Midland

Questions for Davisson's Deposition

(January 14-15, 1981)

January 8, 1981

SUMMARY OF QUESTIONS

- HIS INVOLVEMENT IN JOB (OVERALL)
- HIS RECOMMENDATIONS FOR UNDERPINNING OF VARIOUS STRUCTURES
- DIESEL GEN BUILDING
  - BEFORE SURCHARGE, DURING SURCHARGE, SURCHARGE REMOVAL, BLDG CRACKS EVALUATION
  - ACCURACY OF SETTLEMENT DATA
  - UTILITY CONNECTION TO BLDG + GENERATOR
  - SAFETY OF PIPES + CONDUITS
- WATER SERVICE PUMP STRUCTURE
  - GENERAL DETAILS OF UNDERPINNING
  - STATUS OF PILE LOAD TEST
  - SAFETY OF UTILITIES
  - BLDG CRACKS EVALUATION
  - SEISMIC ANALYSIS
- TECH SPEC FOR PILES + CONCRETE
- TANK FARM
  - CRACKS OF RING GIRDER
  - CONNECTION OF VALVE PIT & RING GIRDER
  - PIPING
- AUX BLDG
  - GENERAL DETAILS OF UNDERPINNING

- Is it correct that you have been retained by Bechtel Corporation as a consultant on Midland job.

- Since when?

- What has been your involvement on this project before December 1979.

- What other projects have you been involved in with Bechtel, as a consultant to Bechtel.

- Besides teaching and research at the University of Illinois, and other professional and private activities, how much time have you had at your disposal, say in 1980, for consultancy work.

- Of the time available to you last year for consultancy, what percentage of time did you devote for Bechtel projects including Midland.

- Over the last several years (say five), what percentage of your consultancy work came from Bechtel (Dollar amount percentage)?

- Specifically, how much time you have devoted to Midland project consultancy work in 1980.

- How many site visits you made to Midland last year? Other site visits?

- How many meetings have you attended with Bechtel or Consumers or NRC that involved Midland project. Any other meetings on this subject. Phone calls? Any other communications?

* - What documents have you received regarding Midland.

- Is it a fair statement that you have not been able to spend sufficient time on Midland to know all the details about all problems at Midland site? Or have you?

* - Specifically, what is the scope of work for Midland that you are required to perform under contract with Bechtel?

- Is there any specified minimum amount of time that you are required to spend on this project under the terms of the contract.

- If Bechtel depended totally on you for a review of the underpinning effort at Midland, would you be willing to give it priority over your teaching and research work at U of I.

- Have you submitted any written reports or any other documents on Midland. Provide copies to NRC.

- [illegible] STRUCTURES ARE ON FILL.

- OF THESE STRUCTURES, HOW MANY, IN YOUR OPINION, NEED REMEDIAL MEASURES.

- I WILL MENTION THE STRUCTURE NAME, AND I WOULD LIKE FOR YOU TO TELL ME THE TOTAL INVOLVEMENT THAT YOU HAD (AS A CONSULTANT IN EVALUATING THE NEED FOR) AFTY AND DESIGN, ANALYSIS (FOR THAT SPECIFIED) TECHNICAL CONTRACTS & SPECIFICATIONS, OR ANY OTHER INVOLVEMENT THAT YOU HAD FOR THE PROPOSED REMEDIAL MEASURE OR UNDERPINNING.

1. DIESEL GENERATOR BUILDING
2. SERVICE WATER PUMP STRUCTURE
3. BORATED WATER STORAGE TANKS
4. ELECTRICAL PENETRATION AREAS (AUXILIARY BLDG)
5. FEEDWATER ISOLATION VALVE PITS
6. DIESEL OIL STORAGE TANKS
7. UNDERGROUND
   a) Service water pipe lines
   b) Borated water pipe lines
   c) Diesel Oil pipe lines
   d) ELECTRICAL DUCT BANKS

DIESEL GENERATOR BUILDING

- WERE YOU INVOLVED IN THE DECISION TO SURCHARGE THE DGB.

- WERE YOU AWARE THAT BEFORE SURCHARGE PLACEMENT DGB HAD SHOWN SEVERAL CRACKS AND UNDERGROUND UTILITIES HAD UNDERGONE LARGE DIFFERENTIAL SETTLEMENTS.

- TO YOUR KNOWLEDGE, WAS CONSIDERATION GIVEN TO THE POSSIBILITY THAT THE BUILDING CRACKS MAY WIDEN AND UTILITIES MAY DEFORM FURTHER AS A RESULT OF SURCHARGE.

- IF YES, HOW WERE THEY CONSIDERED.
- IF NOT, WHY NOT.

EXH # (1)

Draft of NCAR 24, Interim Report 4, dated February 16, 1979 (Inside copy - page 3).

(EXHIBIT 1)

- "As of February 2, 1979, the maximum recorded crack width in diesel generator building, is approximately 28 mils, or approx 3 mils larger than what was first recorded December 5, 1978."

- Were you notified of this development.

- When did you find out that cracks are opening up as a result of surcharging.

- Did you anticipate this before start of surcharge program.

- To your knowledge, was there any criterion for crack widths, extent or length of cracks for DGB, that would have indicated unsafe conditions for the building.

- Have you recommended development of a criterion for other structures that are being planned to be underpinned in the future. HAVE YOU RECOMMENDED MONITORING OF [illegible] THE [illegible] FOR THESE STRUCTURES.

- DID YOU HAD ANY INPUT IN THE [illegible] OF D&E.

- IN VIEW OF THE FACT THAT MANY [illegible] CRACKS APPEAR TO BE CAUSED BY SHEAR, AND FORM POTENTIALLY WEAK SURFACES, DID YOU EVER RECOMMEND THAT STRUCTURAL SAFETY BE INVESTIGATED INCORPORATING THESE CRACKS IN THE MODEL OF [illegible] WHEN SEISMIC LOADS EFFECTS ARE EVALUATED.

- IF NOT, WHAT WAS THE NEED FOR MODELING THE CRACKS.

SURCHARGE REMOVAL

- WERE YOU INVOLVED IN THE DECISION TO REMOVE THE SURCHARGED LOAD FROM D&E.

- TO YOUR KNOWLEDGE, WHO ELSE RECOMMENDED THE TIMING OF SURCHARGE REMOVAL.

- AS AN EXPERT, DO YOU THINK IT WOULD HAVE BETTER IF SURCHARGE HAD STAYED ON FOR A LONGER PERIOD OF TIME THAN IT ACTUALLY DID. OR WHY?

- ISN'T TRUE THAT DECISION TO REMOVE THE SURCHARGE WAS BASED MORE ON FROM ON THE SCHEDULE OF PROJECT THAN TECHNICAL JUSTIFICATION.

- DID YOU REVIEW THE SETTLEMENT DATA AND PIEZOMETER DATA BEFORE SURCHARGE REMOVAL.

Please identify for us

the

- ~~IS THAT ALL THE DATA YOU REVIEWED~~

~~Questions for Dr. Lee~~ A-1 Exh # (2)

SETTLEMENT MONITORING

Refer to Fig. 27-54 (for marker DG-6) EXHIBIT 2

Would you indicate on Fig. 27-54 the period indicated on the note from 3/22/79 to 9/14/79?
(Should indicate the time of 54 days and 230 days)

The note on Fig. 27-54 indicates temporary markers were used during this period to ESTIMATE settlement?

Could you explain for us the procedure that was used to estimate the settlement? (Ask for details such as the installation of the temporary markers, how monitored, how settlement curve for DG-6 was developed based on the temporary markers, etc.)

Bases of his explanation) Could the large rebound (>1 inch) which is indicated on Fig. 27-54 – actually not be a rebound but a result of the procedure which used temporary markers to estimate settlement during this period?

Bases on his explanation Don't you think it is highly unusual that the most IMPORTANT portion of the settlement versus log time curve for ALL the building settlement markers which you have based your position on for being in secondary consolidation – that this portion of the curve is actually based not on directly measured settlements but on temporary markers whose adequacy is questionable?

Questions for Dr. Price

A-1

SETTLEMENT MONITORING

Isn't it likely that the method ~~that's inherent assumptions~~ used to estimate the settlement during this period is inadequate?

Aren't your conclusions on reaching secondary consolidat and your future predictions of settlement during plant operation BASED on the shape of the settlement curve during this period where you were not directly measuring settlement of these markers but rather estimating settlement by another method whose adequacy is questionable?

Doesn't the request of the COE & the NRC staff to take undisturbed samples and perform laboratory consolidation tests on plant fill foundation soils offer a reasonable way to resolve these questions?

(3)

Page 3 of the meeting notes dated August 7, 1979 (EXHIBIT 3)

- Do you recall making a statement that "we should look hard at connections of utilities to the diesel generator and the building and that allowance should be made for a maximum of one-foot movement in any direction."

- What kind of connection design did you have in mind for buried utilities that would have allowance of one-foot movement.

- Did you follow-up on your recommendation.

4, 5 + 6

-2-1

Effect of Settlement on Safety Related Pipes & Conduits

Do you recall what safety related pipes and conduits are founded in the plant fill near and beneath the Diesel Generator Building? (Attempt to have Dr. ~~Peck~~ identify the types of pipes, diameter and approximate location - NRC attorney can refer to Table 17-1 & Fig. 17-1)

EXHIBIT 4 + 5

What is the range in elevation that most of the Category I pipe inverts were placed at?

Have the borros anchors shown this range of foundation elevation to be the most compressible?

Does this give you concern that important safety related pipes were initially installed in a compressible foundation material which condition was aggravated when the surcharge load was imposed? If not - why not?

Were laboratory consolidation test results available to Bechtel and you on plant fill material BEFORE the SURCHARGE was placed? (Answer - yes)
Did you review these lab. results?

Was a prediction of settlement made before surcharging based on these lab results?
If yes - what was that prediction? Who made it?

If no - Ask why no prediction was made?
Refer to 50.54f responses - Vol. 3, Tab. 12, Pg. 3
/ EXHIBIT 6

Effect of Settlement on Pipes

What is the basis for this range of settlement from 6" to 18" that you gave in December 1978?
~~Pursue~~ how did he arrive at these values? It can't be just off the top of his head.

Are you aware that this range of settlement resulted in Bechtel's decision to disconnect the condensate line between the DGB & turbine building?

What maximum settlement actually occurred under the surcharge? (Approx. 3½")

What is his explanation for the large difference between his Dec. 1978 prediction and what actually took place?

In your professional opinion do you consider it good engineering practice to have estimated the amount of settlement which was going to occur along the safety related pipes and conduits before the surcharge load was imposed?
Answer will be No
Why isn't it necessary?

Isn't there a differential settlement limit beyond which structures and components will be overstressed? Answer - Yes
But yet Bechtel elected to go through with the surcharging program without even knowing what limit of differential settlement would not be acceptable. Isn't that correct?

Effect of Settlement on Pipes.. (7) (2-3)

Do you know today whether the DGB and safety related piping and conduits have been overstressed because of the settlements which have occurred at the Midland project?

Do you know today of any tolerable limits of total and differential settlements which have been established for the DGB? for safety related piping & conduits?

Do you know of any practical means for measuring future settlement of safety related piping & conduits while the plant is in operation? What are they?
When will this information be provided to the NRC?

Refer to Fig 19-1, Vol. 1 50.54(f) responses
What does Fig 19-1 show?

EXHIBIT 7

Can you describe for us the procedure and instruments used to establish these profiles?

Do you know the level of accuracy which is obtainable with the instruments which are used to profile the buried pipes?

How do you feel the safety of the DGB and safety related pipes & conduits have been improved by employing the surcharge program?

Did surcharging reduce the amount of settlement?

Effect of Settlement on Pipes (B-1)

Didn't surcharging actually increase the amount of total and differential settlement as reflected by your settlement markers and plates?

In your opinion, did surcharging increase or decrease the level of induced structural stresses on the buried conduits & pipes? On the DGB?

Do you have an opinion as to the extent of cracking which could develop in the DGB structure and still permit the DGB to operate safely?
(Pursue - length of cracks, frequency, width of cracks)

In your professional experiences do you know of any structures that have been subjected to the extent of cracking because of settlement of compacted fill that the DGB has experienced?
Request involved structures w/ brief details.
Were the structures abandoned or safely reconstructed?

- Have you reviewed the proposed underpinning program for water service pump structure?

- Would you draw a sketch of proposed modification.

- To your knowledge, who is designing the underpinning operation for the service water pump structure?

- What information would you generally need if you were to design an underpinning operation such as that at the service water pump structure. (Soil properties, structural configuration, loads, proximity to other structures that may interfere with the operation, load carrying capacity of piles etc).

- To your knowledge, are all the required data available.

- Have you satisfied yourself that the underlying natural soil to which piles will be installed will be able to provide sufficient bearing capacity for the piles.

- How did you satisfy yourself. What data or test results did you use.

- Are you familiar with any other project on which scheme similar to that being proposed for the service water pump structure has been used.

- While reviewing the underpinning program, did you ask for any additional information from Bechtel, or you felt that they had provided you everything you needed?

- Did you ask for any additional borings in the area, or any soil testing?

- Did you discuss with your client any alternate proposals for underpinning the service water pump structure.

- Why were these rejected.

- TO YOUR KNOWLEDGE, WHAT IS THE CURRENT STATUS OF PILE LOAD TEST PROGRAM AND UNDERPINNING PROGRAM FOR THE SW STRUCTURE.

(8)

Exhibit - Page 3 of Interim Report 3 (EXHIBIT 8)

1. Are you aware that underpinning was considered as an option for diesel generator building also?

2. What was the reason for rejecting that option? for DGB.

3. Do you agree that underpinning the building would not minimize the settlement of the utilities during the operation of plant.

4. Have you advised "Consumers" on the possible remedy for assuring the safety of the utilities in addition to that of the structure in case underpinning option is used for Service Water Structure?

5. ARE YOU AWARE THAT THERE ARE CATEGORY I SERVICE WATER PIPE LINES BETWEEN AUXILIARY BUILDING AND SW STRUCTURE AND ALSO BETWEEN DIESEL GENERATOR BUILDING AND SW STRUCTURE.

6. WHAT HAVE YOU SEEN IN BECHTEL'S PROPOSAL OF UNDERPINNING THAT ASSURES YOU THAT THE CONNECTION OF THESE PIPELINES WITH THE SW STRUCTURE BLDG WILL NOT BE DISTURBED DURING UNDERPINNING.

7, 10+11

Figure 62 of Interim Report 5 (EXHIBIT 9)

1. Do you know that service water pump structure has shown cracks throughout the building to this date. To your knowledge, has there been any analysis to insure safety of the structure in its present state, CONSIDERING DEAD LOADS.
2. How will the proposed underpinning operation affect these cracks?
3. During the underpinning operation, if cracks start deteriorating do you have a criterion suggesting that if cracks exceeded that limit the number of cracks, width of cracks, extent of cracks, that you would be concerned about the safety of the building.
4. Do you consider it to be good engineering practice to suggest installing predrilled bearing piles adjoining a badly cracked building.
5. What kind of precautions have you come across in Bechtel's proposal that assures that building will not be damaged any further because of pile installation during underpinning operation.

• TO YOUR KNOWLEDGE, HAS THERE BEEN A SEISMIC ANALYSIS OF SUPERSTRUCTURE IN WHICH REPAIR & ANTICIPATED CRACKS HAVE BEEN MODELED.

6. Do you get all the documents on Midland, or you get selected documents?
7. Do you feel it to be important that in order for you to provide Bechtel with proper guidance, you should receive from them all the pertinent information in a timely manner.
8. What has been your experience so far on Midland project about receiving complete information in a timely manner.
9. Exhibit - Bechtel forwarded to you on March 25 Tech Spec No. 7220-C-94 (Q) for furnishing, testing and installing closed end piles. The memo says that they plan to install test piles within 2-3 weeks. (EXHIBIT 10)

   - Did they send you complete information. (concrete specifications were missing as shown on next exhibit). (EXHIBIT 11)
   - Pursue to determine why conc.-spec. were not sent with the spec. (Negligence on Bechtel's part).
   - Did they give you enough time to complete your review, while they were planning to go ahead with installation of test piles in 2-3 weeks.
   - Is it conceivable in the future that Bechtel may have some vital information regarding the job and you may not be sent that information for review because they sent you only selected documents.

10. Recently, have you been involved in any job on which you were a consultant to the NRC.

11. Would you provide some kind of scrutiny on Midland as you provided when you were a consultant to the NRC.

12. There is a proposal that piles at the service water pump structure will be tested individually to 150 percent of the load, but there would be no proof loading of piles as a group. Do you agree with this recommendation?

13. It is proposed that caissons at the auxiliary building will be proof loaded. Why not the piles at the Service water pump structure be subjected to similar tests.

Same Set - Page 4 of Consultants Report (CATTA INSERT) EXHIBIT 3

- In the report of June 28, 1979, you along with other consultants requested certain information.

  - How important was it for you to obtain this information from Bechtel for your evaluation of the underpinning program.

  - Did you obtain this information, when, in what form, did you use it in your evaluation of underpinning?

  — WHAT WAS THE NEED FOR THE INFORMATION TO DO THE EVALUATION.

  - Did you follow-up on your request for additional information.

Same Set - Last but one page EXHIBIT 3

- Do you consider that underpinning the service water structure with driven piles and a corbel is a positive solution?

- What is the basis for such a conclusion.

- Have you reviewed the seismic analysis of the service water structure? Who performed the analysis? When did you review it? What is your impression of that analysis.

- Have you consdiered lateral drag forces that might be imposed on the SW Structure in the event of liquefaction of sandy soils under the service water pump structure.

EXHIBIT 11

Exhibit - Tech Spec for Furn, Install, and Testing Piles — EXHIBIT 11

- To your knowledge, who prepared these specifications.
- When did you first see these specifications.
- Do you believe that after incorporation of your comments in these specifications, these specifications meet same or higher standard than your recommendations at Bailly.
- Article 7.3.8 - why did you recommend to delete the words "approximately 10 feet." Don't you think it to be important to specify the minimum depth of penetration of pilesinto the bearing stratum.
- Do you have a criterion specified in these Tech Spec for "Restarting of Pile Driving after a Delay." (It [illegible] 7[illegible] He [illegible]
- Why did you recommend to delete the last line of Tech Spec 7.3.6.
- What is the criterion for selecting the piles for load test. (Hetrogeneous Fill will affect selection process)
- Splice in test pile (section 5.1) - Since test pile will eventually be used as Production Pile, splice in upper 20 ft should not be allowed. Comment? (Splice is potentially weak and corrosion susceptible).
- To your knowledge, has the applicant made settlement estimates for the SW structure after the piles are installed.
- Did you recommend that such as estimate be prepared. When or why not? Results?
- In your Tech spec, Shouldn't THERE BE A SECTION ON STRAIGHTNESS OF PILES. (½ in. in 10 ft, ½ in. in 20 ft)
- Also on Allowable Plumbness of the Piles (< 2 %) over the entire length.

(12 + 13)

EXHIBIT 12 & 13

- DO YOU RECALL HAVING REVIEWED THE CONCRETE SPECIFICATIONS FOR MIDLAND JOB.
- EXHIBIT G - IS THIS THE DOCUMENT YOU REVIEWED
- WHO PREPARED THESE SPECIFICATIONS.
- YOUR COMMENT ON THESE SPECS SAYS THAT "WE CANNOT REASONABLY MEET SECTION 11.5 AND SECTION 11.6. THIS SHOULD BE CLARIFIED". WHAT DO YOU MEAN BY "THIS SHOULD BE CLARIFIED".
- IS THERE NO WAY YOU CAN MEET THESE SPECIFICATIONS.
- HOW IMPORTANT IT IS THAT CONCRETE SHOULD NOT BE DROPPED MORE THAN 6 FT. WHAT WAS THE INTENT OF PUTTING THIS SECTION 11.5 IN SPECIFICATION.

- DONT YOU THINK THAT BY NOT FOLLOWING THIS SPEC, YOU WILL BE COMPROMISING WITH ~~THE~~ THE ULTIMATE STRENGTH OF CONCRETE.

- IS IT POSSIBLE THAT YOU MAY CREATE VOIDS IN THE CONCRETE BY NOT FOLLOWING THIS SPECIFICATION

- THEN WHY DID YOU INDICATE INABILITY TO MEET SECTION 11.5 OF SPEC.

- HOW IMPORTANT IT IS THAT CONCRETE BE ADEQUATELY VIBRATED. WHAT WAS THE INTENT OF WRITING SECTION 11.6 OF THE SPEC.

- DON'T YOU THINK THAT BY NOT FOLLOWING SPEC 11.6 YOU WILL BE COMFROMISING WITH THE ULTIMATE STRENGTH OF CONCRETE.

- IS IT POSSIBLE THAT IF CONCRETE IS NOT VIBRATED ACCORDING TO SECTION 11.6, THERE MAY BE VOIDS IN THE CONCRETE.

- THEN WHY DID YOU INDICATE INABILITY TO MEET SECTION 11.6 OF SPEC.

- DO YOU KNOW IF YOUR RECOMMENDATIONS WERE FOLLOWED. DID YOU HAVE ANY FURTHER DISCUSSIONS ABOUT THESE WITH ANYBODY AFTER YOU MADE YOUR RECOMMENDATIONS ABOUT IMPLEMENTATION OF YOUR RECOMMENDATION.

TANK FARM

- ARE YOU AWARE THAT THERE ARE TWO CAT. I BORATED WATER STORAGE TANKS ON FILL.
- WOULD YOU DESCRIBE THE FOUNDATION CONFIGURATION OF THESE TANKS. (TANKS ARE SUPPORTED ON SHORT CONCRETE RING GIRDER ENDING IN STRIP FOOTING) ON FILL.
- IS IT TRUE THAT THE RING GIRDERS HAVE SHOWN CRACKS POSSIBLY BECAUSE OF DIFFERENTIAL SETTLEMENT OF FILL.
- IS IT TRUE THAT THE CAT. I BORATED [illegible] LINES ENTER THE TANK THROUGH VALVE PITS, AND THESE VALVE PITS ARE CONNECTED TO THE RING GIRDERS.
- WHAT KIND OF REMEDIAL MEASURES HAVE BEEN PROPOSED FOR TANK FOUNDATION + VALVE PITS.
- IN THE EVENT OF UNEVEN SETTLEMENT HOW THE SAFETY OF THE PIPE CONNECTION TO THE TANK IS ASSURED.
- ARE YOU AWARE OF THE SETTLEMENT OF THE RUNNING PIPES BETWEEN BORATED WATER STRUCTURE AND THE AUXILIARY BUILDING.
- ARE YOU AWARE OF ANY STATIC OR SEISMIC ANALYSIS OF THESE STRUCTURES + PIPING.

AUXILIARY BUILDING — ELECTRICAL PENETRATION AREAS — UNIT 1 + 2 -S-

- Have you reviewed the proposed underpinning program for ~~water service pump structure~~ AUXILIARY BUILDING?
- Would you draw a sketch of proposed modification.
- To your knowledge, who is designing the underpinning operation for the ~~service water pump structure~~ AUXILIARY BUILDING?
- What information would you generally need if you were to design an underpinning operation such as that at the ~~service water pump structure~~ AUX BLDG. (Soil properties, structural configuration, loads, proximity to other structures that may interfere with the operation, load carrying capacity of ~~piles etc~~ CAISSONS etc).
- To your knowledge, are all the required data available.
- Have you satisfied yourself that the underlying natural soil to which ~~piles~~ CAISSONS will be installed will be able to provide sufficient bearing capacity ~~for the piles~~.
- How did you satisfy yourself. What data or test results did you use.
- Are you familiar with any other project on which scheme similar to that being proposed for the ~~service water pump structure~~ AUX BLDG has been used.
- While reviewing the underpinning program, did you ask for any additional information from Bechtel, or you felt that they had provided you everything you needed?
- Did you ask for any additional borings in the area, or any soil testing?
- Did you discuss with your client any alternate proposals for underpinning the ~~service water pump structure~~ AUX BLDG.
- Why were these rejected.
- TO YOUR KNOWLEDGE, WHAT IS THE CURRENT STATUS OF ~~[illegible]~~ UNDERPINNING PROGRAM FOR THE AUX ~~[illegible]~~ BLDG.

EXHIBIT 14

- In the meeting notes prepared by Mr. Brunner it is stated that "Davisson felt that additional borings would be useless and misleading". Is it a true statement of your feelings. Do you still feel that way?

- Why did you feel that additional borings would be useless and misleading. How could borings mislead you.

- DO YOU RECALL THAT IN THE SAME MEETING, MR. KANE OF NRC STATED (EXHIBIT 14) THAT THERE IS A CONCERN THAT THE NUMBER OF CAISSONS HAVE BEEN UNDERESTIMATED BECAUSE OF SPACE LIMITATION IN THAT AREA. HOW DO YOU JUSTIFY USE OF ONLY 9 CAISSONS FOR ELECTRICAL PENETRATION AREA.

- IN YOUR JUDGEMENT, HOW THE NEGATIVE SKIN FRICTION HAS BEEN ACCOUNTED. [illegible] YOU NEED BARRETTE [illegible] ACCOUNT FOR NEGATIVE SKIN FRICTION.

LIST OF EXHIBITS

1. DRAFT OF MCAR 24 (ISSUED 9/7/78) INTERIM REPORT 4 - FROM DOCUMENTS PRODUCED BY T. R. THIRUVENGADAM FOR DEPOSITION 12/11/80
2. FIGURE 27-54, FROM 50.54(f) RESPONSE, VOL 2.
3. DRAFT OF MEETING NOTES FROM TC COOKE/RMW DATED AUG 6, 1979 "GENERAL MEETING WITH CONSULTANTS - FROM DOCUMENTS PRODUCED BY T. R. THIRUVENGADAM FOR DEPOSITION 12/11/80

4+5 TABLE 17-1 and FIGURE 17-1
FROM 50.54(f) RESPONSES, VOLUME 1

6. MEETING NOTES - DATED DEC 12, 1978
FROM 50.54(f) RESPONSES, VOLUME 3, TAB 12, PAGE 3

7. FIGURE 19-1
FROM 50.54(f) RESPONSES, VOLUME 1

8. MCAR 24, INTERIM REPORT 3, PAGE 3 - 10CFR 50.55(e) INTERIM REPORTS

9. MCAR 24, INTERIM REPORT 5, FIGURE 62 - 10CFR 50.55(e) INTERIM REPORTS

10. COPY OF LETTER FROM SS AFIFI TO MT DAVISSON DATED 8/25/80 FROM DOCUMENTS PRODUCED BY T. R. THIRUVENGADAM FOR DEPOSITION 12/11/80

LIST OF EXHIBITS (CONT'D)

11 LETTER FROM MT DAVISSON TO SSAFIFI DATED 3/29/80. ATTACHED IS TECH SPEC No. 7220-C-94(Q) DRAFT WITH MTDAVISSON'S COMMENTS ON SPECIFICATIONS.
— FROM DOCUMENTS PRODUCED BY T.R. THIRUVENGADA FOR DEPOSITION 12/11/80

12 LETTER TO SS AFIFI FROM MT DAVISSON DATED 4-15-80
— FROM DOCUMENTS PRODUCED BY T.R. THIRUVENGADA FOR DEPOSITION 12/11'80

13. COPY OF DRAFT TECH SPEC NO. 7220-C-95(Q)
— FROM DOCUMENTS PRODUCED BY T.R. THIRUVENGADAM FOR DEPOSITION 12/11/80

14 MEMO TO FILE FROM JE BRUNNER, DATED OCT 3, 1980
— FROM DOCUMENTS PRODUCED BY T.R. THIRUVENGADAM FOR DEPOSITION 12/11/80.

1/8/81
1 of
J. Kane

Deposition of Charles Gould Mergentime Corp.

First became involved in March 1979 (Telephone)
Contacted by Bechtel employee (Ken Ware gave Bechtel Mr. Gould's name)

Worked on Ginna Plant
Installation of water intake structure

First meeting attended on Midland - late March 1979 or early April 1979
Discussed options (e.g. tunneling underpinning, grouting) for treating Elect. Penet. Area

Charles Gould - recommended against tunneling because of concern for ground loss, Affected buildings
- recommeded against grouting - weren't certain of results of grouting program

Went to work on Sept. 1, 1980 for Mergantime (second time)
Worked for Bechtel from March 79 to Aug 30, 1980
Billed Bechtel for ~~500 hours~~ 200 hours ($7000)

Bids received by Bechtel in Sept-Oct 1979 for underpinning work. In late Oct. 1979 Bechtel advised that Mergentime Corp bid was accepted - Later advised (? time unknown) that contract was cancelled

Note to Kane - Look @ Tab 91

1/8/81
2 of
J Kane

First talked to Dr. Davisson in April 1979 @ site
Last talked to Dr. Davisson in July 1980

Objectives of underpinning treatment
- Perfect - positive (inspectable)
- No damage to other Cat-I structures

Referring to Tab 79 (3 Aug 1979) ~~First~~ 2nd time proposed C.H. Gould's ~~recommendation~~ proposed remedial measure for underpinning
(1st proposal was to install caissons from base of EPA - dropped because of structural considerations
Refer to Tab 79

Parametric Spec - Not performance spec
Rely on ability of Underpinning Expert Company
- Peck, Hanson & Thornburn
Hanson Engineers - Consultant to Mergentime who completed the design of underpinning.

Mergentime submittal bid proposal (design & build) to Bechtel in Sept. ~~Dec~~ 1979. This proposal did include design drawings, no calculation, did include design procedure which had been prepared by Hanson. The calculations were later to be completed by Hanson once the contract was awarded

* Stress by Dec. 6, 1979

1/7/81
1 of 4

Step by Step Procedure of Underpinning — Refer to Tab 79

- Assure dewatering is functioning properly

1 - Place needle beams between buttress ~~access~~ access & turbine building (Are fdns of turbine bldg. OK for th
Is the roof of the FIVP adequate for taking the load

2 - Dig access shaft (What size) to 7' below FIVP
(Drive sheet piles)
Excavate drift under FIVP to EPA
(Piles Jacked & lagged & grouted on Turbine Bldg side (put in @ 3' intervals)
what monitoring of Turbine Bldg for settlement & deflection

3 Remove 7' depth height under edge of EPA (approx 5' under EPA slab)
(How far back
Place steel casing (5' ϕ?) - what length - how will add'tl. casing sections be connected
Will jack (what pressure - how does he know EPA base can withstand
this pressure. On what basis is jacking pressure said to be ok

✓ Continue to jack until 4' into till (slope of excavation - how addressed
for bearing capacity

Inspect bottom - clean pipe - fill w/ concrete

✓ Load test caisson (? 1.5 or twice times max. design load DL + LL + SSE?) - What is the max. design load? Dec. 6, 1979

✓ What is failure criteria of load test (1/4" settlement or 0.1" per test load

✓ How are you going to demonstrate caisson is adequate for the lateral load to be imposed

- Install next caisson - where located?

Have they checked that EPA can withstand full jacking pressure — Group load test? - to 1.0 or 1.5 — recommended by Dr. Peck (See Tab 79 - Resolve) and or 1/4" vertical settlement

Explain failure criteria on Tab 79, pg. 2, item 5C
Question is that test must pass ~~both~~ max. design load & settlement criteria

1/8/81
3 of
J. Kane

Criteria for establishing length of caisson
- At least one diameter depth
- At least 5' below the frost line (of excavated slope which existed when reactor was excavated

Exhibit D

Monitor for disturbances - from Technical Specification 8/79
Originally planned detailed spec w/ monitoring requirements
Changed monitoring plans to let as a separate contract

Item 4.2.2 - required plans to be submitted by bidders for monitoring

Max. design load (DL + LL + SSE) to be carried by caisson
Load = 4000 Kips 325,000 ft-kips (controlling moment)
(computed by Bechtel Engineers (B. Dhar

worked on in July & Aug 1980
- How would install the mechanics device to handle the horiz. load
- Worked on variation of dewatering - move to underpinning contract

Temp Dewatering started in Fall 1979
Experienced problems w/ dewatering as late as June 1980 - Problem was on restriction on ppm during TEMP. DEWATERING

¼" deflection limit on group pile test is LIMITED by capacity of EPA base-slab to RESIST jacking pressure

Failure criteria for vert. load on single caisson — spec 72-20-C-95

(Criteria in spec by Mergentime comes from their experience

Long term settlement of caissons (Afifi & Chen)
Completed in Aug 1980 — ½" computed

Finish cost for underpinning ≠ 5 million dollars (His estimate as of Aug. 74)
(Does not include Bechtel design & on site inspection costs

J. Kane
2 of live

What are the maximum bearing stresses (due to dead & seismic loads) on the base of the valve pit (Answer ~ approx 3000 kips - do not give him this value)

- If he doesn't know - ask him if this isn't an essential design value which must be established to determine whether the caisson cap is adequate or not?
- Did Bechtel indicate to him when he was a Consultant what the MAX. bearing stress was? How could Bechtel award an underpinning contract without first knowing whether the valve pit base could carry the load?

What is his ballpark estimate of cost for the construction contract to underpin the Electrical Penetration Rooms & Feedwater Isolation Valve Pits?

What monitoring is being performed or is planned for (e.g. settlement & displacement) building & valve pit during dewatering? Have limits on these instruments during underpinning been established?

When did you stop working on the Midland project as a Consultant to Bechtel?

- Were all design drawings, calculations (NO) and detailed procedures for underpinning the Auxil. Bldg and Valve pit complete at the time you terminated your work as a Consultant to Bechtel?

If not completed - attempt to understand what design drawings & calculations were completed and what was not completed?

Are you aware of any design changes in the underpinning work that have occurred since leaving? What are the changes? Why were they made?

11/6/81
J. Kane
1 of

Questions for Dr. Gould

one step at a time!!!

- Would you say that, in general, underpinning work is a highly specialized field of construction? after the structure is built.

WDP Sequence Chart - Can you describe for us, step by step, the construction procedure which must be completed to do the underpinning at Midland (aux. bldg.)

- Do you consider the underpinning work to be completed at Midland to be difficult? In what ways?

In your estimation what are the critical construction operations to be performed for the: from standpoint of safety & adverse impact on adjacent structures

Dr. MP
Underpinning of the feedwater isolation valve pit area
Underpinning of the electrical penetration area

In underpinning work, do you feel it is necessary to have experienced and qualified superintendents, foreman and other key personnel?

Did you ever make recommendations to Bechtel how qualified personnel could be required for the underpinning work at Midland? (For example, -require submittal at time of bidding of the names, experience & qualification of key personnel, etc.)

If yes - what were those recommendations?

If no - Do you know whether Bechtel is considering this requirement?

Step by Step Procedure
- Assuming load test has passed & EPA finished
- What assurance is there that the control tower can take the additional load? - What addtl settlement can be expected

- How will excavation to top of excavated slope (? El. 540) be now completed to

Dr. Davisson - Dr. Afifi - Mr. Gould - Telephone conversation
- Discussed bearing capacity - zone of influence of loaded caissons
= 25 ksf (Tab. 7, Pg. 3)

* Indicated initial chace of bearing (prior to field testing) was consensus of Peck, Hendron, Davisson, Gould

On exhibit #1 (Gould) Sect B-B word is horse collar

Jacked caisson sections run 4' to 5½' (Controlled by jack height & drift o

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

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

25 March 1980

Dr. M. T. Davisson
14 Lake Park Road
Champaign, IL 61820

Subject: Midland Units 1 & 2
Service Water Pump Structure

Dear Tom:

Enclosed is Technical Specification Number 7220-C-94(Q) for furnishing, installing, and testing closed end pipe piles for supporting the north end of the service water pump structure at the Midland site.

The project has suggested that we conduct a pile load test under the technical requirements of the above mentioned specification utilizing an existing contract with Canonie at Midland regarding a pipe bridge between the plant and Dow Chemical facilities. This testing will be under Q/A requirements. We would appreciate recieving any comments you may have on the specification especially with respect to the pile load test requirements.

Assuming all goes well we will be installing and testing the pile within two to three weeks. At such time we would appreciate having your representative attend the installation and testing.

Please let me know if you need any further information to complete this review. Thank you.

Sincerely,

Sherif S. Afifi
Assistant Chief Soils Engineer

SSA:aa
Enclosure

M. T. DAVISSON

FOUNDATION ENGINEER

2217 Civil Engineering Building
Urbana, Illinois 61801
Area 217: 333-2544

Reply to:

14 Lake Park Road
Champaign Illinois 61820
Area 217: 359-5206

Memo to: S. S. Afifi

From: M. T. Davisson

Date: 3/29/80

Re: Review of Midland Service Water Pump Structure
Load Test & Pile Driving Spec.
See Afifi letter of 25 March 1980

My review comments are made in the margins of the attached spec.

Note that I did not receive the concrete spec. for review.

(81)

PILE STIFFNESS
for
Supplemental Piles
at
Service Water Pump Structure

INTRODUCTION

To perform a re-analysis of the dynamic response of the modified service water pump structure, it is necessary to know the dynamic stiffness of the supplemental piles. These piles are to be 14 inch diameter (O.D.) by 3/8 inch wall steel pipe piles filled with concrete. These piles are to be driven with a closed end into the native till soil. It is anticipated that sufficient pile capacity will be achieved with piles between 40 and 50 feet long. It is also anticipated that the piles will be installed through pre-drilled holes, the depth of which is not yet specified.

PROCEDURE

The dynamic stiffness of piles driven in soil depends on the dynamic properties of the soil among other factors. These dynamic soil properties are best characterized by the shear wave velocity, V_s, (or shear modulus, G) of the soil. To obtain V_s as a function of depth at the proposed supplemental pile locations, crosshole seismic tests were performed.

With a known shear wave profile for the soil, the elastic-side-layer theory of Novak (1974) can be used to predict the

C. H. Gould
(791)

Remedial Measures For Electrical Penetration Areas and Isolation Valve Pits

This is a brief report on the proposed remedial measures for the electrical penetration areas of the auxiliary building and the adjacent isolation valve pits. The objective of the remedial measures is to replace bearing capacity of a questionable measure as evidenced by soil sampling data. The design of the remedial measure has the objective of replacing the suspect soil bearing capacity with structural elements which extend from the existing concrete foundations to underlying undisturbed glacial till while minimizing disturbances to existing structures and construction operations. In order to accomplish this it is planned to utilize the structural capacity of the penetration area to bridge over some of the questionable underlying materials by providing caissons at the extremities of the electrical penetration areas. These caissons shall have sufficient capacity to support approximately one-half of the dead and live loads of the electrical penetration areas with the remaining one-half being supported by the control tower area. The proposed method for supporting the isolation valve pits is to temporarily support them in place, totally undermine them by removing all materials to a depth at which undisturbed glacial till is encountered and filling the excavation with lean concrete.

The plan of attack for performing the work is as follows:

1. Locally dewater the soil above the glacial till in the affected areas. It is essential that the loose granular soils be dewatered to permit excavation under the structures without significant loss of ground. The dewatering system shall be installed and the water drawn down in advance of any excavation. The dewatering system is a curtain cut-off type. A majority of the eductors will be installed from the lower basement of the turbine building. The discharge will be monitored for piped fines.

2. Temporarily support the isolation valve pit by the use of needle beams spanning between the buttress access shaft and turbine building foundation wall at the ground surface.

3. Excavate an access shaft adjacent to the isolation valve pits to a depth of approximately 7 feet below the bottom of these pits. The excavation would then proceed laterally as a drift until the excavation reaches the extreme edge of the electrical penetration area.

4. Install jacked caissons at this location utilizing the electrical penetration area foundation as the reaction. The jacked caisson method has been selected for the following reasons:

    a. It will be possible to jack through loose sands and soft clays without excavating material from within the caisson thus preventing loss of ground from under the electrical penetration area, turbine building and buttress access shaft.

    b. It is known that there are sizable concrete obstructions in the backfill area which will be encountered by the caissons. A caisson provides man-size working room for demolition of the concrete obstructions.

c. Likewise, the man-size working room of the caisson will permit direct excavation of highly compacted sands and/or clay as well as the glacial till (caissons penetrate the glacial till a minimum of 5 feet).

d. The caisson provides access for direct visual inspection of the glacial till for the initial determination of bearing capacity (final bearing capacity is by load test).

5. Concrete the caisson and load test same.

a. Load test one caisson under each electrical penetration area at 2.0 times design capacity.

b. Load test each caisson individually at 1.5 times design capacity.

c. Load test all caissons as a group at 1.0 times design capacity or 1/4" of vertical structure movement, whichever occurs first.

d. Upon completion of any tests the caissons are to be left in a pre-stressed state to prevent any settlement.

6. Install support of excavation system along the turbine building foundation wall and connect it to the access shaft and the jacked caissons. The jacked caissons which were previously installed under the electrical penetration area will temporarily act as support of excavation for the excavation under the isolation valve pit. The containment structure and the buttress access shaft form the remainder of the excavation enclosure under the isolation valve pit.

The support of excavation system along the turbine wall foundation will also act to:

a. Support the temporary additional load imposed on the foundation wall by the needle beams which support the isolation valve pit at the surface.

b. Support the turbine building vertical loads within the zone of influence of the excavation under the isolation valve pit.

7. Excavate all material from underneath the isolation valve pits to a depth at which undisturbed glacial till is encountered.

8. Fill the excavation under the isolation valve pit with lean concrete backfill to within 7 feet of the existing foundation.

9. Place structural concrete in the drift under the isolation valve pit and the access area used for installation of caissons underneath the electrical penetration area.

10. Dry pack and transfer isolation valve pit load to the lean concrete backfill.

The design of the caisson is based upon a very conservative caisson tip pressure of 25 kips per square foot (KSF) for straight sided caissons. This provides a tip load intensity of approximately one-tenth that normally associated with jacked piling, and will bring the long term settlement into line with expected settlements of the balance of the auxillary building. The bearing strata pressure is limited to 20 KSF for straight sided caisson. If the bottom of the jacked caissons are belled in the glacial fill, the design tip pressure is reduced to 17.7 KSF. The bearing strata pressure associated with belled caissons is not relevant. The steel shells for the jacked caissons are neglected in calculating the structural capacity of the caisson.

The bearing pressure on the glacial till below the isolation valve pit is only nominally increased by the substitution of concrete for earthen fill.

Requested of C. Gould on 1/8/81

Accompanied 8/79 Tech Spec Edition (Exhibit D)

Construction Drawings for Underpinning Contract in 9/79

C-2020 Underpinning Temp. Support - Plans & Details

C-2011 (Q) Aux. Bldg. Plant Area Dewatering - SH-2

C-2005 (Q) Excavation, Underpinning & Backfilling - Plan, Sections & Details

C-2006 (Q) Excavation Underpinning & Backfilling - Plan Section & Details

C-2010 (Q) Plant Area Dewatering - SH-2

Also Tech Spec, Exhibit D 8/79 - App. C w/ pay items

Bechtel Construction Drwg. C-44 entitled
Plant Area - Construction Excavation

19 plots on semi-log of settlement versus time (days)
Show settlement greater than 20".

IMPT - AS OF Dec. 6, 1979

Questions for Dr. Gould

- Would you say that, in general, underpinning work is a highly specialized field of construction?
- Can you describe to us the step by step construction procedure of the underpinning which must be completed to do the underpinning at Auxiliary Bldg
- Do you consider the underpinning work to be completed at Midland to be difficult? In what ways?

In your estimation what are the critical construction operations to be performed for the from standpoint of safety & adverse impact on other work:
Underpinning of the feedwater isolation valve pit area
Underpinning of the electrical penetration area

In underpinning work, do you feel it is necessary to have experienced and qualified superintendents, foreman and other key personnel?

Did you ever make recommendations to Bechtel how qualified personnel could be required for the underpinning work at Midland? (For example - require submittal at time of bidding of the names, experience & qualification of key personnel, etc.)

If yes - what were these recommendations?

If no - Do you know whether Bechtel is considering this requirement?

1 Kane
2. f

What are the maximum bearing stresses on the base of the valve pit (Answer - approx. 3ccc kips - do not give him this value)

- If he doesn't know - ask him if this isn't an essential design value which must be established to determine whether the caisson cap is adequate or not?
- Did Bechtel indicate to him that he was a Consultant what the max. bearing stress is? How could Bechtel award an underpinning contract without first knowing whether the valve pit base could carry the load?

What is his ballpark estimate for the cost of the construction contract to underpin the Electrical Penetration Rooms & Feedwater Isolation Valve Pits?

What monitoring is being performed, or is planned for (e.g. settlement & displacement) the auxiliary building & valve pit during dewatering?

~~Have limits on these instruments been established during underpinning?~~

When did you stop working on the Midland project as a Consultant to Bechtel?

Were all design drawings, calculations and detailed procedures for underpinning the Auxil. Bldg and Valve pit complete at the time you terminated your work as a Consultant to Bechtel?

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