



Consumers
Power
Company

6/2/17

Midland Project: P.O. Box 1963, Midland, Michigan 48640 - Area Code 517 631-0951

January 25, 1980

Mr. M. O. Rothwell
Bechtel Power Corporation
P.O. Box 1000
Ann Arbor, MI 48106

MIDLAND PROJECT GWO 7020 -
SOILS RESPONSES TO 50.54(f) QUESTIONS
File: 0485.16 UFI: 00234(S), 71*01 Serial: CSC-4763

After discussions in Bethesda, Maryland, with the NRC on January 16, 1980, and the CP/Bechtel discussions in Ann Arbor on January 22, 1980, the following areas should be clarified and/or amplified in our responses to the 50.54(f) questions.

1. J. Wanzeck should clarify the slide shown in Washington to indicate the day the tank foundation was placed and it should be noted that this is a six month settlement update only. This can be accomplished possibly via an MCAR update or old question response update.
2. The alleged quarter inch diesel fuel oil tank settlement needs to be verified or deleted from wherever it was supposedly reported to the NRC. (J. Wanzeck)
3. S. Afifi, in the response to Question 4, should explain that table 4-1 is a projection (show totals only) and not what the structure can stand. He will also relocate this table to Question 27.
S. Lo should verify that "to date" settlement plus additional future settlement will cause no problems to the diesel generator structure in the response to Question 14.
4. S. Afifi will indicate how we arrived at the half-inch figure for settlement caused by vibration of the diesel generator pedestals due to operation of the diesel generators. In response to Question 27, Dr. Woods analysis to include his method of calculation will be utilized.
5. S. Afifi will delete the word "clay" from the third line under note on table 4-1. (Renumbered 27-). He will also include the total settlement graph instead of only the portion utilized for predictions

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ENVIRONMENT

6. Table 4-1 footnote 2 (Renumbered 27-) - S. Afifi will explain how the settlement of the borated water storage tank is based on measurements of the Diesel Generator Building settlement here and in the response to Question 31.
7. The individual best fit curves projecting diesel generator settlement allow no margin for standard deviation on the best fit. Therefore, this appears to be unconservative. We need to amplify the fact that the curves assume the surcharge remains and that the worst data points are utilized for total settlement. This also would, of course, include something on the worst settlement being utilized for differential settlement calculations and their affect on the structure and connections. S. Afifi will add some discussion to amplify the conservative aspects and a statement on the piezometer in response to Question 27.
8. Our outline of response to Question 27 states: Item B. basis for accuracy. The outline will be changed and one sentence will state that the basis for accuracy is conservatism. We do not appear to be getting the response across on the borated water storage tanks. It is necessary to show that the soil is adequate in more concise terms. S. Afifi will add emphasis to the acceptable quality of the soil and that filling the tanks is only being done to verify the settlement prediction. It will be noted that this is not a soils problem; rather it is more like normal practice. We also have to verify that the tank foundation is adequate and that we will not have the problems which could arise if the foundation should somehow fail and you would have a subsequent stretching of the bottom membrane of the tank followed by a tear in the tank wall. All loads must be considered in this analysis. We should also state that we do not have the same degree of randomness in the soil as was present in the Diesel Generator Building. S. Lo will provide analysis to show that the tank foundation will be able to withstand seismic events. S. Afifi will do more research on the overload test necessity.
9. Our response to Question 33 needs to be amplified to include the effect of bouyancy on the load tests and what effect the lack of water (if any) from site dewatering will have on the tank settlement. Possibly there will be a retest after dewatering (S. Afifi).
10. B. Paris will address whether or not there will be any effect on the ultimate heat sink pond seal due to site dewatering in response to 24. f. and note why we are using timers instead of float switches in the pumps in response to 24. c., utilizing Loughney's input. The basis for the gradation of the gravel pack material will also be addressed by B. Paris in the response to 24. d. The slide for the individual wells freeze protection on the riser pipes will be shown by B. Paris on the response to Question 24.
11. S. Lo, K. Wiedner and T. Johnson will show that all past loads have been accounted for in the analysis of the future settlements of the Category I structures in response to Question 28 and 29. The NRC questioned whether the stress induced by differential settlement in the past was now locked

in the structure and additive to future loads, such as, additional settlement, seismic, etc. Our response will include some crack investigative depth core drilling and analysis of relief of stress due to identified positive remedial measures.

12. A response on the Q-ducts has to include an analysis as a category one structure. It was noted that this may not have been used as criteria in 1970, however, in 1976 this was checked per BC-TOP 4. This will be included in our response to Question 30. (S. Lo)
13. The response for 24. c. will include an analysis for the concrete service water pipes in the cooling pond and any other concrete pipes embedded in the class one fill. In the 24. c. response, B. Paris will also note that concrete pipes are generally away from critical structures and discuss probability failures.
14. After considerable discussion, it appears that the NRC is desirous of having Bechtel's proposed detailed method of analysis for the seismic event (Question 25). Bechtel will provide their normal analysis for new soils conditions under affected category I structures. (M. Rothwell)

Bechtel plans a lump mass analysis to include an envelope for settlement. In discussing Question 26, the NRC noted that they are not in a position to adopt new methods or codes at this point in time, however they (on their own) wish to compare the new methods with earlier analysis to establish some level of margin. S. Lo's analysis will be complete sometime in mid 1980.

15. Miscellaneous:

A. General

A review of the response to Question 16-20 of the subject document indicates that the applicant proposes to impose the 3.0 S_c criterion of subparagraph NC-3652.3(b) of the ASME B&PVC, Section III and the 5% radial deformation limit of the AWWA. Additional criteria which address buckling of the piping should be imposed since neither of the proposed 2 criteria are based on this failure mode. Additionally, criteria compliance analyses should be based on maximum expected differential settlement over the life of the plant.

B. Response to Question 16, Page 16-1 (Civil)

The response addresses stresses based on representative pipes being profiled, i.e.; on current local settlements. The response should be modified to include settlements over the life of the plant.

C. Response to Question 17, Page 17-1, Paragraph 1 (Riat)

If all Seismic Category I piping is not to be profiled, criteria for selection of piping to be profiled should be documented.

D. Response to Question 17, Page 17-2, Paragraph 2 (Riat)

The calculation assumes that the curvature is constant over the length of pipe. In general, this condition will not be met. Criteria for changes in curvature should be addressed.

E. Response to Question 17, Page 17-3, Paragraph 2 (Riat)

If the settlement stresses are based on current profiles only, the analysis should be extended to include settlements over the life of the plant and effects of change in curvature (See item C).

F. Response to Question 17 (Riat)

The question regarding measures to be taken to alleviate conditions if settlement stresses approach code allowables or cannot be determined has not been addressed.

G. Response to Question 18, Page 18-1, Paragraph 2 and 3 (Riat)

It is not clear that most of the anticipated differential settlement will occur by the time of final closure (Paragraph 2). Provisions for effects of settlements occurring after final closure should be specified. The evaluations of Paragraph 3 addresses this issue partially.

H. Response to Question 18, Page 18-2, Paragraph 2 and 3 (Riat)

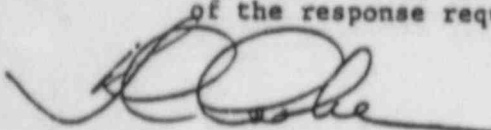
Criteria for assessment of the flexibility of piping to accomodate more than the expected differential settlement should be specified.

I. Response to Question 19, Pages 19-1 to 19-3 (Civil)

The disposition of this response will be delayed pending receipt and review of evaluations based on the preload program (See last paragraph on Page 19-3).

J. Response to Question 20 (Riat)

The first paragraph of the response is acceptable. However, the remainder of the response requires clarification.



T. C. Cooke
Project Superintendent

TCC/ps

Attachment: Attendees List

CC: CAHunt
GSKeeley
DBMiller

KWiedner (Bechtel)
SAfifi (Bechtel)
ABoos (Bechtel)

BDahr (Bechtel)
LCurtis (Bechtel)
LDavis (Bechtel)

Attendees

1/16/80

Name

Darl Hood
Joe Kubinski
William Paris Jr.
Jo Wanzeck
S. S. Afifi
W. R. Ferris
M. O. Rothwell
Karl Wiedner
Gil Keeley
T. C. Cooke
F. Schaufig
J. J. Zabritski
S. Lo
T. E. Johnson
John F. Horton
James W. Simpson
William Lawhead
R. E. Lipinski
Gene Gallagher
Ross Landsman
Daniel M. Gillen
A. J. Cappucci
R. O. Busnak
H. L. Brammer
Ray Gonzales
J. P. Knight
R. E. Jackson
J. G. Spraul
R. E. Shewmaker

Organization

DPM/NRR
COE Detroit Dist.
Bechtel - Geotech
Bechtel - Geotech
Bechtel
Bechtel
Bechtel
Bechtel
Consumers Power
Consumers Power
NRC-SEB
Consumers Power
Bechtel
Bechtel
COE NC Division Chicago
Army Corps NCD Chicago
U.S. Army COE, Detroit
NRC-SEB
NRC Region III:IE
NRC Region III:IE
NRC NMSS

NRC/DSS/MEB
NRC/DSS/MEB
NRC/DSE/HMB
NRC/DSS
NRC/DSS/GSB
NRC/NRR/OAB
NRC/IE/RCI

1/22/80

M. Rothwell
S. Afifi
J. Wanzeck
B. Paris
S. Lo
T. Cooke

Bechtel
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Bechtel
Consumers Power Company

To File
FROM TCCooke/RMW
DATE August 7, 1979
SUBJECT MIDLAND PROJECT GWO 7020
PRE-MEETING WITH CONSULTANTS
File: B3.0.3 Serial: CSC-4274 UFI#-00234-S
CC Attendees
GSKeeley, P14-408B
DBMiller
KCBrooks (2)

Consumers
Power
Company

INTERNAL
CORRESPONDENCE

File
6/27/79 update
of meeting

Attendees:

Karl Wiedner, Bechtel Power
Phil Martinez, Bechtel Power
Sherif Afifi, Bechtel Power
Dr. Ralph Peck, Consultant
Dr. A. Hendron, Jr., Consultant
Dr. M. T. Davisson, Consultant
Tom Cooke, Consumers Power Company

RECEIVED
AUG 09 1979
MIDLAND PROJECT
MEETING

There was a brief discussion on the various options. One of the main reasons for Option Five (Areal Dewatering) was that it grew to a large extent out of the dewatering process for Option One. The consultants expressed the opinion that we had to answer liquefaction questions wherever anyone might think they could occur (for example, the control tower at 6KSF loading). It could be a real thorn in the job at a later date, and areal dewatering is the only clean method. It is very hard to argue against dewatering, and it would be very difficult to prove the effectiveness of grouting. The question was asked about the water that could be trapped in clay. The consultants responded that over the long haul, it would drain with permanent drainage and could be proven by piezometers. While peripheral wells would probably do the job, there would be some intermediate wells. Any vein of water would be drained. Piezometers would convincingly prove that the area was dry. The construction dewatering process for the Auxiliary Building electrical penetration areas will assist in determining how much dewatering and how many wells, etc., are required. P. Martinez indicated that Bechtel would have to take another look at the design calculations in the foundation areas.

The Auxiliary Building electrical penetration area is a high narrow structure with a torsion box at the lower portion. The soil was designed to take the horizontal shear. The low soil blow counts values indicate that this structure is possibly being cantilevered to some extent off of the control tower. Dr. Peck expressed the need for the design basis for this structure. Dr. Hendron indicated that the borings were not necessarily indicative of what was beneath the structure. A parametric study for the structure should be made based on a range of soil properties. A quick rough analysis should first be done, followed by a detailed analysis. Karl Wiedner discussed the possible outer end settlement and his theory on how the structure had possibly picked up a cantilevered load during construction phases.

Midland Project GWO 7020 - Pre-Meeting with Consultants
File: B3.0.3 Serial: CSC-4274 UFI#-00234
August 6, 1979

Tom Davisson then mentioned that, since we were thinking of permanent dewatering, a different underpinning method may be acceptable (one that would take vertical loads only). The Auxiliary Building control tower and the material below the electrical penetration areas have potential for horizontal shear resistance. The three options would be to: (1) do nothing, (2) supply something for vertical loads only, and (3) supply something for vertical loads and horizontal shear. The first step would be to check the horizontal shear resistance required. Possibly horizontal support could be picked up from the Reactor Building and/or Turbine Building. If we remove material and fix the end of the Auxiliary Building electrical penetration areas, we still would have to analyze for an unsupported mid span. Caissons were mentioned as another option. It was noted that even clay with an average blow count of three would have modest shear strength. The consultants noted that they did not have sufficient design information. Karl Wiedner and other Bechtel personnel present did not have all the answers on the design basis at the time of this meeting. However, at T. C. Cooke's suggestion, the consultants agreed to formulate their questions in writing for Bechtel response.

The consultants noted that in their opinion, \$3 Million for the underpinning of the Auxiliary Building electrical penetration areas was very low, especially when compared to the estimate of \$20 Million for permanent dewatering. They also stated that we definitely have a diesel-generator liquefaction problem although the sand would probably never actually liquefy during an earthquake. The problem was the difficulty in providing calculations which verify this and would not be subject to argument.

A brief discussion then followed concerning possible liquefaction regarding utilities, sand backfill around buildings, tank farm, railroad bay and control tower, etc. For the tank farm, railroad bay and control tower, a safety factor of 1.5 is generally acceptable. However, if for any reason, the acceleration criteria goes up in the future, Dr. Peck felt that it may be difficult to prove no liquefaction problems. The borings may not be completely satisfactory for the purpose of proving beyond a shadow of a doubt that everything was satisfactory because needlessly conservative decisions may be formulated on the "what if" type questions. The consultants noted that they were still in favor of a general dewatering program, especially in light of possibly more stringent seismic requirements in the future and the knowledge now available to the effect that generally speaking sand exists in more areas than originally anticipated in the power block area. The consultants believed that the permanent dewatering program, in general, was a must. The temporary dewatering system would show how the permanent system would work. The water can be lowered sufficiently to make the site acceptable in the new licensing arena. Dr. Peck stated that he could attend a meeting on the 18th of July in Washington to discuss the situation with the NRC.

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

File C485.16
Acc RLB
JLZ

August 15, 1979

Subject: Midland Units 1 and 2
Consumers Power Company
Bechtel Job #220
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 6/28/79, Denver, Colo.
 - 5) Summary of Presentation to NRC dated 8/10/79
 - 6) BEBC-3176 (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

RLB

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MIDLAND PROJECT
MANAGEMENT

August 15, 1979

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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-Dunncliff & 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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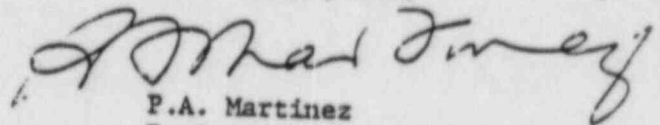
August 15, 1979

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BLC-8021
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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

TO BWMargulio, JSC-220A

FROM C. Sealey, P-14-4083 *G. J. Kelley*

DATE September 17, 1979

SUBJECT MIDLAND PROJECT -
SUGGESTIONS ON BULK
INSTALLATION ACTIVITIES -
FILE 0460 UFI 73* SERIAL 7594

CC SHHowell, P-26-336B
DBMiller, Midland (3)
TCCooke, Midland

**Consumers
Power
Company**

INTERNAL
CORRESPONDENCE

Since March, Project personnel have informally discussed with you some suggestions which we feel may be pertinent to assure a continuing quality effort on the Midland Project. Attached to this memo are recommendations which we feel you should evaluate for possible implementation on the remaining work on the Midland Project. Some of these items were previously discussed with you.

GSK/cg

There have been several problem areas associated with the Diesel Generator Settlement and as our consultant, Dr Peck, noted we may never be able to determine any one principal reason for the incompletely consolidated material which caused the settlement. In spite of this, it is the opinion of CP Co PMO Field personnel that there may be one underlying cause for our problem. Moisture content, supervision in the field, settlement data, testing, spec interpretation, all seem to center around a certain period of time when the job was going up and down due to cash flow problems, and when the majority of the earthwork was complete. The single thread that seems to tie all of the known possible causes together is that during the above-mentioned period of time there could have been insufficient attention to detail of certain activities during plant fill. People were leaving the site or arriving at the site, the majority of the earthwork was done, everyone was looking at the other problems or other work areas or activities that were coming up in the future and that is where the majority of emphasis was placed by all parties. It appears that people had other work activities in the civil area that kept them more occupied at that point in time. We are remedying the situation and taking corrective action with respect to effectively checking our quality as we go to make sure that we do not have a similar problem so far as future earthwork activities. However, we should not overlook the fact that the same thing could happen as other bulk installation activities tail-off. Therefore, as a possible suggestion to preclude repetition, we suggest the following:

1. List all areas of bulk installations and their scheduled completion.
2. Determine which areas may be a prime candidate for problems similar to that which we found with the Diesel Generator Settlement.

The present concrete activities could be in this category, especially since the bulk of the concrete placement is complete and now we have only small isolated pours remaining.

3. Assure that personnel performing the activities during bulk installation and when tailing off are adequately qualified (construction workers, supervision, technical support and quality personnel).
4. Develop specific programs to assure ourselves that as bulk installation programs tail-off, attention to detail will not relax.

GSKeeley/cg
9/17/79

Jo. Kane

MIDLAND SOILS CHRONOLOGY AND SUMMARY

Soils placement on the Midland job is broken down between cooling pond dike construction and plant fill. A subcontractor (Canonie, Inc.) constructed the dikes during the period of 1969-70 and 1973-77. Plant area fill (which is essentially complete) has been placed by both a subcontractor (Canonie, Inc.) and Bechtel. Canonie's work was limited to placement of large, open plant fill areas with mechanical equipment, while Bechtel generally placed smaller areas inaccessible to mechanized equipment with hand compactors. Bechtel has, however, placed some areas of plant fill with mechanized equipment. Placement of plant fill has extended from 1974 to present.

All soils testing on the project is performed by a subcontractor (U.S. Testing, Inc.). Their responsibilities include taking tests in accordance with ASTM standards at locations specified by Bechtel or Canonie. While not explicitly stated in their contract, U.S. Testing has also accepted the job of soils classification to facilitate testing.

Soils placement by Bechtel has been done under the technical direction of Bechtel field engineers assigned to specific plant areas i.e. yard facilities, Auxiliary Building, etc. There was not a designated soils field engineer on the jobsite. Because they were assigned responsibilities in addition to soils placement (i.e. rebar and formwork inspection, material requisitioning, etc.) the field engineers were not always physically present during the fill placement. Labor foremen were utilized to help call for soils tests under the direction of the field engineer. Technical acceptance of plant fill has been based on satisfactory test results.

Bechtel Construction Quality Control performed surveillance over the work done by Canonie. Canonie implemented their own approved QA program and Bechtel QC verified proper implementation by observation and review of records. Two to three times a day Bechtel QC would observe fill placed by Bechtel construction. Full time inspection was not required.

The settlement of the Diesel Generator Building was noted during routine construction survey work. Settlement markers were assigned and an extensive boring program was undertaken to ascertain the extent of the problem. The results of the boring program which are included in MCAR 24 show material with highly variable in-place properties in the first 15 feet under the structure. This fill which includes both clay and sand was placed by Bechtel during 1977.

As a result of the problems noted with the Diesel Generator Building an extensive settlement monitoring and soils boring program was undertaken for the balance of the plant. This program, which is still underway, includes borings taken through building base slabs. Those structures/facilities which are or may be effected by soil not meeting specification requirements to date include:

- 1) Diesel Generator Building
- 2) Unit #1 Main Transformer Area
- 3) Condensate Tank Area
- 4) Service Water Structure (North corner)
- 5) Unit #1 Penetration Room
- 6) Units #1 and #2 Feedwater Isolation Valve Pits
- 7) Borated Water Tank (Western tank only)

As a general rule we note that the "soft" soil encountered under these structures/facilities was placed by Bechtel using hand held equipment.

A surcharging program is currently underway to preconsolidate the fill under the Diesel Generator Building. Remedial measures to correct soils problems with the other above listed structures/facilities are under investigation.