXIAL COMPRESSION TESTS

ROCK COMPRESSION TESTS

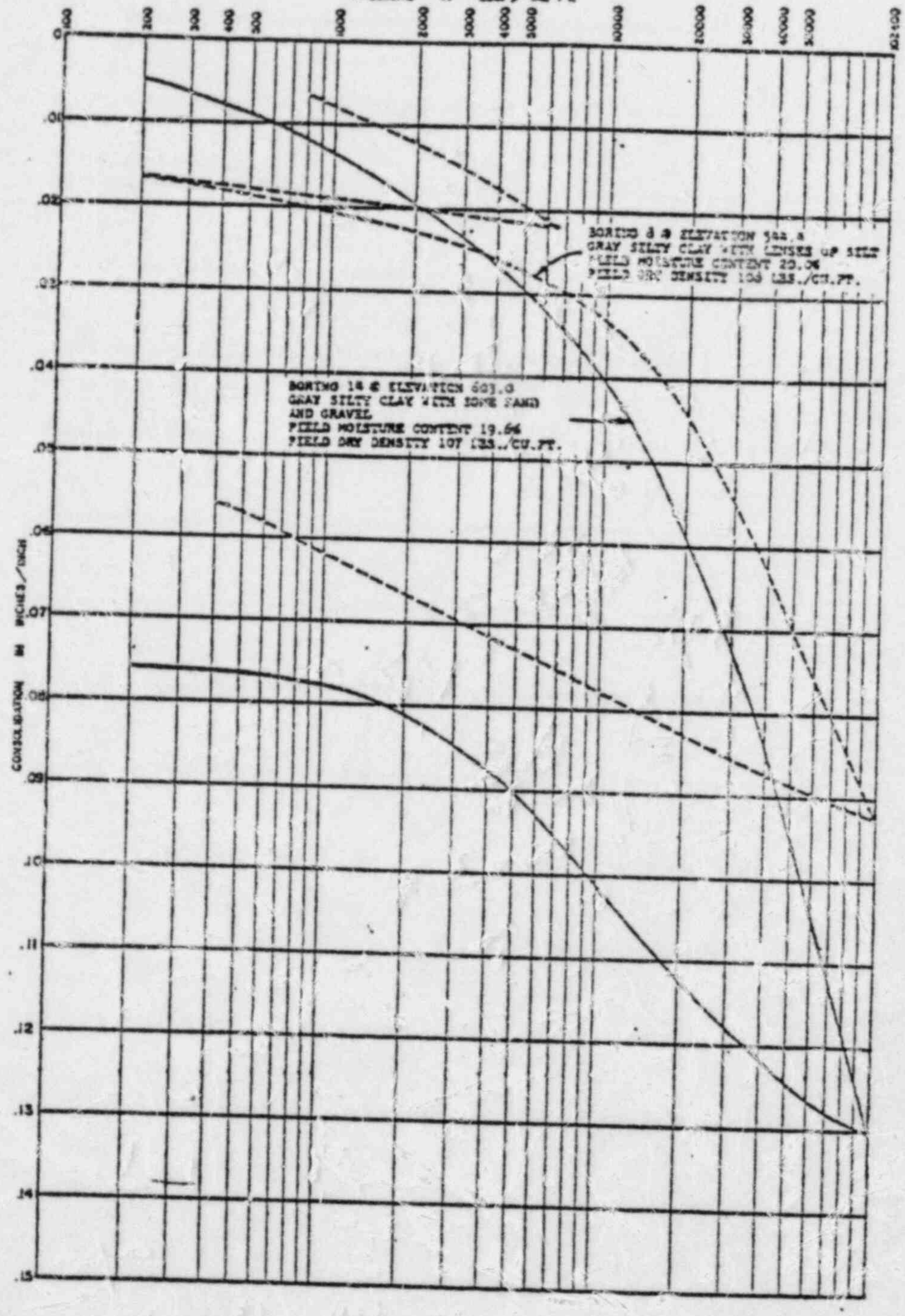
KEY TO TEST DATA

KEY TO SAMPLES



PLASTICITY CHART

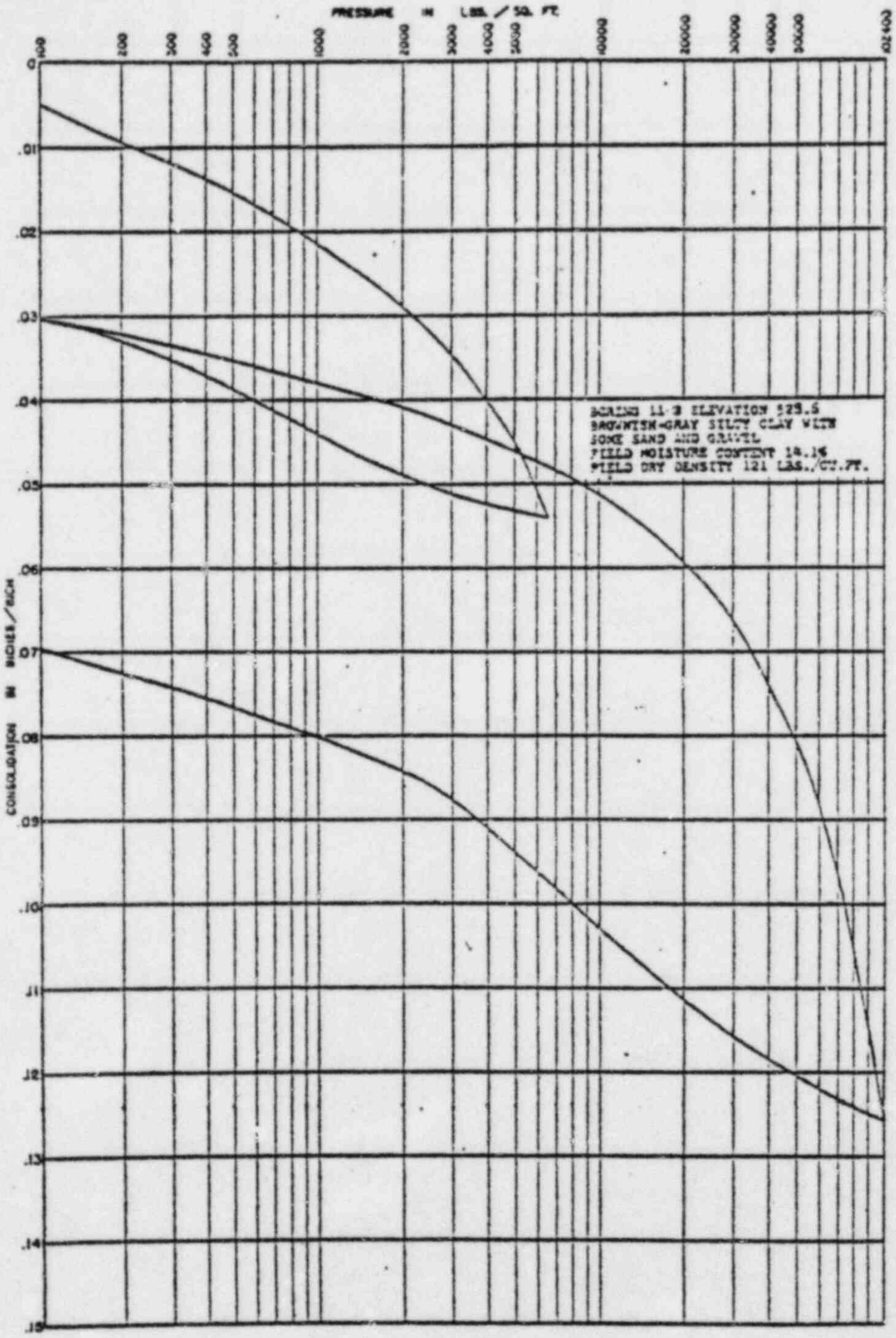
UNIFIED SOIL CLASSIFICATION SYSTEM



CONSOLIDATION TEST DATA

DAMES & MOORE

PLATE A-75



CONSOLIDATION TEST DATA

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PLATE A-76

APPENDIX 5A

DESIGN BASES FOR STRUCTURES, SYSTEMS AND EQUIPMENT

GENERAL

The design bases for structures for normal operating conditions are governed by the applicable building design codes. The design bases for specific systems and equipment are stated in the appropriate PSAR Section. The basic design criterion for the maximum loss-of-coolant accident and seismic conditions is that there be no loss of function if that function is related to public safety.

CLASSES OF STRUCTURES, SYSTEMS AND EQUIPMENT

CLASS 1

Class 1 structures, systems and equipment are those whose failure could cause release of radioactivity which would exceed 10 CFR 20 limits at the site boundary or those essential for immediate and long-term operation following a loss-of-coolant accident or those necessary for safe shutdown. When a system as a whole is referred to as Class 1, portions not associated with loss of function of the system are designated as Class 2.

The following are typical Class 1 structures:

Reactor buildings.

Portions of the auxiliary building housing the engineered safeguards systems, control room and radioactive materials.

Enclosures for the service water pumps, auxiliary feed-water pumps and diesel generators.

Diesel fuel storage facilities.

Supports for Class 1 system components.

Typical Class 1 equipment and systems follow:

Reactor vessel and internals including control rods and control rod drives.

Other reactor coolant system components (steam generators, pressurizer, pumps, etc) and piping, including vent and drain piping inside the reactor building.

Reactor building penetrations up to and including the first isolation valve outside the reactor building.

Main steam and main feed-water piping up to the first stop valves outside the reactor building.

New and spent fuel storage racks and fuel handling equipment, including the crane above the fuel pool (unloaded condition).

Motor-driven and steam-driven auxiliary feed-water systems.

Emergency generators including fuel supply.

Reactor building crane (unloaded condition).

Control boards, switchgear, load centers, batteries, transformers, and cable runs serving Class 1 equipment.

Service water systems (critical portions).

Component cooling (critical portions).

Reactor building spray system.

Reactor building air recirculation and cooling system.

Low-pressure injection and decay heat removal system.

Makeup and purification system (critical portions).

Core flooding tanks and piping.

Borated water storage tank.

CLASS 2

Class 2 structures, systems and equipment are those whose failure would not result in the release of radioactivity which would exceed 10 CFR 20 limits at the site boundary and would not prevent safe shutdown. The failure of Class 2 structures, systems and equipment may interrupt power generation.

DESIGN BASES

CLASS 1 STRUCTURES DESIGN

Normal Operation - For loads to be encountered during normal plant operation (excluding earthquake loads), Class 1 structures are designed in accordance with design methods of accepted standards and codes insofar as they are applicable.

(Paragraph Deleted)

The final design of Class 1 concrete structures (except the reactor building) under normal operating conditions satisfies the most severe of the following load combination equations. (Design equations for the reactor building are given in Section 5, Reactor Building and Structures.)

$$U = 1.5\ D + 1.8\ L$$

$$U = 1.25\ (D + L + H_o + E) + 1.0\ T_o$$

$$U = 1.25\ (D + L + H_o + W) + 1.0\ T_o$$

$$U = 0.9\ D + 1.25\ (H_o + E) + 1.0\ T_o$$

$$U = 0.9\ D + 1.25\ (H_o + W) + 1.0\ T_o$$

In addition, for ductile moment resisting concrete space frames and for shear walls:

$$U = 1.4\ (D + L + E) + 1.0\ T_o + 1.25\ H_o$$

$$U = 0.9\ D + 1.25\ E + 1.0\ T_o + 1.25\ H_o$$

For structural elements carrying mainly earthquake forces, such as equipment supports:

$$U = 1.0\ D + 1.0\ L + 1.8\ E + 1.0\ T_o + 1.25\ H_o$$

Steel structures shall satisfy the following loading combinations without exceeding the specified stresses:

$D + L$ .... Stress Limit $= f_s$

$D + L + T_o + H_o + E$ ... Stress Limit $= 1.25\ f_s$

$D + L + T_o + H_o + W$ ... Stress Limit $= 1.33\ f_s$

In addition, for structural elements carrying mainly earthquake forces, such as struts and bracings:

$D + L + T_o + H_o + E$ ... Stress Limits $= f_s$

Accident, Seismic and Tornado Loads - The Class 1 structures are in general proportioned to maintain elastic behavior when subjected to various combinations of dead, thermal, accident, seismic and tornado loads. The upper limit of elastic behavior is considered to be the yield strength of the effective load-carrying structural materials. The yield strength (Y) for steel (including reinforcing steel) is considered to be the guaranteed minimum given in appropriate ASTM specifications. The yield strength (Y) for reinforced concrete structures is considered to be the ultimate resisting capacity as calculated from the "Ultimate Strength Design" portion of the ACI Code 318-63.

Concrete structures shall satisfy the most severe of the following loading combinations:

$$U = 1.05\ D + 1.05\ L + 1.25\ E + 1.0\ T_A + 10\ H_A + 1.0\ R$$

$$U = 0.95\ D + 1.25\ E + 1.0\ T_A + 1.0\ H_A + 1.0\ R$$

$$U = 1.0\ D + 1.0\ L + 1.0\ E' + 1.0\ T_o + 1.25\ H_o + 1.0\ R$$

$$U = 1.0\ D + 1.0\ L + 1.0\ E' + 1.0\ T_A + 1.0\ H_A + 1.0\ R$$

$$U = 1.0\ D + 1.0\ L + 1.0\ A + 1.0\ T_o + 1.25\ H_o$$

$$U = 1.0\ D + 1.0\ L + 1.0\ T_o + 1.25\ H_o + 1.0\ W'$$

Steel structures shall satisfy the most severe of the following loading combinations without exceeding the specified stresses:

$D + L + R + T_o + H_o + E'$ ... Stress *Limit = 1.5 f_s

$D + L + R + T_A + H_A + E'$ ... Stress *Limit = 1.5 f_s

$D + L + A + T_o + H_o$ .... Stress *Limit = 1.5 f_s

$D + L + T_o + H_o + W'$ .... Stress *Limit = 1.5 f_s

*Maximum allowable stress in bending and tension is 0.9 Fy.
Maximum allowable stress in shear is 0.5 Fy.

Stress in some of the materials may exceed yield strength under certain loading combinations. If this is the case, an analysis shall be made to insure that the affected Class 1 system and equipment do not suffer loss of function and the structure retains its required integrity.

U = required ultimate load capacity.

D = dead load of structure and equipment plus any other permanent loads contributing stresses, such as soil or hydrostatic loads. An allowance is also made for future permanent loads.

L = live load.

R = force or pressure on structure due to rupture of any one pipe.

T_o = thermal loads due to temperature gradient through wall under operating conditions.

H_o = force on structure due to thermal expansion of pipes under operating conditions.

T_A = thermal loads due to temperature gradient through wall under accident conditions.

H_A = force on structure due to thermal expansion of pipes under accident conditions.

E = "design seismic load."

E' = "maximum seismic load."

A = hydrostatic load due to upstream dam failure.

W = wind load as specified in ASCE Paper 3269.

W' = tornado wind load.

f_s = allowable stress for structural steel.

F_y = yield strength for steel.

ϕ = 0.90 for reinforced concrete in flexure.

ϕ = 0.85 for tension, shear, bond, and anchorage in reinforced concrete.

ϕ = 0.75 for spirally reinforced concrete compression members.

ϕ = 0.70 for tied compression members.

ϕ = 0.90 for fabricated structural steel.

ϕ = 0.90 for reinforcing steel (not prestressed) in direct tension.

ϕ = 0.85 for lap splices of reinforcing steel.

ϕ = 0.90 for welded or mechanical splices of reinforcing steel.

ϕ = 0.95 for prestressed tendons in direct tension.

The reactor building, engineered safeguards, steam and feed-water system components are protected by barriers from all credible missiles which might be generated from the reactor coolant system. Local yielding or erosion of barriers is permissible due to jet or missile impact, provided there is no general failure.

The final design of the missile barrier and equipment support structures inside the reactor building is reviewed to assure that they can withstand applicable pressure loads, jet forces, pipe reactions and earthquake loads without loss of function. The deflections or deformations of structures and supports are checked to assure that the functions of the reactor building and engineered safeguards equipment are not impaired.

CLASS 1 SYSTEMS AND EQUIPMENT DESIGN

Components and systems classified as Class 1 are designed in accordance with the following criteria:

a. Primary steady state stresses when combined with the seismic stress resulting from the "Design Earthquake" are maintained within the allowable working stress limits accepted as good practice as set forth in the appropriate design standards, eg, ASME Boiler and Pressure Vessel Code, UASAS B31.7 Code for Pressure Piping.

b. Primary steady state stress when combined with the seismic stresses resulting from the "Maximum Earthquake" are limited so that the function of the component or system is not so impaired as to prevent a safe and orderly shutdown of the plant.

CLASS 2 STRUCTURES DESIGN

Class 2 structures are designed in accordance with design methods of accepted codes and standards insofar as they are applicable. Seismic design is in accordance with the Uniform Building Code with the appropriate working stress allowance and shear coefficients.

CLASS 2 SYSTEMS AND EQUIPMENT DESIGN

Class 2 systems and equipment are designed in accordance with design methods of accepted codes and standards. Wind loads and seismic loads, where applicable, conform to the requirements of the Uniform Building Code.

WIND AND EARTHQUAKE LOADS FOR CLASS 1 STRUCTURES

WIND FORCE

Class 1 structures (except the enclosure over the fuel storage facilities) are designed to resist the effects of a tornado.

The reactor building is analyzed for tornado loading (not coincident with accident or earthquake) on the following basis:

a. Differential bursting pressure between the inside and outside of the reactor building is assumed to be three pounds per square inch positive pressure.

b. Lateral force is assumed as the force caused by a tornado funnel having a maximum peripheral tangential velocity of 300 mph and a forward progression of 60 mph. These components are conservatively applied as a 300 mph wind over the entire surface of the structure for each reactor building and are additive for a 360 mph wind over the entire surface of other Class 1 structures. The applicable portions of wind design methods described in ASCE Paper 3269 are used, particularly for shape factors. The provisions for gust factors and variation of wind velocity with height are not applied.

c. Tornado driven missiles equivalent to an airborne 4 inch by 12 inch by 12 foot plank traveling end-on at 300 mph, or a 4000 pound automobile flying through the air at 50 mph and at not more than 25 feet above the ground, are assumed.

SEISMIC FORCES (E AND E')

AEC Publication TID 7024, "Nuclear Reactors and Earthquakes," is used as the basic design guide for seismic analysis.

The "Design Earthquake" used for this plant is a ground acceleration of 0.06 g horizontally and 0.04 g vertically, acting simultaneously. The "Maximum Earthquake" is a ground acceleration 0.12 g horizontally and 0.08 g vertically, acting simultaneously.

Seismic loads on structures, systems and equipment are determined by realistic evaluation of dynamic properties and the accelerations obtained from the attached acceleration spectrum curves. (Figures 5-A-1 and 5-A-2 in this Appendix)

26 The percent critical damping for structures and systems is as follows:

	Percent Critical Damping	
5	"Design Earthquake" (E) (0.06 g Ground Surface Acceleration)	"Maximum Earthquake" (E) (0.12 g Ground Surface Acceleration)
Welded Steel Plate Assemblies	1	1
Welded Steel Framed Structures	2	2
Bolted or Riveted Steel Framed Structures	2.5	2.5
Reinforced Concrete Equipment Supports	2	3
Reinforced Concrete Frames and Buildings	3	5
Prestressed Concrete Structures	2	5
Critical Piping	0.5	0.5

26 The percent critical damping for equipment is determined by the characteristics of individual equipment.

BURIED PIPING

30 The seismic analysis of buried pipe lines will be based on the principles contained in Section 6 of BC-TOP-4-A Revision 3, "Seismic Analysis of Structures and Equipment for Nuclear Power Plants," Bechtel Power Corporation, November 1974.

FLOODING

Class 1 structures are designed for 632 feet "probable maximum" flood level. Class 2 structures are designed for 614 feet "design" flood level.

LOADINGS COMMON TO ALL STRUCTURES

Ice or Snow Loading - A uniformly distributed live load of 40 pounds per square foot on all roofs provides for any anticipated snow and/or ice loading.

REFERENCES

AEC Publication TID-7024, "Nuclear Reactors and Earthquakes."

Housner, G. W., "Design of Nuclear Power Reactors Against Earthquakes," Proceedings of the Second World Conference on Earthquake Engineering, Volume 1, Japan 1960, Page 133.

Housner, G. W., "Behavior of Structures During Earthquakes," Journal of the Engineering Mechanics Division, Proceedings of the American Society of Civil Engineers, October 1959, Page 109.

Task Committee on Wind Forces, ASCE Paper No. 3269, "Wind Forces on Structures."

VOLUME II - PSAR

AMENDMENT 1

1 SOILS

1.1 INTRODUCTION

This Amendment presents the summarized results of studies of the foundation investigation phase of the environmental study at the proposed Midland nuclear power plant together with the report entitled "Foundation Investigation and Preliminary Exploration for Borrow Materials." The proposed location is adjacent to plant facilities of Dow on the western shore of the Tittabawassee River in Midland, Michigan. The soils overlying bedrock are of glacial origin and consist of glacial tills, glacial outwash, and glacial lake deposits.

A total of 55 borings have been made to determine the subsurface soil profile, to evaluate the foundation soil bearing capacity and settlement characteristics, and to substantiate that suitable fill materials are available within the proposed cooling water reservoir area.

The results of these investigations indicate that the foundation soils are satisfactory to support the plant loads.

1.2 SUBSURFACE EXPLORATION

The exploration program to date has consisted of 55 borings in the plant area and the cooling pond area, as shown in Section 2.6, on Figure 2-8, Location of Field Investigations.

The program indicated that in the plant area the site is blanketed by a layer of topsoil containing roots and other organic material which range in thickness from 4 to 8 inches, except in marshy areas where 2 to 3 feet of organic silty soils are present.

Underlying these soils are loose to dense sandy soils which range in depth from 0 to 40 feet. These sandy soils are underlain by very stiff to hard cohesive soils, predominantly gray silty clay, which extend to depths of 30 to 60 feet. These cohesive soils contain numerous silt lenses.

The deeper soils consist of uniformly hard cohesive soils, predominantly brownish-gray silty clay, containing some sand and gravel to a depth of about 140 to 200 feet. Below these deep cohesive soils is very dense and clayey, sandy gravel down to bedrock. A portion of this layer consists of very dense poorly graded sand at depths extending from 240 to 360 feet below ground surface.

In the cooling pond area, most of the area is blank ted by sandy soils which range in depth from 2 to 9 feet below ground surface. In two localized areas, 1 to 7 feet of silty surface soils were encountered. These sandy and silty soils are underlain by firm cohesive soils. All of these materials should be considered suitable for construction of the plant and dike fills.

1.3 LABORATORY TESTS

The laboratory test program consisted of direct shear, unconfined compression, triaxial compression, dynamic triaxial compression, and consolidation tests on selected undisturbed soil samples from the plant area; plus moisture-density tests in conjunction with each strength and consolidation test and on other undisturbed samples; compaction and permeability tests on remolded soil samples from the proposed cooling pond area, particle size distribution of selected granular soils in the reservoir area; rock compression tests on the shale bedrock; and Atterberg limits on selected samples from both areas.

From these tests, the allowable design values for bearing and settlement in the plant area, the sources of fill material, the estimated settlements in the hard cohesive soils in the plant area caused under maximum earthquake loading, and earthwork required in the plant area were determined.

1.4 DESIGN CRITERIA

1.4.1 FILL AND BACKFILL

All fill and backfill materials are adequately compacted to insure stability of the fill and to provide adequate support for structures founded on this fill without excessive settlements.

1.4.2 EXCAVATION SLOPES

Banks of deeper excavations cut through the dewatered sandy surface soils are cut on a slope of 1 vertical to 1-1/4 horizontal, and banks of deeper excavations cut through the cohesive soils are cut on a slope of 2 vertical to 1 horizontal. Temporary shallow excavations in cohesive soils are cut vertically. All of the above slopes apply to the controlled compacted fill as well as to the natural in-place soils.

1.4.3 FOUNDATION DESIGN

The reactor buildings and auxiliary building are at elevations such that foundations are established on the stiff to hard cohesive soils which underlie the site. Within this material and extending from a depth of 240 to 360 feet below ground surface is a layer of very dense granular material with Standard Penetration Test blow counts of the order of 200 blows or greater per 6-inch penetration. These soils are considered to provide excellent foundation support without excessive settlement under both static and dynamic conditions of loading. These structures are founded on earth-supported mat foundations.

The turbine building, which has its base at approximately elevation 604, does not encounter very stiff to hard cohesive soils at all locations due to the presence of sand-filled erosion channels in the surface of the clay layer. The natural soils at this elevation are beach sands of variable thickness which may not provide suitable foundation support. Consequently, these soils will be removed and foundation grade attained by the placement of controlled compacted fill. Foundation grade is attained using either granular or cohesive fill materials. The turbine building is supported on a mat foundation on the controlled compacted fill.

The allowable bearing pressures for the mat foundations are summarized below:

Structure	Supporting Soils	Foundation Elevation (Feet)	Allowable Bearing Pressure (psf) Dead + Live Load (FS = 3.0)	Dead, Live & Seismic Loads (FS = 2.0)
Reactor Building	Very Stiff to Hard Natural Cohesive Soils	576	16,500	25,000
Auxiliary Building	Very Stiff to Hard Natural Cohesive Soils	577	21,500	32,500
Turbine Building	Controlled Compacted Fill	604	10,000	15,000
Turbine Generator Pedestal	Controlled Compacted Fill	598	10,000	15,000

Shallow spread foundations established in the controlled compacted fill for the support of appurtenant structures are at a minimum depth of 4-1/2 feet below the adjacent plant grade to prevent the effects of frost action. The allowable bearing pressures for spread foundations founded on controlled compacted fill are tabulated below:

Supporting Soils	Minimum Foundation Depth (Feet)	Allowable Bearing Pressure (psf) Dead + Live Load (FS = 3.0)	Dead, Live & Seismic Loads (FS = 2.0)
Controlled Compacted Cohesive Fill	4.5	8,000	12,000
Controlled Compacted Granular Fill:			
Foundation Width = 2 Ft	4.5	3,000	4,500
Foundation Width = 4 Ft	4.5	4,000	6,000
Foundation Width = 8 Ft	4.5	5,000	7,500
Foundation Width = 12 Ft	4.5	6,000	9,000

1.4.4 SETTLEMENT

The maximum total and differential settlements are estimated based on consolidation tests. The estimated settlements include the effects of lowering the groundwater level, excavating, placement of plant fill to elevation 628, and the imposed structural loads. The results of these analyses are tabulated below:

Unit	Estimated Maximum Settlement (Inches)	Estimated Maximum Differential Settlement (Inches)
Reactor Building	1 to 1-1/2	1/4 to 1/2
Turbine Building	1 to 1-1/2	1/4 to 1/2
Auxiliary Building	0 to 1/2	0 to 1/4

It has been further estimated that the maximum differential settlement which could occur between adjacent structures will be as follows:

Adjacent Units	Estimated Maximum Differential Settlement (Inches)
Auxiliary Building and Reactor Buildings	1
Auxiliary Building and Turbine Building	1
Reactor Buildings and Turbine Building	1/2

Earthquake loading of short duration should not cause additional settlement of appreciable magnitude. The estimated additional settlements under earthquake loading are less than 1/4 inch.

Although detailed settlement analyses are not performed to evaluate settlements of shallow spread footings established in the compacted plant fill, it is estimated that settlements will be on the order of 1/2 inch or less provided that the allowable bearing pressures are not exceeded and the fill is adequately compacted.

1.4.5 LATERAL PRESSURE

The walls of structures below final plant grade, elevation 628, are subjected to horizontal loads imposed by backfill materials, possible hydrostatic pressures during floods, and the horizontal components of adjacent foundation loads. In the design of rigid walls to resist the horizontal loads imposed by a granular backfill, submerged during flood periods, the submerged granular backfill is considered to act as an equivalent fluid with a density of 100 pounds per cubic foot. For continuously drained granular backfill, an equivalent fluid pressure of 64 pounds per cubic foot is used. Cohesive materials are not used as backfill against the walls of structures.

1.4.6 FILL MATERIAL

Fills up to approximately 25 feet in thickness are used in the attainment of the proposed final grade of 628 feet. Sources of possible fill material are available from the plant excavation consisting of sandy surface soils and underlying clay soils; from borrow sources within the proposed reservoir area consisting of dune sand deposits, sandy surface soils, and underlying clay and silt soils; and from off-site sources. All of these materials are suitable for use in construction of the plant ...

westerly. These faults are outside of the confines of the Michigan Basin and are not structurally significant to the geology of the basin in the Lower Peninsula.

2.5.3 SITE GEOLOGY

√2.5.3.1 Site Investigations

Site investigations were conducted to evaluate the geologic conditions that are pertinent to the design, construction and operation of the Midland Plant. The investigations include boreholes and a seismic survey. The boreholes, ranging from 40 feet to 432 feet deep, were drilled in the immediate area of the site (Figure 2-8). Samples of the soils were obtained at regular intervals and selected samples were laboratory-tested to define their physical characteristics. Two of the boreholes penetrated into rock and cores were obtained and visually classified. In addition, the logs of water wells in the area and the geologic logs of shallow borings that wer drilled for Dow in 1956 were reviewed.

Seismic surveys were conducted in several directions on the surface of the ground as well as uphole and crosshole shooting.

2.5.3.2 Preglacial Geology

The lower Pennsylvanian Saginaw Formation forms the bedrock at the site (Figure 2-7). It consists of a series of nearly flat-lying, red, green, gray and black micaceous shales interbedded with white, tan and red sandstones and siltstones. Minor quantities of argillaceous limestone, coal, anhydrite, gypsum, siderite, and pyrite are also present in the formation. The Saginaw Formation represents a heterogeneous sequence of lenticular beds of continental origin that were deposited in a cyclic pattern.

Preglacial erosion scoured stream channels into the Saginaw Formation which were later modified by the movement of glaciers. Figure 2-9 is a contour map on the top of the bedrock surface in the site area. The top of bedrock at the site is between 350 to 360 feet below the ground level. This was confirmed by a seismic refraction survey over the area.

Brine and salt removal from the Devonian Detroit River Group has been conducted by Dow in the area at depths of approximately 4,200 feet. Dow has selectively positioned the salt wells and recharged the brine aquifer with depleted brine.

2.5.3.3 Glacial Geology

The Great Lakes region is covered by a thick mantle of glacial drift consisting of clay, sand, gravel and till. The deposits are Pleistocene in age and represent four distinct glacial periods. The fourth and final glacier, which melted 5,000 to 10,000 years ago, formed the land features which now characterize most of the Michigan landscape.

In the Midland area, the glacial material is represented by 350 to 360 feet of lake deposits of various ages and types (Figures 2-10, 2-11). These lake deposits may be divided into four categories:

the horizontal components of adjacent foundation loads. Excluding the horizontal components of adjacent foundation loads, the long-term lateral pressures against rigid and nonrigid walls are computed using the following equivalent fluid unit weights:

	Backfill Material Adjacent to Structure	Equivalent Fluid Unit Weight (Lb/Ft^3) Above Water Level	Below Water Level
Nonrigid Walls	Sand Soils	40	80
	Clay Soils	50	90
Rigid Walls	Sand Soils	60	100
	Clay Soils	80	110

Lateral pressures developed adjacent to rigid walls immediately following placement and compaction of backfill materials may exceed the long-term pressures in the portion of the wall near the ground surface. Consequently, rigid walls are designed for the equivalent fluid unit weights presented above or a uniformly distributed pressure of 600 pounds per square foot, whichever is greater at any particular depth.

2.8.4.6 Fill Material

Fills up to approximately 35 feet in thickness are used in the attainment of the proposed final plant grade of 634 feet. Sources of possible fill material are available from the plant excavation consisting of sandy soils and clay soils; from borrow sources within the proposed reservoir area consisting of dune sand deposits, sandy surface soils, and clay and silt soils; and from off-site sources. All of these materials are suitable for use in construction of the plant fills.

2.8.4.7 Dewatering

Plant excavations will extend through sandy soils below the groundwater level and into relatively impervious clay soils.

While only minor water seepage is anticipated in the lower clay soils, dewatering operations will be required in connection with excavations in the sandy soils.

frequency of the plant buildings would exist, the amplification ratio on an assumed free surface of blue-grey clay would be less than 2.0. However, the intensities recorded in the Midland area from historic earthquakes already reflect the amplification ratio and these intensities are relatively low.

2.7.4 SUMMARY

The Midland nuclear site is located in a region of slight seismic activity for which there is no known geologic control of earthquake distribution or occurrence. Earthquake history for this region begins in 1610. Table 2-7 shows that, although earthquakes have been felt in this region of the United States, Midland experienced all with low intensity. An intensity of V (MM) is assumed to have been experienced at the site as a result of the February 6, 1872 earthquake. Intensities at the site from all other earthquakes were less than V.

2.7.5 DESIGN CRITERIA

The maximum intensity experienced at the proposed Midland nuclear site as a result of any historic earthquake is V. Intensity V corresponds to a surface acceleration of 0.03 g on Hershberger's (1956) curve. A conservative value of 0.06 g should be adequate for design of the plant (design earthquake) and a 0.12 g surface acceleration (maximum earthquake) is recommended for safe shutdown. Although not used in this report, other common terminology for these earthquakes is "Operating Basis Earthquake" and "Design Basis Earthquake," respectively.

2.8 SOILS

2.8.1 INTRODUCTION

This section presents the summarized results of studies of the foundation investigation phase of the environmental study at the proposed Midland Nuclear Power Plant, including the Dames & Moore reports entitled "Report, Foundation Investigation and Preliminary Exploration for Borrow Materials, Proposed Nuclear Power Plant, Midland, Michigan, for Consumers Power Company" filed with the AEC by Amendment No. 1 (dated February 3, 1969) to the Application, and "Supplement to Report - Foundation Investigation and Preliminary Explorations for Borrow Materials, Proposed Nuclear Power Plant, Midland, Michigan," dated March 15, 1969.

The proposed location is adjacent to plant facilities of Dow on the western shore of the Tittabawassee River in Midland, Michigan. The soils overlying bedrock are of glacial origin and consist of glacial tills, glacial outwash, and glacial lake deposits.

Several programs of investigative borings have been made in the project area to determine the subsurface soil profile, to evaluate the foundation soil bearing capacity and settlement characteristics, and to substantiate that suitable fill materials are available within the proposed cooling water reservoir area.

The results of these investigations indicate that the foundation soils are satisfactory to support the plant loads and that suitable fill materials are available within the proposed reservoir area.

2.8.2 SUBSURFACE EXPLORATION

The program indicated that in the plant area the site is blanketed by a layer of topsoil containing roots and other organic material which range in thickness from about 4 to 12 inches, except in marshy areas where 2 to 3 feet of organic silty soils are present.

Underlying the surface in some areas are sands which are loose near ground surface but become very dense with depth and were found to range from 0 to 60 feet. These sandy soils are underlain by very stiff to hard cohesive soils, predominantly gray silty clay, which extend to depths of 30 to 60 feet. These cohesive soils contain numerous silt lenses.

The deeper soils consist of uniformly hard cohesive soils, predominantly brownish-gray silty clay, containing some sand and gravel to a depth of about 140 to 200 feet. Below these deep cohesive soils is very dense and clayey, sandy gravel down to bedrock. A portion of this layer consists of very dense poorly graded sand at depths extending from 240 to 360 feet below ground surface.

In the cooling pond, part of the area is blanketed by sandy and silty soils varying widely in density and composition and ranging in depth from 2 to 22 feet below ground surface. These sandy and silty soils are underlain by firm to very hard cohesive soils. All of these materials should be considered suitable for incorporation in the plant and dike fills.

2.8.3 LABORATORY TESTS

The laboratory test program for determination of design criteria consisted of direct shear, unconfined compression, triaxial compression, dynamic triaxial compression, and consolidation tests on selected undisturbed soil samples from the plant area; plus moisture-density tests in conjunction with each strength and consolidation test and on other undisturbed samples; compaction, relative density, and permeability tests on remolded soil samples from the proposed cooling pond area, particle size distribution of selected soils in the plant and reservoir areas; rock compression tests on the deep shale bedrock; and Atterberg limits on selected samples from both areas.

2.8.4 DESIGN CRITERIA

2.8.4.1 Fill and Backfill

All fill and backfill materials are adequately compacted to insure stability of the fill and to provide adequate support for structures founded on this fill without excessive settlements.

2.8.4.2 Excavation Slopes

Excavations through the dewatered sandy soil are cut on a slope of one vertical to one and one-half horizontal or flatter. Excavations through clay soils are cut on a slope of two vertical to one horizontal or flatter. Temporary excavations within clay soils and which are not subject to surcharge loading are cut vertically with an unsupported height of up to 15 feet.

Temporary excavations through dewatered sand fill soils are cut on a slope of one vertical to one and one-half horizontal or flatter. Temporary excavations through compacted clay fill soils which are not subjected to surcharge loading are cut vertically with an unsupported height of up to 10 feet.

Permanent slopes through compacted granular fill soils are constructed on slopes of one vertical to four horizontal or flatter. Permanent slopes through compacted cohesive fill soils are constructed on slopes of one vertical to two horizontal.

2.8.4.3 Foundation Design

The reactor buildings and the lower portion of the auxiliary buildings are at elevations such that foundations are established on the stiff to hard cohesive soils which underlie the site.

Within this material and extending from a depth of 240 to 360 feet below ground surface is a layer of very dense granular material with Standard Penetration Test blow counts on the order of 200 blows or greater per 6-inch penetration. These soils are considered to provide excellent foundation support without excessive settlement under both static and dynamic conditions of loading. These structures are founded on earth-supported mat foundations.

The south portion of the auxiliary building has its base at elevation 610 while the existing ground surface soils in this area vary between elevation 605 and elevation 612. The surface soils in this area are loose sands of variable thickness which do not provide suitable foundation support. Consequently, these soils are to be removed down to the underlying very stiff to hard cohesive soils and foundation grade then attained by the placement of controlled compacted granular or cohesive fill.

All loose in-site sands, soft or compressible clay soils, and organic soils will be excavated in the turbine building area. The turbine building and turbine generators are supported on mat foundations on controlled compacted fill.

The ultimate bearing capacities for the mat foundations are summarized below:

Unit	Supporting Soils	Foundation Elevation (Feet)	Gross Ultimate Bearing Capacity Lb/Ft^2
Reactor Building	Very Still to Hard Natural Clay Soils	582.5	45,000
Auxiliary Building	Very Stiff to Hard Natural Clay Soils	562.0	50,000
		580.0	45,000
	Controlled Compacted Fill	610.0	30,000
Turbine Building	Controlled Compacted Fill	610.0	30,000
Turbine Generators	Controlled Compacted Fill	602.0	30,000

The preceding tabulation assumes that the fill is composed of compacted clay soils; if compacted sand fill is used, the ultimate aforementioned bearing capacities will be greater than the tabulated values.

Shallow spread foundations established in the controlled compacted fill for the support of appurtenant structures are at a minimum depth of 4-1/2 feet below the adjacent plant grade to prevent the effects of frost action. The allowable bearing pressures for spread foundations on controlled compacted fill are tabulated below:

Supporting Soils	Minimum Foundation Depth (Feet)	Allowable Net Bearing Pressure (psf) Dead + Live Load (FS = 3.0)	Dead, Live & Seismic Loads (FS = 2.0)
Controlled Compacted Clay Fill	4.5	5,000	7,500
Controlled Compacted Granular Fill:			
Foundation Width = 2 Ft	4.5	2,800	4,200
Foundation Width = 4 Ft	4.5	3,100	4,650
Foundation Width = 8 Ft	4.5	3,700	5,550
Foundation Width = 12 Ft	4.5	4,300	6,450

2.8.4.4 Settlement

The maximum total and differential settlements are estimated based on consolidation tests. The estimated settlements include the effects of lowering the groundwater level, excavating, placement of plant fill to elevation 634, the imposed structural loads and subsequent raising of groundwater level to normal cooling pond surface elevation 627.

The results of settlement analyses for structures supported on mat foundations are tabulated below:

Unit	Estimated Maximum Settlement Inches	Estimated Maximum Differential Settlement Inches
Reactor Buildings	1 - 1-1/2	1/4 - 1/2
Auxiliary Building		
At Elevation 562	1/2 - 1	1/4 - 1/2
At Elevation 580	1/2 - 1	1/4 - 1/2
At Elevation 610	1-1/2 - 2	1/4 - 1/2
Turbine Building	1-1/2 - 2	1/4 - 1/2
Turbine Generator Mats	1-1/2 - 2	1/4 - 1/2

It has been further estimated that the maximum differential settlements which could occur between adjacent structures are as follows:

Adjacent Units	Estimated Maximum Differential Settlements Between Structures Inches
Auxiliary at Elevation 562 and at Elevation 580	1/2
Auxiliary at Elevation 562 and at Elevation 610	1
Auxiliary at Elevation 580 and Reactor	1/2
Auxiliary at Elevation 610 and Reactor	3/4
Auxiliary at Elevation 610 and Turbine Building	1/2
Turbine Building and Turbine Mat	1/2

Earthquake loading of short duration should not cause additional settlement of appreciable magnitude. The estimated additional settlements under earthquake loading are less than 1/4 inch.

Although detailed settlement analyses are not performed to evaluate settlements of shallow spread footings established in the compacted plant fill, it is estimated that settlements will be on the order of 1/2 inch or less provided that the allowable bearing pressures are not exceeded and the fill is adequately compacted.

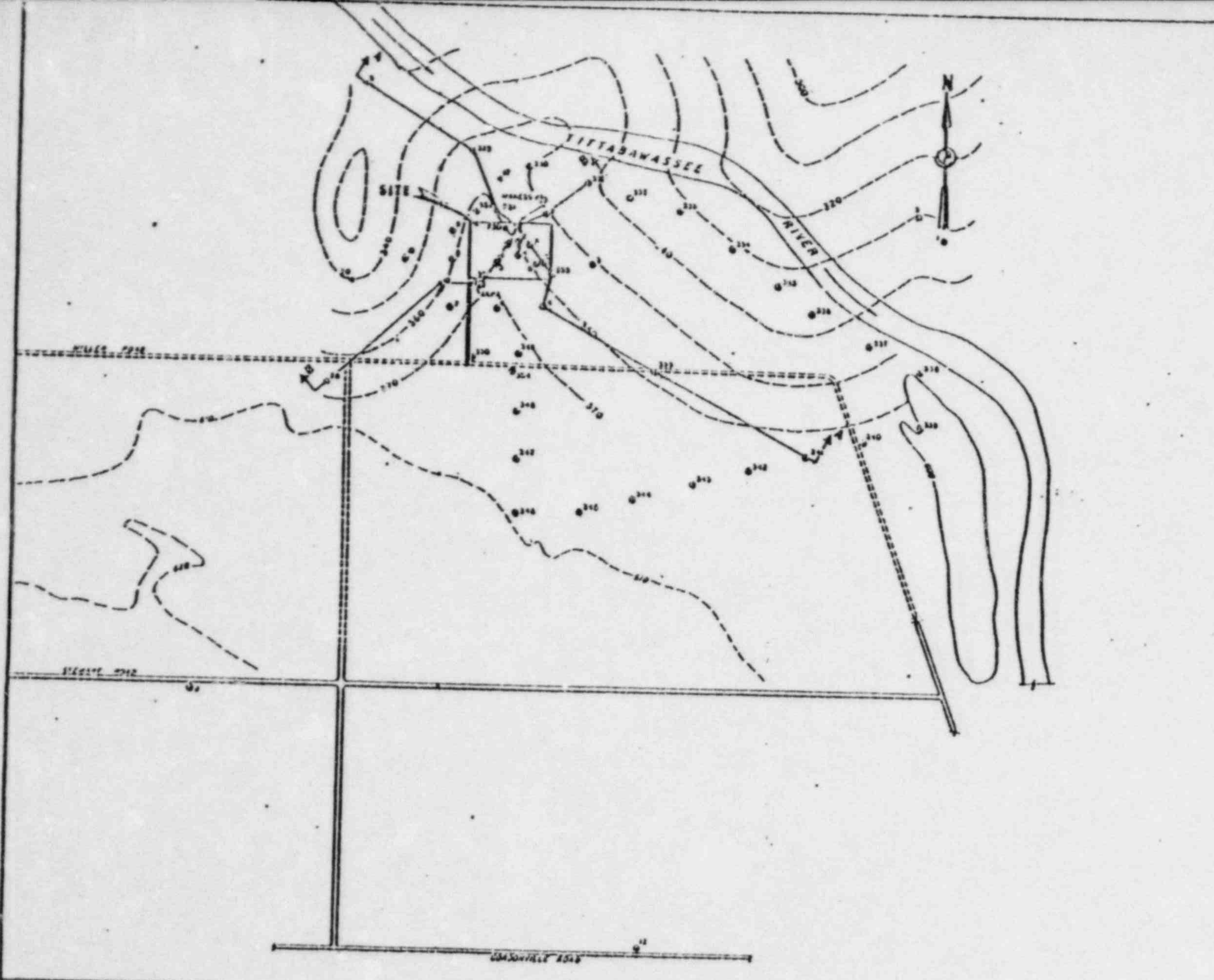
Time Rate of Settlement - It is estimated that one-tenth to one-half of the maximum settlements tabulated previously occur, as elastic recompression, essentially simultaneously with the load application. The remaining one-half to nine-tenths of the maximum settlements occur in accordance with the time rates estimated from consolidation test data and presented below:

Approximate Percent of Total Settlement	Time Years
20	2
50	10
90	50

Settlement of conventional spread foundations, established on an appreciable thickness of controlled compacted granular fill, occurs essentially as the load is applied to the foundation.

2.8.4.5 Lateral Pressures

The walls of structures below final plant grade, elevation 634, are subjected to horizontal loads imposed by backfill materials, hydrostatic pressures, and



EXPLANATION

Isopach, lines of equal thickness of materials above the Saginaw Formation
Contour interval, 10 feet

REFERENCE DRAWINGS:
See Fig 2-6 for explanation of drill holes
See Fig 2-11 for Geologic Sections A-A and B-B.

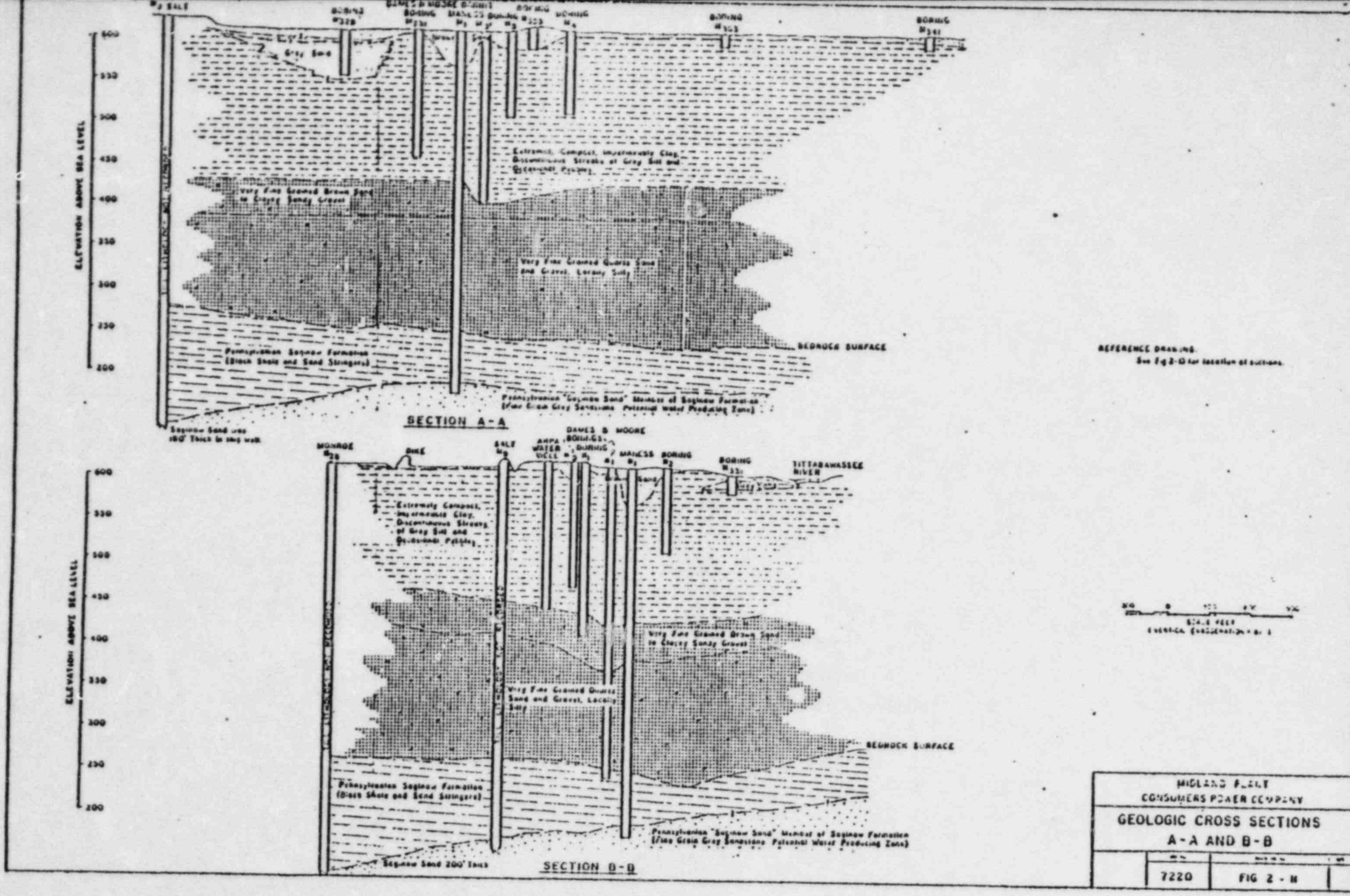
SCALE FEET

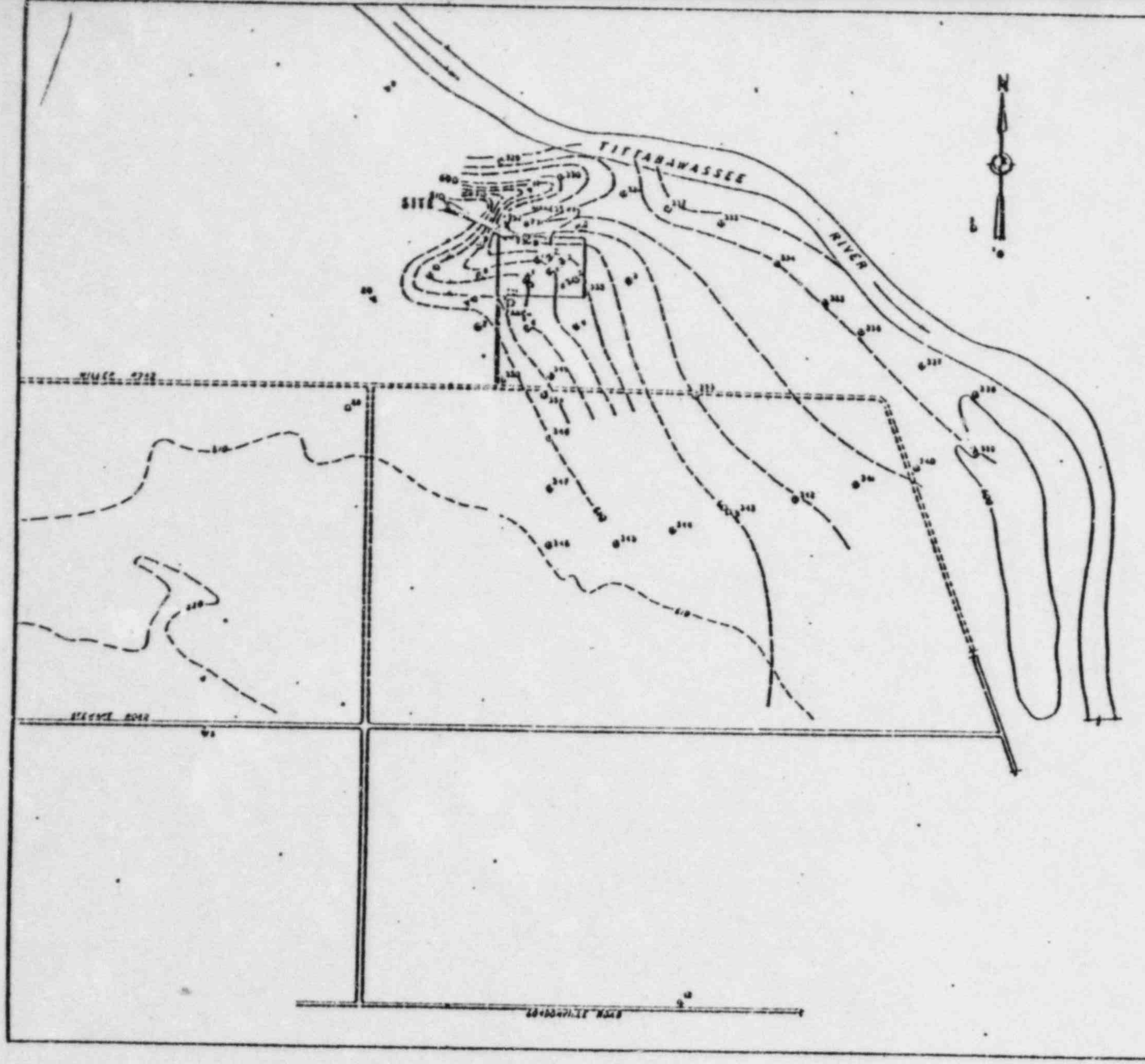
MIDLAND PLANT
CONSUMERS POWER COMPANY

ISOPACH MAP OF DRIFT

7220 | FIG 2-10

PSAR VoL. II


ELEVATION ABOVE SEA LEVEL
600
550
500
450
400
350
300
250
200
Gray Sand
Extremely Compact, Impermeable Clay, Discontinuous Streaks of Gray Silt and Occasional Pebbles
Very Fine Grained Brown Sand to Clayey Sandy Gravel
Very Fine Grained Quartz Sand and Gravel, Locally Silty
BEDROCK SURFACE
Pennsylvanian Saginaw Formation (Black Shale and Sand Stringers)
Pennsylvanian "Saginaw Sand" Member of Saginaw Formation (Fine Grain Gray Sandstone Potential Water Producing Zone)
SECTION A-A
REFERENCE DRAWING
See Fig 2-13 for location of sections.
BORING
DAMES & MOORE BORINGS
AMPA WATER WELL
MONROE
DIKE
SALT
MANESS
TITTABAWASSEE RIVER
Saginaw Sand 200' Thick
SECTION B-B
MIDLAND PLANT
CONSUMERS POWER COMPANY
GEOLOGIC CROSS SECTIONS
A-A AND B-B
7220
FIG 2-11



EXPLANATION

Ground water contour of free water table in surface sand
Datum - mean sea level
Contour interval, 2 feet

REFERENCE DRAWING:
See Fig 2-8 for explanation of grid names.

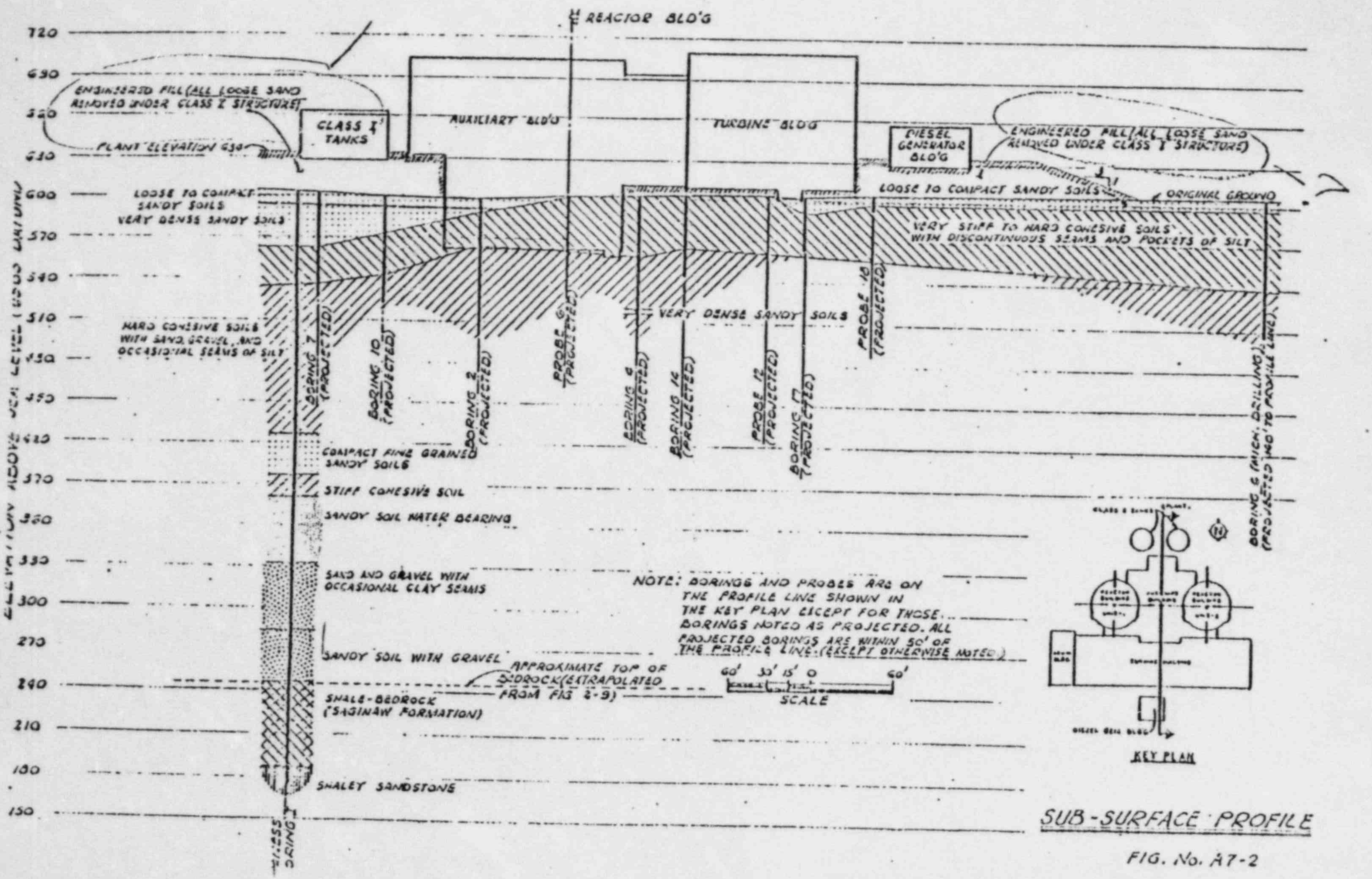
SCALE-FEET

MIDLAND PLANT
CONSUMERS POWER COMPANY

PERCHED WATER TABLE IN SURFACE SAND
GROUND WATER CONTOURS

7220 | FIG 2 - 12

PSAR



SUB-SURFACE PROFILE

FIG. No. A7-2

PSAR /
AMENDMENT #5 & #6

8.0 As discussed at our July 24, 1969, meeting, provide information and calculations in support of your settlement tabulations on Pages 19 and 20 of the Dames and Moore Supplement to the Foundation Report, submitted as Amendment No. 3, to the application.

Answer:

The settlements tabulated on Pages 19 and 20 were evaluated from a consideration of the following conditions:

I. Settlements due to lowering of the water level to El 560 and pressure relief due to excavation of overburden soils above foundation level (short-term conditions).

II. Settlements due to placement of fill to grade and application of structural loads prior to flooding of the reservoir water level at El 600 (short-term condition).

III. Settlements due to fill and structural loads after reservoir filled water level at El 625 (long-term conditions).

For our settlement computations, a total of 72 settlement points were established on a grid and at selected structural locations as shown on Figure A8-1. Thirteen consolidation tests were performed for use in settlement analyses. The boring numbers and locations, and the elevations at which the consolidation tests were performed are also indicated on Figure A8-1.

Four loading areas were delineated for the Case I condition (Figure A8-2) and 17 loading areas were delineated for Cases II and III (Figure A8-1). Loading criteria, including net stresses at foundation elevation, are indicated on Figure A8-2 for the Case I condition and Table A8-1 for the Case II and III conditions based on the respective loading conditions, site soil conditions, and soil consolidation characteristics as evaluated from test data. Settlements at each of the 72 points were calculated utilizing an in-house computer program because of the variation in the thickness of the upper sands across the plant area.

Two computer runs were made for each case:

A. Soils consisting entirely of clays.

B. Upper 20 feet of soil consisting of sands which are underlain by clays.

The soil conditions in the plant construction area, as determined from test boring data, indicate that a sand layer of variable thickness overlies very stiff to hard silty clay. In portions of the Turbine Building and Auxiliary Buildings A and D, the sand is practically nonexistent. The maximum sand thickness in the area is 59 feet, in Boring 9, northeast of the reactor buildings. In the building area, the thickness of sand is generally less than 20 feet. Computer Run A (soils consisting entirely of clay) and Run B (upper 20 feet of soil consisting of sand, underlain by clay) were made to bracket the nonuniform soil conditions in the building area. Settlements at a specific point were then selected or interpolated from the Computer Run A and B values based on the estimated soil conditions, as determined from test borings, at that point. As indicated on Table A8-4, practically all of the evaluated settlements are the clay condition (Computer Run A) settlements. This occurs because excavation to building foundation levels will remove all of the sand with the exception of the Turbine Building area where some sand will remain. The above described method utilizing Computer Runs A and B to approximate actual site conditions is the most realistic approach to the settlement analyses.

Thus, the computer-run settlement analyses were made as follows:

1. IA - dewatering and excavation case, clay soil conditions.
2. IIA - fill and structural loading case prior to flooding reservoir, clay soil conditions.
3. IIIA - fill and structural loading case after reservoir filled, clay soil conditions.
4. IB - dewatering and excavation case, upper sandy soil conditions.
5. IIB - fill and structural loading case prior to flooding reservoir, upper sandy soil conditions.
6. IIIB - fill and structural loading case after reservoir filled, upper sandy soil conditions.

The Case I duration was 15 months; the Case II duration was 2 years. Case III was a permanent condition.

Computer printout sheets for the above six settlement calculations are attached as Figures A8-3 to A8-8. Results for a few of the settlement points are presented for purpose of illustration.

Our settlement computer program has been developed based on current soils engineering practice. Settlements at a point are computed by summing the individual compressions of soil slices of a predetermined thickness. The stress influence from all the loaded areas, as determined by the Boussinesq formula, is computed for each slice.

The compression of each soil slice is calculated by the following general forumla:

$$S = C \times T \times \log\left(\frac{P_o + \Delta P}{P_o}\right)$$

S = slice of compression

C = slope of consolidation curve (percent per log cycle)

P_o = overburden pressure

ΔP = total accumulated stress influence due to the loaded areas considered

T = thickness of soil slice

Values of C used in the computer settlement analyses were evaluated from the thirteen consolidation tests performed and correlations with other laboratory test data. Adjustments were made to the consolidation test curves to correct for sample disturbance. The evaluated values at various depths, for both virgin and recompression conditions, are presented on Figures A8-3 to A8-5 for the clay condition (Computer Run A) and on Figures A8-6 to A8-8 for the upper sand condition (Computer Run B). As noted on the figures, the values did not vary for the various cases analyzed.

Tabulations of the calculated settlements in the structure areas for Cases IA, IIA and IIIA are presented on Table A8-2. Similar tabulations for Cases IB, IIB and IIIB are presented on Table A8-3.

As noted in the tabulations, Cases IA and IB were adjusted for excavation relief and time effects, and those for Cases IIA and IIB for time effects (calculated settlements are ultimate settlements that must be modified for short-term loading conditions).

The adjusted settlements were then summed to obtain the total settlement at each point for the clay and upper sand condition. These settlements are also indicated on Tables A8-2 and A8-3. Based on estimated sand thickness as determined from borings in the plant area, settlements at specific points were then selected or interpolated from the appropriate values in Tables A8-2 and A8-3.

These resulting values are tabulated on Table A8-4. Based on the Westergaard stress distribution theory, these settlement values were modified by a factor of 2/3. The Boussinesq equations for calculating stresses are based on an elastic, isotropic, homogenous mass, whereas Westergaard's equations consider a stratified, nonisotropic condition. The test boring and laboratory data indicate that the soils at the site are nearer to the conditions upon which the Westergaard solutions are based. Therefore, it was concluded that the Westergaard stress distribution theory was more applicable than the Boussinesq theory for calculating stress distributions at the site.

Finally, the modified settlements were further evaluated in light of our past experience with similar soils to obtain the estimated settlements noted on Pages 19 and 20 of our report. These settlement tabulations are also presented in Table A8-4.

TABLE AB-1
LOADING CRITERIA
CASES II AND III

	REACTOR BUILDINGS	AUXILIARY BUILDING A	AUXILIARY BUILDINGS B & C	AUXILIARY BUILDING D	TURBINE BUILDING	TURBINE MAT	COMPACTED FILL
1. FOUNDATION ELEVATION	582.5	562	580	610	610	602	603
2. DEPTH OF EXCAVATION OR FILL (FEET)	-20.5	-41	-23	7	7	-1	31
3. LOAD DUE TO EXCAVATION OR FILL (LBS./SQ.FT.)	-1620	-3060	-1800	920	920	-130	4090
4. HYDROSTATIC PRES. (W.L. AT EL.600)	-1090	-2370	-1250	0	0	0	0
5. HYDROSTATIC PRES. (W.L. AT EL.625)	-2650	-3930	-2810	-935	-935	-1435	-1375
6. BUILDING LOAD (LBS./SQ.FT.)	8000	65[illegible]	5000	3500	3000	1500	0
CASE II Total Applied Load Prior to Flooding Reservoir - W.L. At El. 600 (Lbs./Sq.Ft.)	5690* (5290)	1070	1950	4420	3920	1370	4090
CASE III Total Applied Load After Reservoir Filled- W.L. At El. 625 (Lbs./Sq. Ft.)	4130* (3730)	-490	390	3055	2455* (2555)	-65	2615* (2715)

*Values used in computer analyses that were subsequently found to be incorrect. It is our opinion that the errors would not significantly affect the results. Correct values shown in parentheses.

NOTES:
1. Initial ground surface at Elevation 603.
2. Soil unit weight 132 Lbs./Cu. Ft.

TABLE A8-2
SETTLEMENT TABULATIONS - CLAY CONDITION

SETTLEMENT POINT	CASE I-A (1)	(2)	CASE II-A (3)	(4)	CASE III-A (5)	TOTAL (6)
1. REACTOR						
25	1.46	0	2.64	.66	1.96	2.62
26	1.55	0	2.65	.66	1.96	2.62
47	1.55	0	2.24	.56	1.57	2.13
48	1.54	0	2.63	.66	1.95	2.61
49	1.53	0	2.77	.69	2.09	2.78
50	1.50	0	2.76	.69	2.09	2.78
51	1.52	0	2.76	.69	2.09	2.78
2. REACTOR						
13	1.46	0	2.64	.66	1.96	2.62
14	1.55	0	2.65	.66	1.96	2.62
42	1.42	0	2.45	.61	1.78	2.39
43	1.49	0	2.73	.68	2.06	2.74
44	1.53	0	2.77	.69	2.09	2.78
45	1.54	0	2.72	.68	2.05	2.73
46	1.55	0	2.27	.57	1.59	2.16
67	1.46	0	2.58	.64	1.91	2.55
68	1.55	0	2.25	.56	1.57	2.13
3. AUXILIARY BUILDING A						
19	1.05	0	1.41	.35	.69	1.04
55	1.12	0	1.47	.37	.73	1.10
69	1.07	0	2.05	.51	1.49	2.00
70	.95	0	1.54	.38	.90	1.28
71	.95	0	1.50	.37	.83	1.20
72	1.14	0	1.58	.39	.90	1.29
4. AUXILIARY BUILDING B						
52	1.26	0	2.06	.51	1.37	1.88
53	1.27	0	1.90	.48	1.18	1.66
5. AUXILIARY BUILDING C						
54	1.38	0	1.89	.43	1.18	1.66
6. AUXILIARY BUILDING D						
20	3.26	0	3.82	.95	2.83	3.78

TABLE A8-2 CONT'D)

SETTLEMENT POINT	CASE I-A (1)	(2)	CASE II-A (3)	(4)	CASE III-A (5)	TOTAL (6)
7. TURBINE BUILDING						
9	3.04	.30	4.31	1.08	3.20	4.58
33	3.0	.30	4.31	1.08	3.20	4.58
56	3.19	.32	3.84	.96	2.84	4.12
60	2.85	.28	4.35	1.09	3.27	4.64
61	2.95	.30	4.37	1.09	3.24	4.63
62	3.04	.30	4.39	1.10	3.24	4.64
63	3.23	.32	4.23	1.06	3.14	4.52
64	3.25	.33	4.24	1.06	3.14	4.53
8. TURBINE MAT						
21	3.06	.31	4.42	1.10	3.02	4.43
27	3.04	.30	4.48	1.12	3.02	4.44
59	2.93	.29	4.41	1.10	3.05	4.44
65	2.98	.30	4.55	1.14	3.04	4.48
66	3.02	.30	4.55	1.14	3.03	4.47
9. TURBINE MAT						
15	3.04	.30	4.47	1.12	3.03	4.45
57	3.09	.31	4.66	1.16	3.18	4.65
58	3.07	.31	4.23	1.06	3.03	4.40

NOTES:

1. All settlements in inches.
2. Data from columns 1, 3, and 5 obtained from computer analyses and represent long-term settlements (See Figures A8-3 to A8-5).
3. Column 2 represents the Case IA settlements. At certain structures with deep excavations, it is zero. At other structures with shallow excavations, it is approximately 10% of the column 1 values, which were calculated for the effects of dewatering only. The column 2 values reflect the effect of rebound of the excavations together with the settlements due to dewatering and short-term loading effects.
4. Column 4 represents the Case IIA settlements. It is approximately 25% of the column 3 values, due to the actual short-term loading conditions (before filling of the reservoirs).
5. Column 6 is the summation of columns 2, 4, and 5 and is the estimated settlement based on a consideration of all loading and time conditions.

TABLE A8-3
SETTLEMENT TABULATIONS - UPPER SAND CONDITIONS

SETTLEMENT POINT	CASE IB (1)	CASE IB (2)	CASE IIB (3)	CASE IIB (4)	CASE IIIB (5)	TOTAL (6)
1. REACTOR						
25	1.46	0	2.64	.66	1.96	2.62
26	1.55	0	2.65	.66	1.96	2.62
47	1.55	0	2.24	.56	1.57	2.13
48	1.54	0	2.63	.67	1.95	2.61
49	1.53	0	2.77	.69	2.09	2.78
50	1.50	0	2.76	.69	2.09	2.78
51	1.52	0	2.76	.69	2.09	2.78
2. REACTOR						
13	1.46	0	2.64	.66	1.96	2.62
14	1.55	0	2.65	.66	1.96	2.62
42	1.42	0	2.45	.61	1.78	2.39
43	1.50	0	2.73	.68	2.06	2.74
44	1.53	0	2.77	.69	2.09	2.78
45	1.54	0	2.72	.68	2.05	2.73
46	1.55	0	2.27	.57	1.59	2.16
67	1.46	0	2.58	.64	1.91	2.55
68	1.55	0	2.25	.56	1.57	2.13
3. AUXILIARY BUILDING A						
19	1.05	0	1.41	.35	.69	1.04
55	1.12	0	1.47	.37	.73	1.10
69	1.07	0	2.05	.51	1.49	2.00
70	.95	0	1.54	.38	.90	1.28
71	.95	0	1.50	.37	.83	1.20
72	1.14	0	1.58	.39	.90	1.29
4. AUXILIARY BUILDING B						
52	1.26	0	2.06	.51	1.37	1.83
53	1.27	0	1.90	.48	1.18	1.66
5. AUXILIARY BUILDING C						
54	1.38	0	1.89	.48	1.18	1.66
6. AUXILIARY BUILDING D						
20	1.77	0	2.20	.55	1.45	2.00

Amendment No. 5
11/3/69

TABLE A8-3 (CONT'D)

SETTLEMENT POINT	CASE IB (1)	CASE IB (2)	CASE IIB (3)	CASE IIB (4)	CASE IIIB (5)	TOTAL (6)
7. TURBINE MAT						
9	1.55	.16	2.55	.64	1.77	2.57
33	1.55	.16	2.55	.64	1.77	2.57
56	1.70	.17	2.34	.58	1.63	2.38
60	1.37	.14	2.57	.64	1.81	2.59
61	1.49	.15	2.60	.65	1.79	2.59
62	1.55	.16	2.62	.66	1.79	2.61
63	1.74	.17	2.48	.62	1.71	2.50
64	1.76	.18	2.49	.62	1.71	2.51
8. TURBINE MAT						
21	1.68	.17	2.62	.65	1.70	2.52
27	1.66	.17	2.66	.66	1.71	2.54
59	1.55	.16	2.62	.65	1.73	2.54
65	1.60	.16	2.70	.69	1.72	2.57
66	1.64	.16	2.70	.69	1.71	2.56
9. TURBINE MAT						
15	1.66	.17	2.66	.66	1.71	2.54
57	1.60	.16	2.71	.68	1.76	2.60
58	1.69	.17	2.56	.64	1.70	2.51

NOTES:

1. All settlements in inches.
2. Data from columns 1, 3, and 5 obtained from computer analyses and represent long-term settlements (See Figures A8-6 to A8-8).
3. Column 2 represents the Case IB settlements. At certain structures with deep excavations, it is zero. At other structures with shallow excavations, it is approximately 10% of the column 1 values, which were calculated for the effects of dewatering only. The column 2 values reflect the effect of rebound of the excavations together with the settlements due to dewatering and short-term loading effects.
4. Column 4 represents the Case IIB settlements. It is approximately 25% of the column 3 values, due to the actual short-term loading conditions (before filling of the reservoirs).
5. Column 6 is the summation of columns 2, 4, and 5 and is the estimated settlement based on a consideration of all loading and time conditions.

Amendment No. 5
11/3/69

TABLE A8-4
SETTLEMENT SUMMARY

SETTLEMENT POINT	CLAY CONDITION TOTAL (1)	UPPER SAND CONDITION TOTAL (2)	EVALUATED FROM (1) AND (2) (3)	WESTERGAARD CONDITION (4)	PRESENTED IN REPORT TOTAL	PRESENTED IN REPORT DIFFERENTIAL
1. REACTOR						
25	2.62	2.62	2.6	1.8		
26	2.62	2.62	2.6	1.8		
47	2.13	2.13	2.1	1.4		
48	2.61	2.61	2.6	1.7	1 - 1½	¼ - ½
49	2.78	2.78	2.8	1.8		
50	2.78	2.78	2.8	1.9		
51	2.78	2.78	2.8	1.9		
2. REACTOR						
13	2.62	2.62	2.6	1.7		
14	2.62	2.62	2.6	1.8		
42	2.39	2.39	2.4	1.6		
43	2.74	2.74	2.7	1.8		
44	2.78	2.78	2.8	1.9	1 - 1½	¼ - ½
45	2.73	2.73	2.7	1.8		
46	2.16	2.16	2.2	1.5		
67	2.55	2.55	2.6	1.7		
68	2.13	2.13	2.1	1.4		
3. AUXILIARY BUILDING A						
19	1.04	1.04	1.0	.7		
55	1.10	1.10	1.1	.7		
69	2.00	2.00	2.0	1.3		
70	1.28	1.28	1.3	.9	½ - 1	¼ - ½
71	1.20	1.20	1.2	.8		
72	1.29	1.29	1.3	.9		
4. AUXILIARY BUILDING B						
52	1.88	1.88	1.9	1.3	½ - 1	¼ - ½
53	1.66	1.66	1.7	1.1		
5. AUXILIARY BUILDING C						
54	1.66	1.66	1.7	1.1	½ - 1	¼ - ½
6. AUXILIARY BUILDING D						
20	3.78	2.00	3.8	2.5	1½ - 2	¼ - ½

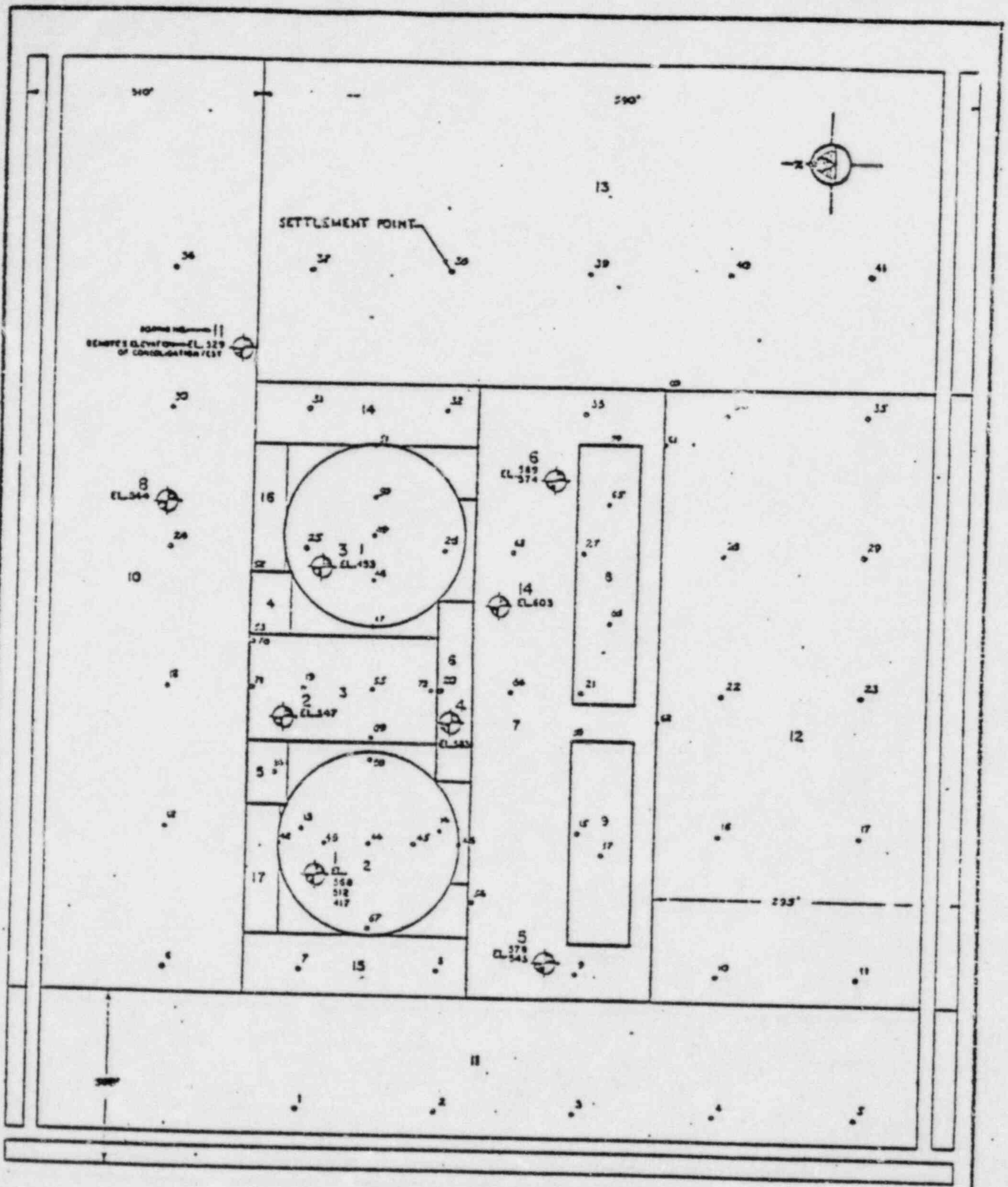
Amendment No. 5
11/3/69

TABLE A8-4 (CONT'D)

SETTLEMENT POINT	CLAY CONDITION TOTAL (1)	UPPER SAND CONDITION TOTAL (2)	EVALUATED FROM (1) AND (2) (3)	WESTERGAARD CONDITION (4)	PRESENTED IN REPORT TOTAL	PRESENTED IN REPORT DIFFERENTIAL
7. TURBINE BUILDING						
9	4.58	2.57	2.6	1.8		
33	4.58	2.57	3.6	2.4		
56	4.12	2.38	3.0	2.0		
60	4.64	2.59	3.6	2.4	$1\frac{1}{2} - 2$	$\frac{1}{4} - \frac{1}{2}$
61	4.63	2.59	4.6	3.1		
62	4.64	2.61	4.6	3.2		
63	4.52	2.50	4.4	3.0		
64	4.53	2.51	4.4	3.0		
8. TURBINE MAT						
21	4.43	2.52	4.4	3.0		
27	4.44	2.54	4.4	3.0		
59	4.44	2.54	4.4	3.0	$1\frac{1}{2} - 2$	$\frac{1}{4} - \frac{1}{2}$
65	4.48	2.57	4.5	3.0		
66	4.47	2.56	4.5	3.0		
9. TURBINE MAT						
15	4.45	2.54	3.6	2.4		
57	4.65	2.60	3.9	2.9	$1\frac{1}{2} - 2$	$\frac{1}{4} - \frac{1}{2}$
58	4.40	2.51	4.4	3.0		

NOTES:

1. All settlements in inches.
2. Column 3 settlements evaluated from column 1 and 2 settlements based on estimated sand thickness at a specific settlement point.
3. Column 4 values are 2/3 of column 3 settlements, and are based on Westergaard stress distribution theory.



KEY TO LOADED AREAS—
CASES II AND III

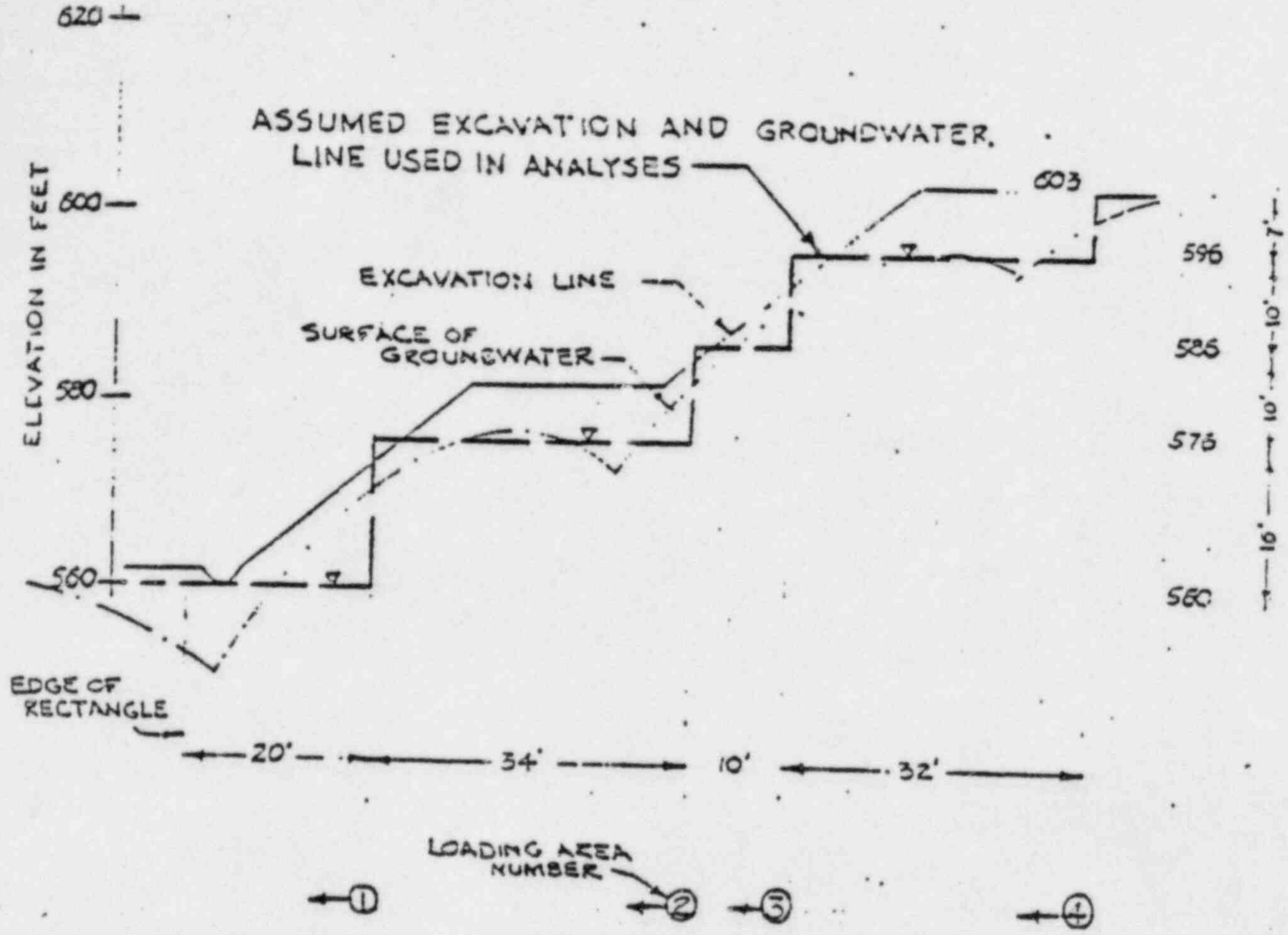
1 REACTOR BUILDING EL. 582.5
2 REACTOR BUILDING EL. 582.5
3 AUXILIARY BUILDING A EL. 582
4 AUXILIARY BUILDING B EL. 580
5 AUXILIARY BUILDING C EL. 580
6 AUXILIARY BUILDING D EL. 610
7 TURBINE BUILDING EL. 610
8 TURBINE MAT EL. 602
9 TURBINE MAT EL. 602
10-17 AREAL FILL SURFACE EL. 636

PLOT PLAN

FEET
50 0 50 100

DAMES & MOORE

FIGURE A8-1 AMEND. NO. 6



WATER TABLE LOWERED TO EL. 560 IN 440' x 298' RECTANGULAR AREA

LOADED AREAS		LOAD	ELEVATION
①	480' x 338'	16' x 62 PCF = 992 PSF	560
②	548' x 406'	10' x 62 PCF = 620	576
③	588' x 425'	10' x 62 PCF = 620	586
④	632' x 490'	7' x 62 PCF = 434	596

LOADING CRITERIA DEWATERING - CASE I

DAMES AND MOORE

ANALYSES OF SETTLEMENTS DUE TO AREAL LOADS

JOB NO 3697-034-07 JOB NAME CONSUMERS POWER CO   MPS 021169

SOIL DATA

TOTAL NUMBER OF SOIL LINES = 6

LINE NO	LINE DEPTH-FT	WT BELOW LINE-PCF	REBOUND SLOPE	VIRGIN SLOPE	PRECONS. PRESS-PSF	OVERCONS. PRESS-PSF
1	[illegible]	[illegible]	[illegible]	[illegible]	10000.	[illegible]
2	20.0	70.0	.005	.090	20000.	-0.
3	[illegible]	[illegible]	[illegible]	[illegible]	10000.	[illegible]
4	60.0	70.0	.004	.100	22000.	-0.
5	[illegible]	[illegible]	[illegible]	.100	33000.	[illegible]
6	240.0	.0	-.000	-.000	-0.	-0.

LOAD DATA

TOTAL NUMBER OF AREAL LOADS = 4

LOAD NO	BASE LINE COORDINATES LEFT-X	LEFT-Y	RIGHT-X	RIGHT-Y	ACTUAL HEIGHT	DEPTH	FOUNDATION PRESS-PSF
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	303.
2	1155.00	1126.00	1501.00	1126.00	548.00	.00	620.
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]
4	1113.00	1084.00	1603.00	1084.00	632.00	.00	434.

MINIMUM INFLUENCE VALUE = .030

SPECIFIED THICKNESS OF SOIL SLICE IN FT. = 5.00

RESULTS

POINT NO = 1   X-COORD.(FT) = 1250.00   Y-COORD.(FT) = 1100.00   DEPTH (FT) = .00
SETTLEMENT CAUSED BY LOADED AREA NOS. 1 2 3 4

TOTAL SETTLEMENT AT POINT NO 1 = 1.1[illegible] IN

POINT NO = 65   X-COORD.(FT) = 1464.00   Y-COORD.(FT) = 1535.00   DEPTH (FT) = 1.00
SETTLEMENT CAUSED BY LOADED AREA NOS. 1 2 3 4

TOTAL SETTLEMENT AT POINT NO 65 = 2.981 IN

POINT NO = 66   X-COORD.(FT) = 1468.00   Y-COORD.(FT) = 1450.00   DEPTH (FT) = 1.00
SETTLEMENT CAUSED BY LOADED AREA NOS. 1 2 3 4

TOTAL SETTLEMENT AT POINT NO 66 = 1.330 IN

POINT NO = 67   X-COORD.(FT) = 1300.00   Y-COORD.(FT) = 1230.00   DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. 1 2 3 4

TOTAL SETTLEMENT AT POINT NO 67 = 1.451 IN

POINT NO = 68   X-COORD.(FT) = 1300.00   Y-COORD.(FT) = 1350.00   DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. 1 2 3 4

TOTAL SETTLEMENT AT POINT NO 68 = 1.548 IN

POINT NO = 69   X-COORD.(FT) = 1300.00   Y-COORD.(FT) = 1265.00   DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. 1 2 3 4

TOTAL SETTLEMENT AT POINT NO 69 = 1.372 IN

POINT NO = 70   X-COORD.(FT) = 1215.00   Y-COORD.(FT) = 1435.00   DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. 1 2 3 4

TOTAL SETTLEMENT AT POINT NO 70 = .951 IN

POINT NO = 71   X-COORD.(FT) = 1215.00   Y-COORD.(FT) = 1400.00   DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. 1 2 3 4

TOTAL SETTLEMENT AT POINT NO 71 = .953 IN

POINT NO = 72   X-COORD.(FT) = 1341.00   Y-COORD.(FT) = 1400.00   DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. 1 2 3 4

TOTAL SETTLEMENT AT POINT NO 72 = 1.139 IN

COMPUTER SETTLEMENT ANALYSIS
CASE I-A

DAMES & MOORE

FIGURE A8-3

DAMES AND MOORE . . . ANALYSIS OF SETTLEMENTS DUE TO AREAL LOADS

JOB NO 5697-004-07 JOB NAME.CONSUMERS POWER CO   AFE 021169

SOIL DATA   TOTAL NUMBER OF SOIL LINES = 6

LINE NO	LINE DEPTH-FT	WT BELOW LINE-PCF	REBOUND SLOPE	VIRGIN SLOPE	PRECONS. PRESS-PSF	OVERCONS. PRESS-PSF
1	.0	70.0	.009	.090	20000.	-0.
2	20.0	70.0	.005	.090	20000.	-0.
3	40.0	70.0	.003	.090	20000.	-0.
4	60.0	70.0	.004	.100	20000.	-0.
5	100.0	70.0	.005	.100	22000.	-0.
6	240.0	.0	.000	.000	-0.	-0.

LOAD DATA   TOTAL NUMBER OF AREAL LOADS =17

LOAD NO	BASE LINE COORDINATES LEFT-X	LEFT-Y	RIGHT-X	RIGHT-Y	RECTGL HEIGHT	DEPTH	FOUNDATION PRESS-PSF	
1	0X= 1300.00	0Y= 1510.00	R= 65.00			20.50	3690.	—CIRCULAR LOAD
2	0X= 1300.00	0Y= 1290.00	R= 65.00			20.50	3690.	—CIRCULAR LOAD
3	1210.00	1352.00	1347.00	1362.00	76.00	41.00	1070.	
4	1210.00	1438.00	1240.00	1438.00	45.00	23.00	1990.	
5	1210.00	1317.00	1240.00	1317.00	45.00	23.00	1990.	
6	1347.00	1336.00	1373.00	1336.00	123.00	.00	4420.	
7	1373.00	1182.00	1505.00	1182.00	416.00	.00	3920.	
8	1445.00	1393.00	1490.00	1393.00	145.00	1.00	1470.	
9	1445.00	1222.00	1495.00	1222.00	145.00	1.00	1470.	
10	900.00	1182.00	1210.00	1182.00	658.00	.00	4090.	
11	900.00	882.00	1800.00	882.00	300.00	.00	4090.	
12	1505.00	1182.00	1800.00	1182.00	416.00	.00	4090.	
13	1210.00	1618.00	1800.00	1618.00	300.00	.00	4090.	
14	1210.00	1575.00	1373.00	1575.00	43.00	.00	4090.	
15	1210.00	1182.00	1373.00	1182.00	43.00	.00	4090.	
16	1210.00	1443.00	1235.00	1443.00	72.00	.00	4090.	
17	1210.00	1225.00	1235.00	1225.00	92.00	.00	4090.	

MINIMUM INFLUENCE VALUE = .030

SPECIFIED THICKNESS OF SOIL SLICE IN FT. = 5.00

RESULTS

POINT NO = 1 X-COORD.(FT) = 1250.00 Y-COORD.(FT) = 1100.00 DEPTH (FT) = .00
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 1 = 4.324 IN

POINT NO =50 X-COORD.(FT) = 1300.00 Y-COORD.(FT) = 1540.00 DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 50 = 2.759 IN

POINT NO =51 X-COORD.(FT) = 1390.00 Y-COORD.(FT) = 1525.00 DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 51 = 2.761 IN

POINT NO =52 X-COORD.(FT) = 1210.00 Y-COORD.(FT) = 1481.00 DEPTH (FT) = 23.00
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 52 = 2.064 IN

POINT NO =53 X-COORD.(FT) = 1210.00 Y-COORD.(FT) = 1440.00 DEPTH (FT) = 23.00
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 53 = 1.903 IN

POINT NO =54 X-COORD.(FT) = 1240.00 Y-COORD.(FT) = 1340.00 DEPTH (FT) = 23.00
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 54 = 1.690 IN

POINT NO =55 X-COORD.(FT) = 1300.00 Y-COORD.(FT) = 1400.00 DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 55 = 1.449 IN

COMPUTER SETTLEMENT ANALYSIS
CASE II A

DAMES & MOORE

FIGURE AB-4

DAMES AND MOORE   ANALYSIS OF SETTLEMENTS DUE TO AREAL LOADS

JOB NO 5447-004-07 JOB NAME CONSUMERS POWER CO   RPE 021169

SOIL DATA   TOTAL NUMBER OF SOIL LINES = 6

LINE NO	LINE DEPTH-FT	WT BELOW LINE-PCF	REBOUND SLOPE	VIRGIN SLOPE	PRECONS. PRESS-PSF	OVERCONS. PRESS-PSF
1	.0	70.0	.039	.090	20000.	-0.
2	20.0	70.0	.005	.030	20000.	-0.
3	40.0	70.0	.003	.095	20000.	-0.
4	60.0	70.0	.004	.100	20000.	-0.
5	100.0	70.0	.005	.100	22000.	-0.
6	240.0	.0	.000	.000	-0.	-0.

LOAD DATA   TOTAL NUMBER OF AREAL LOADS =17

LOAD NO	BASE LINE COORDINATES LEFT-X	LEFT-Y	RIGHT-X	RIGHT-Y	VERTCL HEIGHT	DEPTH	FOUNDATION PRESS-PSF	
1	QX= 1300.00	QY=	1310.00	R=	65.00	20.50	4130.	---CIRCULAR LOAD
2	QX= 1300.00	QY=	1290.00	R=	65.00	20.50	4130.	---CIRCULAR LOAD
3	1210.00	1362.00	1347.00	1362.00	76.00	41.00	-440.	
4	1210.00	1418.00	1240.00	1418.00	45.00	23.00	390.	
5	1210.00	1317.00	1240.00	1317.00	45.00	23.00	390.	
6	1147.00	1336.00	1375.00	1336.00	128.00	.00	3055.	
7	1373.00	1182.00	1509.00	1182.00	415.00	.00	2455.	
8	1445.00	1393.00	1490.00	1393.00	165.00	1.00	-65.	
9	1445.00	1222.00	1490.00	1222.00	165.00	1.00	-65.	
10	900.00	1182.00	1210.00	1182.00	800.00	.00	2615.	
11	900.00	882.00	1800.00	882.00	300.00	.00	2615.	
12	1509.00	1182.00	1800.00	1182.00	436.00	.00	2615.	
13	1210.00	1618.00	1800.00	1618.00	100.00	.00	2615.	
14	1210.00	1575.00	1373.00	1575.00	43.00	.00	2615.	
15	1210.00	1182.00	1373.00	1182.00	43.00	.00	2615.	
16	1210.00	1463.00	1239.00	1463.00	92.00	.00	2615.	
17	1210.00	1225.00	1239.00	1225.00	92.00	.00	2615.	

MINIMUM INFLUENCE VALUE = .030

SPECIFIED THICKNESS OF SOIL SLICE IN FT. = 5.00

RESULTS

POINT NO = 1 X-COORD.(FT) = 1290.00   Y-COORD.(FT) = 1100.00   DEPTH (FT) = .00
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 1 = 1.288 IN

* * * * * * * * * * * * * * *

POINT NO =50 X-COORD.(FT) = 1300.00   Y-COORD.(FT) = 1540.00   DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 50 = 2.089 IN

* * * * * * * * * * * * * * *

POINT NO =51 X-COORD.(FT) = 1300.00   Y-COORD.(FT) = 1525.00   DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 51 = 2.087 IN

* * * * * * * * * * * * * * *

POINT NO =52 X-COORD.(FT) = 1210.00   Y-COORD.(FT) = 1481.00   DEPTH (FT) = 23.00
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 52 = 1.371 IN

* * * * * * * * * * * * * * *

POINT NO =53 X-COORD.(FT) = 1210.00   Y-COORD.(FT) = 1440.00   DEPTH (FT) = 23.00
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 53 = 1.170 IN

* * * * * * * * * * * * * * *

POINT NO =54 X-COORD.(FT) = 1240.00   Y-COORD.(FT) = 1340.00   DEPTH (FT) = 23.00
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 54 = 2.183 IN

* * * * * * * * * * * * * * *

POINT NO =55 X-COORD.(FT) = 1300.00   Y-COORD.(FT) = 1400.00   DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. — 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 55 = .736 IN

* * * * * * * * * * * * * * *

COMPUTER SETTLEMENT ANALYSIS
CASE III A

DAMES & MOORE

FIGURE A8-5

DAMES AND MOORE ANALYSIS OF SETTLEMENTS DUE TO AREAL LOADS

JOB NO 5097-004-07 JOB NAME CONSUMERS POWER CO [illegible] 021169

SOIL DATA TOTAL NUMBER OF SOIL LINES = 6

LINE NO	LINE DEPTH-FT	WT BELOW LINE-PCF	REBOUND SLOPE	VIRGIN SLOPE	PRECONS. PRESS-PSF	OVERCONS. PRESS-PSF
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	20.0	70.0	.005	.090	20000.	[illegible]
3	40.0	70.0	[illegible]	[illegible]	20000.	-0.
4	60.0	70.0	.004	.100	22000.	-0.
5	100.0	70.0	[illegible]	.100	23000.	-0.
6	240.0	.0	.000	.000	0.	-0.

LOAD DATA TOTAL NUMBER OF AREAL LOADS = 4

LOAD NO	AREA LINE COORDINATES LEFT-X	LEFT-Y	RIGHT-X	RIGHT-Y	AREA HEIGHT	DEPTH	FOUNDATION PRESS-PSF
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	1135.00	1126.00	1501.00	1126.00	546.00	.00	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.05	620.
4	1113.00	1084.00	1401.00	1084.00	632.00	.00	534.

MINIMUM INFLUENCE VALUE = .039

SPECIFIED THICKNESS OF SOIL SLICE IN FT. = 5.00

RESULTS

POINT NO = 1 X-COORD.(FT) = 1250.33 Y-COORD.(FT) = 1100.00 DEPTH (FT) = .00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4
TOTAL SETTLEMENT AT POINT NO 1 = [illegible] IN

* * * * * * * * * * * * * * *

POINT NO =65 X-COORD.(FT) = 1440.00 Y-COORD.(FT) = 1335.00 DEPTH (FT) = 1.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4
TOTAL SETTLEMENT AT POINT NO 65 = 1.599 IN

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POINT NO =66 X-COORD.(FT) = 1446.30 Y-COORD.(FT) = 1450.00 DEPTH (FT) = 1.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4
TOTAL SETTLEMENT AT POINT NO 66 = [illegible] IN

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POINT NO =67 X-COORD.(FT) = 1300.00 Y-COORD.(FT) = 1230.00 DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4
TOTAL SETTLEMENT AT POINT NO 67 = [illegible] IN

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POINT NO =68 X-COORD.(FT) = 1300.00 Y-COORD.(FT) = 1350.00 DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4
TOTAL SETTLEMENT AT POINT NO 68 = [illegible] IN

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POINT NO =69 X-COORD.(FT) = 1370.00 Y-COORD.(FT) = 1285.00 DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4
TOTAL SETTLEMENT AT POINT NO 69 = 1.073 IN

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POINT NO =70 X-COORD.(FT) = 1215.00 Y-COORD.(FT) = 1435.00 DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4
TOTAL SETTLEMENT AT POINT NO 70 = [illegible] IN

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POINT NO =71 X-COORD.(FT) = 1215.00 Y-COORD.(FT) = 1400.00 DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4
TOTAL SETTLEMENT AT POINT NO 71 = .953 IN

* * * * * * * * * * * * * * * *

POINT NO =72 X-COORD.(FT) = 1341.00 Y-COORD.(FT) = 1400.00 DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4
TOTAL SETTLEMENT AT POINT NO 72 = 1.139 IN

COMPUTER SETTLEMENT ANALYSIS
CASE I B

DAMES & MOORE

FIGURE 18-[illegible]

DAMES AND MOORE ANALYSIS OF SETTLEMENTS DUE TO AREAL LOADS

JOB NO 1497-004-07 JOB NAME CONSUMERS POWER CO APR 021169

SOIL DATA

TOTAL NUMBER OF SOIL LINES = 6

LINE NO	LINE DEPTH-FT	WT BELOW LINE-PCF	REBOUND SLOPE	VIRGIN SLOPE	PRECONS. PRESS-PSF	OVERCONS. PRESS-PSF
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	20.0	70.0	.005	.040	20300.	-0.
3	[illegible]	[illegible]	[illegible]	.040	[illegible]	-0.
4	60.0	70.0	.004	.100	22000.	-0.
5	[illegible]	[illegible]	[illegible]	.100	[illegible]	-0.
6	240.0	.0	.000	.000	0.	-0.

LOAD DATA

TOTAL NUMBER OF AREAL LOADS =17

LOAD NO	BASE LINE COORDINATES LEFT-X	LEFT-Y	RIGHT-X	RIGHT-Y	ACCEL. HEIGHT	FOUNDATION DEPTH	PRESS-PSF	
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20.50	5880.	---CIRCULAR LOAD
2	0A*	1300.00	0Y*	1290.00	A* 65.00	20.50	5890.	---CIRCULAR LOAD
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
4	1210.00	1418.00	1240.00	1418.00	49.00	23.00	1997.	
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
6	1347.00	1336.00	1375.00	1376.00	128.00	7.00	4443.	
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
8	1449.00	1393.00	1490.00	1393.00	145.00	1.00	1470.	
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
10	900.00	1187.00	1212.00	1187.00	464.00	.00	4390.	
11	900.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
12	1305.00	1182.00	1900.00	1182.00	436.00	.00	4093.	
13	1210.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
14	1210.00	1575.00	1375.00	1575.00	41.00	.00	4390.	
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
16	1219.00	1443.00	1235.00	1443.00	92.00	.60	4090.	
17	1210.00	1225.00	1235.00	1225.00	[illegible]	.00	4080.	

MINIMUM INFLUENCE VALUE = .330

SPECIFIED THICKNESS OF SOIL SLICE IN FT = [illegible]

RESULTS

POINT NO = 1 X-COORD.(FT) = 1350.00 Y-COORD.(FT) = 1100.00 DEPTH (FT) = .00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 1 = 2.538 IN

POINT NO =10 X-COORD.(FT) = 1550.00 Y-COORD.(FT) = 1200.00 DEPTH (FT) = .00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 10 = 2.567 IN

POINT NO =11 X-COORD.(FT) = [illegible] Y-COORD.(FT) = 1300.00 DEPTH (FT) = .00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 11 = [illegible] IN

POINT NO =12 X-COORD.(FT) = 1150.00 Y-COORD.(FT) = 1300.00 DEPTH (FT) = .00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 12 = 2.445 IN

POINT NO =13 X-COORD.(FT) = 1350.00 Y-COORD.(FT) = 1300.00 DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 13 = [illegible] IN

POINT NO =14 X-COORD.(FT) = 1350.00 Y-COORD.(FT) = 1300.00 DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 14 = 2.646 IN

POINT NO =15 X-COORD.(FT) = 1450.00 Y-COORD.(FT) = [illegible] DEPTH (FT) = 1.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 15 = 2.657 IN

COMPUTER SETTLEMENT ANALYSIS
CASE II 8

DAMES & MOORE

FIGURE 46-7

DAMES AND MOORE — ANALYSIS OF SETTLEMENTS DUE TO AREAL LOADS

JOB NO 5617-014-07 JOB NAME CONSUMERS POWER CO — APE 021169

SOIL DATA — TOTAL NUMBER OF SOIL LINES = 6

LINE NO	LINE DEPTH-FT	WT BELOW LINE-PCF	REBOUND SLOPE	VIRGIN SLOPE	PRECONS. PRESS-PSF	OVERCONS. PRESS-PSF
1	.0	70.0	[illegible]	[illegible]	[illegible]	-0.
2	20.0	70.0	.009	.090	20500.	-0.
3	40.0	70.0	.003	.050	20000.	-0.
4	60.0	70.0	.004	.100	22000.	-0.
5	100.0	70.0	.003	.100	23000.	-0.
6	240.0	.0	.003	.003	-0.	-0.

LOAD DATA — TOTAL NUMBER OF AREAL LOADS = 17

LOAD NO	BASE LINE COORDINATES LEFT-X	LEFT-Y	RIGHT-X	RIGHT-Y	FACTOR HEIGHT	FOUNDATION DEPTH	PRESS-PSF	
1	1180. 1160.00	[illegible]	1310.00	[illegible]	[illegible]	20.50	4132.	---CIRCULAR LOAD
2	1180 1160.00	079	1290.00	16	65.00	20.50	4132.	---CIRCULAR LOAD
3	1210.00	1162.00	1162.00	1162.00	76.33	[illegible]	[illegible]	
4	1210.00	1418.00	1240.00	1418.00	45.00	23.00	190.	
5	1210.00	1317.00	1240.00	1317.00	45.00	[illegible]	190.	
6	1167.90	1336.00	1173.00	1336.00	123.00	.00	3055.	
7	1173.00	1182.00	1305.00	1182.00	[illegible]	.00	2655.	
8	1465.00	1173.00	1490.00	1191.00	139.00	1.30	465.	
9	1465.00	1222.00	1465.00	1222.00	165.00	[illegible]	[illegible]	
10	900.00	1162.00	1213.00	1182.00	888.00	.00	2615.	
11	900.00	882.00	1407.00	882.00	133.00	.00	2615.	
12	1505.00	1162.00	1407.00	1182.00	416.00	.00	2615.	
13	1210.00	1618.00	1160.00	1618.00	161.00	.00	2615.	
14	1210.00	1575.00	1173.00	1575.00	43.00	.00	2615.	
15	1210.00	1162.00	1173.00	1182.00	43.00	.00	2615.	
16	1210.00	1463.00	1235.00	1463.00	42.00	.00	2615.	
17	1210.00	1225.00	1233.00	1225.00	32.00	.00	2615.	

MINIMUM INFLUENCE VALUE = .030

SPECIFIED THICKNESS OF SOIL SLICE IN FT. = 5.00

RESULTS

POINT NO = 1 X-COORD.(FT) = 1250.00 Y-COORD.(FT) = 1100.00 DEPTH (FT) = .00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 1 = 1.411 IN

* * * * * * * * * * * * * * *

POINT NO =50 X-COORD.(FT) = 1320.00 Y-COORD.(FT) = 1540.00 DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 50 = 2.049 IN

* * * * * * * * * * * * * * *

POINT NO =51 X-COORD.(FT) = 1330.00 Y-COORD.(FT) = 1525.00 DEPTH (FT) = 20.50
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 51 = 2.057 IN

* * * * * * * * * * * * * * *

POINT NO =52 X-COORD.(FT) = 1210.00 Y-COORD.(FT) = 1461.00 DEPTH (FT) = 23.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 52 = 1.371 IN

* * * * * * * * * * * * * * *

POINT NO =53 X-COORD.(FT) = 1210.00 Y-COORD.(FT) = 1440.00 DEPTH (FT) = 23.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 53 = 1.174 IN

* * * * * * * * * * * * * * *

POINT NO =54 X-COORD.(FT) = 1240.00 Y-COORD.(FT) = 1440.00 DEPTH (FT) = 23.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 54 = 1.169 IN

* * * * * * * * * * * * * * *

POINT NO =55 X-COORD.(FT) = 1330.00 Y-COORD.(FT) = 1490.00 DEPTH (FT) = 41.00
SETTLEMENT CAUSED BY LOADED AREA NOS. -- 1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17

TOTAL SETTLEMENT AT POINT NO 55 = .734 IN

* * * * * * * * * * * * * * *

COMPUTER SETTLEMENT ANALYSIS
CASE III B

DAMES & MOORE

FIGURE A8-8

2.5.4.3.4.3 Borrow Area Borings

Between 1956 and 1974, a total of 90 borings, as shown in Figures 2.5-35 and 2.5-36 and listed in Table 2.5-8, were made in the borrow area inside the dike system. Twenty-one of the borings were made in the area that is now the emergency cooling water pond. Twenty borings were done in 1974 on what is referred to as the Mergard Property in the south central portion of the site. These borings range in depth from 10 to 15 feet.

The other 49 borings were drilled at various locations within the cooling pond area, and they ranged in depth from 5 to 60 feet. These borings were drilled to evaluate the cooling pond interior area as a borrow source.

2.5.4.3.4.4 Borings for Structures Outside Power Plant Area

Additional exploration was conducted for three structures away from the main plant area. Nine exploratory borings were drilled at the railroad bridge site and one in the embankment area. These were made in 1969 and ranged in depth between 25 and 70 feet. A total of eight borings with depth ranging from 60 to 75 feet were made in 1974 in the vicinity of the Bullock Creek bridge. Sixteen borings ranging in depth between 9 and 60 feet were made in the vicinity of the spillway through the east leg of the dike in 1969. These borings are plotted in Figures 2.5-35 and 2.5-36 and listed in Table 2.5-8.

2.5.4.3.4.5 Pre-startup Borings

Sixteen borings, shown in Figure 2.5-35 and listed in Table 2.5-8, were drilled at the plant excavation area and the partially completed northeast dike. These were made in 1973 in preparation for resumption of construction activities after the shutdown period which began in 1970. These borings ranged in depth from 20 to 75 feet.

2.5.4.3.5 Site Conditions

2.5.4.3.5.1 General

The general topography of the site is level to gently rolling, with original ground surface elevations ranging from approximately elevation 604 to 612 in the plant area. Construction activities have altered the physical topography of the site. The plant area was raised approximately 25 to 30 feet to a final plant grade elevation of 634. The cooling pond area was used as a borrow area to secure material for construction of the plant area fill and the dike system.

The soils overlying the bedrock are predominantly of glacial origin in the Pleistocene age and consist of glacial tills, glacial outwash, and glacial lake deposits. The bedrock consists of shale of the Saginaw formation of the early Pennsylvanian epoch. The geologic features at the site are addressed in Subsection 2.5.1.2.

2.5.4.3.5.2 Soil Conditions

Two generalized subsurface sections were developed in the main power plant area and these are presented as Figures 2.5-20 and 2.5-21. Another generalized subsurface section, shown in Figure 2.5-22, was made through the emergency cooling water reservoir. The site can be generally characterized as a layer of 4 to 8 inches of topsoil underlain by discontinuous surficial sand of varying thickness, then ±200 feet of cohesive soils overlaying ±150 feet of very dense sandy soils. Below this, shale bedrock was encountered.

2.5.4.3.5.2.1 Topsoil and Organics

The top layer is organic soil 4 to 8 inches thick, except in three marshy areas, located in the vicinity of the Unit 2 containment, where 2 or 3 feet of organics were found.

2.5.4.3.5.2.2 Sandy Layer

The organic layer is underlain in most areas by localized sand pockets and is graded from loose near the surface to very dense with increasing depth. The sand (Unit a, Subsection 2.5.1.2.2.2) extends to approximately elevation 585 at both the east and west ends of the turbine building. See Figure 2.5-17 for building locations. Similarly, the bottom of the sand stratum varies approximately from elevation 600 in the vicinity of the Unit 1 containment, to approximately elevation 575, near the northeastern edge of the Unit 2 containment, and also along a part of the northern edge of the auxiliary building. The maximum depth of sand in the plant area was found at boring 329, located 200 feet northwest of the evaporator building (Appendix 2A), where the boring terminated in sand at approximately elevation 552. The blowcount value for this material ranged from 4 to 65 blows per foot. The low blowcounts encountered were found on samples taken from a shallow depth, about 5 feet below existing ground level. Furthermore, these are localized pockets and do not represent a loose stratum across the site.

2.5.4.3.5.2.3 Very Stiff to Hard Gray Silty Clay

The sandy soils in the plant area are underlain by very stiff to hard cohesive soils, predominantly gray silty clay, which extends to depths ranging from elevation 578 to 545 (upper portion of Unit c, see Subsection 2.5.1.2.2.2). The cohesive soils contain numerous discontinuous silt lenses, which vary in orientation from horizontal to approximately 75 degrees from the horizontal. They have been preconsolidated under an overburden pressure of at least 15,000 to 20,000 lb/ft^2 by the weight of glaciers. The silt lenses did not contain any free water at the time of the investigation (June 1968) and were in a dry, powdery condition. Random sand seams or layers, up to 6 feet in thickness, were also encountered. The blowcount range for this cohesive material varied from 20 to 100+ blows per foot.

2.5.4.3.5.2.4 Brownish-Gray Silty Clay

Below the very stiff to hard cohesive soils, there is a layer of uniformly hard cohesive soils, predominantly brownish-gray silty clay containing some sand and gravel (lower portion of Unit c, see Subsection 2.5.1.2.2.2). Three of the borings (Dames & Moore borings 5 and 6, Michigan Drilling boring 1) penetrated the bottom of these cohesive materials at elevations between 365 and 431. The blowcount value for this material ranged from 40 to 100+ blows per foot.

2.5.4.3.5.2.5 Very Dense Sandy Soils

From the base of the cohesive soils to bedrock, very dense sandy soils grading into very dense sandy soils with cobbles and boulders were encountered (Units d and e, Subsection 2.5.1.2.2.2). The blowcounts for the sand for the most part exceeded 200 blows for 6 inches.

2.5.4.3.5.2.6 Bedrock

The bedrock was black shale of the Saginaw formation and was cored from elevation 248 to 238 by Dames & Moore (boring 1), and to approximately elevation 174 by Michigan Drilling (boring 1A).

2.5.4.4 Geophysical Survey

The site geophysical survey report is contained in Appendix 2C. The objectives of the work were 1) to determine the depth to bedrock by means of a refraction survey, and 2) to measure seismic velocities of compressional (V_p) and shear (V_s) waves through the subsurface materials by means of a cross hole survey. The stratification indicated by the refraction and cross hole survey is confirmed by site borings (Appendix 2A). 1

2.5.4.5 Excavation and Backfill

2.5.4.5.1 Excavation Plan and Sections

The plant area excavation plan and sections are presented in Figures 2.5-37 and 2.5-38. The excavation extended through the sandy surface soils into relatively impervious clay soils. Slopes were no steeper than 1.5 horizontal to 1 vertical.

JS

Engineering design drawings required that loose sands be removed as part of the work scope to be performed in the earthwork subcontract. These loose sands were identified by shallow depth borings made before and during construction operations.

Figure 2.5-21 was prepared to show the original soil profile, including the loose sands, and is based on these shallow depth borings. This figure represents the condition before construction. 8

The request to provide plan figures of areas where the loose sands were removed will be responded to in more detail by August 1978.

The maximum depth of excavation was approximately 40 feet (to elevation 561.5) at the auxiliary building location. The safety of the slope geometry was verified by stability analysis and is discussed in Subsection 2.5.5.

A lean concrete mud mat was used to prevent disturbance of the soil structure during construction. The mud mat thickness was no less than 6 inches for the two containments and auxiliary buildings and other structures as needed for workable conditions. 5

2.5.4.5.2 Dewatering

Dewatering during construction is discussed in Subsection 2.5.4.6.2.

2.5.4.5.3 Fill

Up to 35 foot thick compacted fill was required to attain final plant grade elevation 634. Fill was also required to achieve the foundation elevation for portions of the auxiliary and turbine buildings. The compaction criteria for fill in different areas are presented in Table 2.5-9. Onsite excavated soils meeting gradations as shown in Table 2.5-10 were used for fill material. Select sand backfill adjacent to all safety-related structures was also required and placed according to Table 2.5-9 around all structures. 1

JS

All fill and backfill were placed with an uncompacted lift thickness of not more than 12 inches. Sheepsfoot rollers and vibratory compaction equipment were used to meet the minimum compaction criteria as shown in Table 2.5-9. In areas not accessible to heavy compaction equipment the material was placed in 4 inch layers and compacted to the required density by mechanical hand tampers. 1

One hundred and sixty-eight proctor tests have been performed on various fill source materials to establish moisture-density relationship curves and used to determine the percent of compaction for in-place fill. Figure 2.5-39 shows representative moisture-density relationship curves obtained by the ASTM D 1557-66T method, modified to achieve 20,000 foot-pounds of compactive energy per cubic foot of soil. Frequency of laboratory and field testing for control of materials is shown in Table 2.5-11; additional testing was done when required by field engineering. The numbers of field in-place density control tests taken in structural and plant areas are summarized in Table 2.5-12. 1

Figures 2.5-66 through 2.5-69 show summaries of field density tests for compaction and moisture contents of fill placed beneath and around Seismic Category I structures. 8

JS

The quality assurance program during construction was performed in accordance with Chapter 17. Quality control was a daily program that checked both field and laboratory work. The program was approved by a quality control engineer before any work was accepted; any deviation from specifications required a nonconformance report which had to be satisfied before that portion of the work could proceed or be accepted.

Test fills were constructed to evaluate compaction equipment to be used on the site. Given below are the results of this investigation.

Three types of compaction equipment were used to compact a 1 foot lift of similar Zone 1 material on the three pads. They consisted of the following units:

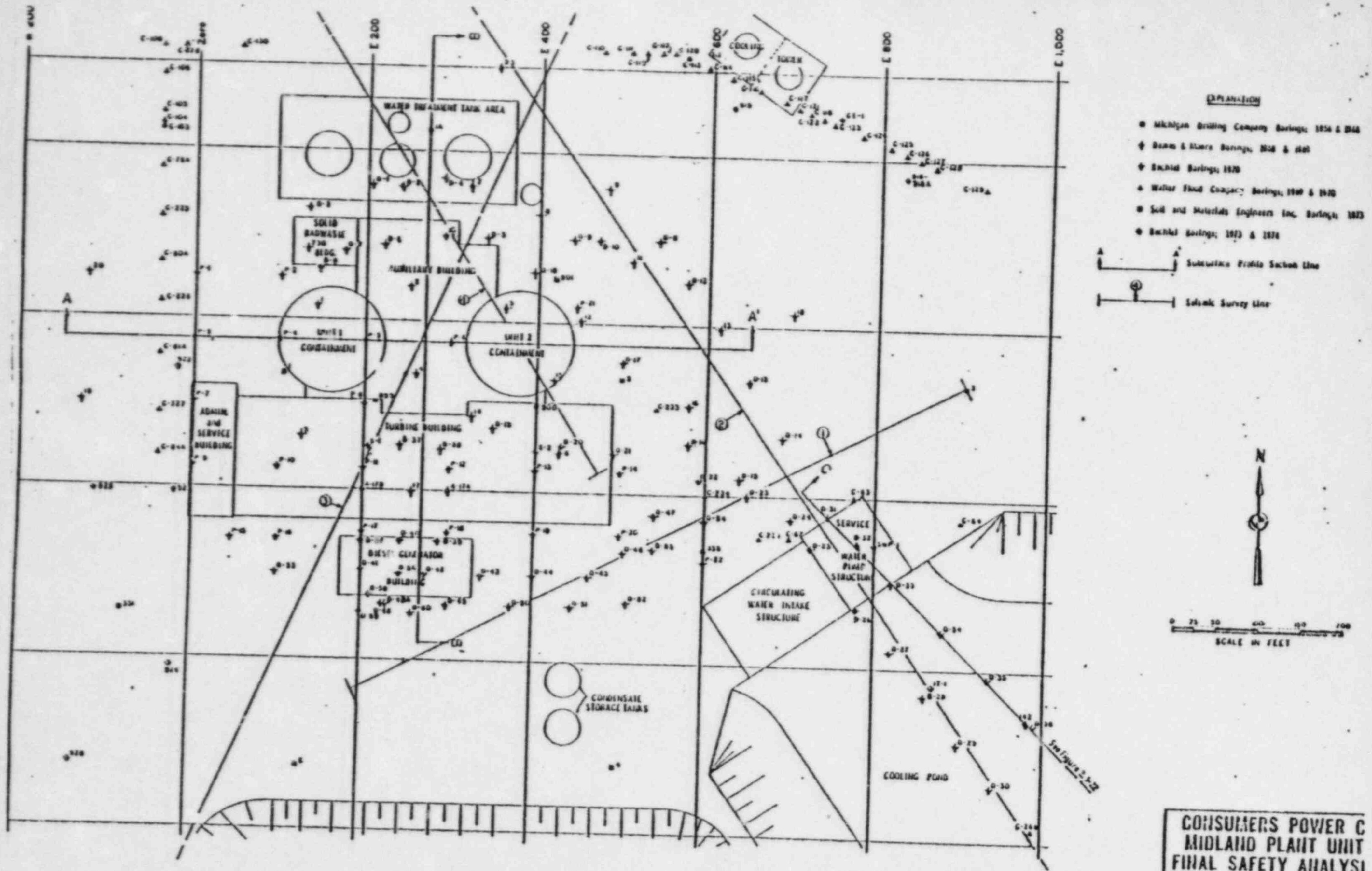
1. Bros roller, having four pneumatic rubber tires on one axle, which has been loaded to a gross weight of 50 tons, pulled by a Terex 8240 dozer

2. A smooth steel drum vibratory roller, Raygo Rumbler, pulled by a Michigan 280 tractor with the following specifications:

gross weight	20,000 pounds
drum diameter	60 inches
drum length	100 inches
dynamic vibration force	45,000 pounds
vibration frequency	1,100 to 1,500 vpm

3. A CF43 Vibroplus Sheepsfoot roller, pulled by a Michigan 280 tractor with the following specifications:

static weight	12,000 pounds
centrifugal force	11.5 tons
total applied load at 1,600 vpm	35,000 pounds
vibration frequency	1,400-1,600 vpm
diameter of drum	63 inches
length of drum	75 inches



CONSUMERS POWER C
MIDLAND PLANT UNIT
FINAL SAFETY ANALYSI

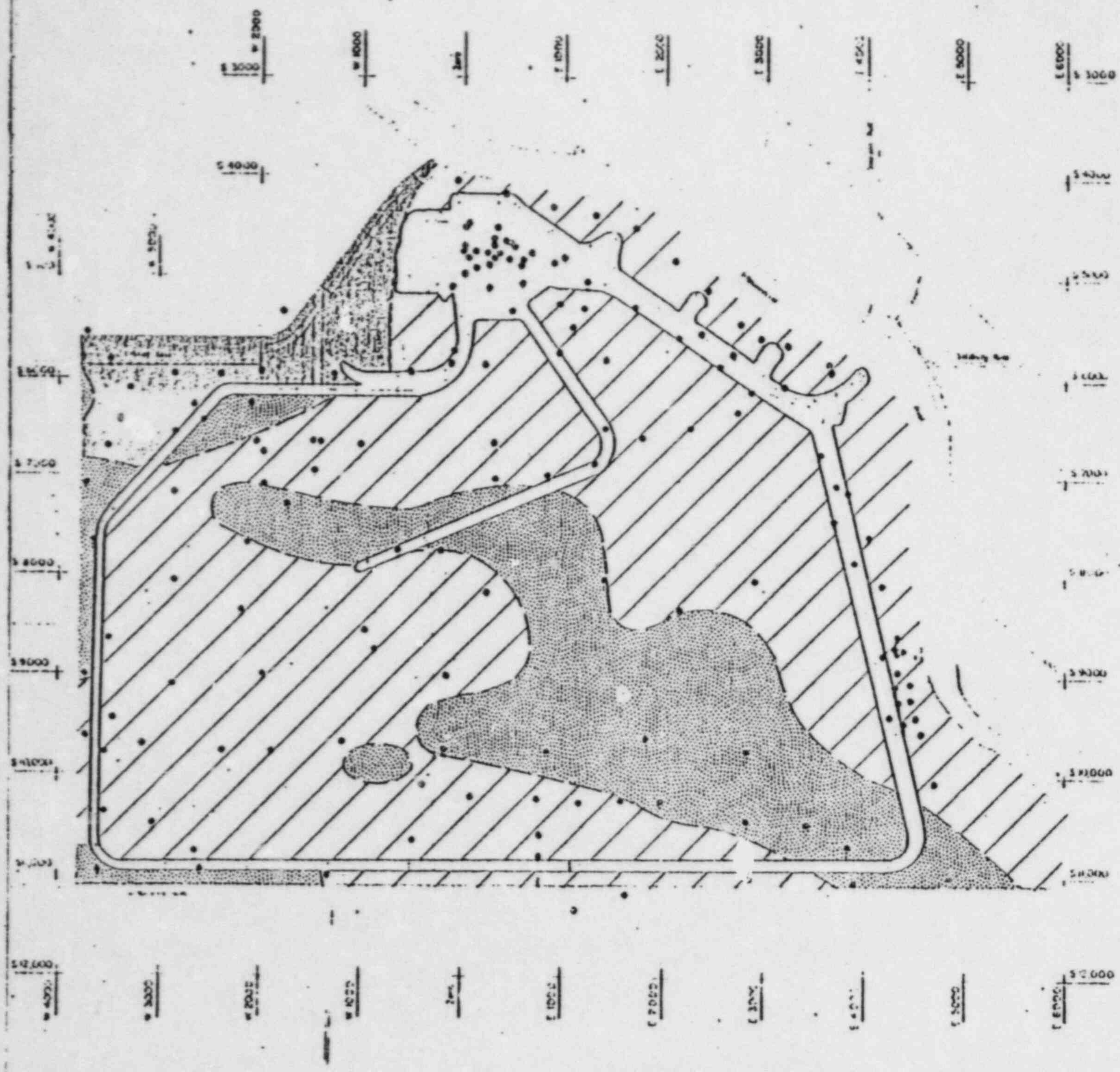
Plant Area Borir;

(SK-G-43, Rev 1)

FSAR Figure 2.5-

11/77

Fig. 2.5-17



EXPLANATION

ESTABLISHED CONTACT

INFERRED CONTACT

SITE BORING LOCATION

CENOZOIC

PLEISTOCENE HOLOCENE

ALLUVIAL DEPOSIT-DARK GRAY TO LOOSE, SANDY SILT. LOCALLY FO AS LOOSE TO FINE GRAINED SILTY SAND. GENERALLY THIN, RANGING FROM 1 TO 4 FOOT THICK.

BEACH AND DUNE SAND-TAN TO BRO FINE TO MEDIUM GRAINED SAND. GENERALLY OCCURS AS A THIN VEN 1 TO 2 FOOT THICK OVERLYING GLACIAL TILL.

GLACIAL DRIFT-GRAY TO TAN, SILT OR SANDY CLAY. DEPOSITED AS A TILL DURING THE WISCONSIN ICE OCCURS AS A THICK GEOLOGICAL SURFICIAL AND SUBSURFICIAL UNIT IN THE MAPPED AREA.

NOTES:

1. FIGURE DEVELOPED FROM INFORMATION OBTAI THROUGH RECONNAISSANCE OF SITE AREA.
2. ALL SURFACE SAND DEPOSITS IN ALL AREAS ENGINEERED FILL WERE REMOVED PRIOR TO CONSTRUCTION.

N

0 400 800 1600

SCALE IN FEET

CONSUMERS POWER C
MIDLAND PLANT UNIT
FINAL SAFETY ANALYSI

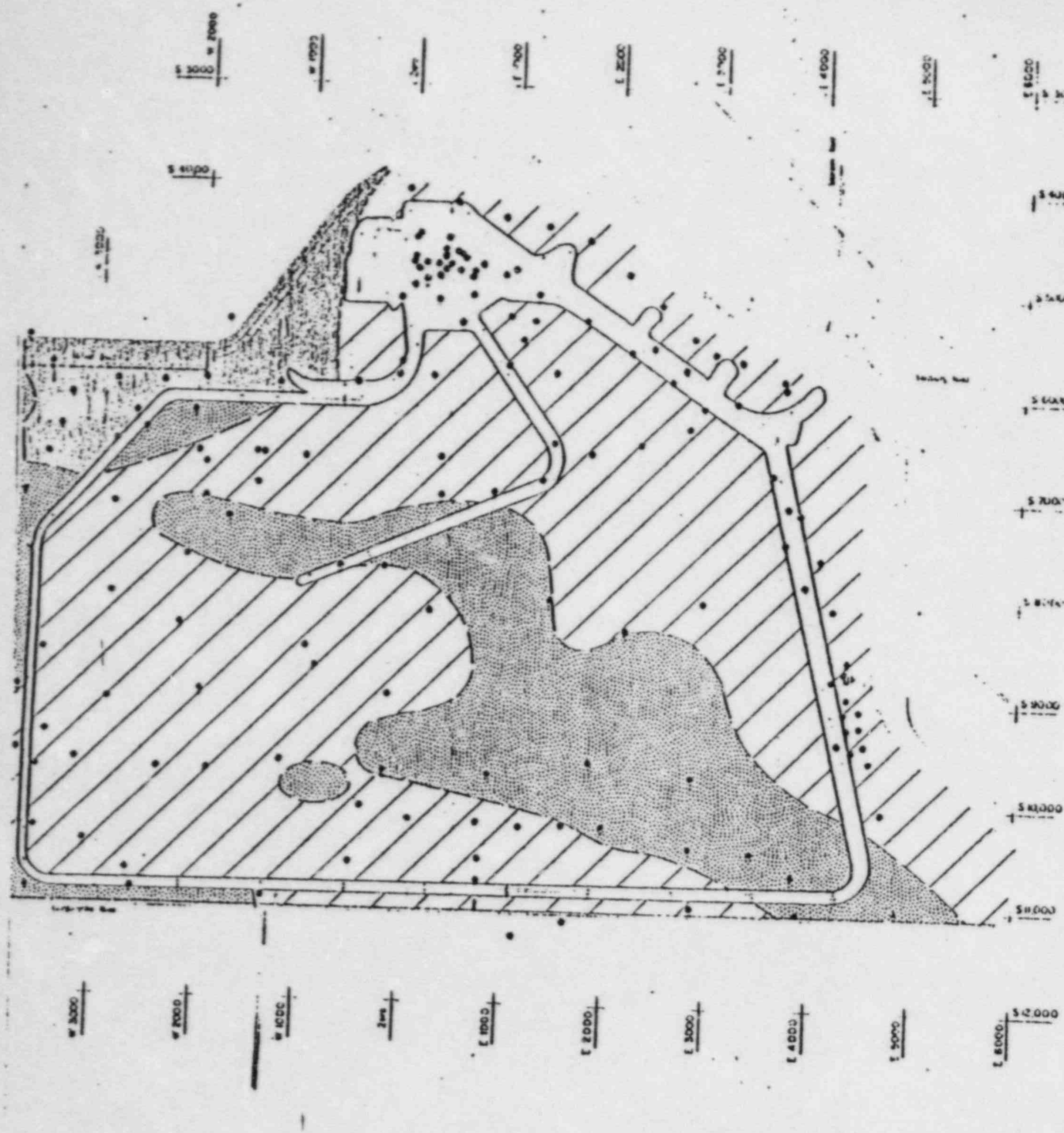
Site Surface Geolo

(SK-G-146, Rev 0)

FSAR Figure 2.5-

11/77

Fig. 2.5-19



EXPLANATION

	— —	ESTABLISHED CONTACT
	- - - -	INFERRED CONTACT
	•	SITE BORING LOCATION
CENOZOIC — HOLOCENE		ALLUVIAL DEPOSIT-DARK GRAY TO TAN, LOOSE, SANDY SILT. LOCALLY FOUND AS LOOSE TO FINE GRAINED SILTY SAND. GENERALLY THIN, RANGING FROM 1 TO 4 FOOT THICK.
CENOZOIC — PLEISTOCENE		BEACH AND DUNE SAND-TAN TO BROWN, FINE TO MEDIUM GRAINED SAND. GENERALLY OCCURS AS A THIN VENEER 1 TO 2 FOOT THICK OVERLYING GLACIAL TILL.
CENOZOIC — PLEISTOCENE		GLACIAL DRIFT-GRAY TO TAN, SILTY OR SANDY CLAY. DEPOSITED AS A TILL DURING THE WISCONSIN ICE AGE. OCCURS AS A THICK GEOLOGICAL SURFICIAL AND SUBSURFICIAL UNIT IN THE MAPPED AREA.

NOTES:

1. FIGURE DEVELOPED FROM INFORMATION OBTAINED THROUGH RECONNAISSANCE OF SITE AREA.
2. ALL SURFACE SAND DEPOSITS IN ALL AREAS OF ENGINEERED FILL WERE REMOVED PRIOR TO CONSTRUCTION.

0 400 800 1600

SCALE IN FEET

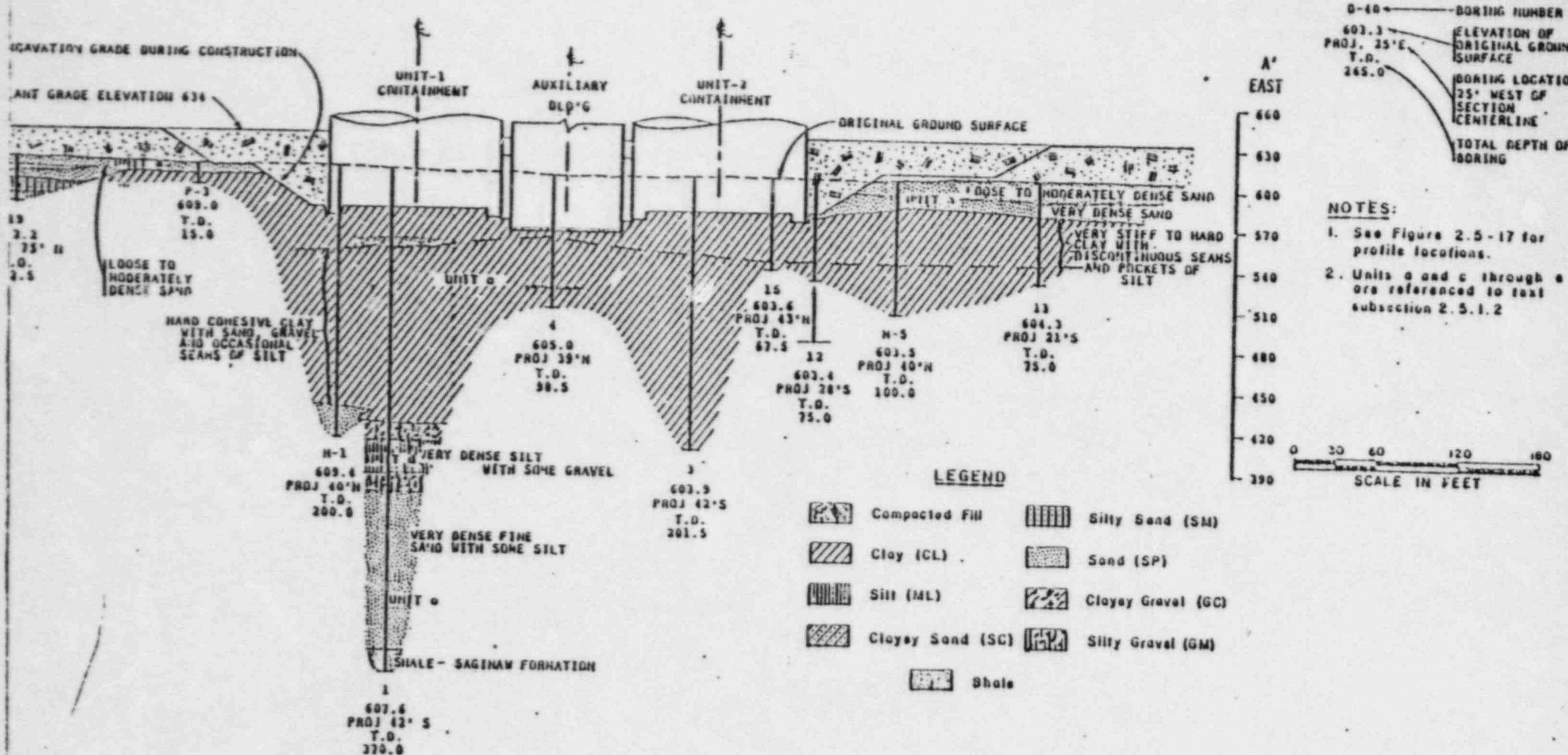
CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Site Surface Geology

(SK-G-146, Rev 0)

FSAR Figure 2.5-19

11/77 Revision

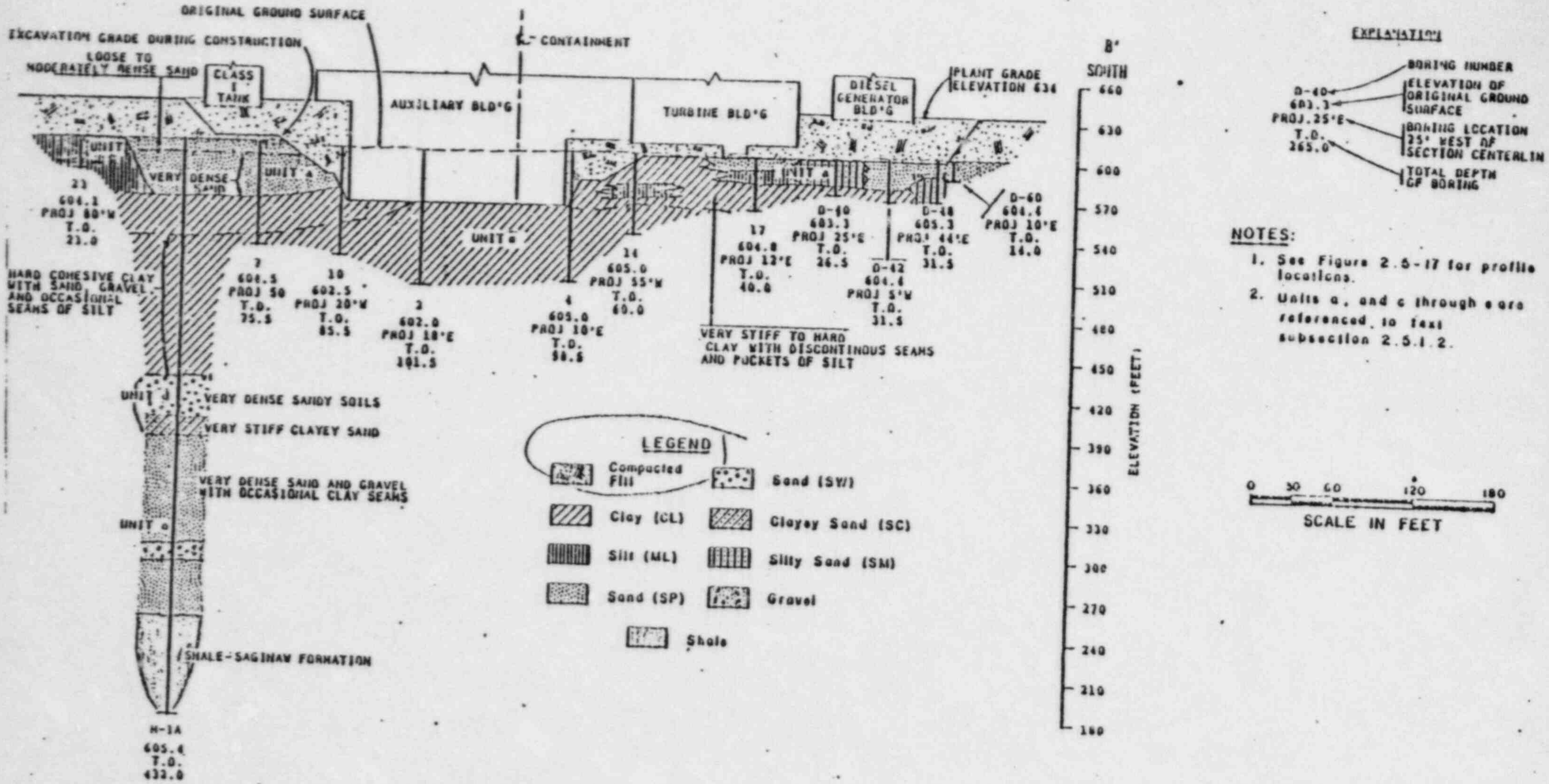


NOTES:

1. See Figure 2.5-17 for profile locations.
2. Units a and c through e are referenced to text subsection 2.5.1.2

CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Generalized Subsurface Profile Section A
(SK-G-107, Rev 0)
FSAR Figure 2.5-20

11/7 Revision 1



NOTES:

1. See Figure 2.5-17 for profile locations.
2. Units a, and c through e are referenced to text subsection 2.5.1.2.

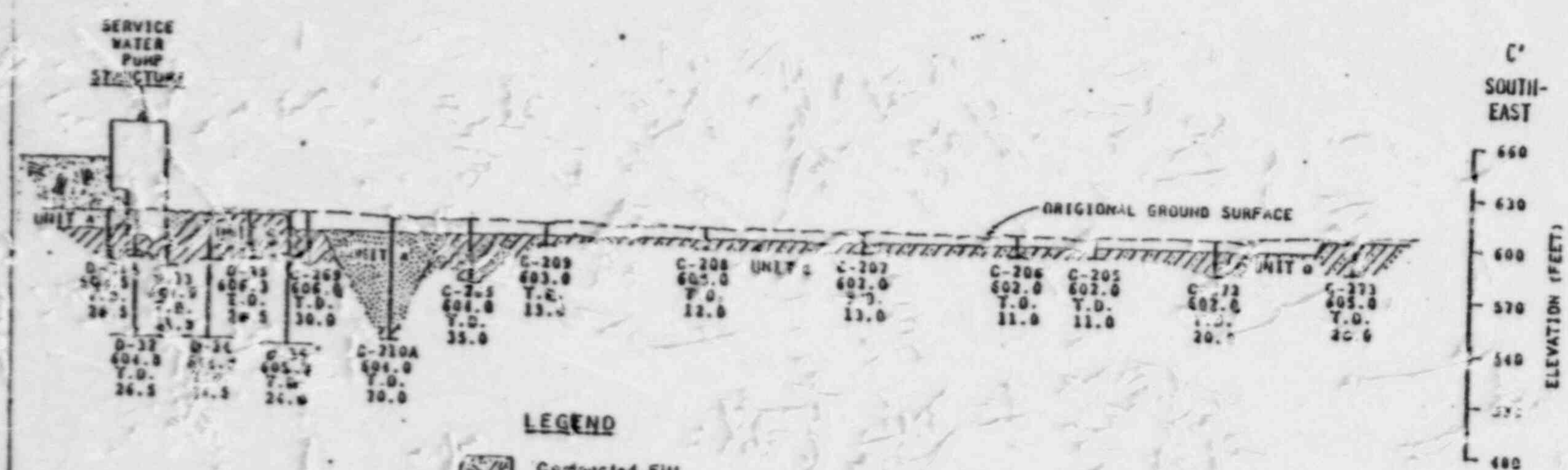
CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Generalized Subsurface Profile Section B

(SK-G-108, Rev 0)

FSAR Figure 2.5-21

11/7 Revision 1



EXPLANATION

B-40 — BORING NUMBER
603.3 — ELEVATION OF ORIGINAL GROUND SURFACE
PROJ. 35'E — BORING LOCATION 35' WEST OF SECTION CENTERLINE
T.D. 265.0 — TOTAL DEPTH OF BORING

NOTES:

1. See Figure 2.5-17 for profile locations.
2. Units a, and c through e are referenced to subsection 2.5.1.2.

0 100 200 400 600

SCALE IN FEET

LEGEND

Compacted Fill

Clay (CL)

Clayey Sand (CL-SC)

Sand (SP)

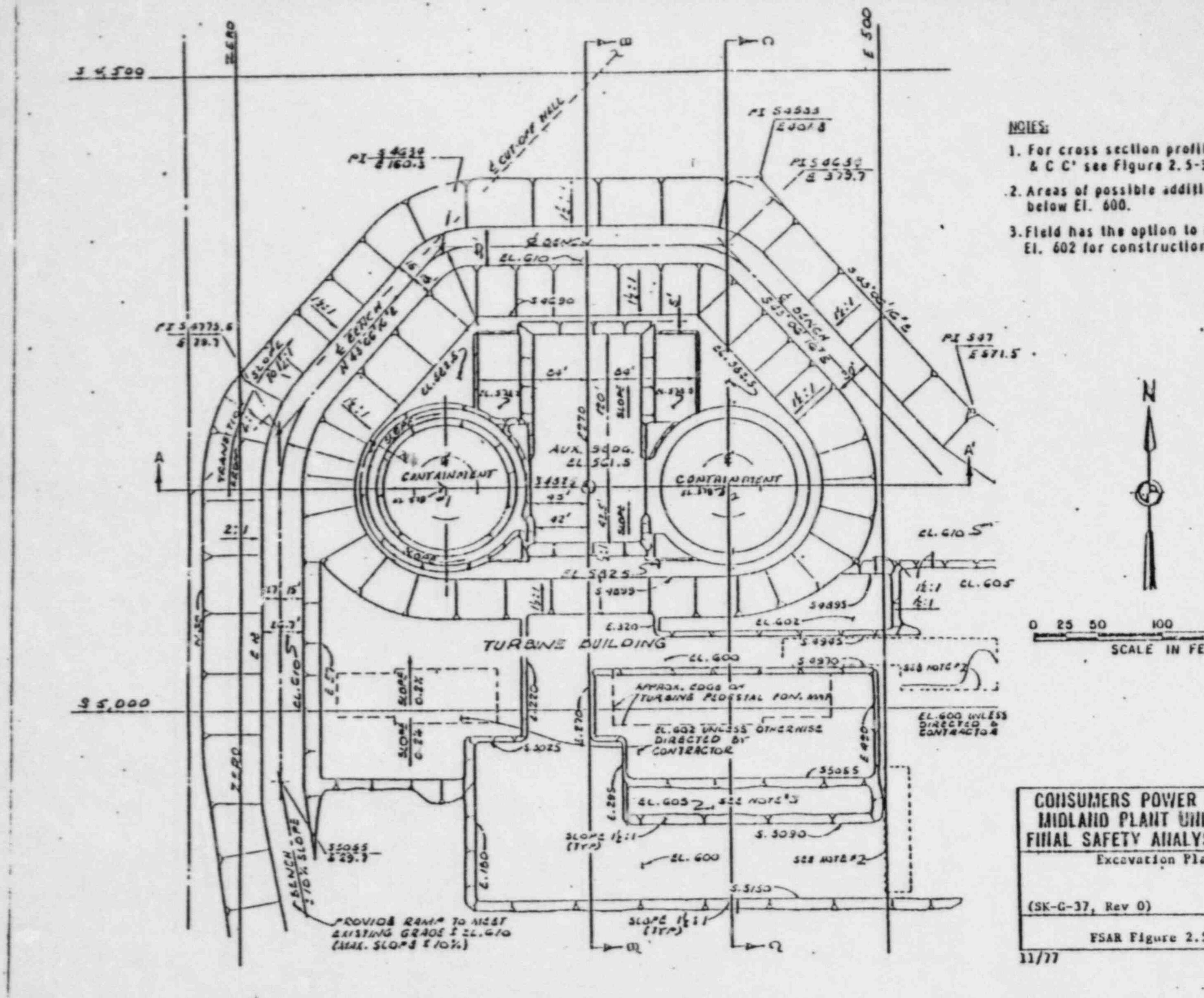
CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Generalized Subsurface Profile Section C

(SK-G-109, Rev 0)

FSAR Figure 2.5-22

11/77 Revision 1



NOTES:

1. For cross section profiles A A', B B', & C C' see Figure 2.5-38.
2. Areas of possible additional excavation below El. 600.
3. Field has the option to excavate to El. 602 for construction ease.

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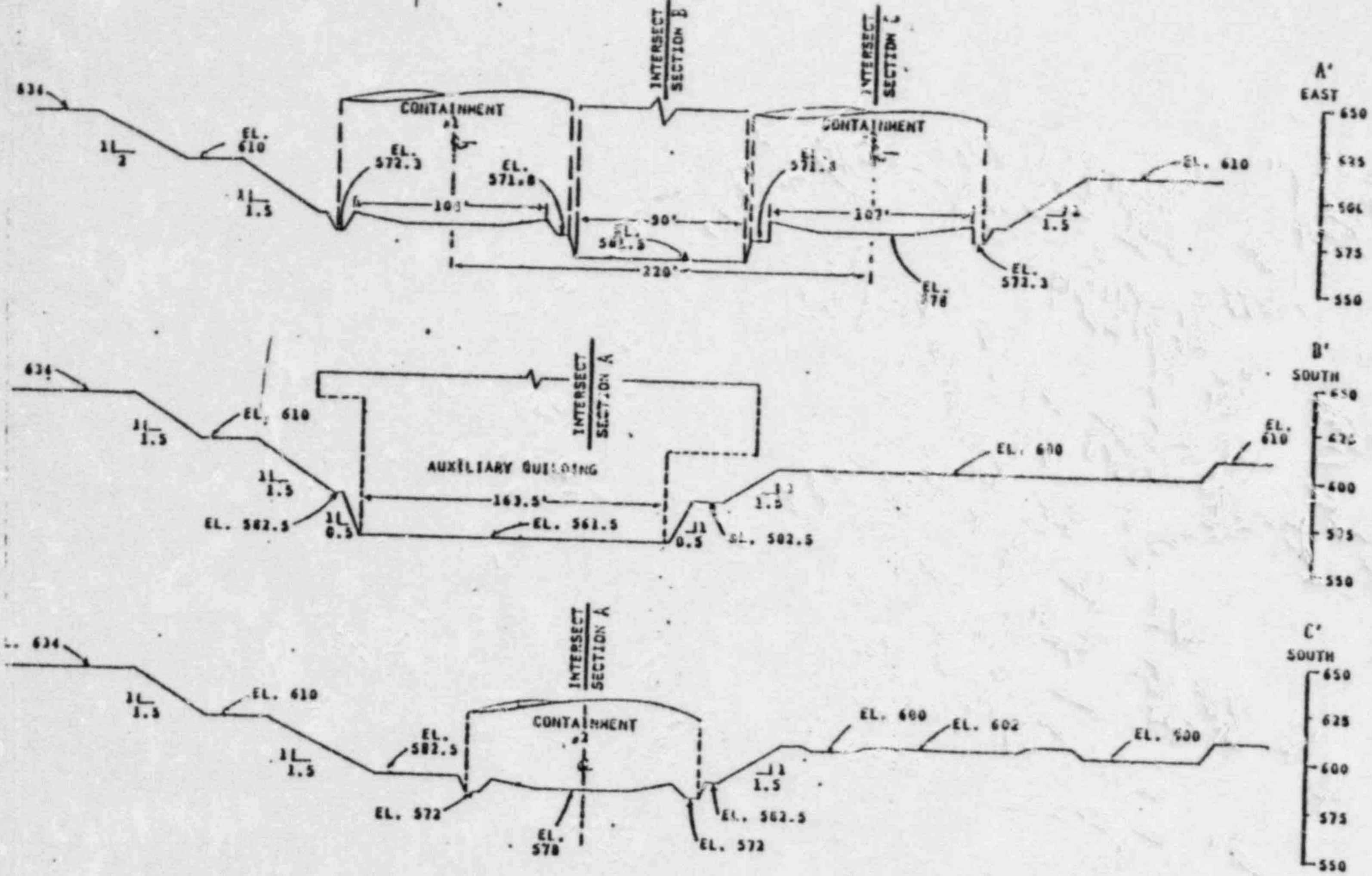
MIDLAND PLANT UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Excavation Plan

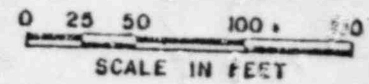
(SK-G-37, Rev 0)

FSAR Figure 2.5-37

11/77 Revision 1



NOTE:
FOR LOCATION OF CROSS SECTIONS
SEE FIGURE 2.5-37.



CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Excavation Cross-Sections

(SK-G-170, Rev 0)

FSAR Figure 2.5-38

11/77

Revision 1

2.5.4.10.2.5 Surcharge Load Due To Adjacent Structures

Surcharge loads caused by adjacent structures can generally be defined both in magnitude and area of application. The pressure developed by adjacent structures is additive to the lateral pressure directly applied by the backfill material. This additional earth pressure can best be determined by using methods derived from the theory of elasticity which are available for most loading shapes encountered in engineering applications. Suitable solutions are given by Bowles.[72] If the wall is considered to be rigid, the earth pressure will be twice that due to the elastic solutions as described and accounted for in this reference.

2.5.4.10.2.6 Live Load Surcharge

The lateral earth pressures due to live load depend on the load intensity, location, and shape; therefore, these lateral pressures can best be determined by elastic methods. Several possible load configurations that may be anticipated are given by Bowles.[72]

Surcharge pressures caused by dead or live loads were added to the pressures shown in Figure 2.5-45.

2.5.4.10.3 Settlements

This section deals with the evaluation of vertical ground movements (heave or settlement) under the plant facilities caused by construction. An excavation up to 40 feet below the original ground surface was made to enable the construction of the containment and portions of the auxiliary building. A large area fill up to 35 feet high, measuring approximately 1,000 feet by 1,100 feet, has been placed as shown in Figure 2.5-46. Heavy structural loads will be applied on this fill. The groundwater table at the plant area will be raised to elevation 627 when the cooling water reservoir is filled.

The effects of the above construction operations on ground movements at the Midland site are as follows:

a. First, when the site was excavated to depths of 40 feet, the resulting removal of material caused the underlying soils to rebound upward.

b. Next, as the large area fill was placed and structures were constructed, the resulting loads recompressed the prior upward rebound and then caused additional settlement.

c. Finally, raising the groundwater table will reduce the net foundation pressures. However, some settlement will continue until equilibrium is reached under the net increase in load.

Ultimate heave or settlement values were estimated by calculating the stress changes from elastic half-space theory and then computing the settlement or heave using Terzaghi's theory of one-dimensional consolidation.

Parameters to establish the analytical model are discussed in the following subsections.

2.5.4.10.3.1 Plant Layout and Loads

As shown in Figure 2.5-47, the two units and the contiguous structures occupy a total area measuring approximately 600 feet by 600 feet. Preconstruction grade at the site is approximately elevation 603. Finished grade at the plant site is 31 feet higher, at elevation 634. Compacted fill was used to raise the original ground surface to grade elevation.

Each containment was founded on a circular mat having a diameter of 128 feet and located at a depth of 20 feet below original ground surface. Portions of the auxiliary building were established 40 feet below original ground surface on the layer of very stiff to hard cohesive soils. The mat foundation grades for the rest of the auxiliary building, the turbine building, and associated facilities were placed at various elevations on compacted fill. The building loads superimposed by the structures on undisturbed soil or compacted fill are given in the soil pressure plan, Figure 2.5-47.

2.5.4.10.3.2 Subsurface Conditions

The plant site was essentially flat, and the ground surface was at about elevation 603. A detailed description of soil conditions together with generalized soil profiles through the plant site is given in Subsection 2.5.4.3.5. For the purpose of analysis, the soil profile is divided into the layering system shown in Table 2.5-16.

2.5.4.10.3.3 Soil Parameters

The soil compressibility parameters used in the settlement calculation are presented together with soil profile in Table 2.5-16. The normalized compression and swelling indexes ($C_{c,r}/1+e_0$) were evaluated by two methods. The first method used, presented by Dames & Moore,[58] is based on laboratory consolidation tests with adjustments for the effects of sample disturbance as discussed in Subsection 2.5.4.2.9. | 1

The other method is based on mathematical relationships among compression index, constrained modulus, and Young's Modulus as illustrated by Lambe and Whitman.(73) Young's Modulus ($E = 600\ Su$)(74) is based on a statistical relationship with the unconfined compressive strength or undrained shear strength. The undrained shear strength used is interpreted conservatively from the summation plot of shear strength vs elevation given in Figure 2.5-33.

The sampling of overconsolidated glacial clays is usually difficult due to the stiffness of the clays. Sample disturbance is inevitable. This evidence is clearly shown from all the laboratory consolidation test curves. Furthermore, experience indicated that the estimated soil compressibilities from consolidation tests are influenced and increase by the specimen preparation of trimming and ring fitting. On the other hand, the empirical compressibilities are derived from shear strength test results, which are not affected by sample disturbance to the same degree as laboratory consolidation test results. The normalized compression and swelling indexes ($C_{c,r}/1+e_o$) adopted in settlement calculations are the weighted average values derived from both methods.

2.5.4.10.3.4 Groundwater Conditions

Chuck Hunt ②

For settlement evaluation, the static groundwater level is conservatively estimated at or near the existing ground surface before construction. The post-construction long-term water level in the plant area is taken to be elevation 627. This elevation will be the maximum operational level of the filled cooling pond.

Can ground water cause settlement problems

2.5.4.10.3.5 Analysis

The settlement evaluation for the plant structures was made from a consideration of the following cases:

a. Settlements due to placement of fill to grade and application of building net loads prior to flooding of the cooling water reservoir, water level at elevation 603 (short-term condition)

b. Settlements due to fill and building net loads after reservoir is filled, water level at elevation 627 (long-term condition)

Heave from pressure relief due to excavation of overburden soils above the foundations is not analyzed because: 1) pressure relief due to excavation would decrease quickly to zero by the subsequent placement of fill and building loads, 2) the heave associated with stress reduction is relatively small compared to the settlement due to large area fill and building loads, and is essentially elastic due to the highly overconsolidated nature of the in situ glacial till, and 3) the ultimate settlement analyzed for the above Case a and b loading conditions was based on the application of appropriate building net loads.

For settlement computations, a total of 41 settlement points are established on a grid and at selected structure locations as shown in Figure 2.5-48.

Loading criteria for Case a and b conditions plus the other pertinent parameters are presented in Figure 2.5-47. Based on the respective loading conditions, site soil conditions, and the selected soil compressibility characteristics, ultimate settlements at each of the 41 points are calculated for load conditions -- Cases a and b. Settlement values resulting from each loading condition are calculated by evaluating the stresses from elastic half-space theory(75) and then computing the settlement using Terzaghi's theory of one-dimensional consolidation.

To account for possible time-dependent relationship, the estimated total settlements at each of the 41 points were obtained respectively by adding 25% of the calculated settlement values of loading Case a to the calculated ultimate settlement values of loading Case b. These values are presented in Figure 2.5-48.

2.5.4.10.4 Discussion

Chuck Hunt (1)

Settlements at the 41 points calculated for Units 1 and 2 show the best estimates of settlement expected. Because of the possible variations in loads, soil conditions, and soil properties, deviations from the estimated values are possible.

how much?

TO ANSWER

It is known that if clays have previously been consolidated by pressures equal to or greater than those to be added by new construction, their settlement is relatively small and occurs so rapidly that it may be considered to be elastic. On the other hand, if the added pressures exceed the preconsolidation load, the settlements are larger and occur with appreciable time lag. With respect to the Midland site, the glacial till at the site is heavily preconsolidated and the pressure added by new construction does not exceed the estimated preconsolidation pressures. Therefore, it is concluded that the settlement of the most heavily loaded portions of the plant will be essentially elastic. Most of the settlement occurs as the fill is placed and as the dead weight of the structures is added. It is estimated that settlements on the order of 20% of the calculated ultimate settlements can be expected after the vital pipe connections are made. It is anticipated that maximum differential settlements on the order of one inch may occur between adjacent structures. The differential settlements will be appreciably smaller than the maximum settlements.

To ensure the integrity of the plant facilities and verify the settlement predicted by analysis, settlement measurements will be monitored at each instrument location to provide a history of time-movement. The measurements reflect what the structures will actually experience. The monitoring program is discussed in Subsection 2.5.4.13.

2.5.4.11 Design Criteria

The design criteria and methods of design related to the stability studies of all safety-related facilities have been discussed previously in Subsection 2.5.4.10.

Settlements at various locations of Units 1 and 2 are calculated by the Terzaghi one-dimensional consolidation theory. It is estimated that the essentially elastic settlements in the power block will be between 2 and 3 inches. Maximum differential settlements among buildings are not expected to exceed 1 inch. Refer to Subsection 2.5.4.10.4.

Gross bearing capacity of the soil of various mat foundations is determined by conventional Terzaghi theory. The computed factors of safety (ratio values between gross ultimate bearing capacity versus the maximum contact stress beneath footing) for various plant facilities are greater than three for dead and live loads combined and greater than two for the combination of dead, live, and seismic loadings. See Table 2.5-14.

The design values for the principal earth pressure conditions are conservatively derived by neglecting the wall friction force. Furthermore, the design values for passive earth pressures have reduced by a factor of two from the calculated theoretical values.

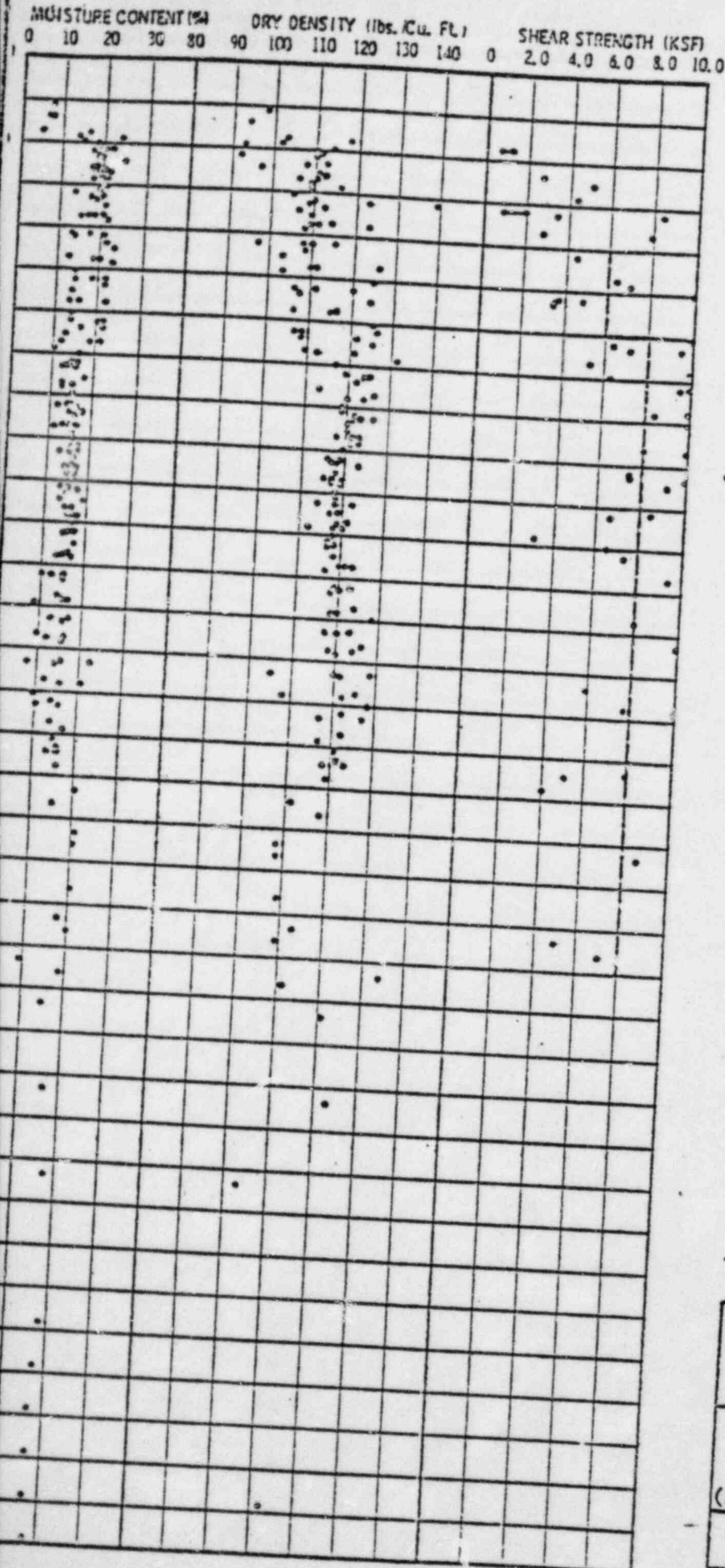
2.5.4.12 Techniques to Improve Subsurface Conditions

Because of the competent nature of the subsurface soil conditions, measures (such as grouting, vibroflatation, dental work, rock bolting, and anchors) to improve foundations were not required. Slurry cutoff trench treatments were placed to prevent seepage loss during construction of the cooling pond dikes and plant area fill. This is discussed in Subsection 2.5.6.3.

2.5.4.13 Subsurface Instrumentation

2.5.4.13.1 Benchmark Locations

Settlement measurements are to be taken at benchmark locations installed at the various plant structures to provide a history of settlement versus time as shown in Figure 2.5-73. These measurements, as listed in Table 2.5-14A, will provide a record 8



EXPLANATION

Design Shear Strength

NOTE:

Data based on Dames & Moore (Reference: Consultant Reports-Midland Nuclear Plants, Units 1 and 2, Bechtel Power Corporation, Ann Arbor, Michigan, 1977)

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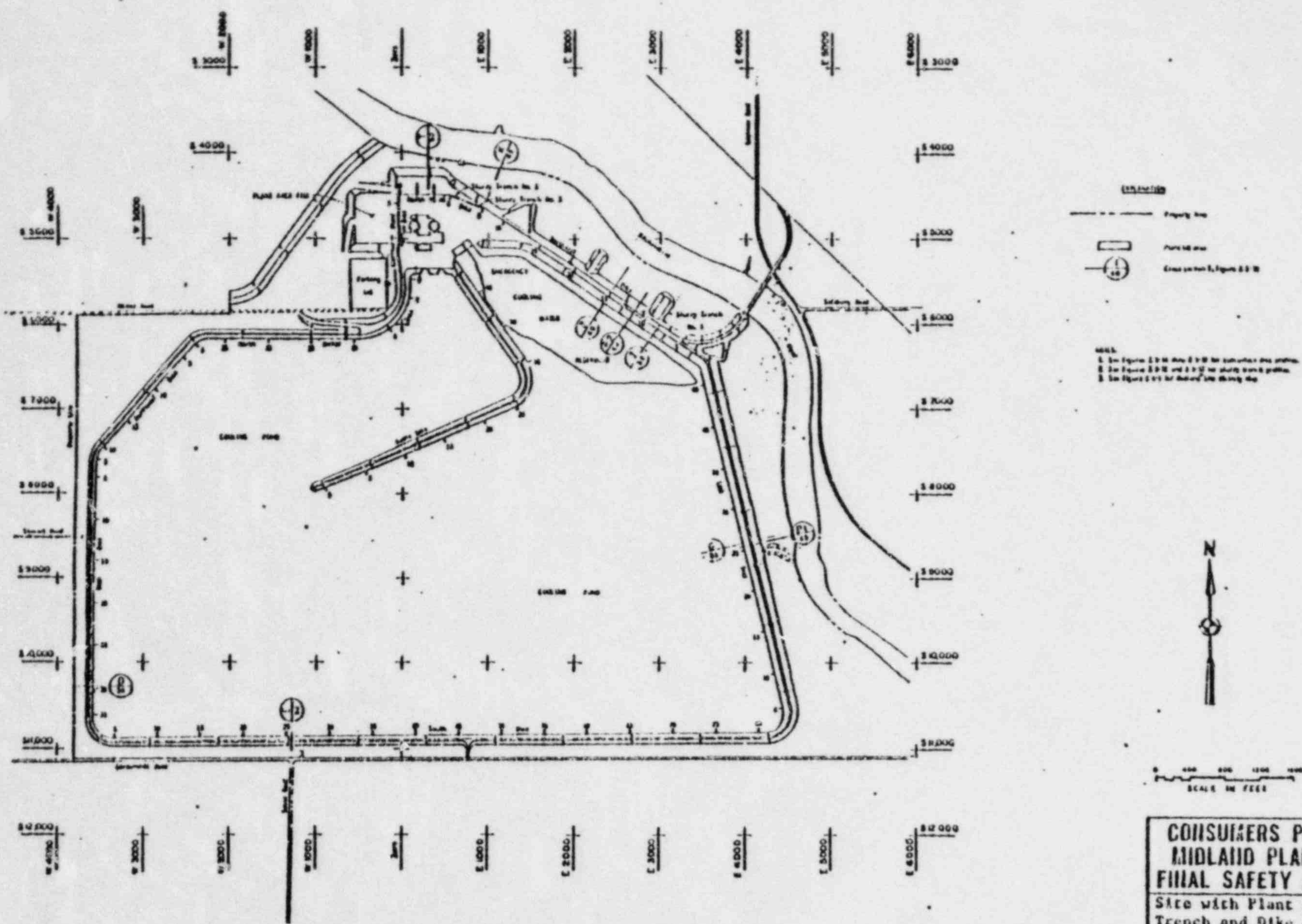
Moisture Content, Dry Density and Shear Strength versus Elevation for Plant Area (SK-G-111, Rev 0)

FSAR Figure 2.5-33

11/77

Revision 1



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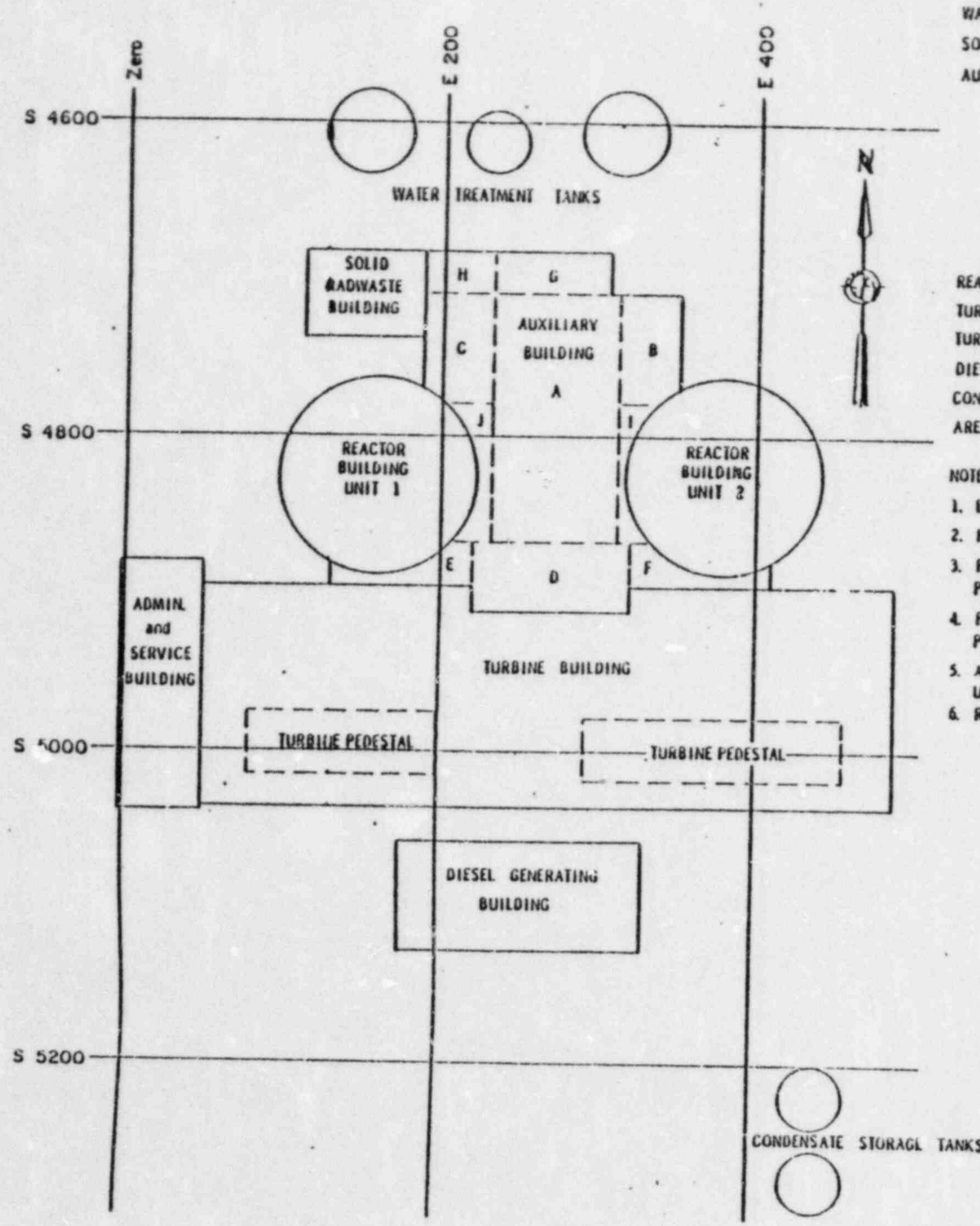
Site with Plant Fill Area, Slurry Trench and Dike Section Locations

(SK-G-117, Rev 0)

FSAR Figure 2.5-46

11/77 Revision 1



	El_m	P_s	P_{n1}	P_{n2}
WATER TREATMENT TANKS	634	2.5	2.5	2.5
SOLID WASTE BLDG.	634	6.0	6.0	6.0
AUXILIARY BLDG. A	562	7.0	1.57	-0.12
B & C	579	8.0	4.83	3.15
D	609	6.0	6.0	4.63
E & F	609	6.0	6.0	4.83
G	630	4.0	4.0	4.0
H	609	6.0	6.0	4.85
I & J	569	6.5	1.82	0.13
REACTOR BLDGS. 1 & 2	582.5	8.0	5.29	3.60
TURBINE BLDG.	609	3.0	3.0	1.88
TURBINE PEDESTALS (2)	602	5.0	4.87	3.31
DIESEL GEN. BLDG.	634	4.0	4.0	4.0
CONDENSATE STORAGE TANKS	634	2.5	2.5	2.5
AREA FILL LOAD	603	4.09	4.09	2.60

NOTES:

1. El_m is the elevation of the bottom of the foundation.
2. P_s is the superimposed load intensity.
3. P_{n1} is the short term net load intensity (before the cooling water reservior filling) $P_{n1} = P_s$ - Excavation load
4. P_{n2} is the long term net load intensity (after the cooling water reservior filling) $P_{n2} = P_{n1}$ - Hydrostatic pressure
5. All units for load intensity in kips per square foot (ksf), elevations in feet from U.S.G.S. datum.
6. Reference Table 2.5-14.

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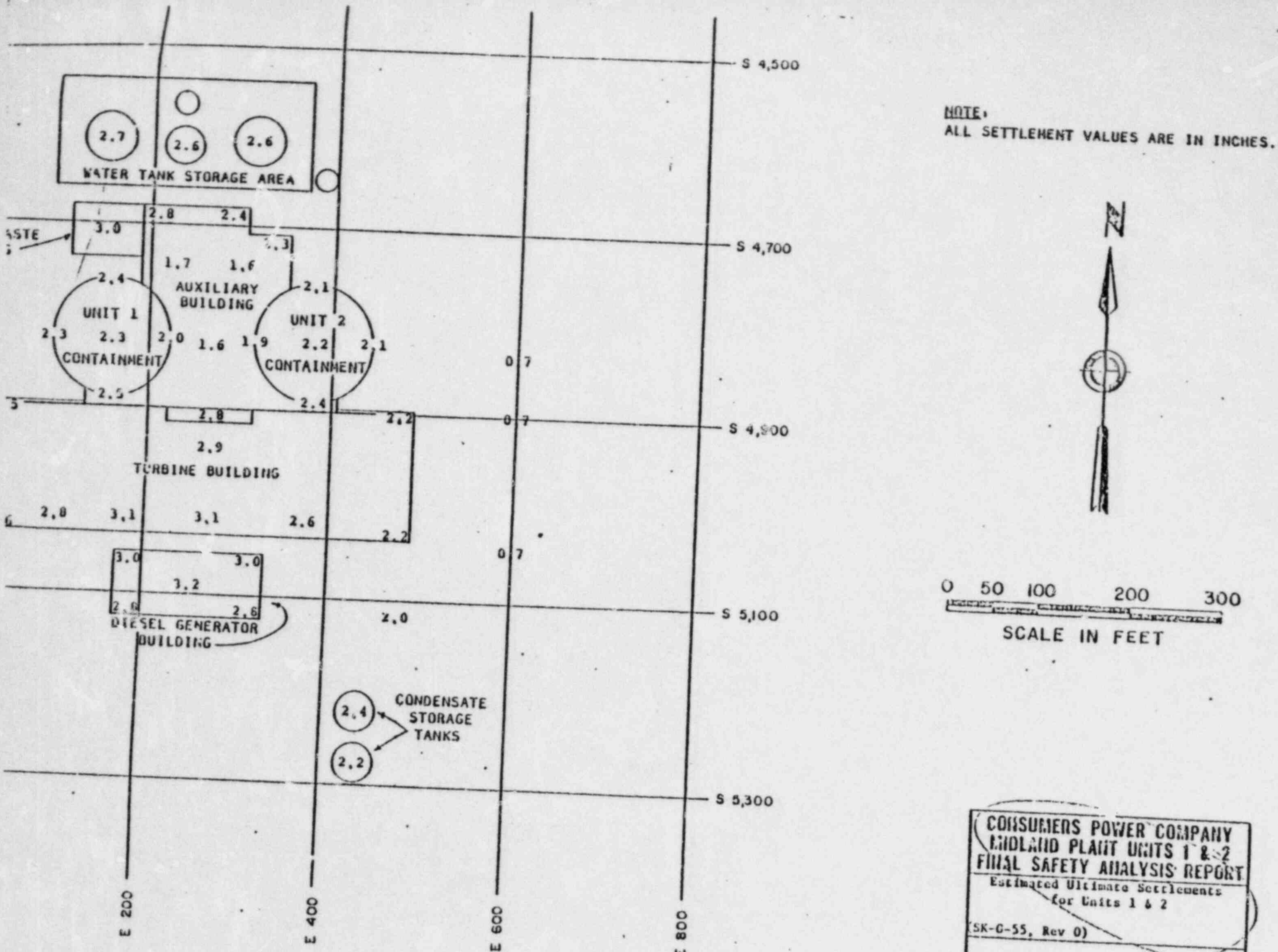
Soil Pressure Diagram
Category I and II Structures

(SK-G-59, Rev 0)

FSAR Figure 2.5-47

11/77 Revision 1



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MIDLAND PLANT UNITS 1 & 2
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Estimated Ultimate Settlements for Units 1 & 2

(SK-G-55, Rev 0)

FSAR Figure 2.5-48

11/77

Revision 1

TABLE 2.5-9

MINIMUM COMPACTION CRITERIA

Function	Zone[1] Designation	Soil Type	Compaction Criteria Degree	ASTM Designation
Adjacent to structures	Structural backfill	Sand	80%	ASTM D 2049
Support of structures		Clay	95%	ASTM D 1557-66T (modified)[2]
Plant area fill	1 or 1A	Clay	95%	
	2	Clay or sand	95%	
	3	Sand	95%	
Cooling pond embankment	1 or 1A	Clay	95%	
	2	Clay or sand	95%	
	3	Sand	95%	

[1]For zone designation see Table 2.5-10

[2]The method was modified to get 20,000 foot-pounds of compactive energy per cubic foot of soil.

TABLE 2.5-10

GRADATION RANGES FOR FILL MATERIAL

Zone	Type	Description	Source	Gradation	
1	Impervious fill	Sandy silty clays or sandy silts with some clay	Designated borrow area and all required excavation	Not less than 20% passing No. 200 sieve	
				U.S. Std Series Sieve Sizes	Percent Passing
1A	Impervious fill	Native broadly graded sandy glacial till	Designated borrow area and all required excavation	No. 4	40-100
				No. 30	30-100
				No. 100	25-80
				No. 200	20-70
				0.01 (millimeters)	10-40
				0.002 (millimeters)	0-20
2	Random fill	Any material free of humus, organic or other deleterious material	Designated borrow area and all required excavation	No restrictions	
3	Sand drain	Clean sand graded as specified	Imported	3/8 inch	100
				No. 8	55-100
				No. 30	20-55
				No. 100	0-10
				No. 200	0-3
Structural backfill	Sand fill	Clean sand graded as specified	Imported	1 inch	100
				No. 4	75-100
				No. 10	50-100
				No. 40	5-60
				No. 200	0-5

TABLE 2.5-11

FREQUENCY OF FILL TESTING

Test	Approximate Frequency
Equipment calibration	Frequency to be based on Bechtel Field Inspection Manual, or, if not otherwise stated, upon manufacturer's suggested frequency.
Field densities, moisture content	One per 500 cubic(2) yards of fill
Compaction, grain size, specific gravity	One per 10,000 cubic yards of fill

TABLE 2.5-14

SUMMARY OF CONTACT STRESSES AND ULTIMATE BEARING CAPACITY FOR MAT FOUNDATIONS SUPPORTING SEISMIC CATEGORY I AND II STRUCTURES

Unit	Supporting Soils	Foundation Elevation	Contact Stress Beneath Footing (lb/ft²) Dead Plus Live Load	Contact Stress Beneath Footing (lb/ft²) Dead, Live, and Seismic Load	Ultimate Bearing Capacity (lb/ft²)	Factor of Safety Dead Plus Live Load	Factor of Safety Dead, Live, and Seismic Load
Reactor containment buildings	Very stiff to hard natural cohesive soils	582.5	8,000	17,500	45,000	5.6	2.6
Auxiliary building A	Very stiff to hard natural cohesive soils	562	7,000	14,000	50,000	7.1	3.6
Auxiliary building B&C	Very stiff to hard natural cohesive soils	579	8,000	16,000	50,000	6.2	3.1
Auxiliary building D	Controlled compacted cohesive fill	609	6,000	12,000	30,000	5.0	2.5
Auxiliary building E&F	Controlled compacted cohesive fill	609	6,000	12,000	30,000	5.0	2.5
Auxiliary building G	Controlled compacted cohesive fill	630	4,000	8,000	15,000	3.8	1.9
Auxiliary building H	Controlled compacted cohesive fill	609	3,000	6,000	30,000	10.0	5.0
Auxiliary building I&J	Very stiff to hard natural cohesive soils	569	6,500	13,000	50,000	7.7	3.8
Turbine mat	Controlled compacted cohesive fill	602	5,000	10,000	30,000	6.0	3.0
Turbine building	Controlled compacted cohesive fill	609	3,000	6,000	30,000	10.0	5.0
Solid radwaste building	Controlled compacted cohesive fill	629.5	2,500	5,000	15,000	6.0	3.0
Diesel generator building	Controlled compacted cohesive fill	629.5	4,000	6,000	15,000	3.8	2.5

TABLE 2.5-16

IDEALIZED SOIL PROFILE AND PARAMETERS
FOR ELASTIC HALF-SPACE SETTLEMENT AND HEAVE ANALYSES

Layer	Idealized Soil Type	Elevation Interval (ft)	Thickness (ft)	Average $\frac{C_{c,r}}{1+e_o}$ (1)
A	Fill (CL)	634-609	25	0.003
B	Fill (CL)	609-603	6	0.003
C	CL	603-582.5	10.5	0.002
C	SP	603-582.5	20.5	
D	CL	582.5-562	20.5	0.003
E	CL	562-543	19	0.002
F	CL	543-503	40	0.003
G	CL	503-363	140	0.006

NOTE: Final groundwater table is taken at elevation 627.

(1) Values were estimated from the mathematical relationship between Young's Modulus and Compression and rebound indexes and averaged with those obtained from consolidation tests. Young's Modulus was estimated from empirical relationship with shear strength.

3.8.5.1.2 Auxiliary Building

The auxiliary building is founded on reinforced concrete mat foundations at six different elevations as shown in Figure 3.8-61. The figure shows the bottom elevations and thicknesses of the mat foundations at different areas. The major portion of the auxiliary building (between column lines A and H in the north-south direction and between column lines 5.6 and 7.4 in the east-west direction) rests on a 6 foot thick reinforced concrete mat, 158'-3" long and 79'-0" wide, founded on glacial till, with the bottom elevation at 562 feet. The southern portion of the auxiliary building, south of column line H, rests on a 5 foot thick reinforced concrete mat with the bottom elevation at 609 feet. It is founded on compacted fill. The elevations and the thicknesses of the mat foundations in the other areas are shown in Figure 3.8-61. All the mat foundations with their bottom elevations above 570 feet are founded on compacted fill. Figure 3.8-62 and 3.8-63 show the cross-sections of the foundations and typical reinforcement details.

3.8.5.1.3 Diesel Generator Building

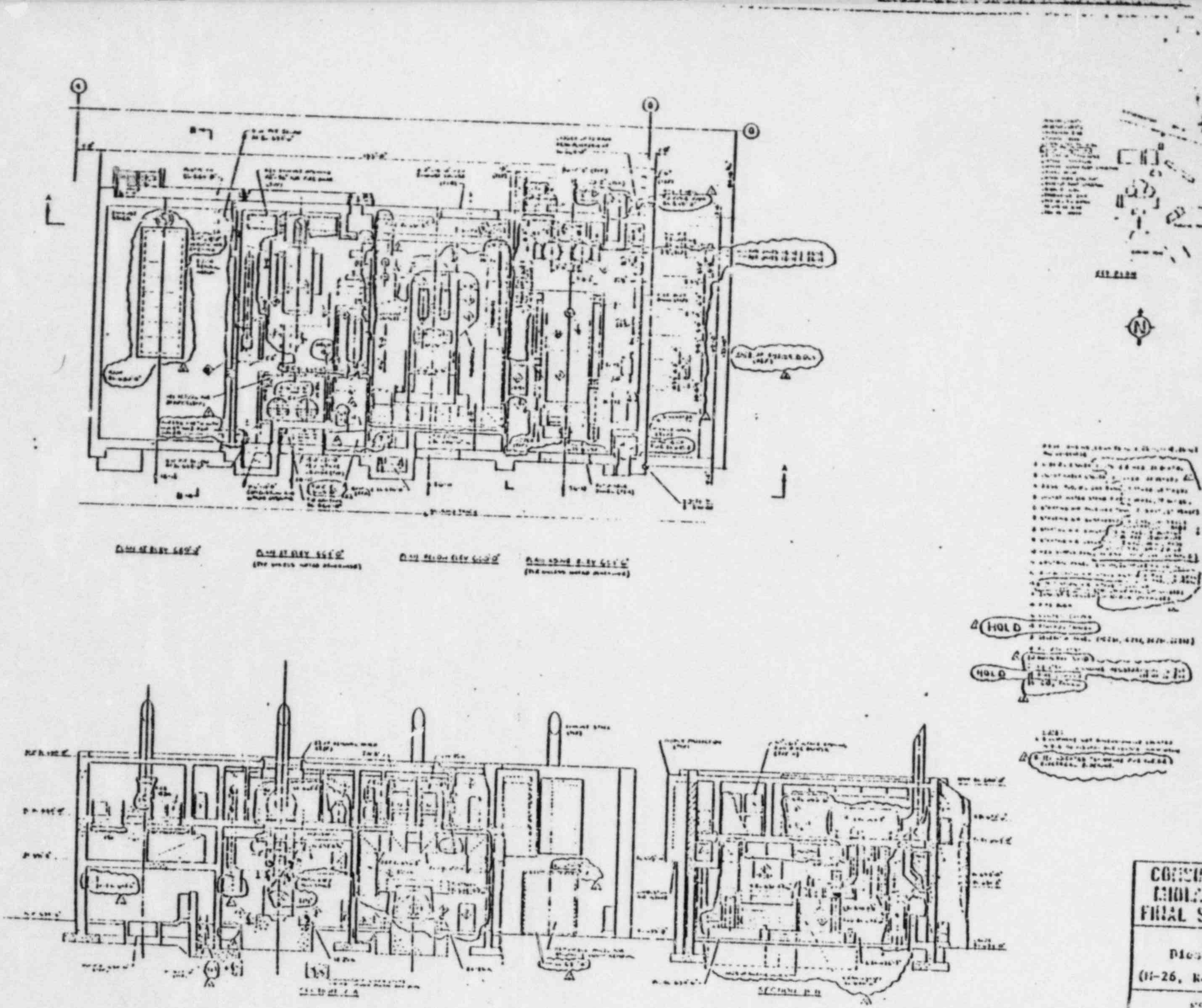
The foundation for the exterior and interior walls of the diesel generator building consists of continuous reinforced concrete footings, 10'-0" wide and 2'-6" thick, with their base at elevation 628 feet. Adjacent to any pit location (e.g., sump pit), the exterior wall footing base is locally lowered to elevation 625 feet. The diesel generators rest on 6'-6" thick concrete pedestals. The overall arrangement of the foundation in relation to the superstructure is shown in Figure 3.8-55. The footings are placed on compacted fill.

3.8.5.1.4 Service Water Pump Structure

The foundation for the service water pump structure consists of two reinforced concrete mats at elevations 592 feet and 620 feet. The lower mat is 90 feet long, 74 feet wide, and 5 feet thick, and is founded on glacial till. The upper mat is 86 feet long, 38 feet wide, and 3 feet thick, and is founded on compacted fill. The details of the foundation and reinforcement are shown in Figure 3.8-56.

3.8.5.2 <u>Applicable Codes, Standards, and Specifications</u>

The applicable codes, standards, and specifications used in the structural design, fabrication, and construction of foundations are discussed in Subsection 3.8.1.2 for the containment, in Subsection 3.8.3.2 for the internal structures, and in Subsection 3.8.4.2 for other Seismic Category I structures.



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Gary Caster

Bechtel Power Corporation

Interoffice Memorandum

To	R. L. Castleberry	File No.	
Subject	Job 7220 Midland Project Q-Listed Plant Fill Above 627'0" BCBE-1535R	Date	August 18, 1977
		From	J. F. Newgen
		Of	Construction
Copies to	S. K. Rao	At	Midland, MI Ext. 200

As referenced on drawing C-45 Rev. 2, note #3 states that Q-Listed requirements for plant area fill above elevation 627'0" may be waived provided the following conditions are met:

A) It is determined that no other Q-Listed system or structure will be located in this area.

B) Engineering reviews and approves the proposed waiver.

The field herein requests that all Q-area backfill above 627'0" be exempt from Q-List requirements except for (1) structural backfill within 3'0" of a Q-Listed structure. (2) Cross hatched area at the diesel generator storage tanks location as shown on drawing C-45, Rev. 2. (3) Backfill of fuel lines between diesel generator building and diesel storage tanks. (4) Backfill of all Q-Listed service water lines.

Please review the proposed waiver and comment by 9/1/77.

J. F. Newgen

JFN/GSC/dlf

26

R. L. Castleberry

Job 7220 Midland Project
Q-Listed Plant
Fill Above 627'0"
BCBE-1535R

August 18, 1977

J. F. Newgen

Construction

S. K. Rao

Midland, MI 200

As referenced on drawing C-45 Rev. 2, note #3 states that Q-Listed requirements for plant area fill above elevation 627'0" may be waived provided the following conditions are met:

A) It is determined that no other Q-Listed system or structure will be located in this area.

B) Engineering reviews and appooves the proposed waiver.

The field herein requests that all Q-area backfill above 627'0" be exempt from Q-List requirements except for (1) structural backfill within 3'0" of a Q-Listed structure. (2) Cross hatched area at the diesel generator storage tanks location as shown on drawing C-45, Rev. 2. (3) Backfill of fuel lines between diesel generator building and diesel storage tanks. (4) Backfill of all Q-Listed service water lines.

Please review the proposed waiver and comment by 9/1/77.

J. F. Newgen

ok

JFN/GSC/dlf

R. L. Castleberry

Job 7220 Midland Project
Q-Listed Plant
Fill Above 627'0"
BCBE-1535R

August 17, 1977

J. F. Newgen

Construction

S. K. Rao

Midland, MI 200

As referenced on drawing C-45 Rev. 2, note #3 states that Q-Listed requirements for plant area fill above elevation 627'0" may be waived provided the following conditions are met:

A) It is determined that no other Q-Listed system or structure will be located in this area.

B) Engineering reviews and approves the proposed waiver.

The field herein requests that all Q-area backfill above 627'0" be exempt from Q-List requirements except for (1) structural backfill within 3'0" of a Q-Listed structure. (2) Cross hatched area at the diesel generator storage tanks location as shown on drawing C-45, Rev. 2. (3) Backfill of fuel lines between diesel generator building and diesel storage tanks.

Please review the proposed waiver and comment by 9/1/77.

J. F. Newgen

JFN/GSC/dlf

(4) BACKFILL OF ALL Q-LISTED SERVICE WATER LINES.

S.K. RAO
F. TEAGUE
E. CUKER

bcc:

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

Date

Approvals (Circle)

J.C. Church
T.C. Valenzano

Other

TO: R.L. CASTLEBERRY

Attn: S.K. RAO

Subject: Q-LISTED PLANT FILL ABOVE 627-0

File or Log No: BCBE-1535R

References: 1)

2)

Dear Mr.

Body: ~~This letter is in response to~~ (~~Cross out if not applicable~~)

AS REFERENCED ON DRAWING C-45 REV Z, NOTE #3 STATES THAT Q-LISTED REQUIREMENTS FOR PLANT AREA FILL ABOVE ELEVATION 627-0 MAY BE WAIVED PROVIDED THE FOLLOWING CONDITIONS ARE met ~~[illegible]~~:

A) IT IS ~~[illegible]~~ DETERMINED THAT NO OTHER Q-LISTED SYSTEM OR STRUCTURE WILL BE LOCATED IN THIS AREA

B) ENGINEERING REVIEWS AND APPROVES THE PROPOSED WAIVER

THE FIELD HEREIN REQUESTS THAT ALL Q-area BACKFILL ABOVE 627-0 BE EXEMPT FROM Q-LIST REQUIREMENTS EXCEPT FOR (1) STRUCTURAL BACKFILL WITHIN 3'-0 OF A Q-LISTED STRUCTURE

(2) CROSS HATCHED AREA AT THE DIESEL

JFN/GSC ← Place your initials

Attachments: ☐ yes ☒ no

Response: ☒ yes ☐ no

26

26

MEMORANDUM

TO ______ LOCATION ______

FROM ______ DATE ______

SUBJECT ______

GENERATOR STORAGE TANKS LOCATION AS SHOWN ON DRAWING C-45, Rev. 2

3) BACKFILL OF FUEL LINES BETWEEN DIESEL GENERATOR BUILDING AND DIESEL STORAGE TANKS.

PLEASE REVIEW THE PROPOSED WAIVER AND COMMENT BY 9-1-77

26

TELECOPY

Bechtel Power Corporation

Interoffice Memorandum

To R. L. Castleberry

File No.

Subject Job 7220 Midland Project
Backfill Moisture Requirement
Spec. C-210
BCBE-1669R

Date November 18, 1977

From J. F. Newgen

Of Construction

At Midland, MI Ext.

Copies to G. Richardson
B. Cheek
G. Tuveson
J. Dean

Confirming verbal requests; please provide written clarification of the 2% tolerance on backfill moisture content during compaction. Although moisture tests are taken both <u>during</u> and sometimes <u>after</u> compaction we have been verbally informed that for Zone I material moisture tests taken within a few days after compaction which do not fall within 2% of optimum moisture shall be cause for rejection of the fill, even though proper compaction is achieved. Information moisture tests taken more than a week after Zone I fill has been properly compacted are not so limited. For Zone II materials these limits can also be extended in accordance with previous written direction.

Your response is required by 11/30/77 in order to process documentation of backfill which was not placed in accordance with the verbal information above, if necessary.

J. F. Newgen

JFN/FGT/jae

G. Corston JSC

8024-(2-71)

CC. J. P. BETTS 27
G. COASTER

MEMORANDUM

TO R. WHEELER LOCATION

FROM E. TEAGUE DATE 1/16 1977

PURSUANT TO YOUR QUESTION ON MOISTURE TESTING OF BACKFILL, I HAVE AGAIN APPROACHED PROJECT ENGINEERING WITH THE FOLLOWING RESULTS:

FOR ZONE 2 MATERIAL, PROJECT ENGINEERING BELIEVES, AND I AGREE, THAT SECTION # 12.6.1 ALLOWS US TO ACCEPT MOISTURE CONTENTS IN THE 2% TO 5% RANGE. (NOTE THAT PARA 2 OF THAT SPECIFICATION ALLOWS FIELD REPRESENTA. ACCEPTANCE OF MOISTURES IN THIS RANGE) PROJECT ENGINEERING POINTED OUT THAT WE (THE FIELD REPS.) WERE REQUIRED TO APPROVE THIS CONDITION DUE TO THE POSSIBLE SCHEDULE & COMMERCIAL IMPACT OF PROVIDING INCREASED COMPACTIVE EFFORT (IE ADDITIONAL ROLLING TIME) WHEN MOISTURES ARE IN THE +2% to +5% RANGE FROM O.M. THERE IS NO TECHNICAL PROBLEM.

ALSO, LETTER BEBC-1993 PROVIDES THE ACCEPTANCE OF FAILING MOISTURES ON TEST MO-859 THROUGH MO-861. YOU WILL NOTE THAT DRY DENSITIES (AND THEREFORE COMPACTION) ARE HIGH FOR THESE TESTS AND EVEN THOUGH IT IS ZONE 1A, BEBC-1993 DOES NOT REQUIRE REJECTION BASED ON FAILING MOISTURE.

4

(COHESIVE SOILS)

COMMENTS ON COMPACTED FILL DENSITY REPORTS VAH 1-24-79

MD-36	WHERE DID THE 0.2% ACCURACY TOLERANCE COME FROM?
MD-37	M.C. IS NOT WITHIN 2% OF O.M.C. YET THE TEST IS PASSING.
MD-57	M.C. IS NOT WITHIN 2% OF O.M.C. YET THE TEST IS PASSING
MD-208 MD-209	M.C. IS NOT WITHIN 2% OF O.M.C. YET THE TEST IS PASSING
MD-245 MD-246	MD-246 CLEARS MD-245 YET HAS A DIFFERENT BMP.
MD-251 MD-253	MD-253 CLEARS MD-251 YET HAS A DIFFERENT BMP.
MD-324 MD-325	MD-325 CLEARS MD-324 YET HAS A DIFFERENT BMP.
MD-389 MD-391 MD-393	MD-393 CLEARS MD-389 & MD-391 YET HAS A DIFFERENT BMP.
MD-392 MD-394	MD-394 CLEARS MD-392 YET HAS A DIFFERENT BMP.
MD-554 MD-556	MD-556 CLEARS MD-554 YET HAS A DIFFERENT BMP.
MD-555 MD-558	MD-558 CLEARS MD-555 YET HAS A DIFFERENT BMP.
MD-634 MD-668	MD-668 CLEARS MD-634 YET HAS A DIFFERENT BMP.

MD-2471
MD-2473
MD-2476
MD-2479
MD-2482
MD-2486
MD-2488
MD-2492
MD-2496
MD-2497
MD-2498
MD-2499
MD-2501
MD-2506
MD-2507
MD-2508
MD-2509
MD-2510
MD-2517
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MD-3109
MD-3110
MD-3111
MD-3112
MD-3114
MD-3115
MD-3130
MD-3132
MD-3134
MD-3136

MD-3137
MD-3141
MD-3143
MD-3144
MD-3145
MD-3156
MD-3158
MD-3159

MD-2297
MD-2300

M.C.'s ARE NOT WITHIN 2% OF O.M.C.'s
YET TESTS ARE PASSING.

Master Inspection Plan No. C-4, Rev. 0

Originator Donald E. Horn

Approved By Donald E. Horn Date 6/26/79

Approved By W.R. Bird Date 6/26/79

Master Inspection Plan

Title SOIL TESTING

Characteristic No.	Characteristic Description
1.0	Material Source/Receiving Tests
1.1	Structural backfill has been tested as required: a. Frequency of tests. b. Method of tests. c. Results of tests are as specified.
1.2	Purchased offsite sand has been tested as required: a. Frequency of tests. b. Method of tests. c. Results of tests are as specified.
1.3	Zone 4A material has been tested as required: a. Frequency of tests. b. Method of tests. c. Results of tests are as specified.
2.0	Structural Backfill/Plant Area Tests
2.1	Moisture content tested as required: a. Frequency of tests. b. Method of tests. c. Results of tests are as specified.
2.2	Field density for cohesive material: a. Frequency of tests. b. Method of tests. c. Results of tests are as specified.

Master Inspection Plan No. C-4, Rev. 0	Master Inspection Plan
Originator Donald E. Horn	Title SOIL TESTING
Approved By Donald E. Horn Date 6/26/79	
Approved By W.K. Bird Date 6/26/79	

Characteristic No.	Characteristic Description
2.3	Field density for noncohesive material has been tested as required: a. Frequency of tests. b. Method of tests. c. Results of tests are as specified.
3.0	Standard Lab Tests
3.1	Relative density standard determined as specified: a. Frequency of tests. b. Method of tests. c. Results of tests.
3.2	Proctor standard determined as specified: a. Frequency of tests. b. Method of tests. c. Results of tests.
4.0	Test Reports
4.1	The field density results are reasonable, compared with the Standard Lab Tests.
4.2	The test reports are acceptable. a. Completeness. b. Proper date of tests. c. Proper technician listed for running test. d. Proper calibration status of equipment. e. Proper location and proper elevation of tests. f. Applicable QA Organization Approval has been given these tests.

Project Inspection Plan No. 01-C-4A Rev. Rev 0

Project Midland 1 & 2

Job No. NA

Work Authorization No. NA

Originator Donald E. Horn

Approved By Donald E. Horn Date 8/24/79

Approved By [illegible] Date 8/28/79

Approved By [illegible] Date 8/29/79

Project Inspection/Overinspection Plan

Title SOIL TESTING

Page 1 of 2

Characteristic No.	Reference Criteria	Degree of Inspection 100%	<100%	Type of Overinspection	Point of Overinspection	Supplementary Records
1.1a	Spec		X	M	IP-PP	
1.1b	Spec/ASTM		X	V	IP	
1.1c	Spec	X		R	PP	
1.2a	Spec		X	M	IP-PP	
1.2b	Spec/ASTM		X	V	IP	
1.2c	Spec	X		R	PP	
1.3a	Spec		X	M	IP-PP	
1.3b	Spec/ASTM		X	V	IP	
1.3c	Spec	X		R	PP	
2.1a	Spec		X	M	IP-PP	
2.1b	Spec/ASTM		X	V	IP	
2.1c	Spec	X		R	PP	
2.2a	Spec		X	M	IP-PP	
2.2b	Spec/ASTM		X	V	IP	
2.2c	Spec	X		R	PP	
2.3a	Spec		X	M	IP-PP	
2.3b	Spec/ASTM		X	V	IP	
2.3c	Spec	X		R	PP	
3.1a	Spec		X	M	IP-PP	
3.1b	Spec/ASTM		X	V	IP	
3.1c	None		X	R	IP-PP	

Project Inspection Plan No. 01-C-4A Rev. 0

Project Midland

Job No. NA

Work Authorization No. NA

Originator Donald E. Horn

Approved By Donald E. Horn Date 8/24/79

Approved By WABird Date 8/28/79

Approved By [illegible] Date 8/29/79

Project Inspection/Overinspection Plan

Title SOIL TESTING

Characteristic No.	Reference Criteria	Degree of Inspection 100%	<100%	Type of Overinspection	Point of Overinspection	Supplementary Records
3.2a	Spec		X	M	IP-PP	
3.2b	Spec/ASTM		X	V	IP	
3.2c	None		X	R	IP-PP	
4.1	None	X		R	PP	
4.2a	None		X	R	PP	
4.2b	None		X	R	PP	
4.2c	None		X	V-R	PP	
4.2d	None		X	V-R	PP	
4.2e	Spec		X	V-M-R	PP	
4.2f	Spec		X	R	PP	

Project Inspection Plan No. 01-C-3A Rev. 0

Project Midland 1 & 2

Job No. NA

Work Authorization No. NA

Originator Donald E. Horn

Approved By Donald E. Horn Date 8/24/79

Approved By WU Bird Date 8/28/79

Approved By [illegible] Date 8/29/79

Project Inspection/Overinspection Plan

Title EXCAVATION, FOUNDATION PREPARATION, REQUIRED MATERIAL, PLACEMENT AND COMPACTION OF BACKFILL

Page 1 of 2

Characteristic No.	Reference Criteria	Degree of Inspection 100%	<100%	Type of Overinspection	Point of Overinspection	Supplementary Records
1.1	Spec		X	V-M	IP	
1.2	Spec and Dwgs		X	V-M	IP	
2.1	Spec and Dwgs		X	V-M	IP	
2.2	Spec	X		R	IP	
2.3	Spec		X	V-M	IP	
2.4	Spec	X		V-R	IP	
3.1	Spec		X	V-R	IP	
3.2	Spec		X	V-R	IP	
3.3	Spec and Dwgs		X	V-M	IP	
3.4	Spec		X	V-R	IP	
4.1	Spec	X		V	IP	
4.2	Spec and Dwgs	X		V-R	IP	
4.3	Spec	X		V-R	IP	
4.4	Spec		X	V-R	IP	
4.5	Spec	X		V-M	IP	
4.6	Spec		X	V	IP	
4.7	Spec		X	V-M	IP	
4.8	Spec	X		V	IP	
4.9	Spec		X	V-M	IP	
4.10	Spec		X	V-R	IP	
4.11	Spec	X		R	IP	
4.12	Spec	X		V-M-R	IP	

Project Inspection Plan No. 01-C-3A Rev. 0

Project Midland 1 & 2

Job No. NA

Work Authorization No. NA

Originator Donald E. Horn

Approved By Donald E. Horn Date 8/24/79

Approved By W M Bird Date 8/28/79

Approved By J. [illegible] Date 8/29/79

Project Inspection/Overinspection Plan

Title EXCAVATION, FOUNDATION PREPARATION, REQUIRED MATERIAL, PLACEMENT AND COMPACTION OF BACKFILL

Characteristic No.	Reference Criteria	Degree of Inspection 100%	<100%	Type of Overinspection	Point of Overinspection	Supplementary Records
5.1	Spec	X		V-R	IP	
5.2	Spec	X		V-M	IP	
5.3	Spec	X		R	IP	
5.4	Spec	X		V-M-R	IP	

Master Inspection Plan No. C-3, Rev. 0

Originator Donald E. Horn

Approved By Donald E. Horn Date 8/24/79

Approved By WH Bird Date 8/28/79

Title: Master Inspection Plan

EXCAVATION, FOUNDATION PREPARATION, REQUIRED MATERIAL, PLACEMENT AND COMPACTION OF BACKFILL

Characteristic No.	Characteristic Description
1.0	Excavation
1.1	Disturbed materials below and beyond the required excavation limits has been removed and replaced with suitable compacted material.
1.2	Concrete mudmat poured on the bottom of excavation for building foundations.
2.0	Foundation Preparation
2.1	Soil foundations established on firm material.
2.2	Soil and subgrade approved foundation prior to fill placement.
2.3	The subgrade does not contain any frozen material.
2.4	The layer upon which the fill is to be placed has been tested and results are as specified.
3.0	Required Material
3.1	"Structural backfill" material is from an approved source, meets the gradation requirements and is acceptable material.
3.2	"Plant area backfill" may include (1) random material, (2) "structural backfill material" or (3) purchased offsite sand as specified.
3.3	Lean concrete used in place of structural and/or plant area backfill as approved, in such a manner as not to create possible rigid support for structures and differential settlement.
4.0	Placement
4.1	Areas inaccessible to motorized rollers must use sand from offsite sources.

Master Inspection Plan No. C-3, Rev. 0 Originator Donald E. Horn Approved By Donald E. Horn Date 8/24/79 Approved By WH Bird Date 8/28/79	Title	Master Inspection Plan EXCAVATION, FOUNDATION PREPARATION, REQUIRED MATERIAL, PLACEMENT AND COMPACTION OF BACKFILL

Characteristic No.	Characteristic Description
4.2	"Structural backfill" material is used within three feet of the exterior wall of any plant area structure.
4.3	No material placed on any known failing material, until satisfactory tests are obtained.
4.4	Uniform composition and distribution of materials throughout the backfill.
4.5	The specified uncompacted lift thicknesses are being placed.
4.6	Backfill areas being placed are raised simultaneously and parallel with the final grade.
4.7	Each lift is tied into previously placed material.
4.8	All soils work performed under the direction of a qualified onsite soils engineer.
4.9	Backfilling in which moisture conditioning is required is suspended in cold weather.
4.10	Moisture conditioning of the soil is as specified.
4.11	Moisture content for cohesive material during the density test is as specified and representative of the material placed.
4.12	All material represented by failing tests have been reworked until the specified moisture is obtained or removed.
5.0	<u>Compaction of Backfill</u>
5.1	Compaction equipment meets the requirements and has been prequalified.
5.2	Compaction method (effort) is uniform and meets or exceeds the effort given in the prequalification of the compaction equipment.

Master Inspection Plan No. C-3, Rev. 0	Master Inspection Plan
Originator Donald E. Horn	Title EXCAVATION, FOUNDATION PREPARATION, REQUIRED MATERIAL, PLACEMENT AND COMPACTION OF BACKFILL
Approved By Donald E. Horn Date 8/29/79	
Approved By W H Bird Date 8/28/79	

Characteristic No.	Characteristic Description
5.3	Compaction results are as specified and representative of the material placed.
5.4	All material represented by failing tests have been reworked until the specified density is obtained or removed.

Note

BEBC - 828

Bechtel Associates Professional Corporation

Inter-office Memorandum

To J. F. Newgen

en 7/76

Date August 5, 1975

Subject: Midland Plant Units 1 & 2
Job No. 7220
Construction Utility Lines
File: C-211, C-210, C-1140, 0274

From R. L. Castleberry

Of Engineering

At Ann Arbor

RECEIVED
AUG 6 1975
BECHTEL POWER CORP.
JOB 7220
PER

Copies to
G. A. Tuveson
S. S. Afifi
R. L. Rixford
S. Rao

References: a. BCBE-583 dated May 7, 1975
b. Telecons, J. Serafin and R. L. Rixford, dated 10-21-74 and 12-3-74.

This is a complete response to Ref. a.

The following are engineering's recommendations (including input from Geotechnical Services) for installing and abandoning the construction utility lines.

1. All excavations shall be backfilled with the same zone material originally present prior to the excavations. This provision has been made in Specification 7220-C-211, Rev. 2. Backfilling shall be done in accordance with applicable technical Specification 7220-C-210 or 7220-C-211.

2. No structural backfill material shall be used for backfilling pipe trenches across the dike.

3. All piping which extends from cooling pond into the plant area fill and does not cross the dike, shall be fully grouted for a minimum distance of fifty (50) feet from the top edge of the cooling pond toward the plant. Alternatively, the piping may be removed for the same distance and the surface restored to its original condition.

4. All piping four (4) inches in diameter and less and which does not cross the dike, may be abandoned as is. Piping larger than four (4) inches in diameter shall be fully grouted upon abandonment; or the piping may be removed and the surface restored to its original condition.

5. The following criteria apply to piping which crosses the dike:

   1) Every attempt shall be made to avoid piping through the sand drain. When such placement becomes essential, Construction shall seek Engineering's approval on a case by case basis.

ii) All piping across the dike shall be removed upon abandonment and ground restored to its original condition as indicated in Item No. 1. Alternatively, the piping may be encased in concrete at the time of installation and fully grouted for the entire width of the dike at invert elevation of the pipe upon abandonment. Concrete thickness around the outside of the pipe shall be at least one diameter for pipes up to and including 12" diameter. Engineering will provide criteria on an individual case basis for pipes larger than 12" in diameter.

6. A set of as-built drawings of all construction utility lines indicating the location and elevations shall be maintained up to date. A copy of this should be transmitted to Engineering for information. Construction shall indicate on these drawings the piping which is to be maintained during Unit 1 Construction after Unit 2 goes into operation.

We understand that some questions on this subject were left unanswered in a meeting held between Geotech and the Field on November 27, 1974 in your office. If additional discussion of alternatives is still required, a meeting between Geotech, Engineering and the Field can be arranged at your request.

R. L. Castleberry

RAC:gt

C-211

Telephone call

CN 9/1/76

BY John Hnik OF B A2 ROUTE RLR

TO Richard Grote OF B Field GT

DATE 7-18 19 75 TIME 2:30 xc R. Grote

SUBJECT Structural backfill JOB NO. 7220

1. During a discussion with R. Grote about Palisades, Dick asked a question about Midland backfill spec C-211 which requires sand within 3 feet of a wall. Specifically, he described a backfill area near the NE corner of Unit 2 Turbine Pedestal mat. He asked if it was necessary to use sand in this area?

2. I noted that we had placed sand requirement to be consistent with surcharge loads used in the structural wall design. Because this backfill in question was against a foundation mat and not a wall, there was no need to place sand in the area described.

J C Hnik

0046 (12-67)

TELEPHONE CALL Midland Project GWO 7020

COPY GSKeeley
XXXXX DBMiller
PAMartinez
JFNewgen/ABoos
KWiedner
TRThiruvengadam
DHorn

By Ron Lipinski Of NRC Washington

To TCCooke Of CPCo

Date July 3 19 79 Time 9:40 AM

Subject

File

Mr. Lipinski was returning TCCooke's call of July 2, 1979 and noted that he was in the process of reviewing the April 24 or May 31 response to the 50.54f questions (both dates were mentioned by Mr. Lipinski). TCCooke briefly discussed the discovery of the problem and subsequent 50.55e notification to the NRC and the fact that the latest response to same was dated June 25, 1979 (Interim Report 6). The discussion then settled around the recent changes to the various fixes resolving soils questions at the Midland Site, since Mr. Lipinski stated that he was somewhat familiar with the background and had visited the site in conjunction with soils questions recently. During the discussion, Mr. Lipinski had the following questions:

1. Since we were making some changes to the Auxiliary Building wingwall design, how will it be modeled? A new analysis will be required. TCCooke noted that the vertical load would be supported by cassions and that the horizontal load will probably be taken up by a tie to the Turbine Building slab unless we found it necessary to complete the underpinning operation as originally planned (mining and lean concrete backfill).

2. Mr. Lipinski wondered how we arrived at the conclusion that nothing was required beneath the railroad bay. TCCooke noted that it was done by Bechtel Ann Arbor Engineering via their analysis of the soils beneath the railroad bay and the structure itself.

3. Mr. Lipinski questioned whether the original design was for saturated fill or not and received an affirmative response. TCCooke noted that our recent analysis indicates that there will be no detrimental effects going to the dry fill and that it would enhance overall site conditions.

4. The fact that the Diesel Generator settlement will be on the subject of the hearings on the 18th. (How will we proceed on this area).

5. Mr. Lipinski again noted that he was reviewing the responses to the 50.54f questions and that hopefully he will have reviewed everything in sufficient depth prior to the meeting on the 18th. TCCooke noted that the total site dewatering concept and other fixes revisions should be in Mr. Lipinski's hands next week.

6. Mr. Lipinski noted that he was still concerned on the response to question 15 in that settlement stresses were self-limiting and did not affect the structural integrity of the plant. He noted that he had discussed this with Mr. Ted Johnson during his recent site visit, and that re-analysis was very important in that stress results from settlement were locked into the structure in case of an earthquake or any other load. He further noted that the analysis will have to account for these stresses TCCooke then noted that the Diesel Generator Building was the only building where differential settlement was noted and again stated that we are taking a super-conservative approach in effecting remedial action for all areas of the plant based on questionable material (found during soil boring program) and not settlement. Furthermore, our total dewatering program is designed to eliminate any questions that could arise concerning liquefaction in any area of the site. Mr. Lipinski generally concurred with the concept and again noted that he is mainly concerned over any area of stress.

During the discussion Mr. Cooke discussed the tentative agenda and noted that probably the following people would be attending the soils meeting on the 18th:

Consumers Power Company

GSKeeley
TCCooke
TRThiruvengadam

Bechtel Power Corporation

PAMartinez
SAfifi
CWeidner
BDahr
and others

J Betts

BECHTEL MIDL

BECHTEL ARB
810-223-6032 CLG 810-266-9497
TWX 3663 9/22/78 16:10

ATTN: J F NEWGEN

SUBJECT: CPCO/MIDLAND PLANT JOB 7220
PLANT SITE BACKFILL
FILE: 0274, C-210, C-211PR
BEBC-2451

REFERENCE: BCBE 2046 J.F. NEWGEN TO R.L. CASTLEBERRY DATED
9/21/78

PER YOUR REQUEST, WE HAVE RVIEWED THE LIST OF AREAS WHICH REQUIRE BACKFILLING. THE FOLLING AREAS AS DESCRIBED IN YOUR REQUEST ARE REALEASED FOR CONSTRUCTION.

1. DOMESTIC EWATER LINES (8"-OYSG-7) NORTH AND SOUTH OF THE EVAPORATOR BUILDING INCLUDING 3"-OYSG-1

2. FIBERGLASS LINES (4"-OYXD-1 6"-OYXD-1) FROM TURBINE BUILDING TO (4"- OYXD-2) EVAPORATOR BUILDING

3. FIRELINE (8"-OKSF-29 6"-OKSF-15) SEWER AND STORM DRAIN BETWEEN COMBINATION SHOP AND EVAPORATOR BUILDING.

4. 66-INCH DIAMETER BLOWDOWN LINE NEAR COOLING TOWER.

5. SERVICE WATER (4"-OJBD-737 AND 738) FIRELINE (8"-OKSF-28) AND STORM DRAIN SOUTH OF RADWASTE BUILDING.

6. STORM DRAIN AND ROOF DRAIN AT NORTHEAST CORNER OF AUXILLIARY BUILDING.

7. 48-INCH DIAMETER (48"-OHBC-2) PIPE AT SERVICE WATER BUILDING.

8. DIESEL FUEL TANKS (TANKD 1T-78A AND B, 2T-78A AND B) AND LINES (1 1/2"-HBC-3 AND 4, 1 1/2"-2HBC-3 AND 4, 2"-1HBC-498 AND 499 AND 2"-2HBC-497 AND 498.

GEOTECH'S SOIL ENGINEERING REPRESENTATIVE AT THE SITE IS TO PROVIDE TECHNICAL GUIDANCE DURING BACKFILLING OPERATIONS.
AREA WITH PRIORITIES 1, 5 AND 8 INDICATED IN REFERENCE CANNOT BE APPROVED FOR BACKFILLING UNTIL EVALUATION OF THE SOIL INVESTIGATION IS COMPLETED.

R.L. CASTLEBERRY
ANN AT:GT/TPE8117/7220-001/ER

BECHTEL MIDL

41

January 2, 1974

Midland Project GWO 7020
Earthwork Personnel Assignments
File: C-210, 0400 Serial: 1

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

Dear Mr. Felton:

As you are aware, there was a question concerning the number of inspectors needed for the earthwork operation last year. Some people were eventually borrowed from Quality Control to meet requirements.

We wish to ascertain at this time that there will be a sufficient number of experienced inspectors to follow the work this spring. We hope that you will continue with the same personnel used last year so as to maintain continuity as well as to have experienced people. We realize that you will have to replace the people borrowed from Quality Control, but we expect that you will secure experienced people to replace them with the amount of time available to you before the work resumes this spring.

We would like to have your anticipated assignments for this work by February 1, 1974 for informal discussions with your office. We should have the names of the people available who will be assigned to this area, not just the number. We realize that you may not be able to give us the names of those people who are not yet assigned to this project.

Yours very truly,

T. C. Cooke
Project Superintendent

TCC/DES/mb

41

CONSUMERS POWER COMPANY
RECEIVED
APR 19 1974
MIDLAND PLANT PROJECT
MIDLAND, MICHIGAN

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

April 15, 1974

TCC
PKW
BHP
WCB
TC
DES
GLG
DJV
RES
RRD
File
Return

Consumers Power Company
P. O. Box 1963
Midland, Michigan 48640

Attention: T. C. Cooke

Dear Mr. Cooke:

Job 7220 Midland Project
Subcontract 7220-C-210
Personnel Assignments
BCCC 299

We acknowledge receipt of your letter dated January 2, 1974 requesting information regarding personnel assignments for the 1974 earthwork operations. Because of the unknown elements such as, testing of plant area fill, status of borrow, and the availability of the Mergard property, we have delayed answering your request until this time.

Earthwork operations are currently scheduled to start approximately May 1, 1974. Canonie plans to operate four spreads, plus sealing wells, placing Zone 3, Zone 4, and Zone 5-A material. We are currently planning on assigning six Subcontract Field Engineers to cover the total work operations of Canonie this year. There may be occasions that one additional engineer will be assigned to cover operations that are short term in nature.

The Subcontract Field Engineers to be assigned are as follows:

Clark
Brineman
Juneman
Cerafin
Coaster
Deycous

In addition Mr. Wanzeck of Geotech, Ann Arbor will be available as needed.

If you have any questions regarding the above and want an informal meeting as suggested in your letter, please let me know.

Very truly yours,

E. E. Felton

EEF/JMJ/ja

Bechtel Power Corporation

Interoffice Memorandum

To T. C. Valenzano

Date June 10, 1974

Subject Job 7220 Midland Project
Subcontract 7220-C-210
Item 13.7 Compaction Requirements
7220-C-210-17

From J. C. Church

Of Subcontracts

At Midland, Michigan

Copies to J. P. Connolly

There has been some confusion as to the interpretation of the following item.

13.7 COMPACTION REQUIREMENTS

All backfill in the plant area and the berm shall be compacted to not less than 95 percent of maximum density as determined by modified Proctor method (ASTM 1557, Method D), with the exception that Zone 4. 4A. 5. 5A. and 6 Materials need no special compactive effort other than as described in Section 12.8.1.

The question that has been posed by the Quality Control people is: does the exception stated above apply only to Zone 4, 4A, 5, 5A, and 6 or do we also have to abide by Section 12.8.1 for Zones 1 and 2? Our interpretation is that for the plant and berm areas, all we need to obtain is a compaction of not less than 95 per cent of maximum density as determined by modified Proctor method (ASTM 1557, Method D), with no restrictions as to the method used to obtain these results.

Attached find a memo from Quality Control and a Field Change Request on the above subject. Because of time element for this item, your immediate action on this would be appreciated.

John C. Church

John C. Church

JCC/JRS/ja

Attachment

5024 (10-72)

BECHTEL POWER CORPORATION

FIELD CHANGE REQUEST

PROJECT NO. 7220

1. PAGE 1 OF 1

Q No.

2. No. 40

3. DATE MO DAY YR 6 10 7?

4. REF. DWG. OR SPEC. C-210, 13.7 REV. 0

5. TITLE Baffle and Cooling Pond Dikes

6. DESIGN ORIGIN: ENGRG ☒ VENDOR ☐ (IDENTIFY) NAME

7. EXISTING CONDITION:

Compaction requirements of Specification 13.7

8. CHANGE REQUEST/SKETCH

Clarify Specification 13.7 as to whether or not four (4) equipment passes are additionally required for Zones 1 and 2 along with 95% maximum density.

Section 13.7 should read as follows:

All backfill in the plant area and the berm shall be compacted to not less than 95% of maximum density as determined by modified Proctor method (ASTM 1557, Method D) regardless of compactive method. The exception shall be that Zone 4, 4A, 5, 5A, and 6 Materials need no special compactive effort other than as described in Section 12.8.1.

10. REVIEWED BY: Date

CIVIL

ELECT.

PLANT DESIGN

INSTRUMENTATION & CONTROL

MECH.

WELDING

9. PREPARED BY: W. Chud

11. APPROVAL OF FIELD DISPOSITION:

Project Field Engineer Date

12. PROJECT ENG'R'G APPROVAL: YES ☐ NO ☐ PROJ. ENGR.: Date

REMARKS:

40

Bechtel Power Corporation

Interoffice Memorandum

To John Church

Date June 6, 1974

Subject Roller Passes in "Q" Area
QCFM-194

From J. P. Connolly

Of Quality Control

Copies to
L. Albert
D. Horn

At Midland, Michigan
Job 7220

Letters signed by you on September 18, 1973 and October 5, 1973 indicate that four (4) machine or equipment passes should be made by either the Hyster C455A No. 1125 or the Caterpillar 835 sheepsfoot roller to attain the proper compaction requirements stated in paragraph 12.8.1 of Spec. C-210, Rev. 2.

Robert Haney of Canonie Construction Company feels that under paragraph 13.7 of Spec. C-210 Rev. 2, he is not held to any specified number of passes as long as he achieves 95% of maximum density.

Don Horn of Consumers Power Company feels that they are held to the four (4) passes and 95% of maximum density. Quality Control is also of the opinion that four (4) equipment passes are required because of existing documentation. The situation could be clarified with an F.C.R. to the effect that in the Q-Listed areas. No specified number of passes would be required as long as 95% of maximum density was achieved.

Please resolve this situation as soon as possible.

J.P. Connolly

J. P. Connolly

JPC/LVH/jmw

5024 (10-72)

29

Chrch
SERAFIN
BRINEMAN

Bechtel Power Corporation

Interoffice Memorandum

To	J. C. Church	Date	June 24, 1974
Subject	Job 7220 Midland Project Specification 7220-C-210 Paragraph 13.7 7220-C-210-23	From	T. C. Valenzano
		Of	Construction
Copies to		At	Midland, Michigan

We have reviewed your June 10, 1974 IOM concerning compactive effort required on Zones 1 and 2 in the plant and berm backfill areas. We agree with your interpretation; i.e., a 95% of maximum density is the acceptance criteria, and the number of roller passes listed in Paragraph 12.8.1 does not apply to plant and berm backfill. We feel that the specification is now clear, and no FCR is required.

T. C. Valenzano
T. C. Valenzano

TCV/RAG/bk

5024 (10-72)

29

P. A. Martinez

July 25, 1974

Job 7220 Midland Project
Structural Backfill
Specification 7220-C-211, Rev. 0
BCBE-370

E. E. Felton

Construction

Midland, Michigan

H. M. Krout
K. A. Lawes
J. C. Fink
J. H. Allen
J. F. Newgen

On July 23, 1974, R. Grote contacted R. Rixford for clarification of structural backfill requirements per Specification 7220-C-211, Rev. 0. The following discussion confirms that conversation and outlines how the field will proceed with construction.

The structural backfill material required by Specification 7220-C-211, Revision 0, is required to be placed only within three feet of the exterior wall of any plant area structure. This material is not required under a structure. Beyond the three feet line and under Class 1 structures, Zone 2 material at 95% compaction is all that is required. This does not prevent the field from placing the cohesionless material required by C-211 beyond the three feet line if we choose to do so. It would be permissable to use the cohesionless material for all backfill, however, it is not required.

Specification 7220-C-211 is to be followed for placing all backfill within three feet of exterior walls of all plant area structures. This requirement, however, does not make all structural backfill Q-Listed. Only backfill against Class 1 structures is "Q" Listed.

Outstanding items requiring project engineering action are as follows:

1. Drawing SK-C-355 which is referenced in Section 7.0 of Specification 7220-C-211 has not been transmitted to the field.

2. Response to BCBE-319 is required. (Letter transmitted 6/5/74.)

3. Is the 95% compaction required in the plant area to be 95% of Bechtel Modified or 95% of ASTM 1557, Method D?

Please reply by July 31, 1974 if you have any questions on the above. We have been attempting to resolve this matter for many months and hope this letter serves that end.

ORIGINAL SIGNED BY E. E. FELTON

E. E. Felton

EEF/RAG/al

29

Bechtel Associates Professional Corporation

Inter-office Memorandum

BEBC - 456

To E. E. Felton

Date August 1, 1974

Subject Midland Plant Units 1 & 2
Job No. 7220
Structural Backfill
File: C-211, 0274, C-1140

From R. L. Castleberry

Of Engineering

At Ann Arbor

RECEIVED
AUG - 6 1974
BECHTEL POWER CORP.
JOB 7220
PER

Copies to
J. C. Hink
J. H. Allen
S. S. Afifi

Reference: A) BCBE-370, 7-25-74

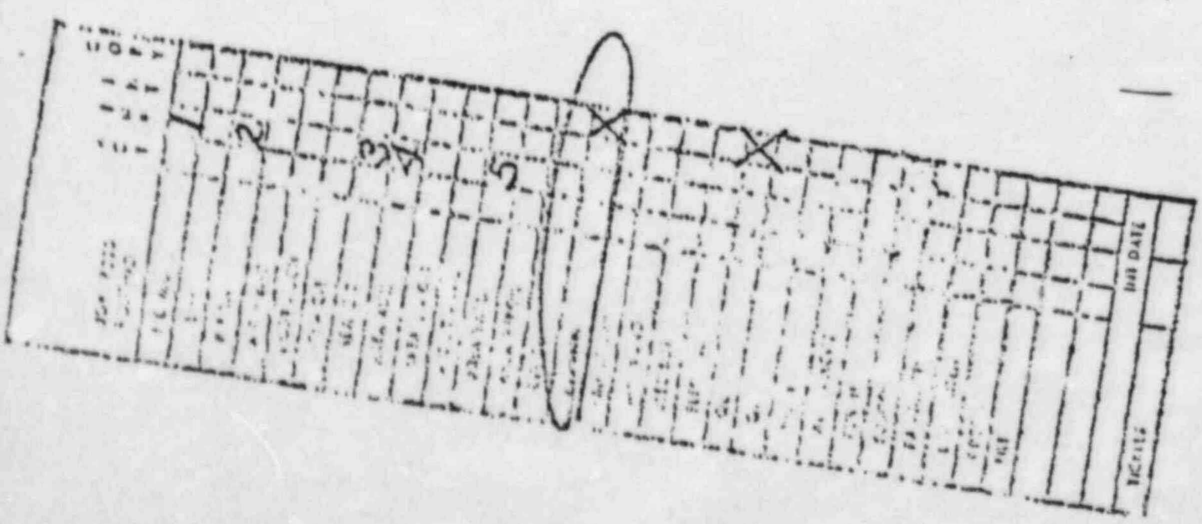
Field Engineering's understanding of the intent of the Structural Backfill specification, as expressed in reference A, is correct in all respects - with one minor clarification.

The last sentence of paragraph 3 of reference A states, "Only backfill against Class 1 structures is 'Q' listed." To be accurate this statement should be, "Only structural backfill against Class 1 structures is 'Q' listed." This would prevent a future attempt to wrongly apply this statement to other non-structural backfill, such as backfill over a Q-listed electrical duct bank.

Work is continuing on the three outstanding items, requiring project engineering action mentioned in referance A. Item 1 is being prepared within the Civil group, items 2 and 3 are being addressed by Geotech.

R. L. Castleberry

RLR/jef



shall be of such size and ply that tire pressures can be maintained between 80 and 100 pounds per square inch for a 25,000 pound wheel load during rolling operations. Unless otherwise required, rolling shall be done with tires inflated to 100 psi. The roller wheels shall be located abreast in a rigid steel frame, each wheel loaded by an individual weight box so that each will carry an equal load when traversing uneven ground. The spacing of the wheels shall be such that the distance between the nearest edges of adjacent tires shall be not greater than one-half of the tire width of a single tire at the operating pressure for a 25,000 pound wheel load. The weight boxes shall be suitable for ballast loading such that the load per wheel may be varied as required from 18,000 to 25,000 pounds. The roller shall be towed at speeds not to exceed 10 miles per hour.

An alternate roller approved by the Contractor may be used in which case additional passes may be required.

14.7.3 Power Tampers

Power tampers shall be operator-held type of a size capable of performing the required compaction and shall be subject to approval. Approval will be on the basis of demonstrated ability of the tampers to accomplish adequate compaction as determined by the Contractor.

12.8 Compaction Requirements

14.8.1 Rolling

After material has been placed and spread on the fill and the moisture content and condition of the fill is satisfactory, the material shall immediately be compacted. All roller passes shall be made parallel to the axes of the dikes or embankment unless otherwise approved by the Contractor. The rolling requirements for each zone of the dikes and embankment are as follows:

Zone	Type of Compaction Equipment	Minimum Number of Passes per Lift
1	50-ton Rubber Tired Roller	4
1A	50-ton Rubber Tired Roller	4
2	50-ton Rubber Tired Roller	4
3	50-ton Rubber Tired Roller or Vibr. Roller	4
4	Construction Equipment routed over the zone or additional rolling as directed by Contractor	-
4A	50-ton Rubber Tired Roller as directed by Contractor.	-
5	Not Required	-
5A	Not Required	-
6	Not Required	-

A pass shall consist of the entire coverage of the area with at least one trip of the equipment specified. In order to effect complete coverage of the area being rolled, each trip of the roller shall overlap the adjacent trip by not less than 2 feet. Dumping, spreading, sprinkling, disking, or harrowing, and compacting may be performed at the same time at different points along the section where there is sufficient area to permit these operations to proceed simultaneously.

12.8.2 Additional Rolling

If, as determined by the Contractor, the desired compaction of any portion of embankment is not obtained by the minimum passes specified, additional passes shall be made over the surface area of such designated portions of the embankment until the desired degree of compaction has been attained. However, where lift thickness is greater than specified, or moisture content at time of rolling is improper or specified rolling has not been performed, such rolling shall be by and at the expense of the Subcontractor.

13.6 Moisture Control

Moisture control of the plant area and berm material shall conform to Section 12.6.

13.7 Compaction Requirements

All backfill in the plant area and the berm shall be compacted to not less than 95 per cent of maximum density as determined by modified Proctor method (ASTM 1557, Method D), with the exception that Zone 4, 4A, 5, 5A, and 6 materials need no special compactive effort other than as described in Section 12.8.1.

13.8 Slides and Winter Protection

All provisions for slides and winter protection shall be similar to requirements in Sections 12.9 and 12.10

13.9 Measurement & Payment

13.9.1 Measurement

Embankment will be measured in place to the nearest cubic yard of embankment material of the various zones, satisfactorily placed and compacted in the plant area and the berm. Such measurement will be made between the foundation lines as determined by survey in the field and the neat fill lines, grades and slopes shown. No allowance will be made for settlement of the foundation or of the embankment during construction.

13.9.2 Payment

Embankment will be paid for at the applicable contract price stated in the Price Schedule for the items listed below.

FROM TCCooke

DATE December 11, 1973

SUBJECT Midland Project GWO 7020
Soil Testing
File: C-208 Serial: 403 (Q2)

Consumers Power Company

INTERNAL CORRESPONDENCE

38

CC File
EEFelton (Bechtel)

It has come to our attention that there may be a problem with the frequency of soil testing during the time that the testing was being performed by Pittsburgh Testing under an interim contract. For the portion of the earthwork which was Q-listed, Bechtel's governing specification at the time called for tests to be taken at the direction of the Contractor. The personnel requesting the tests were from Geotech under temporary assignment to the Subcontract Administrator.

In performing an in depth review of their test frequency after questions were raised by Consumers Power Midland Project personnel and by Bechtel QA, Bechtel first thought the frequency was satisfactory and told us so. In order to be sure, we asked them to give us the number of yards placed in the plant fill (which is Q-list) and the number of tests taken. During their further investigation, they found that the frequency called for in PTL's "Quality Control Procedure" was one per 500 cubic yards which is the same as required of U. S. Testing under C-208. Approximately 20-25% of the tests required by that frequency have been taken.

We feel that the frequency of testing by U. S. Testing should also be investigated as it could also be incorrect. However, since they did not assume responsibility for the testing until October 22, there is less chance than with PTL of this being the case.

In our review of the files regarding this work, we found that Geotech personnel often signed off the inspection plans or parts thereof as both Field Engineer and Quality Control Engineer which seems to us to be inappropriate. In discussing this situation with Mr. T. Velanzano, Bechtel Field, it would appear that Geotech personnel were given a free hand insofar as the inspection processes were concerned since they are considered the experts in this area. While this may be an acceptable practice, it does nothing for proper documentation of the QA/QC program. At this point in time, Bechtel has written one NCR and is carrying out extensive investigations on the subject. I noted to Mr. Velanzano that we would need some assurances that proper reviews would in the future prohibit utilization of subcontractors approved QA/QC programs which spelled out inspection criteria which differs from that which will be used and/or Bechtel specifications. Differences must be ironed out prior to starting work operations. Mr. Velanzano also indicated that Bechtel Engineering may require additional soil borings or trench inspection.

Since Bechtel is currently reviewing the situation, I would not propose a Consumers Power nonconformance be issued at this time which would duplicate existing paper. By copy of this letter, however, I am requesting a reply on above questions from Mr. E. E. Felton with a copy to be sent to your office.

RICHARD D. WOODS
Professional Engineer
700 MT. PLEASANT
ANN ARBOR, MICHIGAN
48103
313-769-4352

GEOTECH ANN ARBOR DISTRIBUTION				
DISC	ACT	INFO	W/A	INIT
MGR		1		
ADMIN				
DRFT				
SOILS	XX	2		
GEOL				
H&H				
		3		
ASM		4		
		5		
Proj Engl				
JOB 7220		FILE 2140		
REC'D NOV 0 8 1978				

November 6, 1978

MEMO

FROM: R.D. Woods R.D. Woods

TO: Mr. Austin Marshall
Bechtel Professional Corp
Ann Arbor, MI

RE: Dutch Cone Static Penetrometer Soundings at
Diesel Generator Building
Consumers Power Company, Midland Plant

I have reviewed the logs of 14 Dutch cone penetrometer soundings from the diesel generator building at the Midland plant. These soundings reveal highly erratic bearing values in the upper 20 feet. These bearing values suggest non-uniform compaction effort both in vertical and horizontal directions.

Friction Ratios were obtained in 7 soundings and these ratios indicate materials which behave more as granular soils than cohesive soils. Generally, when the friction ratio is low (less than 3 %) the soils are more granular than cohesive. In the 14 soundings reviewed, some showed very high friction ratios. However, in each case where this was observed, the high ratios were the result of differences between small gage readings and were not reliable. For example in sounding P-1 friction ratios as high as 15% were calculated, but these do not reflect real soil behavior. The low friction ratios in soundings like P-5A tend to reinforce the low plasticity classifica of the soils encountered.

For the soundings reviewed, I would suggest the following relationships for comparisons with other common soil parameters;

$$q_c = 2N \text{ to } 3N$$

and

$$S_u = c \approx q_c/15 \quad \text{(tsf)}$$

in which

q_c= Dutch cone penetration resistance

N = SPT blow count

S_u= Ultimate shear strength

c = Cohesion.

The indications for subsurface conditions provided by the Dutch cone soundings are for a highly variable soil with very loose or soft condtions both near the surface in some locations and as deep as 20 feet in other locations. These materials would be very susceptible to non-uniform settlement under flexible loads. A thick mat (rigid foundation) may be able to bridge the soft areas to force uniform settlement.

Correct Name of apparatus:

Engine-driven hydraulic deep sounding apparatus
10,000 kg capacity

Manufacturer:

N.V. Goudsche Machinefabriek
Gouda, Holland

56

BECHTEL MIDL

BECHTEL ARB
310-223-6032 CLG 510-266-9497
TWX 3694 10/2/78 9:02

RECEIVED
OCT 0 2 1978

ATTN: J.F. NEWGEN/J. BETTS

BEBC-2466
SUBJECT: CPCO/MIDLAND PLANT- JOB 7220
PLANT SITE BACKFILL
FILE: 0274, C-210, C-211PR

REFERENCE) A) BCBE-2046 R J.F.NEWGEN TO R.L. CASTLEBERRY DATED 9/21/78
B) BCBE-2451 R.L.CASTLEBERRY TO J.F.NEWGEN DATED 9/22/78
C) BCBE-2048R J.F.NEWGEN TO R.L.CASTLEBERRY DATED 9/25/78

WE HAVE REVIEWED THE AREAS REQUIRED BACKFILLING WHICH WERE NOT RELEASED FOR CONSTRUCTION IN REFERENCE B. AND REQUEST IN REFERENCE C. THE FOLLOWING AREAS ARE NOW RELEASED FOR CONSTRUCTION.

1. FIELD ERECTED TANK FARM AREA ("Q"-LISTED).
2. AREA NORTH AND WEST OF DIESEL GENERATOR BUILDING (Q-AREA.)
3. BASED ON BORING INFORMATION OBTAINED THE COOLING TOWER AREA (REF.C) IN THE BACKFILL FROM ELEVATION 619'-6" TO 628'-6" AROUND THE SUMP AND FROM ELEVATION 628'-6" TO GRADE (634'+-) AROUND THE TOWER FOUNDATION.

THE AREA WITH PRIORITY 8 INDICATED IN REFERENCE B. CANNOT BE APPROVED FOR BACKFILLING UNTIL THE ELAVUATION OF THE SOIL INVESITIGATION IS COMPLETED.

AS STATED IN SPECIFICATION 7220-C-210, SECTION 13.7, ALL COHESIVE BACKFILL IN THE PLANT AREA SHALL BE COMPACTED TO NOT LESS THAN 95 PERCENT OF MAXIMUM DENSITY AS DETERMINED BY ASTM D 1557, METHOD D.

IN ADDITION, A GEOTECH SOIL ENGINEERING REPRESENTATIVE SHALL BE USED FOR TECHNICAL GUIDANCE FOR BACKFILLING OPERATIONS.

R.L. CASTLEBERRY
7PE2113/7220-001/ER
ANN ARBOR

BECHTEL MIDL
3

western union Telex/TWX

Bechtel Power Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

TELECOPY
BLC-8021

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

Subject: Midland Units 1 and 2
Consumers Power Company
Bechtel Job 7220
DIESEL GENERATOR BUILDING
REMOVAL OF SURCHARGE
File: 0614/2801

References:
1) BLC-6801 dated 11/16/78, P. Martinez to G. Keeley
2) Meeting Notes of Consultants Meeting on 5/10/79
3) Meeting Notes of Consultants Meeting on 6/18 and 6/19/79
4) Meeting Notes of Consultants Meeting on 6/23/79, Denver, Colo.
5) Summary of Presentation to NRC dated 8/10/79
6) BERC-3175 (teletype) dated 8/13/79, R.L. Castleberry to J.F. Newgen

Dear Mr. Keeley:

The purpose of this letter is to advise you that the intent of the preload program has been achieved, and the surcharge can now be removed. On November 16, 1978, we advised you in a letter (Reference 1) of our intent to carry out our consultants' recommendation to preload the diesel generator building and equipment foundations. The placement of surcharge inside and around the diesel generator building was completed in April 1979. The surcharge consisted of sand as shown in Drawing 7220-C-1141 issued for construction on January 10, 1979.

During the meeting with the consultants on May 10, 1979 (Reference 2), the surcharge depth of 20 feet was considered adequate. It was recommended by the consultants that the surcharge be maintained at that level for approximately 6 additional weeks to allow prediction of long-term settlement.

In the first part of June 1979, additional instrumentation was installed to obtain precise settlement data and measurement of rebound. During a mid-June meeting (Reference 3), the consultants concluded that on the basis of available data at that time, prediction of future settlement could not be made, and it was requested that the settlement readings be continued to improve the data base.

During a late June 1979 meeting (Reference 4), the consultants concluded that the surcharge could be removed in August, provided that the settlement trend continued after proper temperature corrections have been made. The temperature correction devices were developed by the staff of Goldberg-Zoino-Dunnicliff & Associates. The adequacy of the surcharge program has been summarized by R.B. Peck, one of the consultants at the presentation to the NRC on July 18, 1979, as follows (Reference 5).

> "The results of the preload procedure have been convincing. The observed pore pressures were smaller than actually anticipated, and they dissipated rapidly. Hence, primary consolidation was accomplished quickly, and the curve of settlement as a function of the logarithm of time became linear shortly after the completion of placement of the fill. Therefore, it is possible to forecast the settlement that would occur at any future time by simple extrapolation, on the assumption that the surcharge will remain in place. Even this amount of settlement would be acceptable. However, the projected settlement determined on this basis is an upper bound because the surcharge will be removed, and the real settlements will certainly be smaller."

It was R.B. Peck's judgment that foregoing circumstances eliminate any uncertainties concerning the settlement behavior of the diesel generator building resulting from the underlying clay fill.

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On August 2, 1979, consultants R.B. Peck and A.J. Hendron, Jr. were provided with the latest precise settlement data and calculations for establishing residual settlement. On August 10 and 13, 1979, A.J. Hendron concurred, in a telephone conversation, with Bechtel's findings that the rate of settlement has decreased to such an extent that for the last 6 weeks there has been essentially no settlement, and that sufficient data have been obtained to allow prediction of long-term settlement by extrapolating the available settlement data. Calculations based on present data indicate that the residual settlement over a period of 40 years due to secondary consolidation of clay will be less than 1 inch. A copy of this confirmation letter from the consultants will be provided as soon as it is received. Because of the favorable settlement characteristics of the surcharge, the design intent of the PSAR in regard to prediction of long-term settlement has been met.

In conclusion, the preload operation has been successfully completed. The acceptance criteria have been met by providing a reliable residual settlement prediction. Structures, components, and utilities will be designed to accommodate the long-term settlement. Removal of surcharge will commence on August 15, 1979. Construction has been instructed accordingly (Reference 6).

Very truly yours,

P.A. Martinez
Project Manager

AG/bm
8/15/1

cc: D.B. Miller
T.J. Sullivan
B.W. Marguglio
W. Bird
T.C. Cooke

X BECHTEL MIDL 54

BECHTEL ARB
313-223-6032 CLG 510-266-9497
TWX 5315 8/14/79 9:50

RECEIVED
AUG 14 1979

ATTN: J.F. NEWGEN

BEBC-3176
SUBJECT: CPCO/MIDLAND PLANT JOB 7220
DIESEL GENERATOR BUILDING
FILE: 0274, C-2645

REFERENCE: 1) DRAWINGS 7220-C-1040 AND 7220-C-1141
2) NCR 1482
3) SPECIFICATION 7220-C-83

YOU ARE RELEASED TO REMOVE SURCHARGE FROM THE DIESEL GENERATOR SUILDING AND THE UNIT 1 TRANSFORMER AREA SHOWN ON REFERENCE 1. STARTING ON AUGUST 15, 1979. THE FOLLOWING REQUIREMENTS ARE PRESENTED TO ALLOW PLANNING OF THIS ACTIVITY.

1. LIFT-OFF READINGS SHALL BE TAKEN ON THE FOUR MONITORED TIE RODS IN THE TURBINE BUILDING IN ACCORDANCE WITH SPECIFICATION 7220-C-83 PRIOR TO BEGINNING AND AFTER THE REMOVAL OF THE SURCHARGE.

2. SETTLEMENT READINGS SHALL BE TAKEN ON ALL BUILDING, PEDESTAL, AND SOIL INSTRUMENTATION PRIOR TO BEGINNING REMOVAL OF THE SURCHARGE.

3. SETTLEMENT READINGS FOR ALL BUILDING MARKERS SHALL CONTINUE TO BE TAKEN ON A WEEKLY BASIS UNTIL FURTHER NOTICE.

4. THE SONDEX INSTRUMENTS, DEEP BORROS ANCHORS, AND PIEZOMETERS SHALL BE PROTECTED FROM DAMAGE DURING SURCHARGE REMOVAL TO ALLOW CONTINUOUS OPERATION. THIS OPERATION IS A Q LISTED ITEM.

5. GOLDBERG-ZOINO-DUNNICLIFF & ASSOCIATES (GZD) SHALL TAKE READINGS ON THE SONDEX INSTRUMENTS DURING SURCHARGE REMOVAL.

6. THE SURCHARED DOES NOT HAVE TO BE REMOVED IN LAYERS BUT THE REQUIREMENT OF NOTE 2 IN DRAWING C-1141 FOR A 5-FOOT MAXIMUM DIFFERENTIAL IN SURCHARGE ACROSS ANY INTERIOR WALL STILL APPLIES.

7. A DAILY LOG SHALL BE KEPT, SHOWING LOCATION AND QUANTITIES OF SURCHARGE REMOVED EACH DAT. THIS SHOULD INCLUDE ELEVATION OF SURCHARGE IN EACH ZONE DEFINED IN DRAWING C-1141.

8. SURCHARGE MATERIAL MAY BE STOCKPILED OR DISPOSED OF OFFSITE. IF THE SURCHARGE MATERIAL MEETS THE REQUIREMENT OF SPECIFICATION 7220-C-211, REV 7, IT MAY BE USED FOR RANDOM BACKFILL IN THE PLANT AREA.

RL CASTLEBERRY
ANN ARBOR/7PE2118/7220-001/ER

CORRECTION... 2ND LINE FIRST WORD SH READ BUILDING
NO. 7 2ND LINE 4TH WORD SH READ... DAY

53

TELECOPY

BEBC-2480

Bechtel Associates Professional Corporation

Inter-office Memorandum

To: J.F. Newgen

Date: October 4, 1978

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

From: R.L. Castleberry

Of: Engineering

At: Ann Arbor

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

RECEIVED
OCT 6 1978
BECHTEL POWER CORP
JOB 7220
PER ____________

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

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

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

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

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

Bechtel Associates Professional Corporation

Undisturbed, thin-walled (Shelby) tube sampling shall be taken in accordance with ASTM D 1587. The minimum outside diameter of thin-walled (Shelby) tubes should be 3 inches. When obtaining undisturbed samples, Denison, Osterberg, or Pitcher samplers may be used as directed. The minimum outside diameter of Denison, Osterberg, or Pitcher samples should be 3 inches. The undisturbed sample should not be removed from the tube, but should be trimmed back from the ends of the tube, the space filled with hot microcrystalline (nonshrinking) wax, and the tube capped and sealed with hot wax and tape. The thin-walled tube should be clearly identified, using a water proof marker or label that is firmly attached to the tube showing the job designation, date, boring number, sample number, depth, length (in inches), and inches recovered.

Observation wells may be installed as directed by the Geotech representative for subsurface water level monitoring. The borings for observation wells where advanced by the rotary drilling method should use a biodegradable drilling mud such as Revert. After installation, the observation wells should be flushed and a response test should be conducted to make certain the wells are operative. The minimum outside diameter of riser pipes should be 2 inches.

Test pits for supplemental information should be made as directed by the Geotech soils engineer at the site. Density test and block samples may be taken, as directed.

To assist in the above soil investigation program, the following additional ASTM standards are recommended for use.

ASTM D 2488-69	Description of Soils (Visual) Manual Procedure)
ASTM D 653-67	Terms and Symbols Relating to Soil and Rock Mechanics
ASTM D 2113-70	Diamond Core Drilling for Site Investigation
ASTM D 1452	Soil Investigation and Sampling by Auger Borings
ASTM D 3441-75T	Deep, Quasi-Static, Cone and Friction Cone Penetration Tests of Soil

R.L. Castleberry

JH/cap
10/4/2

ACTION ITEMS FROM RESPONSE
TO
50.54f QUESTION NO. 1

ACTION ITEM NO.	50.54f RESPONSE PAGE NO. (PARA.)	ACTION DISCRIPTION	RESPONSIBILITY	ACTION COMPLETION DATE	DATE COMPL:
		From response to Question 1			
		flow chart, procedure, examples of review			
1	1-3 (Item 1)	Perform a final review and update of the PSAR commitment list.	J. Clements B. Rixford pkg.	1-1-80	
2	1-4 (Item 2)	Review sections of the PSAR determined to be inactive	J. Clements	1-1-80	
3	1-4 (Item 3)	Review EDP 4.22 also review doc. Before & after revision	R. Baltazar	6-29-79	6-1-7
4	1-4 (Item 4)	Audit action items 1-3 Audit schedule to be shown 10-26 in process for 1-2 item 10-26 for 3	L. Dreisbach	10-26-79	
5	1-4 & 1-5 (Item 2) App. I I-8 (D.2.C)	Review specifications not included in the specificity study initially C-208 C-231 A-41 Cross reference to old specs. Highlight sections of spec.	R. Baltazar	6-29-79	(see attach
		FROM APPENDIX I			
6	I-6 (C.1.b)	Complete review of the Dames and Moore Report Memos from Geo Tech & P.E.	J. Wanzeck B. Dhar	6-29-79	7-13-
7	I-6 (C.3)	Complete review of pertinent portions of the FSAR Sections 2.5 and 3.8 P.E. 2.5 & 3.8 need Geo Tech doc. of 2.5 & 3.8	P. K. Chen B. Dhar	6-29-79	(see attach.
8	Rixford I-6 (C-4.a)	Correct settlement calculations and update FSAR Letter to Keeley from Martinez	P. K. Chen	11-1-79	
9	I-7 (C.4.c)	Schedule audits of the geo-tech section on a six months basis. Audit of Geo Tech Feb. 1979 Copy of Schedule	L. Dreisbach	7-27-79 (first audit)	5-1-1
10	I-7 (C.5.b)	Review drawing for possible effect of vertical duct bank restrictions Doc. of areas looked @ resolution	C. McConnel	6-1-79	6-30- (see attac
11	I-7/8 (D.1)	Complete actions in response to DRVCL audit Audits & findings closed & all doc.	R. Baltazar	5-18-79	(see attac

ACTION ITEMS FROM RESPONSE
TO
50.54f QUESTION NO. 1

ACTION ITEM NO.	50.54f RESPONSE PAGE NO. (PARA.)	ACTION DISCRIPTION	RESPONSIBILITY	ACTION COMPLETION DATE	DATE COMPL
12	I-8 (D.2.d)	Revise EDP 4.49.1 to incorporate clarifications & instructions for use of SCN Rev 1, 2 & 3 to EDP 4.49.1	M. O'Mara	5-1-79	5-4-7
☆ CPCo 13	I-8/9 (D.4)	Schedule audits of each design discipline calculations on a yearly basis. Audit schedule & audits preformed.	L. Dreisbach	6-27-79	5-4-7
☆ 14	I-11 (C.1) Savo Get with	Re-evaluate construction equipment used for compaction Telecon Norm Thiel	A. Boos	Prior to resuming soils work	(see attac
15	I-11 (C.2.a)	Assign field soils engineer and soils engineer from the design section Resumes -	J. Newgen	Prior to resuming soils work	5-1-7 (approx
16	I-11 (D.1)	Field Proc. Review cons't. specs and procedures to identify equip. requiring qualifications Memo 0-2386 from Boos 6/27/79	A. Boos	6-29-79	
Savo 17	I-11 (D.2)	Review Field Procedure FPG-3.000 to assure clarity and completness. New & Old FPG-3.000	A. Boos	5-31-79	7-3-79
18	I-16 (C.1.a) (C.1.b) I-17 (C.3.b)	Revise FQCI C-1.02 to provide inspection rather than surveillance and to record inspections Copy of both before & after	R. Simanek	Prior to resuming soils work	8-1-79
Needs work 19	I-17 (C.3.a)	Complete indepth review of soil test results	S. Afifi	7-31-79	6-25-79
Savo 20	I-18 (C.4.b) (D.3.c)	Perform indepth audit of U.S. Testing Audit report & closures of the findings.	L. Dreisbach	5-31-79	4-26-
Savo 21	I-18 (D.1)	Review all active QCI's for surveillance callouts and modify where necessary. Letter, Action Items Doc., Plans that have changed C-8.50 or C-8.60	R. Simanek	6-29-79	(see attac
Savo 22	I-18	Evaluate documentation callouts on QCIs Same as 21	R. Simanek	6-29-79	(see attac.

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ACTION ITEMS FROM RESPONSE
TO
50.54f QUESTION NO. 1

ACTION ITEM NO.	50.54f RESPONSE PAGE NO. (PARA.)	ACTION DISCRIPTION	RESPONSIBILITY	ACTION COMPLETION DATE	DATE COMPL
23	I-20 (D.5.f)	Incorporate scientific sampling plans for inspection R-1.00 old Rev - new Rev. Buttonhead EQ Review	R. Simanek	10-19-79 (QCI for receipt by 5-15-79)	(see attac
24	I-22 (D.1.a)	Complete indepth review of the Bechtel Trend Program Doc. Draft revision to this	J. Milandin B. Marguglio	6-1-79	5-25-7
25	I-22 (D.1.b)	Conduct QA Training GLR - letter 79-13	J. Milandin	6-1-79	6-1-79

ACTION ITEM NO.	50.54f RESPONSE PAGE NO. (PARA.)	ACTION DISCRIPTION CPCO ACTIONS	RESPONSIBILITY	ACTION COMPLETION DATE	DATE COMPL.
CPCo #1	I-11 (C.2.b) I-16 (C.1.c) I-17 (C.3.c)	Implement overinspection for soils placement and U.S. Testing Activities	CPCo - QA	Upon resuming soils work	
CPCo #2	I-22 (D.2)	Conduct QA Training	CPCo - QA	6-1-79	6-1-7[illegible]

50.54f QUESTIONS NO.	ACTION ITEM	ACTION DESCRIPTION	RESPONSIBILITY	ACTION COMPLETION DATE	DATE COMPL
3	a	Clarify response to FSAR Question 362.12	J. Clements B. Dhar	5-79 FSAR Amend.	6-1-7
4	a	Provide Criteria for permissible residual settlement	B. Dhar S. Afifi	8-79	
	b	Provide details of treatment of loose sands	B. Dhar S. Afifi	8-79	(see attac
	c	Take dynamic moduli measurements upon removal of preloads for D.G.B. and other buildings	S. Afifi	10-79	
	d	Use data (c) to evaluate the seismic response of these structures	B. Dhar	11-79	
	e	Prepare additional response to NRC for items 4a and 4b	B. Dhar S. Afifi	8-79	(see attac for 4
6	a	Establish procedure & criteria for filling borated water storage tanks with water to demonstrate satisfactory subsoil condition	B. Dhar	9-1-79	
	b	Deleted			
	c	Deleted			
	d	Evaluate settlement of diesel fuel oil tans - provide precise corrective measures if required	S. Afifi	9-1-79	
7	a	Perform continuity check on duct banks after completion of preload program	A. Boos	11-79	
	b	(Included in a)			
	c	(Included in a)			

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50.54f QUESTION NO.	ACTION ITEM	ACTION DISCRIPTION	RESPONSIBILITY	ACTION COMPLET-ION DATE	DATE COMPL
8	a	Establish a requirement to Realign diesel generators if manufacture's tolerances for pitch and roll are exceeded	B. Dhar	9-15-79	
12	a	Complete one additional boring in middle of diesel fuel oil tanks area	J. Wanzeck	Open	4-23-
	b	Complete three additional borings in the auxilary building control tower area	J. Wanzeck	Open	5-79
	c	Complete table 12-1 for soils investigation and planned remedial measures. Respond to NRC.	B. Dhar	5-79	5-31- Rev.
13	a	Complete seismic reanalysis of D.G.B. to account for current lack of compaction	B. Dhar	10-79	(see attach
	b	Review D.G.B. design and Cat. 1 equipment, piping and elec. systems to the enveloped seismic responses	B. Dhar	12-79	
	c	Service water pump structure - Conduct a seismic reanalysis to account for revised soil - structure interaction. - Review structural design and Cat. 1 equipment, piping and elec. systems and incorporate the seismic responses of the reanalysis	B. Dhar	10-79 12-79	
	d	Auxilary Building - If significant change of foundation properties results, conduct a seismic reanalysis. - Review structural design and cat. 1 equip, piping, and elec. systems and incorporate the seismic response of the reanalysis.	S. Afifi B. Dhar	— 12-79	(see attach

50.54f QUESTION NO.	ACTION ITEM	ACTION DISCRIPTION	RESPONSIBILITY	ACTION COMPLET-ION DATE	DATE COMPL
13	e	Underground Utilities - Investigate the change in differential displacement separately for buildings founded on fill pending results of seismic reanalysis	B. Dhar S. Afifi	12-79	
14	a	Review estimated settlement val es for borated water storage tanks upon completion of load test program	S. Afifi	After Tank Comple-tion	
	b	For flexable buildings - analyze for differential settlement based on stiffness at the time of distortion. Evaluate forces due to arching and combine with loads from Question 15	B. Dhar	12-79	
	c	Examine auxilary building, feed-water isolation valve pits and borated water storage tank ring foundations for cracks - map significant cracks.	B. Dhar	6-79	6-30-7
	d	Analyze building effected by differential settlement for observed differential settlement plus predicted differential settlement.	B. Dhar S. Afifi	8-79	
	e	Prepare additional response to the NRC to provide analysis and evaluation	B. Dhar	8-79	
15	a	For Seismic Category I structures evaluate differential settlements in accordance with ACI 318-71	B. Dhar	12-79	
	b	Expand the Midland structural design criteria for Class I structures to include the differential settlement effects.	B. Dhar	12-79	—
	c	Prepare additional response to the NRC	B. Dhar	12-79	

50.54f QUESTION NO.	ACTION ITEM	ACTION DISCRIPTION	RESPONSIBILITY	ACTION COMPLET-ION DATE	DATE COMPL.
16	a	Perform soils borings in the areas of buried pipes.	J. Wanzeck	8-79	4-13-
17	a	Complete evaluation of impact of the failure of non-seismic Category I piping on safety-related structures, foundations and/or equipment.	B. Dhar	6-29-79	7-9-7
	b	If future profiles show any extreme conditions, analyze the piping system and make necessary repairs.	B. Dhar	9-1-79	
	c	Prepare additional response to the NRC	B. Dhar	6-29-79	7-9-7
18	a	Perform re-examination of stresses in seismic Cat. I piping connecting between buildings as part of normal iteration of design. Consider stresses induced by differential settlement after connecting pipe and anticipated future settlement.	D. Riat	12-79	
19	a	Profile pipes in vicinity of D.G.B. after removal of preload-evaluate as described in Response 17.	C. McConnel	9-15-79	
	b	Take additional gap measurements between embedded sleeves and pipes when surcharge is removed. Coordinate this information with the profile data.	C. McConnel	9-15-79	
	c	Perform a complete evaluation of safety related piping after completion of the preload program.	D. Riat	12-79	
20	a	Analytically check affected pump and nozzle loadings. If necessary disassemble flange joints and evaluate separation.	D. Riat	6-29-79	7-9-7
	b	Verify piping support loads for systems subjected to settlement induced loads.		6-29-79	7-9-7
	c	Prepare additional response to the NRC.	D. Riat	6-29-79	7-9-7

STATUS OF 50.54(f) ACTION ITEMS

50.54(f) Question 1, Action Item 5:
Specificity study done July 13, 1979. Comments to be resolved by July 29, 1979. Civil response completed July 30, 1979. Arch. (A-41) has held 2 weeks of discussion with Bechtel Coatings people - changes will be resolved shortly.

50.54(f) Question 1, Action Item 7:
Reviews by Civil & Geo.Tech. for those portions of Section 2.5 and 3.8 relative to soils have been done. ~~Need documentation from Civil for review of 3.8.~~ Need documentation from Geo.Tech. for review of both sections.

50.54(f) Question 1, Action Item 10:
Actions are completed. Need to complete documentation.

50.54(f) Question 1, Action Item 11:
Actions are completed. Need to complete documentation.

50.54(f) Question 1, Action Item 14:
Equipment for compacting sand is qualified. Equipment for compacting clay is still being evaluated.

50.54(f) Question 1, Action Items 21 & 22:
Review completed June 25, 1979. Resolution of review comments is in process - response expected from PFQCE week ending 8-3-79.

50.54(f) Question 1, Action Item 23:
Letter to B. Marguglio, June 26, 1979 (LAD-971) gave a schedule for completion. Currently trying to select a plan for implementation still plan to achieve implementation by mid-August, as scheduled.

50.54(f) Question 4, Action Item 6:
Details presented in meeting with NRC on July 18, 1979. Response due to NRC in writing August, 1979.

50.54(f) Question 13, Action Item a:
This reanalysis has been done as long as assumed soil properties ~~are substantiated.~~

50.54(f) Question 13, Action Item d:
Reanalysis will be based upon caisson stiffness and shear wave velocity.

Bechtel Associates Professional Corporation 68

Inter-office Memorandum

BEBC-1859

To J. F. Newgen

Date September 30, 1977

Subject Midland Plant Units 1 & 2
Job 7220
Quality Action Report
QAR No. SD-40

From R. L. Castleberry

Of Engineering

At Ann Arbor

Copies to File: 0274, C-0467.1

S. Afifi
J. Klacking

RECEIVED
OCT 0 5 1977
BECHTEL POWER CORP.
JOB 7220
PER

Reference: 1) BCBE-1533 dated 8/15/77

This is a complete response to Reference 1.

It should be noted that it is ideal to control the moisture of backfill material at the borrow areas by conditioning. It is true that moisture content tests should be conducted at the borrow areas in order to establish the control to meet the specification requirements. However, in the placing of soil in large quantities, it should be noted that after placement and compaction, the moisture is not necessarily the same due to drying and mixing with other loads. This implies that a moisture content check is needed after the compaction is acheived. Therefore, the procedure used to take the moisture content tests after compaction would not have direct impact on the quality of work.

Based on the above, we agree with field and backfill placed prior to modification of the moisture testing methods to be accepted as is.

for J E Hinkle
R. L. Castleberry

SR/bkp
9/30/5

J. Dean

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

November 9, 1979

CONSUMERS POWER COMPANY
RECEIVED
NOV 1 5 1979
FIELD QUALITY ASSURANCE
MIDLAND, MICHIGAN

BLC- 8439

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

Attention: Mr. R.C. Bauman

Subject: Consumers Power Company
Midland Plant - Job 7220
Meeting Notes No. 1061
Midland Diesel Generator Meeting
File: 0270, 0279, C-2645

Gentlemen:

Attached for your review and information are copies of Meeting Notes No. 1061 for the diesel generator building task group meeting held in Ann Arbor, Michigan on October 9, 1979.

Very truly yours,

for MORothwell
L.H. Curtis
Project Engineer

DR/sg
11/2/7

Enclosure: Meeting Notes No. 1061

cc: S.S. Afifi
K.D. Bailey
T.C. Cooke
L.H. Curtis
L. Davis
[redacted]
D.B. Miller
J.A. Rutgers
T.J. Sullivan
D. Sibbald
T. Thiruvengadam
K. Wiedner
Com Log

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

MEETING NOTES NO. 1061

MIDLAND PLANT UNITS 1 AND 2

CONSUMERS POWER COMPANY

BECHTEL JOB 7220-101

DATE: October 9, 1979

PLACE: Ann Arbor, Michigan

SUBJECT: Meeting of the Diesel Generator Building Task Group

FILE: 0279, C-2645 w/a

ATTENDEES:

Bechtel

A. Boos*
B. Dhar*
C. Martin
C. McConnel
W. Paris*
D. Reeves*
M. Rung
J. Wanzeck
K. Wiedner

CPCo

T. Cooke
D. Horn*
D. Sibbald
T. Thiruvengadam

*Part-time

PURPOSE: The meeting was held at the Ann Arbor office to discuss the items in relation to the diesel generator building settlement and other Seismic Category I structures on plant fill.

ITEMS DISCUSSED:

A) Review of Prior Action Items

The current status of action items identified in the previous meeting held on August 1, 1979, is as follows.

1) Action Item 1 of Meeting Notes No. 1018

This item is open. The analysis for the borated water lines has not been completed.

2) Action Item 2 of Meeting Notes No. 1018

This item is closed. The FSAR change for Section 2.5 is now with the licensing group for action and tracking.

3) Action Item 3 of Meeting Notes No. 1018

This item is closed. Crack mapping for areas of the railroad bay, feedwater isolation valve chambers, and borated water storage tanks has been completed. Sketches SK-C-666 and SK-C-667 have been issued.

4) Action Item 4 of Meeting Notes No. 1018

This item is open. It was noted that the present method of analysis uses a stress amplification factor for elbows, tees, and reducers. This results in very large stresses at these points. It was suggested that two analyses be performed; one based on the difference between the design location and the location from the last survey and one based on the difference between the first survey and the last survey. Construction noted that if some of the lines are to be unearthed, it must be done soon or not until next spring, otherwise heated shelters must be provided during backfill operations.

5) Action Item 5 of Meeting Notes No. 1018

This item is closed. Specification 7220-C-94 and Drawing 7220-C-2000 for the piling subcontract were issued on August 29, 1979, and September 4, 1979, respectively.

6) Action Item 6 of Meeting Notes No. 1018

This item is open. Borated water storage tanks are under construction. The load test procedure, including water chemistry and protection of permanent plant facilities, will be issued by October 15, 1979.

7) Action Item 7 of Meeting Notes No. 1018

This item is closed. The conflict in the response to Question 6 of the NRC's 10 CFR 50.54(f) was resolved in Revision 3 of the response to the questions on September 13, 1979.

8) Action Item 8 of Meeting Notes No. 1018

This item is closed. The comments to FSAR Q&R 362.15 have been resolved. The response will remain as written.

9) Action Items 9 and 10 of Meeting Notes No. 1018

These items have been combined and are open. Project engineering will revise and clarify the specifications and responses to the NRC's 10 CFR 50.54(f) questions to show requirements for a compaction of 95% ASTM D 1557 under buildings and 90% ASTM D 1557 at other locations.

10) Action Item 11 of Meeting Notes No. 1018

This item is closed. The report of the soil test program for the air line leak in the tank farm has been completed.

11) Action Item 12 of Meeting Notes No. 1018

This item is closed. The report on the air line leak was included in Revision 7 of MCAR 24.

12) Action Item 13 of Meeting Notes No. 1018

This item is open. Consultant R. Loughney is to submit a conceptual plan for the preliminary design and scope of work for the permanent dewatering.

13) Action Item 14 of Meeting Notes No. 1018

This item is open. The bid package for permanent dewatering will be issued by January 1980.

14) Action Item 15 of Meeting Notes No. 1018

This item is open. The contract for permanent dewatering will be awarded by March 1980.

15) Action Item 16 of Meeting Notes No. 1018

This item is open. There have been several discussions with mechanical and nuclear staff. The following subjects have been discussed:

a) A long recharge time is required because of systems that are required after safe shutdown earthquake (SSE).

b) A program is required to establish the reliability of the piezometers.

c) Demonstrate the capability to repair the system during recharge time.

16) Action Item 17 of Meeting Notes No. 1018

This item is open. A review of the NRC regulations with respect to permanent dewatering is continuing.

17) Action Item 18 of Meeting Notes No. 1018

This item is open. The licensing group has started a docket search for information on permanent dewatering at other plants.

18) Action Item 19 of Meeting Notes No. 1018

This item is open. Cost estimates for all Q-listed and part-Q-listed systems are not complete.

19) Action Item 20 of Meeting Notes No. 1018

This item is closed. It was recommended that the service water building piles be added to the underpinning contract.

20) Action Item 21 of Meeting Notes No. 1018

This item is closed. Piling will be part of the underpinning contract and will not have separate bids.

21) Action Item 22 of Meeting Notes No. 1018

This item is open. Construction will determine the terminology for the permanent dewatering by November 1, 1979.

22) Action Item 23 of Meeting Notes No. 1018

This item is closed. The underpinning bid package was sent out in August 1979. The preaward meeting will be on October 22, 1979. Consumers Power Company comments will be discussed at that time. The contract will be awarded by November 15, 1979.

23) Action Item 24 of Meeting Notes No. 1018

This item is open. Construction will review the insurance requirements concerning underground work associated with underpinning by November 1, 1979.

24) Action Item 25 of Meeting Notes No. 1018

This item is open. Removal of water from the diesel fuel tanks is being reviewed.

25) Action Item 26 of Meeting Notes No. 1018

This item is open. It is feasible to run the diesel generators to vibrate the pedestals but is is not presently included in the specifications. Project engineering and geotechnical services will establish a procedure and run duration for the diesels and a settlement monitoring program by December 1, 1979. This activity will have to be coordinated with the startup test program.

26) Action Item 27 of Meeting Notes No. 1018

This item is closed. None of the surcharge sand will be used as Q-listed fill.

27) Action Item 28 of Meeting Notes No. 1018

This item is closed. Pile stiffnesses for the service water building have been finalized. It was verified during the meeting that the original values provided would not change.

28) Action Item 29 of Meeting Notes No. 1018

This item is closed. Removal of fill in the tank farm has been resolved. Refer to report on tank farm.

29) Action Item 30 of Meeting Notes No. 1018

This item is closed. The temporary air line in the tank farm that had a leak has been grouted. All other temporary lines in the tank farm will be abandoned and grouted as soon as they can be rerouted around the tank farm.

30) Action Item 31 of Meeting Notes No. 1018

This item is open. A summary of the data from the test pits and soil borings will be incorporated into the January amendment of the FSAR.

31) Action Item 32 of Meeting Notes No. 1018

This item is closed. Letters BEBC-3294 and BEBC-3311 which were sent on September 24, 1979, and October 3, 1979, respectively describe the plan that will be used to determine the permanent dewatering system parameters.

32) Action Item 33 of Meeting Notes No. 1018

This item is closed. All items relevant to the MCAR 24 scope were discussed in Revision 7 of MCAR 24.

33) Action Item 34 of Meeting Notes No. 1018

This item is closed. TWX BEBC-3176 was sent on August 13, 1979, describing the surcharge removal procedure.

34) Action Item 35 of Meeting Notes No. 1018

This item is closed. Density plots for the dike area north of the auxiliary building have been completed.

B) <u>Status of Site Activities</u>

1) Backfill operation and compaction tests

Backfill operations are proceeding at the site. An extensive program of documentation of material placement has been developed. Two soils engineers are presently onsite to assist in the control of backfill placement.

The questionable fill material in the tank farm has been removed and replaced. The tank farm is backfilled to el 630'-0".

Geotechnical services has given a response to NCRs 1004 and 2294. NCR M-01-5-9-012 has been partially resolved.

All compaction equipment being used at the site has been qualified for technique and can be included in the FSAR if required.

2) Temporary dewatering

In area 3 (see Attachment 1), all of the dewatering wells outside of the turbine building have been installed. Only a couple of wells, including observation wells, are left to be installed inside the turbine building. For the temporary construction dewatering in Areas 1 and 2 (see Attachment 1), almost all of the dewatering wells are installed.

The schedule for temporary dewatering is as follows (see Attachment 1):

October 15 - Start installing deep pump test well in Area 4
October 22 - Start pumping deep pump test well in Area 4 for 3 days
October 25 - Start pumping Areas 1 and 2
October 25 - Approval of Loughney procedures
November 1 - Start pumping Area 3

There are three more procedures from Loughney that must be reviewed by project engineering before dewatering in Area 3 can start. A meeting with project engineering, subcontracts and construction will be scheduled to discuss these and the other Loughney procedures.

3) Test program for permanent dewatering

Locations and directions for the borings for the well pump tests were established in the letter, BEBC-3299, sent on September 24, 1979. They were modified by letter BEBC-3311 on October 3, 1979, to expedite construction. This letter deleted and relocated some wells and established the test well diameter and requirements for piezometers and borros anchors. Based on the present schedule in Item 2 above (temporary watering), more piezometers are needed near Areas 1 and 2 prior to pumping. Their locations will be coordinated by the onsite geotechnical representative.

C) Status of Remaining Subcontracts

The status of the remaining subcontracts was not discussed as an individual item but was covered during the discussions on the various action items. The following is a summary:

1) Piling - Specification 7220-C-94 and Drawing 7220-C-2000 were issued on August 29, 1979, and September 4, 1979, respectively, for the piling subcontract. The service water building piles will be added to the underpinning contract. (See Items 5, 19, and 20 of the Review of Prior Action Items.)

2) Underpinning - The underpinning bid package was sent out in August 1979. The preaward meeting will be on October 22, 1979. Construction will review the insurance requirements concerning underground work. (See Items 22 and 23 of Review of Prior Action Items.)

3) Permanent dewatering - The consultant, R. Loughney, will submit a conceptual plan for the preliminary design and scope of work. The bid package will be issued by January 1980, and the contract will be awarded by March 1980. The Q-listed and non-Q-listed portions of the permanent dewatering system still have to be determined. (See Items 12 through 18 and 21 of Review of Prior Action Items.)

D) Cost Estimate and Schedule for Remaining Work

Schedules were provided for:

1) Service water pump structure piling (see Attachment 2)

2) Auxiliary building underpinning (see Attachment 3)

3) Permanent and temporary dewatering (see Drawings EP-101 and EP-102)

4) Overall cost and schedule status (see Attachment 4)

E) NRC 10 cFR 50.54(f) questions were not discussed.

F) MCAR Report

The scope of the MCAR will be limited to soil exploration and the diesel generator building. The settlement records and pipe profile figures will be submitted for the last time.

The MCAR will not contain the final results of the future predicted settlement because the meeting with J. Peck and A.J. Hendron, Jr. will not be held until October 25, 1979. No additional borings or cross-sections will be included because they will go into the January 1980 FSAR amendment.

The schedule section will be revised or shortened to one paragraph with no dates.

G) Diesel Generator Building

The grout requirements under the footings were discussed. Portions of the footings in Bays 3 and 4 were exposed and a maximum gap of 3/4 inch was found. The gap penetrated up to 2-1/2 feet under the footing. It was decided that more exploration would be performed and the information would be presented to J. Peck and A.J. Hendron, Jr.

H) Diesel Fuel Oil Lines

A design change notice (DCN) was issued requiring the diesel fuel lines to be buried 6 feet below grade. It was questioned whether the design requirements could be satisfied.

ACTION ITEMS:

Project Engineering	1)	Analyze the flexibility of piping connected to the borated water storage tanks assuming 4 inches of differential settlement. Set up meeting with stress group (K. Wiedner and J. Betts to attend) to discuss analysis. Investigate eliminating link seals at penetrations by October 30, 1979.
Project Engineering	2)	Evaluate stress conditions in the resurveyed pipes. The following two analyses were suggested: a. Difference between original design location and latest survey b. Difference between first survey and latest survey
Geotechnical Services/ Project Engineering	3)	Issue program for load test of borated water storage tanks by October 15, 1979.
Project Engineering	4)	Revise and clarify the specifications and responses to the NRC's 10 CFR 50.54(f) questions to show requirements for a compaction of 95% ASTM D 1557 under buildings and 90% ASTM D 1557 at other locations.
Consultant, R. Loughney	5)	Submit conceptual design and scope of work for the permanent dewatering sytem.
Geotechnical Services/ Project Engineering	6)	Permanent dewatering system a. Design permanent dewatering system and have it reviewed in-house (SF) or by an outside consultant. b. Issue bid package by January 1980. c. Award contract by March 1980. d. Establish a program to determine the reliability of the piezometers. e. Determine Q-listed items for the following two options.

1. Complete cutoff wall, long recharge time (Q-listed monitoring of inspection procedure)

2. Partial cutoff wall with local grouting, shorter recharge time (all Q-listed monitoring and pumping equipment)

f) Establish program to demonstrate capability to repair dewatering system during recharge time.

g) Establish elevations and locations at which liquefaction would occur for 0.12 g and 0.20 g seismic events.

h) Continue review of NRC regulations with respect to permanent dewatering.

i) Continue docket search for information on permanent dewatering at other plants.

j) Estimate costs for two options discussed in Item e above.

Construction	7)	Determine terminology to be used for dewatering with respect to union jurisdictions and transmit to project engineering by November 1, 1979.
Construction	8)	Review insurance requirements concerning underground work associated with underpinning and inform project engineering by November 1, 1979.
Geotechnical Services/ Project Engineering	9)	Review diesel fuel tank settlements and issue release for removal of water from fuel tanks by October 15, 1979. Determine cleaning procedures that will be required.
Geotechnical Services/ Project Engineering	10)	Establish a procedure and time period for running the diesel generators. Establish a settlement monitoring program including readings:

a) Before placement of generators

b) After placement of generators

c) After operation of generators

Geotechnical Services/ Project Engineering	11)	Incorporate a summary of data from test pits and soil borings into the January FSAR amendment.
Project Engineering	12)	Disposition NCRs 1004 and 2294.
Geotechnical Services	13)	Resolve remaining portions Consumers Power Company NCR M-01-5-9-012.
Project Engineering	14)	Determine if compaction requirements for current onsite compaction equipment need to be included in the FSAR.
Construction/ Subcontracts	15)	Expedite U.S. Testing's response to Bechtel's Review of U.S. Testing's Field and Laboratory Construction Test Data on Soils Used as Fill.
Geotechnical Services	16)	Establish locations for more observation wells near the construction temporary dewatering areas.
Geotechnical Services/ Project Engineering	17)	Develop a combined schedule for the temporary dewatering and pump tests for the permanent dewatering.
Construction/ Project Engineering	18)	Schedule a meeting between project engineering, construction, and subcontracts to discuss Loughney Dewatering procedures.
Project Engineering	19)	Revise the schedules (Attachments 2 through 4) to reflect the interface with the temporary dewatering.
Project Engineering	20)	Provide a procedure for grouting under the diesel generator building footings by October 12, 1979.
Project Engineering	21)	Establish the requirements for additional investigation of gaps under the diesel generator building footings both inside and outside the building.

Project Engineering — 22) Review the design requirements for the diesel fuel lines and determine if the DCN is satisfactory as issued.

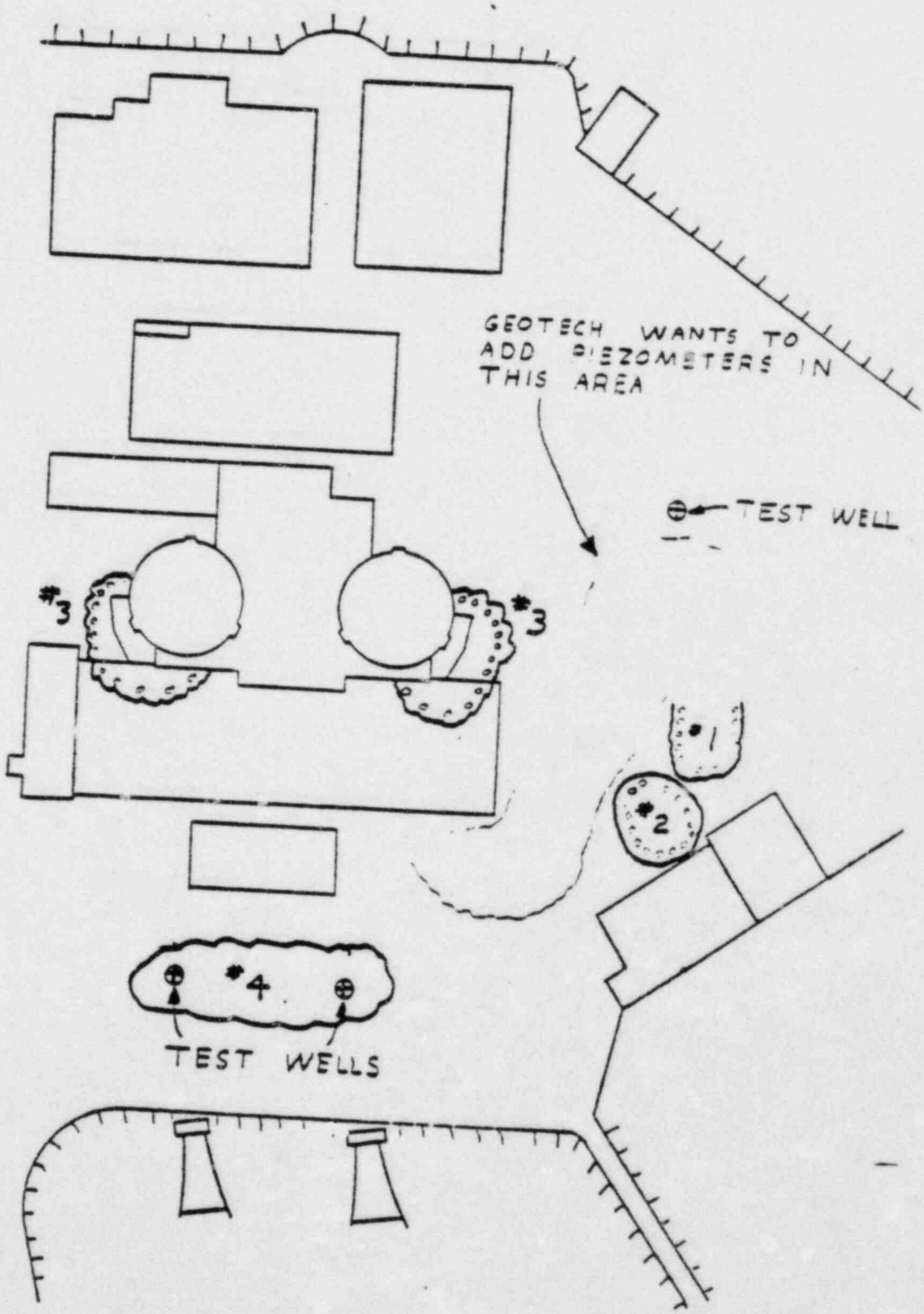
D. Reeves

D. Reeves

DR/js
10/17/7

Attachments
1) Temporary dewatering and test well locations
2) Schedule for service water pump structure piling
3) Schedule for auxiliary building underpinning
4) Overall cost and schedule status

Meeting Notes No. 1061
Attachment 1
Temporary Dewatering and
Test Well Locations



DRAWN BY D. REEVES

TEMPORARY DEWATERING AND TEST WELL LOCATIONS

10/6/79

[illegible] SCHEDULE
[illegible] PILE FOR SERVICE WATER PUMP STRUCT

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
(1) ADDITIONAL SUPPORT																
A. PILE SPECIFICATION	(C)	COMPLETE														
B. INCORPORATE SUBCONTRACT WITH UNDERPINNING S/C	(F)															
C. SUBMIT DRWGS & PROCEDURES	(S/C)															
D. APPROVE DRWGS & PROCEDURES																
E. PERFORM PILE TEST	(S/C)															
F. REVIEW PILE TEST RESULTS	(G,C)															
G. DRIVE PILES	(S/C)															
H. CORBELS																
1. ISSUE DRWGS FOR CONST'N	(C)															
2. PROCURE & FABRICATE STEEL	(F)															
3. CONSTRUCT	(F)															
J. PERFORM JACKING	(S/C)															
(2) DOCUMENTATION																
A. RECHECK DESIGN PARAMETERS	(C,G)															
– SOIL PRESSURE & STABILITY																
SHEAR WALL ANALYSIS																
– FLOORS & BEAMS																
– SEISMIC ANALYSIS																
– EVALUATION OF CRACKS																
B. SPECTRUM CURVES	(C)															
C. FSAR REVISIONS	(C,G)															

RESPONSIBILITIES
F FIELD
C CIVIL
G GEOTECH
S/C SUBCONTRACT

NOTE: THE DELAY IN COMMENCING WORK AFTER INCORPORATION OF WORK INTO SUBCONTRACT IS DUE TO RESTRAINT FROM UNDERPINNING OF THE AUX BLDG

Meeting Notes No. 1061
Attachment 2
Schedule for Service Water
Pump Structure Piling

... THE AUX. BLDG.
ENGINEERING SCHEDULE

		1979 Oct	Nov	Dec	1980 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
① LOCAL DEWATERING																
A. INSTALL WELLS																
1. OUTSIDE WELLS	(F)															
2. INSIDE WELLS	(F)															
B. ERECT TEMPORARY VLV. SUPPORTS, DRWG C-2020	(F)															
C. DEWATER	(F)															
② UNDERPINNING CONTRACT																
A. EVALUATE BIDS	(C,G)															
B. AWARD CONTRACT	(C)															
C. SUBMIT DESIGNS & PROCEDURES	(S/C)															
D. APPROVE DESIGN DOCUMENTATION & PROCEDURES	(C,G)															
E. REMOVE TEMPORARY CONSTRUCTION FACILITIES & COVER DEWATERING HEADERS	(F)															
F. INSTALL BUILDING MOVEMENT DEVICES	(S/C)															
G. PERFORM EXCAVATION	(S/C)															
H. INSTALL CAISSONS	(S/C)															
I. REMAINING CONCRETE WORK	(S/C)															
③ SETTLEMENT MONITORING																
A. READ FEEDWATER VALVE CHAMBER MONITORS	(F)															
B. LOCATE MONITORS	(C)															
C. INSTALL MONITORS	(S/C)															
D. READ ALL AUX. BLDG CRACK MONITORS	(F)															
④ DESIGN DOCUMENTATION																
A. DRWG REVISIONS																
B. SPECIFICATION FOR GROUTING AUX. BLDG TOWER	(C)															

RESPONSIBILITIES
- F* FIELD
- C CIVIL
- G GEOTECH
- S/C* SUBCONTRACT

* ACTIVITIES REQUIRE ENGINEERING SUPPORT

Meeting Notes No. 1061
Attachment 3
Schedule for Auxiliary
Building Underpinning
(sheet 1 Of 2)

X

Jim Betts

Telephone call

For your info

S. E. Afifi
A. Boos
R. L. Castleberry
L. A. Dreisbach

BY P. A. Martinez OF Bechtel PM

TO G. S. Keeley OF CPCo PM

DATE September 26, 19 78 TIME

SUBJECT RECORDS ON REMOVAL OF NATURAL SANDS

JOB NO 7220, MIDLAND 1 & 2

D. R. Johnson
J. F. Newgen
J. Milandin
W. G. Moring

The call was made to update Keeley on our search for records relating to removal of the natural sands. This search had been started as a result of the April 1978 FSAR question 362.2 which asked for a discussion of the methods employed in mapping and removing the sands under Class 1 structures and beneath non-Class 1 structures if their failure could endanger the adjacent Class 1 structures.

We have records to show that the sand was removed under the main plant power block and under the service water pump structure. From the present boring program it appears that there are no natural sands under the diesel building. We have not so far been able to find records on the tank farm north of the power block or the service water piping or the Class 1 electrical duct runs. We are still reviewing Field Engineering records and expect to be complete with this in about two weeks.

This is not true.

Keeley indicated that Consumers Power intends to discuss this record search with the NRC today. We think that is a good idea to brief them although we do not see it as a major problem yet, since we have so far not encountered any soft natural sands under the Class I structures or components. The FSAR question will be answered when the present boring program results have been evaluated.

Should be complete in Nov.

PAM/pp

P. A. Martinez

AAO-522

TO Dc

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

MEETING NOTES NO. 907

MIDLAND PLANT UNITS 1 AND 2

CONSUMERS POWER COMPANY

BECHTEL JOB 7220-101

DATE: January 23, 1979

PLACE: Midland Jobsite

SUBJECT: Meeting of the Diesel Generator Building Task Group

ATTENDEES:

Bechtel Engineering	Bechtel Construction	CPCo
K. Wiedner	A. Boos	G. Johnson
C. McConnel	J. Betts	*R. Wheeler
B. Dhar	S. Kirker (QC)	
R. Marl	*W. Netzela	
*G. Richardson (QA)		
W. Jones (Cost and Schedule)		
*J. Wanzeck (Geotech)		
S. Afifi (Geotech)		
*R. Brown (Clark, Klien and Assoc.)		

*Part-time

PURPOSE: The meeting was held at the Midland jobsite to review engineering and construction progress on the diesel generator building settlement problem, and to discuss action items initiated in the January 4, 1979, meeting in Ann Arbor. The next meeting will be held on Wednesday, February 7, 1979 in the Ann Arbor office.

The following notes document the discussions on the agenda items.

ITEMS DISCUSSED:

1) Visit to diesel generator building and turbine building:

The diesel generator and turbine buildings were visited to witness the construction progress to date. Engineering expressed concern that some settlement markers and piezometers were not being protected as they should be. Construction stated that they would check on this to ensure adequate protection is provided.

2) Amendments to January 4, 1979, meeting notes:

It was agreed that the last sentence on Page 4 of Meeting Notes No. 897 should read, "The new schedule dates are listed in Item 5."

Construction discussed Action Item 19 from Meeting Notes No. 895. It is construction's intent to defrost only the first 15 feet outside the east and north walls of the diesel generator building below el 634'-0". (No frost protection has been provided in this area due to excavation for the duct bank and installation of the rods.) All other areas originally had 3 to 4 feet of granular material for frost protection.

No other amendments were made.

3) Review of prior action items:

Actions items from the January 4, 1979, meeting were reviewed with the following current status:

Action Item 1: It was agreed that as-built drawings showing embeds will be complete by March 1, 1979. However, this is an engineering function and the action item is closed as far as the task group's responsibility is concerned.

Action Item 2: This action item is closed. The 3/4-inch diesel generator model has been started. The total manhour estimate is 2,150 hours. The key to completion of the model will be the steady flow of information from both engineering and construction. Because construction wants the model as soon as possible, cost and scheduling agreed to review the current schedule and report by the next task group meeting when the model can be sent to the jobsite.

Action Item 3: Complete. DCN 5 to Drawing C-1040 was issued on January 17, 1979.

Action Item 4: Closed out. A block wall has been used as a form for the concrete corbel.

Action Items 5&6: Engineering is currently coordinating a drawing on design effects of the counterforts on the plant. However, CPCo indicated (Serial CSC-3766 dated January 18, 1979) that the counterforts will have to be cut back to behind the service water lines. It was agreed that no door trim bar will be provided and that the counterforts will be cut back as required by CPCo. This closes out Action Items 5 and 6 from Meeting Notes No. 897.

Action Item 7: This action item was closed by letter, BEBC-2627, sent January 4, 1979, regarding purchase of steel brace material.

Action Item 8: Drawing C-1040 was issued on January 10, 1979, showing corbel design. Drawing C-1142 was issued January 16, 1979, showing the design of the steel braces. The counterfort design will be issued by January 29, 1979. It was decided that a steel brace would be used in lieu of the counterfort at column line 8.0 because steel braces will be easier to remove.

Action Items 9&10: Initial form design has been submitted to project engineering. However, further information has been requested from construction. The reforecast date for engineering review of form design is January 29, 1979.

Action Item 11: Closed out. Waiting periods at surcharge hold point will remain as shown on Drawing C-1141.

Action Item 12: Geotech contacted the soil consultant regarding defrosting. However, more clarification is required. Geotech agreed to contact the soil consultant again to determine if defrosting of the frost protection is required prior to surcharging. The present construction plans are for defrosting the entire north side and 15 feet ouside the east wall prior to surcharge. No special frost breakup or defrosting is planned for the south and west sides of the diesel generator building where 3 feet of sand is already placed for frost protection. Breakup of the frost will take place because of work in the area.

Action Item 13: Complete. Drawing C1040 was issued January 10, 1979, showing instrumentation protection.

Action Item 14: Complete. Drawing C-1040 has been issued showing the cutting of the condensate lines.

Action Item 15: Pipe profile data has been completed for one condensate line only. However, project engineering must get Goldberg-Zoino-Dunnicliff & Associates (GZD) to convert this data to elevations. Construction inquired as to whether all condensate lines have to be monitored and if so, how often? It was agreed that, due to the closeness and similiarity of the lines, only one line needs to be monitored after surcharge steps IV, VI, and VII shown on Drawing C-1141 are completed. Engineering will revise Drawing C-1141 to show this. Project engineering will also contact GZD on monitoring the condensate line after the hold points.

Action Item 16: Still open. Project engineering will show circulating water pipe ovality reading requirements by February 15, 1979.

Action Item 17: This action item closed. The present profile accuracy and frequency are adequate.

Action Item 18: Still open. A letter confirming that the resident engineer is to read strain gages will be sent by January 26, 1979. Geotech discussed the work done by GZD and indicated that readings performed by GZD were not in the original scope of work. Geotech agreed to inform engineering of the necessary budget changes required for this extra work. All instrumentation readings will be taken over by Bechtel. Soil anchors will be read by field engineering. The resident engineer will read the strain gages, and the Bechtel geology group will read the piezometers. Geotech agreed to confirm that support from the geology group will be obtained in reading the piezometers. It was agreed that plots will be kept up-to-date by whomever is taking the readings.

Action Item 19: A preliminary schedule has been issued for coordination. The schedule will be sent by February 2, 1979. The forecast date for a revised cost estimate is still good.

Action Item 20: Complete. Drawing C-1040 was issued as Q-listed on January 10, 1979.

Action Item 21: The responses to FSAR Questions 130.21, 362.11, 362.12, and 362.13 were discussed. Project engineering stated that their response to Question 130.21 will be ready for the February 14, 1979, FSAR amendment. Geotech stated that the remaining questions will have draft answers by January 26, 1979. It was agreed that the draft answers would be distributed for coordination by February 2, 1979, so that the February 14, 1979, amendment can be met.

Action Item 22: Closed. QA has obtained CPCo's concurrence on our proposed date of response to Gallagher's questions.

Action Item 23: Still open. The draft answer to Gallagher's questions is scheduled to be ready by February 20, 1979.

Action Item 24: Still open. However, project engineering stated that they will need soils boring reports from geotech for the next MCAR 24 interim report. Geotech agreed to have the report on the diesel generator building borings ready by January 31, 1979.

Action Item 25: Still open. Engineering has drafted meeting notes for the December 4, 1978 meeting with the NRC. These notes have been coordinated with geotech. However, comments are still required from San Francisco geotech and the legal department. These notes are estimated to be issued by February 2, 1979.

Action Item 26: Engineering discussed settlement data sketches and indicated that some milestone construction dates have been included. It was agreed that dates for the following items should be included:

a. Pond fill) placement removal
b. Foundation placement
c. Wall placement
d. Slab placement
e. Duct bank releases
f. Frost protection placement
g. Structural sand placement
h. Surcharge placement
i. Pedestal

Project engineering also agreed to develop a time-history settlement plot for points on the diesel generator building.

Action Item 27: Complete. Construction joint information has been provided.

Action Item 28: Engineering has given verbal notification on the required number of strain gages. Construction is experiencing difficulty in obtaining these gages. It was agreed that the surcharge operation would not be held up due to the inability to get these gages. Engineering agreed to investigate the final location and use of the strain gages.

Action Item 29: Complete. Specification C-83 was reviewed by construction with comments transmitted via phone on January 11, 1979. Construction indicated there may be a problem jacking some tie rods due to interferences, but stated they could get the required tension with the turn-of-the-nut method. Engineering agreed to investigate this problem.

Action Item 30: Complete. The pipe interference has been resolved.

Action Item 31: Geotech is presently developing calculations on liquifaction between the diesel generator building and the turbine building. Geotech will resolve this documentation problem with engineering.

Action Item 32: Closed. No inclinometer has been installed nor was one committed to be installed.

Action Item 33: Still open. Construction has concluded that turbine wall deflection cannot be determined by optical means. No final method has been developed yet. Construction will resolve this with engineering.

4) Review of construction progress:

Construction progress was reviewed. The steel braces are being installed. The corbel concrete block form is almost complete. Concrete placement for the corbel is expected to take 1 week to complete after all reinforcing has been installed. Construction of the counterforts is expected to start this week. Construction asked if the level of surcharge could be held to ±1'-0" in lieu of the required ±6" at the surcharge hold points. Geotech will discuss this with the soil consultant, if necessary, and resolve this item with engineering. Construction also inquired whether grout could be used in lieu of steel shims for shimming the steel braces. It was agreed that this was an acceptable option. Project engineering will determine if this grout needs to be removed after surcharging is complete.

5) Acceptance criteria for preload operation:

The methods of providing an acceptance criteria for the surcharge operation was discussed. Geotech stated that the acceptance criteria will be based on the settlement records and not on additonal borings or density tests. Settlement rebound will provide data values for use in seismic analysis of the diesel generator building. It was agreed that geotech will provide its philosophy on acceptance for deflection, bearing capacity, and seismic analysis in draft form to engineering prior to the next task group meeting. Consultant review of this will be required.

It was agreed that existing density tests should be plotted for the entire plant area. Construction will plot all field density tests above el 619'-0" for the entire plant area.

The acceptance of the Q-listed diesel fuel lines from the storage tanks was discussed. No surveillance is being provided on these lines. Construction stated that, from a construction cost standpoint, they prefer to abandon these lines and put in new ones if necessary. An initial survey was performed on the line at the time of installation so deflection or settlement of the line could be determined by uncovering the line at any future point. It was agreed that no action is required at this time.

6) Corrective action on transformer pad and condensate storage tanks:

Construction stated that they prefer to drive piles or place caissons under the condensate tanks in lieu of surcharging the entire area. This region is a primary area for construction access. Geotech agreed to supply preliminary pile capacity data to engineering by January 26, 1979. Engineering agreed to have a preliminary design ready by the next task group meeting.

Corrective action for the transformer pads was discussed. It was agreed that, because settlement on the Unit 2 transformers was minimal, no action is required. However, the soil consultant has recommended that 5 to 10 feet of surcharge plus the equivalent weight of the transformer be placed in the Unit 1 transformer pad. Construction prefers to use concrete blocks in lieu of fill in this area. Engineering agreed to evaluate the proposed method of using concrete blocks and establish required limits prior to the next meeting. It was also agreed that construction will plug the holes drilled in the bottom of the transformer basins.

The field-erected tanks located in the tank farm were also discussed. CPCo expressed concern that any corrective action which is necessary may not be initiated early enough to meet the present turnover schedule. It was agreed that geotech and engineering would investigate the status of all the tanks in the tank farm area and report at the next meeting.

It was also agreed that project engineering will investigate the necessary corrective action on the guardhouse and the pipe bridge and report the status by February 6, 1979.

7) Establish plan for investigating causes:

Questions developed by project engineering were discussed. Project engineering stated that answers to these questions would assist in developing a response to Gallagher's concerns. It was agreed that the questions would be answered prior to the next task group meeting with responses forwarded to project engineering.

Quality assurance distributed a list of possible causes for the settlement problem. It was agreed that all members of the task group will review this list and provide comments by the next task group meeting.

It was also agreed that all members of the task group will read FSAR Section 2.5 prior to the next task group meeting in order to identify additional necessary changes.

ACTION ITEMS:

Cost and Schedule	1)	Will investigate progress on the diesel generator building model and report by February 7, 1979, when the model can be sent to the jobsite.
Project Engineering	2)	Will issue counterfort design by January 29, 1979. DCN 4 TO DWG C-1040 2-6-79 DCN 3 TO DWG C-1141 2-6-79
Project Engineering	3)	To show steel brace in lieu of a counterfort at column line 8.0. FCK-1843 DATE - 2-6-79 2024 R. FSK-CT2-39 SHT 1&2
Project Engineering	4)	Will review the double wood form design by January 29, 1979. REVIEWED / LETTER TO GEOTECH 2-6-79 FOR BEARING PRESSURE)
Geotech	5)	Will contact the soil consultant regarding defrosting of the frost protection prior to surcharge, or defrosting surcharge after hold points.
Project Engineering 2-21-79	6)	Will revise Drawing C-1141 to show monitoring requirements for the condensate line at hold points IV, VI, and VII by January 26, 1979. Project engineering will also contact GZD regarding this requirement.) need to revise profile + date future need. Markup in to FORECAST 2-21-79
closed Project Engineering	7)	Will obtain pipe profile elevations from GZD. completed.
Project Engineering 2-21-79	8)	Will show circulating water ovality reading requirements on Drawing C-1040 by February 15, 1979. Mark up into drafting Forecast 2-21-79
Geotech closed	9)	Will notify engineering of necessary changes required for the GZD budget for the expanded scope.
Geotech	10)	Pond Jan 12 ... Will confirm that the geology group will assist in taking piezometer readings.

Cost and Schedule	11)	Will issue the engineering and construction schedule for the diesel generator building by February 2, 1979.	
Cost and Schedule	12)	Will develop a revised cost estimate by February 1, 1979.	
Geotech/ Project Engineering	13)	Will have draft answers to FSAR questions out for coordination by February 2, 1979.	Review req
Project Engineering	14)	Will prepare a draft answer to Gallagher's questions by February 20, 1979, or 2 weeks after the NRC exit meeting.	—1065
Project Engineering	15)	Will prepare the next MCAR interim report which is due on February 16, 1979.	
Geotech closed	16)	Will complete the soil the soil borings around the diesel generator building by January 31, 1979, for the MCAR report.	paper work
Project Engineering	17)	Will issue meeting notes on the December 4, 1978, meeting with the NRC after receipt of comments from geotech and the San Francisco legal department.	SM
Project Engineering	18)	Will revise settlement drawings to show more milestone dates. (See Page 5 regarding the discussion of Action Item 26 from Meeting Notes No. 897.)	TIME-EVENT-HISTORY DEVELOPED. FINAL PRESENTA- HAS NOT BEEN DE
Project Engineering	19)	Will develop a time-history settlement drawing for points on the diesel generator building.	DWG COMPLETE
Project Engineering	20)	Will reinvestigate the turbine building monitoring program especially the locations and necessity for strain gages.	LOCATIONS REV MARK-UP IN DRAFTING 2-21-79
Project Engineering	21)	Will investigate the problem of using the turn-of-the-nut method for tie rod tensioning where the tension jack cannot be used.	2-20-
Geotech	22)	Will resolve documentation problems on liquifaction by providing calculations to engineering. Complete unbar thing	
Construction	23)	Will resolve the turbine building wall deflection monitoring method with engineering.	—
Project Engineering/ Geotech	24)	Will resolve whether fill tolerance can be increased to $\pm 1'-0''$ in lieu of $\pm 6''$.	

AGREED MARK-UP IN DRAFTING 2-21-79

Project Engineering — 25) Will determine whether grout used for shimming needs to be removed after the surcharge operation. off the tank surcharge
ON GOING QUESTION, NO NEED TO TRACK

Construction — 26) Will plot all field density tests above el 619'-0" for the entire plant area.

Geotech — 27) Will develop a philosophy of acceptance for the surcharge operation and give a draft of this to project engineering by February 2, 1979.

Geotech — 28) Will supply engineering with preliminary pile capacity data for the condensate tanks by January 26, 1979.

Project Engineering — 29) Will have a preliminary condensate tank foundation design using piles by February 7, 1979.
PILE INVESTIG 100 PIPE 1/4" PREL SCHEME SENT TO FIELD FOR ... 2-9- 2752-2705

Project Engineering — 30) Will evaluate the method of placing concrete blocks on the Unit 1 transformer pad and establish necessary limits by February 7, 1979.

Construction — 31) Will plug holes drilled in the transformer basin.

Project Engineering/ Geotech — 32) By February 6, 1979, investigate the status of the tank farm regarding necessary corrective action or design changes to meet the turnover dates to CPCo.
CONSULTANT RECOMENDATION BUILD IT FILL WITH WATER - WATER.

Project Engineering/ Geotech — 33) Will report status of any corrective action necessary on the guardhouse and pipe bridge by February 6, 1979.
PIPE BRIDGE ... NEED ...

Construction/QA/ Geotech — 34) Provide responses to project engineering's questions by February 6, 1979, for our answer to Gallagher's questions.

Task Group — 35) Review and comment by February 6, 1979, on the potential cause list developed by QA.

Task Group — 36) Review and comment on FSAR Section 2.5 by February 6, 1979.

R J Marl

R.J. Marl

RM/bob
1/25/6

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Bechtel Associates Professional Corporation

Inter-office Memorandum

To	L. H. Curtis	Date	26 November 1979
Subject	Midland Units 1/2-Job 7220-001 Plant Area Fill - Notes for Meeting 25 October 1979	From	S. S. Afifi
		Of	Geotechnical Services
Copies to	1320, 3310 [redacted] S. L. Blue H. H. Burke/W. R. Ferris J. O. Wanzeck	At	Ann Arbor 10 D 5 7220-79-261

Attached are the meeting notes for the meeting held in Ann Arbor on 25 October 1979.

S. S. Afifi

JBG/nm
Attachments

CONSUMERS POWER COMPANY
RECEIVED
DEC 3 1979
FIELD QUALITY ASSURANCE
MIDLAND, MICHIGAN

Midland Units 1/2
Job 7220-001

MEETING NOTES

DATE: October 25, 1979

LOCATION: Ann Arbor Office 10 D 5

SUBJECT: Problems associated with the plant area fill at the Midland Site.

ATTENDEES:

Bechtel

S. S. Afifi
J. Davie
P. K. Chen
W. R. Ferris
A. Mohan
J. B. Givens
B. C. McConnel
W. C. Paris, Jr. *
S. L. Lo *
J. Hook *
C. Farrell *
M. Rothwell *
B. Dhar *

Consultants

A. J. Hendron
C. Gould *

CPCo

D. Sibbald
[redacted]
T. Cooke

*Part-time

DISCUSSION:

The meeting was led by P. K. Chen and centered around the following topics:

1. Diesel Generator Building

A. Mohan provided background information. The predicted future settlements were discussed. The fill is between foundation el. 628 and el. 600-605 with grade at el. 634. In addition to building and pedestal markers, borros anchors and settlement platforms have been installed for settlement monitoring and sondex for rebound monitoring. Maximum observed settlement is at the southeast corner and the minimum is at the northwest corner. Estimated settlements were given for various "zero-time" dates. The maximum ratio between settlements was about 2 for these dates. The date at which the final surcharge of 20' was completed was assumed to be realistic (Case 4). It was pointed out that the predicted settlements are conservative because of the inherent assumption that the surcharge will continue although it cannot be shown at this time how conservative they are. Based on building settlement markers, the predicted settlement for 40 years would be about 0.5 inch at the northwest corner and 1 inch at the southeast corner. Settlement platforms and building and pedestal markers show higher observed settlements than Borros anchors. Concern was expressed by A. Hendron about the somewhat higher settlement rate which is occurring after rebound for reference (deep) borros anchor No. 62. Hendron requested to look at the recent data immediately to see if this trend is continuing. (During the meeting, the data was updated and it was demonstrated to Hendron that this high settlement rate had leveledoff). Hendron stated that we should not have any lag time between the data reading date at the field and submittal to Geotech. Hendron said that it would be prudent to use settlements of 0.5 inch in the northwest corner and 1.5 inches in the southeast corner and it was agreed that the project should proceed in their evaluation of utilities and structures with 1.5 additional inches of total settlement and 0.75 additional inches of differential settlement. Based on the data the differential settlement can be considered rigid body rotation from north to south.

2.0 Settlement of Plant Structures

Background was provided by P. K. Chen. It is necessary to confirm the settlement predictions presented in FSAR Figure 2.5-48 in light of the data obtained from the diesel generator building surcharge loading. Settlement parameters were back-calculated from the diesel generator building settlements measured during the preload program. Concern was expressed by K. Wiedner about the high settlement parameter back-calculated for el. 584-603 but Hendron said that this stratum has never been questioned before and is not of concern. P. K. Chen added that the layer is thin and the parameter will therefore have a negligible effect on the settlement. The settlement predictions were verified by (1) comparing soil parameters which were used previously to those which have been back-calculated and (2) by comparing the measured settlement for the reactor with the settlements calculated using the back-calculated parameters.

3.0 Piping and Duct Banks

It is necessary to predict the long term settlements of the safety-related piping and duct-banks in the plant area fill. The absolute movements from the GZD profiling are in question because the reference elevations used were questionable. The pipe stress group has not determined whether or not the existing stresses in the pipes generally exceed the allowable. B. Dhar said that, in general, the pipe stresses for straight pipes don't exceed the allowable, but the stresses at elbows and bends do. K. Wiedner said that he had already suggested that the project request the field to cut the pipes at certain points to check stresses. The hypothesis was presented that the pond rise is causing "structural breakdown" of the soil and is therefore causing settlement. Discussion centered around the settlement of the fill and till due to dewatering. It was estimated that the fill settlement will be 0.5 inch to 1 inch due to dewatering and the till settlement will be 1.8 inches and will be uniform. Hendron said that the number for the till sounds high. (After the meeting, Hendron said to calculate only the settlement due to compression of the till above the building foundation elevation because this is what contributes to the differential settlement).

4. Temporary Dewatering and Underpinning of Auxiliary Building

W. C. Paris provided background information for dewatering. Wells have been installed on the east side of the Unit 2 containment and west side of the Unit 1 containment for the purpose of dewatering during underpinning of the auxiliary building. It was intended to start dewatering as soon as possible to see if piezometers to the north of the turbine building will react and if in fact more wells will be necessary in this area. C. Gould said that he is concerned about the seepage path between the utility tunnels (between reactors) into the work area. S. Afifi and B. Dhar discussed having a meeting with Loughney to discuss temporary dewatering before underpinning is to proceed. S. Lo provided background information for underpinning. The plan is to place caissons under the turbine building first and continue into the auxiliary building. C. Gould said that all subcontractors involved in underpinning should be able to describe the procedure on paper before construction begins to ensure that the job runs smoothly. Gould said that he would like to meet with the underpinning contractor to make sure that they are aware of the risks in the procedures and to review the procedures he proposes. Gould indicated that the structural goal is to provide caissons uner the wing wall, and the turbine building is of secondary importance. Gould suggested that the subcontractor should be required to assume at least partial liability by cash settlement, insurance, or other means. S. Lo said that because of overstressing near the wing wall and control tower juncture he wants to know what support the soil offers. Hendron said to assume none. B. Dhar said that engineering should (1) refine calculations to consider 100 $ft.^2$ ground loss and (2) increase tension capacity by using cables or some other means.

5. Permanent Dewatering

W. C. Paris provided background information. Permanent dewatering has been proposed as a solution to the problem of possible liquefaction of backfill sands. Paris said that some borings drilled along a line perpendicular to the discharge lines near the reservoir showed 5 to 10 feet of sand which was not discharge line backfill. Paris proposed consideration of a cutoff wall near the pond running parallel to the south edge of the diesel generator building and following the pond to the service water pump (SWP) structure. Pump tests will be run at the location of the east discharge line and the SWP structure. W. R. Ferris stated that the consultants and the NRC are aware of permanent dewatering and not the cutoff wall. This should be considered. Discussion centered around the sudden change in plan to the cutoff wall. Ferris said that all consultants including Peck and Loughney should be notified. Chen asked Hendron what the drawdown level is to prevent liquefaction. Hendron suggested that the same procedures that have been used already be used to calculate the safety factors against liquefaction for different drawdown levels. B. Dhar said that the seismic criteria is 0.12 g but this may raised to 0.20 g. Chen asked Hendron if he thinks we can prove that the site is safe against liquefaction if shown based on the borings we have drilled (which are a limited number) . Hendron said that if 90% of the points are safe then it is probably all right, but you have to convince the NRC of that. Hendron said that one of the reasons for permanent dewatering was to prevent liquefaction if the criteria was changed to 0.20 g.

HIGHLIGHTS AND OBSERVATIONS FROM CONSULTANTS MEETING
REGARDING DIESEL GENERATOR BUILDING SETTLEMENTS
11/7/78

At the subject meeting the consultants said that the only two alternatives available were as follows:

1. Densify the material which is already in place.
2. Remove the fill and refill the area with adequate backfill.

Dr. Peck felt that at this point in time the only solution to the problem is to pre-load the building area. In supporting the pre-loading effort, the following items are critical in order to get the work underway as soon as possible:

1. Free up the building from the underground utilities which may be restricting building settlement.

2. Soil monitoring instrumentation needs to be in place prior to commencing with the pre-load.

The consultants were asked how long it would take to successfully pre-load the diesel-generator building area. They answered that they did not know at this point in time exactly how long it would take. However, if the instrumentation which is on the critical path for getting the work underway were in place and the soil could be monitored, the consultants would be able to give us a more definitive answer.

Bechtel noted that they had made five months available in their schedule for pre-loading. The consultants were asked if there were any restrictions on when the pond can be filled. The consultants said that they preferred to have the soil saturated after the pre-load had been applied. By not saturating the soil, the consolidation process would be accelerated due to the absence of the water in the void areas. The consultants also noted that they would like to see the area saturated with water to the maximum pond level before the pre-load is removed from the diesel-generator building area.

The consultants were asked the question of how much settlement can be expected as the result of the pre-loading process. They answered by saying that they could not be sure at this time, given the different kinds of soil that are under the building. However, if they were pressed into giving a guess or an estimate, they felt that the total settlement could range from 6" to 18" as a result of the pre-load.

The consultants recommended grouting under the footings prior to releasing the duct banks from the footings. The grout would dampen the effect of any instantaneous settlements which may occur in the areas where there are gaps between the footings and the soil. Consultants also recommended grouting between the footings and the soil below after the pre-load has been removed from the building area. The consultants also were made aware of the fact that there are some sands under the northeast end of the diesel-generator building which exhibit properties which may be conducive to liquefaction. This problem will have to be studied in great detail in order to determine if any remedial action is necessary to correct this problem. The consultants will review the situation to determine if any further action is required. Regardless of the outcome of the liquefaction question, the pre-load will still be required.

The pre-load will extend 20 feet out away from the walls of the building and slope down at the angle of repose of the sand which will be used for the surcharge material. The load will be applied in five-foot increments and instrumentation will be monitored to determine what effect the pre-load is having on the soil below the building. The maximum height of the surcharge was restricted to 20 feet above grade.

11-8-78
RMWheeler/pp

CONCERNS FOR PRELOADING

1. What is Bechtel's basis for recommending pre-load?

   a) Is it based on the results of the laboratory tests?

   b) Is it based on a structural analysis of the building and the underground utilities?

   c) What results does Bechtel expect go get as a result of pre-loading? (settlement)

   d) What is the maximum permissible differential settlements which can be allowed?

   e) Can the desired results, i.e.; near ultimate settlement during a relatively short period of time be obtained without preloading the building?

   f) Have the parameters been defined which may cause deteriment to the buildings and utilities?

   g) Under this preload concept - what will be the bearing capacity of the soil after preloading?

   h) How will the soil bearing capacity be determined after preloading?

   i) If the attained value is less than the design value, how will Bechtel resolve this problem?

   j) Have the consultants commented on the effect of the preloading on the underground facilities or is this not in their "scope"?

   k) If this is not in their scope, has Bechtel considered bringing in an outside consultant to look at this problem?

   l) We see new cracks and the proprogation of old cracks in the East wall, what is the criteria for acceptance? 40 mils, 50 mils?

2. Continue with construction on building

   a) Will the building be built to compensate for settlements?

b) What is to be gained in terms of schedule by continuing construction at this point?

3. Filling the pond

a) Will this help accelerate the settlements?

b) Could this complicate other repairs if preloading turns out to be unacceptable?

c) What can be expected as a result of the higher water level to be the effect on other structures?

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To: File

From: BHPeck, RMW

Date: December 15, 1978

Subject: MIDLAND PROJECT GWO 7020 - MEETING WITH CONSULTANT REGARDING DIESEL GENERATOR BUILDING PROBLEM ON DECEMBER 8, 1978
File: B3.0.3 Serial: CSC-3699

CC

Consumers Power Company

INTERNAL CORRESPONDENCE

Those in attendance were:

Dr. Peck, Consultant
Gordon Tuveson, Bechtel
Sherif Afifi, Bechtel
RMWheeler, Consumers
WFerris, Bechtel

1. Diesel Generator Building preload

There are basically three areas discussed during the meeting. The first area which was discussed related to the Diesel Generator Building preload. Second area discussed was relative to the Consumers Power letter, Serial 2663, to Phil Martinez regarding observations during the NRC meeting of December 4, 1978. The third area discussed was status of and future actions for plant area building structures founded on backfill.

a. Turbine buildin The magnitude of the loads exerted on the wall resulting from the preload between ~~Diesel Generator Building Preload Details - Gordon Tuveson, of Bechtel, discussed with Dr. Peck the magnitude of the loads exerted on the Turbine building wall resulting from the preload between~~ the Diesel Generator Building and the ~~Turbine Building. Dr. Peck indicated that the loads~~ as previously calculated by Bechtel were quite conservative. Therefore, the horizontal loading on the wall could be reduced for all practical purposes.

b. ~~The question of breaking up the mud mat between the Diesel Generator pedestal and the outside structure was discussed. It was decided that~~ the mud mat did not need to be broken up. ~~Dr. Peck felt that~~ and this action would not impair the results of the preload.

c. ~~A question was raised as to whether it would be advantageous to~~ Take measurements during removal of preload to determine if rebound was occurring. ~~Dr. Peck felt that this information~~ may be useful later on in evaluating the condition of the soil.

The possible avenues of investigation after preloading was discussed. Dr. Peck said that he would like not to undertake any additional borings or test pits. He would like to argue that we have in essence rebuilt the foundation under the building and that the information gathered during preload substantiates the acceptability of the material under the building and the structure itself. However, if further investigation is required, Dr. Peck felt that a new boring program should not be undertaken. He felt that this method of investigation would raise more questions that it would answer. He would lean more toward the use of test pits to develop the kind of information we may be required to develop.

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~~The possible action after preloading was discussed. The two options discussed were 1) pouring a continuous reinforced mat between the Diesel Generator pedestal and the outside Diesel Generator structure and 2) underpinning the pedestal and the outside structure. Dr. Peck indicated that he would not consider underpinning an option and it should be ruled out as such. If further action is required, Dr. Peck would lean toward utilizing the mat concept. Dr. Peck felt that bearing capacity would not be issue. He felt that laboratory tests and other data would justify good bearing capacities.~~

2. ~~If~~ CPCo Letter Serial 3663 to Phil Martinez.

a. ~~Item 1 - The Consumers Power letter concludes that~~ There is a possibility that the condensate lines below the North and South wall of the Diesel Generator Building may be holding up the building and not allowing free settlement of the building. ~~This item was discussed and it was concluded that~~ If the lines and the encasement did restrain the settlement, ~~the restraint should be removed. This would be accomplished by~~ cutting the pipe and encasement on either side of the footing and allowing space so ~~that~~ free settlement could occur would be necessary.

b. ~~Item 2 - The question of the necessity~~ To map the cracks on the various parts of the Diesel Generator Structure ~~was discussed.~~ ~~that~~ It would be desireable ~~to~~ have this information in determining what the effects of the preloading were relative to the building.

c. ~~Item 3 - The criteria for determining whether the preload had given us the desired results was discussed. More specifically, the question of acceptance criteria after removal of preload was discussed. Dr. Peck indicated that he~~ The consultant would have to look at the load settlement curves and the time rate of settlement curves to determine if we had reached a point where the preload could be removed.

3. ~~Next~~ Status of the other plant area buildings founded on backfill and possible future actions discussed.

a. ~~Item 1~~ The Unit I Transformer Pads

Status: Two inches of settlement was reported prior to the transformer monitoring program. Since September 16, 1978, there has been ½ inch settlement occurring in this area.

Possible Actions: Depending on the amount of flexibility in the overall transformer scheme, preloading of the area may be required. ~~It was noted that~~ determination of the system flexibility should be investigated to determine the effects of differential settlements. As a guideline for the preloading, Dr. Peck indicated that approximately five to ten feet of sand over this area would provide the desired results.

b. ~~Item 2~~ Tank Farm Area

Status: The soil conditions in this area are generally better than those conditions observed near and around the Diesel Generator Building.

Possible Actions: In order to accelerate any settlements which may occur after installation of the tanks, if was felt that retaining water in the tanks after hydrotests may be desireable. It was noted that water quality considerations would have to be addressed, if the hydro water was retained in the tanks for a considerable period of time. During the period in which the tanks would be filled, monitoring of the incoming piping and the tanks support ring ~~and~~ would take place. Due to the better soil conditions in this area, the tanks should be released to be constructed.

c. ~~Item 3~~ The Condensate Tanks

Status: The support rings have been placed and have settled approximately 3/4 inch since monitoring has been employed. A review of the boring logs and the observed settlements indicate that the material in this area is quite similar in properties to that of the soil under the Diesel Generator Building.

Possible Actions: (1) ~~The first possible action~~ The first possible action would be to build a tank and load the tanks with water to accelerate localized settlements. (2) The other alternate would be to preload the area to accelerate settlements prior to constructing and utilizing the tank. It was noted the piping associated with the tank was attached to the tank bottom and stresses and possible warping of these lines could occur as a result of tank settlements. It was concluded that this area and this question should be looked at in greater detail to determine which method would provide the best results. A decision regarding this matter is to be made by Bechtel prior to February 15, 1979, since tank construction is to begin in the spring of 1979.

d. ~~Item 4~~ Guard House

Status: Borings in the area indicate the material under the yet to be constructed basement mat of the building is loose and similar to materials under the Diesel Generator Building.

Possible Actions: ~~Three possibilities were discussed.~~ (1) The first being modification to the floating basement slab to accommodate settlement. (2) A second possibility discussed was build potential caissons. (3) A third possibility discussed was the use of H piles under the building. It was decided that H piles at a depth of approximately 40 feet may be the best solution to minimize the affects of the poorly compacted material under the building.

e. ~~Item 5~~ Pipe Bridge

Status: Borings in this area indicate the presence of some unacceptable foundation materials.

Possible Actions: Bechtel was planning to place the abutements on piles to minimize settlement problems.

8. ~~Item 6~~ Radwaste Building

Status: Borings have been taken in the area and indicate that material for the most part under the building is good. Settlement observed in the building have been on the order of ½ inch or less which reconfirms the presence of well compacted material.

Possible Actions: Area will be monitored through the normal settlement program. Based on the information that has been developed, it appears that no action will be required to modify or change the building.

9. Item 7 Service Water and Circulating Water Retaining Walls

Status: The retaining walls, which were constructed on backfill material, have settled significantly more than those which were founded on undisturbed till material.

Possible Actions: Except for continuous monitoring of the program, it was felt that no other action was necessary. Only if undesireable movements of the walls were observed would any remedial action be undertaken.

PROBLEM: "UNCOMPACTED BACKFILL" Plant Area-does not Include Dikes

	IS	IS NOT	DISTINCTION	CHANGES
WHAT?	D/G Bldg.	Power Block	Recent Plant Area Fill	Use of both C-210, C-211 Prior - used only C-210
	X-Former Pads	Evaporator Bldg	Not part of Dike/ North Plant Area Fill	Sand & clay vx clay alone
	Condensate Tanks	Cooling Tower	Fill placed during different time periods	Two contractors - Bechtel & Canonie
	Radwaste Bldg*	Steam Tunnel	Last ares to be backfilled	Bechtel used C-211
	Tank Farm*	Service** Water	Settlements seem to occur in spread type footings	Large equipment to large & small equipment
	*Not as significant or wide spread as other areas	Circulating Water	Excavation/Re-excavations (significant areas	Use of ramps/temporary fill
	Guard House	**Problem exists with sands around structure but not under		
WHEN?	Occurred After 1975	Prior to 1975	Slowdown of 75 with personnel changes	Specification interpretations by didfferent individuals
			Late in jobless emphasis on civil work	deletion of 4" lift requirement
			Cooling Pond Filled	Urgent need to see work completed
				Sand/structural fill used together with clays
				Qualification of personnel may have changed
				Differing weather conditions
				Rebar problems occurred

PROBLEM: "UNCOMPACTED BACKFILL" Limited to Plant Area - does not Include Dikes

	IS	IS NOT	DISTINCTION	CHANGES
EXTENT?	Plant Area Fill AFter 1975	Plant Area Fill prior to 1975	Sand incorporated in fill	Sand/clay interfaces - softing of clays due to watering
	elev 612' & above	Below elev 612'	Smaller areas of fill	Larger lift thickness for equipment and harder to control lift thickness
	Most significant problem area south & southeast of Turb Bldg		Most extensive examination re-excavations	Introduction of smaller equipment
WHERE?		Glacial Till Undisturbed	Require handling & Placement by Equipment	
	Backfill (clay) (sands)	Natural sands	Clays - N/W Plant dike sand/clay rest of area	More mixing & material interfacing
		Backfill Concrete	Area exposed the longest during construction	More winters
		North/West Plant Fill		

Possible Causes

Test	Yes	No	?	Cause
Use of different Specification	X			Problem is only associated with areas which used Spec C-211
Recent Work		X		
Not Part of Dike/Plant (N/W) Area			X	
Placement of Fill during different periods	X			Different personnel different equipment
Last Areas to be Backfilled	X			Schedule pressures
Occurs on spread FIGS	X			Design may be deficient
Excavations Re-Excavation	X			Most significant problem in area where most excavation/re-excavation occurred
Introduction of C-211	X			Differing requirements/people/ interpretations
Different Materials	X			Differing methods for compaction - addition of water to sands
Use of small equipment	X			Not able to compact as effectively (no test pads for small equipment qualifications)
75 Slow Down	X			Changes in personnel and discontinuing of work
Filled Cooling Pond		X		Designed to be in saturated condition
Less emphasis on civil work	X			Less supervision and inspection
Specification intrepretation	X			Relates to personnel
Larger lifts per spec.	X			Coupled with small equipment

Test	Yes	No	?	Cause
Schedule pressures	X			Complete work hastily
Personnel qualifications	X			No soils engineer on site
Smaller fill areas	X			Relates to equipment and lifts
More Freeze-thaw cycles	X			These areas filled during several winters
Weather (dry or wet) also when material was placed			X	
Removal of temporary ramps and fill	X			Uncompacted materials placed and left in large amounts
Rebar Problem occurred	X			Deals - priorities for inspection/ extent of inspection

ACTION PLAN

1. Define problem areas better by boring logs and TOPO's (PMO - work on this).
2. Define problems by elevations (use boring logs) (PMO - QA later).
3. Define difference between C-211 and C-210 (QA).
4. Define what work was done by Bechtel and Canonie (PMO).
5. Define where trenches were made (excavations) (photos, TOPO's, etc) (PMO - QA).
6. List all equipment used by a) Bechtel
   b) Canonie
   (photos, rental sheets).
7. Look at changes in personnel/qualifications (QA, PMO).
8. Look at assignments of supervision to earthwork by period.
9. Look at telecons/FCR's to spec, DR's (QA).
10. Look at specs and also photos.
11. Look at rate fill in areas where there was problems (PMO).
12. Check problem areas with completion of the year's work (freeze - thaw) do with 4.
13. Look at number of QC people assigned to soils, their time involved with soils (IR's, FE Reports).
14. Ramps - Check photos, TOPO's, compare with borings (also gravelly areas in borings) (can do in conjunction with 12, 4) (QA, PMO).
15. Review weather date for periods of problems (PMO).

X 86

To File

From BHPeck/RMW

Date December 20, 1978

Subject MIDLAND PROJECT GWO 7020 - MEETING ON DECEMBER 14, 1978 WITH BECHTEL ENGINEERING REGARDING DIESEL GENERATOR BUILDING CONCERNS
File: B3.0.3 Serial: CSC-3712

CC

Consumers Power Company

Internal Correspondence

Attendees:

Consumers Power Company	Bechtel Power Corporation
RMWheeler	CWiedner
DESibbald	RLCastleberry
CAHunt	GTuveson
	SAfifi

Background:

The purpose of the meeting was to discuss with Bechtel Engineering the results of the December 8 meeting with the consultant and the concerns expressed in the Consumers Power letter, Serial 3663. In particular, Consumers Power noted that there was much concern over whether the Diesel Generator Building was being supported by the condensate line encasement and other utilities in that area. Significant support would be detrimental to free unhindered building settlement. This conclusion is supported by the settlement profiles which indicate less settlement near the condensate line encasements. It can be concluded from these profiles, that the condensate lines may be providing a point support about which the building may rotate and not settle uniformly.

Agreements/Conclusions:

Our concerns were expressed to Bechtel and Bechtel provided their rationale for not following the consultants advice to have a building freed up from the condensate line encasement if they were restraining settlement of the building. Bechtel feels that the building will not be restrained from free settlement. It became apparent during the meeting that this issue could not be resolved with the information available. Consumers Power concluded by indicating that our concerns have been brought to Bechtel's attention and that Bechtel should address these concerns. Bechtel indicated they would review our concerns and factor them into their future plans.

105

R SHULMAN

Bechtel Associates Professional Corporation

Inter-office Memorandum

BEBC- 2286

To J.F. Newgen

Subject Midland Plant Units 1 & 2
Job 7220
Moisture Control
File: 0274

Date June 1, 1978

From R. L. Castleberry

Of Engineering

At Ann Arbor

Copies to
C-210
J. Hancock F. E. Meyer
J. Hurley
G.L. Richardson
R. Schulman

Reference: 1) Memo from G.L. Richardson to R.L. Castleberry dated 5/16/78

The purpose of this letter is to clarify the intent of controlling moisture content in the borrow areas as requested in Reference 1.

Subparagraph 12.6.1 of Specification C-210 requires ("Insofar as practicable,...") qualitative control of moisture conditioning in the borrow areas so that the soil is not "too wet" or "too dry" to be compacted with the least amount of effort after being placed on the plant fill. The only quantitative control of moisture content is specified for soil during compaction.

Insufficient moisture control may lead to considerable increase in work effort and is therefore to be avoided. But moisture content is not necessarily a measure of a soil's adequacy to act as a foundation or as backfill material. If the density of a soil meets the requirements of the specification, in accordance with the correct standard, then the soil is acceptable.

The intent of this letter is to point out that a soil with the specified density following compaction should not be rejected on the basis that its moisture content was not controlled in the borrow area. On the other hand, we do not intend to eliminate moisture control in the borrow areas because this procedure minimizes the work effort required to attain the desired plant fill density.

R. L. Castleberry

LJD/jp
5/23/78

D Horn
Please advise me on this ~~idea~~ w...

RECEIVED
AUG 16 1979
QUALITY ASSURANCE

Bechtel Power Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

August 10, 1979

CONSUMERS POWER COMPANY
RECEIVED
AUG 20 1979
FIELD QUALITY ASSURANCE
MIDLAND, MICHIGAN

BLC-7993

Consumers Power Company
Mr. G. S. Keeley
Project Manager
1945 West Parnall Road
Jackson, Michigan 49201

Midland Units 1 and 2
Consumers Power Company
Bechtel Job 7220
REVIEW of U. S. TESTING FIELD AND LABORATORY TESTS ON SOILS
Files 0614/2801

Dear Mr. Keeley:

Attached for your records is the completed report dated July 1979, entitled "Review of U. S. Testing Field and Laboratory Construction Test Data on Soils Used As Fill."

This report includes resolutions to the questions raised by Consumers Power personnel on the earlier draft report.

The report will now be sent to the subcontractor, United States Testing Company, Inc., for their response to the findings.

Very truly yours,

P. A. Martinez
Project Manager

PAM/pp