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Transcript of Proceedings

50-329/330

IN THE MATTER OF:

CONSUMERS POWER COMPANY  
(Midland Units 1 and 2)

DEPOSITION OF JOSEPH D. KANE

Bethesda, Maryland

~~Wednesday~~, December <sup>TUES.</sup> 2, 1980

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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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In the matter of:	:	
	:	Docket Nos.: 50-329-OM
CONSUMERS POWER COMPANY	:	50-330-OM
	:	50-329-OL
(Midland Units 1 and 2)	:	50-330-OL
	:	

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DEPOSITION OF JOSEPH D. KANE

VOLUME IV

Bethesda, Maryland

Tuesday, 2 December 1980

Deposition of JOSEPH D. KANE resumed by agreement of counsel, pursuant to adjournment, at 9:00 a.m., in Room P-110, Phillips Building, 7920 Norfolk Avenue, Bethesda, Maryland, before William R. Bloom, a notary public in and for the District of Columbia, when were present on behalf of the respective parties:

On behalf of the Applicant:

RONALD ZAMARIN Esq., Isham, Lincoln and Beale,  
One First National Plaza, Chicago, Illinois  
JAMES E. BRUNNER, Esq., Consumers Power Company,  
212 W. Michigan Avenue, Jackson, Michigan

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On behalf of the Regulatory Staff:

WILLIAM D. PATON, Esq. and BRADLEY JONES, Esq.,  
Office of Executive Legal Director,  
United States Nuclear Regulatory Commission,  
Washington, D. C.

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C O N T E N T S

<u>Witness</u>	<u>Direct</u>	<u>Cross</u>	<u>Redirect</u>	<u>Recross</u>
Joseph D. Kane (Resumed)		4		

<u>Consumer Exhibits</u>	<u>For Identification</u>
18	6
19	103

P R O C E E D I N G S

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MR. ZAMARIN: This is the continuation of the deposition of Joseph D. Kane, continued from the previous session of Thursday, October 16th, 1980.

Whereupon,

JOSEPH D. KANE

resumed the stand and, having been previously duly sworn, was examined and testified further as follows:

FURTHER CROSS-EXAMINATION

BY MR. ZAMARIN:

Q Mr. Kane, you understand you are still under oath and sworn to tell the truth, don't you?

A I do understand.

Q Do you know what type of Piezometer was used with regard to the surcharge program of the diesel generator building at Midland?

A Before we start, could I give you some information that I had indicated in my previous testimony that I would give to you--

Q Oh, surely.

A -- having to do with record sampling?

MR. PATON: Why don't you identify it, tell fairly

eb2

1 precisely what it is just so it can be clearly identified  
2 again.

3 THE WITNESS: It is in response to my previous  
4 testimony and it can be found in Volume I, page 54, of the  
5 previous testimony, and it is sources of information having to  
6 do with record sampling and testing during construction. And  
7 these are excerpts from a Corps of Engineers' Engineering  
8 Manual.

9 There are three pages from EM11102-2300 and they  
10 are pages 7-1 through 7-3.

11 In addition as I recall, Mr. Zamarin also asked me  
12 for a list of events that I had before me which I had given  
13 to him in deposition. And I have made a copy again of that  
14 chronology of events for Midland.

15 One other comment I would like to make is when  
16 questioned about the number of employees in the Geotechnical  
17 Engineering Section I think I gave the names of seven people.  
18 I should correct that to add two additional names. The names  
19 that were missing were Gerry Pearring and John Chen.

20 BY MR. ZAMARIN:

21 Q Would you spell the two names, please?

22 A Pearring is P-e-a-r-r-i-n-g, and Chen is C-h-e-n.

eb3

1 Q John Chen?

2 A Yes.

3 Q What are their titles?

4 A Geotechnical engineers.

5 Q Have either of them done any work on the Midland  
6 soil settlement issue; to your knowledge?

7 A No, they have not done work, to my knowledge.

8 MR. ZAMARIN: I am marking as Exhibit Number 18,  
9 Consumers Exhibit Number 18 as of today's date, 12/2/80,  
10 the document that you produced today, the first three pages --  
11 the first four pages of which are the sources of information  
12 that you referred and the last three pages of which are  
13 the chronology to which you referred.

14 (Whereupon, the documents  
15 referred to were marked  
16 as Consumers Exhibit 18  
17 for identification.)

18 BY MR. ZAMARIN:

19 Q Is that right?

20 A Are there only two pages to the chronology?

21 Q Three pages, I believe.

22 A I thought there were only two. Okay.

eb4

1 Q Well, I don't know. Look at what's on the last  
 2 page. Maybe that's not part of the chronology. What's that  
 3 on the last page of what I've just marked as Exhibit Number  
 4 18?

5 A There are two pages of chronology, and one addi-  
 6 tional page of events that were developing as the soil  
 7 settlement issue was being reviewed by NRC that had been  
 8 prepared by Lyman Heller.

9 Q I have a question pending. I will withdraw it now  
 10 because I want to get onto another line, and I'll come back to  
 11 it.

12 Since October 16th, the date of the last session of  
 13 your deposition, have you come into possession of any docu-  
 14 ments that would be within the purview of the notice to pro-  
 15 duce at the taking of the deposition as modified by Counsel?

16 A Have I come into the possession?

17 Q Yes.

18 A Does that mean things that I have written?

19 Q Things that you've written or things that have been  
 20 transmitted over, given to you which would be items that are  
 21 not in the Public Document Room, unmarked copies -- strike  
 22 that -- marked copies of things that are not in the Public



eb5

1 Document Room, or items that otherwise were not transmitted  
2 to or from Consumers Power Company?

3 A I would say Yes to that question.

4 Q Okay.

5 Do you have any of those items with you now?

6 A I do not.

7 Q Where are they located?

8 A In my office.

9 Q Would it be possible for you to bring them with  
10 you after the lunch break?

11 A I could bring as many as I can identify, but there  
12 may be some that I could not readily-- I would have to go  
13 through all my files again and determine which ones I have not  
14 given you.

15 Q You could make an effort then to at least bring  
16 as many as possible after the lunch break, and then at some  
17 later date, do a more careful review of your files and supply  
18 us via Mr. Paton with other documents?

19 A Some of those documents refer to the preparation  
20 of our testimony with regard to the up-coming hearing. I  
21 would want to discuss those with my Counsel.

22 Q Obviously. And I would assume the claim of

1 privilege would be asserted, and then we'll see whether we  
2 agree or whether we have to seek higher authority.

3 Really all that I'm asking is--

4 MR. ZAMARIN: And perhaps, Bill, I should be asking  
5 this of you rather than the witness, if he can just bring  
6 us what he can find over the noon hour and with regard to the  
7 items that would require a more thorough search, if he could  
8 do that and you could supply copies to us. And obviously  
9 the claim of privilege is something that needs to be identi-  
10 fied and then assert a privilege.

11 MR. PATON: Yes, we'll respond to that after the  
12 lunch hour.

13 THE WITNESS: Could I ask that since you're asking  
14 me to bring it after lunch, I will not have time to make  
15 copies, that I bring those and you identify, similar to what  
16 you're doing for us, which documents you would want?

17 MR. ZAMARIN: Yes. I anticipate that I may have  
18 some questions on them after lunch but yes, we will then  
19 identify those of which we want copies.

20 BY MR. ZAMARIN:

21 Q Do you know what type of piezometer was used with  
22 regard and in connection with the diesel generator building's

eb7

1 surcharge at Midland?

2 A To my recollection there were two types of piezo-  
3 meters used.

4 Q And what were they?

5 A The manufacturer's name?

6 Q Yes.

7 A I do not recall.

8 Q Can you identify them by type?

9 A They were, to my recollection, pressure-cell type  
10 piezometers where the mode of measurement is by air.

11 Q Measurements by air did you say? A-i-r?

12 A Yes.

13 Q Is there any other description or nomenclature  
14 that is generally associated with the type of piezometer that  
15 was used during the diesel generator building surcharge?

16 A Those types of piezometers may be referred to as a  
17 closed system.

18 Q Are there several different types of piezometers  
19 of which you're aware?

20 A There are many different types of piezometers.

21 Q And are response sensitivity of these piezometers  
22 of different types different?

eb8

1 A The sensitivity of the different type piezometers  
2 are different.

3 Q And does the type of response that each gives  
4 differ in that some would have a slow while others would have  
5 a more instantaneous response?

6 A Yes.

7 Q Do you know which type, with regard to sensitivity  
8 and method of response, was used for the diesel building  
9 surcharge?

10 A Being the air pressure type piezometer, you would  
11 expect a more rapid response to the pressure versus such as  
12 an open-tube type piezometer where the larger quantity of  
13 water would be required and there would be a period that it  
14 would take to respond for that water to build up.

15 Q If you had, for example, the more slow response  
16 type, would that influence piezometer readings insofar as  
17 making a record of excess pore dissipation was concerned?

18 A Would you repeat the question? My understanding  
19 of the question is if we had the type of piezometer that had  
20 a slow response, would it represent or be affected by the  
21 excess pore pressure. Is that correct?

22 Q No. The question is if a piezometer of the slow

eb9

1 response type were used, would that have some influence on  
2 piezometer readings of excess pore water dissipation?

3 A It would have some influence.

4 Q And will you describe what that influence would  
5 and the mechanism of that influence?

6 A A slow response type of piezometer would be, say  
7 an open tube and the measurement of the pressure in the tube  
8 would be dependent on the time it would take for that water  
9 to either move in or out of that tube. And so if there was  
10 a rapid development in pore pressure you may not be getting  
11 an accurate reading in the slow response type because it has  
12 not fully had enough time to either allow movement of water  
13 into the tube or out of the tube.

14 Q In short then, it would be fair to say that it's  
15 possible with the slow response type piezometer that you would  
16 have dissipation while the piezometer is responding and that  
17 it wouldn't record the total dissipation?

18 A It's possible.

1.158

19 Q If in fact such slow response piezometers were  
20 used rather than the closed system or instantaneous response  
21 piezometers at the diesel generator building, would that, in  
22 your mind, possibly account for what you perceive to be a

eb10

1 rise in pore water pressure that was less than expected?

2 A No.

3 Q Why not?

4 A Because the time that we were measuring pore water  
5 pressures was over several months, and I think the time lag  
6 that is a problem with the slow response type piezometers  
7 would not be over that period. I think it would be over  
8 periods of days rather than months.

9 Q The time lag you say would be over a period of days  
10 rather than months; is that right?

11 A Yes.

12 Q And in your mind it is not possible then that  
13 pore pressure dissipation was so rapid that it could have  
14 occurred in significant magnitude during the first several  
15 days and therefore not have been accurately recorded?

16 A Well, it's my understanding that the piezometers  
17 were a closed system and therefore, they would be more  
18 accurate.

19 Q Could you answer that question assuming that they  
20 were the slow response open system?

21 A They would be influenced, because they are the slow  
22 type. Whether they would have only indicated that levels tha

eb11

1 were observed at Midland, in my opinion even with the slow  
2 type it would have been higher. The pore pressures would have  
3 developed higher than what was indicated and what you have  
4 submitted for Midland.

5 Q And is it also your opinion that not only would  
6 they have developed higher but that they would have been  
7 recorded higher even assuming the use of slow response open  
8 system piezometers?

9 A Would you repeat the question?

10 (Whereupon, the Reporter read from the record  
11 as requested.)

12 THE WITNESS: Yes.

13 BY MR. ZAMARIN:

14 Q Are you familiar with the piezometer styled a  
15 Casa Grande type piezometer?

16 A Yes.

17 Q Is that a slow response or instantaneous response  
18 piezometer, in your opinion?

19 A Slow response.

20 Q You testified at one of the previous sessions of  
21 your deposition that you had expected, or one could calculate,  
22 I believe, a 35-foot head as a result of the excess pore

eb12

1 pressure. Is that correct?

2 A I indicated that would be the maximum level that  
3 you could expect.

4 Q Are there certain assumptions that one would have  
5 to make in order to expect to reach or approach that maximum  
6 head?

7 A Yes.

8 Q Can you tell me what those assumptions are?

9 A That the soil is fully saturated, that the load  
10 imposed initially is imparted to the water in the pore pres-  
11 sures and not carried any by the soil structure.

12 Q Would one of the assumptions also be an instan-  
13 taneous application of surcharge?

14 A You'd have to define "instantaneous." Are we saying  
15 within seconds?

16 Q Why don't you tell me within what period of time  
17 the surcharge would have to be applied in order to be con-  
18 sistent with an expectation of the maximum 35-foot head?

19 A The time that would have to be applied is before  
20 any drainage would occur.

21 Q With regard to the diesel generator building area,  
22 what is your opinion of the amount of time before drainage



eb13

1 would occur?

2 A Because of the heterogeneous nature of the soils,  
3 that would differ in different locations.

4 Q And what would be the average drainage time of  
5 drainage path, in your opinion?

6 A I don't think there is an average. In some loca-  
7 tions it is my understanding we have essentially a full depth  
8 of fill that is clay. In other areas we have mixed. In othe-  
9 areas we have entire sand. And I don't think I can give an  
10 average for those three conditions.

11 Q What would you expect the time to be in the area  
12 of mainly sand?

13 A I would expect it to dissipate rapidly.

14 Q How rapidly? Within a day?

15 A Over a period of several days.

16 Q What about--

17 A It depends on the permeability of the sands. Ther  
18 would be some sands where it would not build up. There would  
19 be some sands where it would.

20 Q When you say "it" what are you referring to?

21 A The pore pressure .

22 Q Okay.

ebl4

1 Now, we're talking now about drainage path; right?

2 A We're talking about drainage path. But the drainage  
3 path is the means by which the pore pressures dissipate.

4 Q Right.

5 You say there were some sands where pore pressure  
6 wouldn't build up. You mean it would not act as a drainage  
7 path?

8 A No. What I mean is there were some sands that are  
9 so permeable that upon loading, the water would not build  
10 up -- the water would not build up a pressure because of that.  
11 loading and it would drain almost instantaneously.

12 There are other sands, because of the gradation  
13 or the percent fines, where that would not occur.

14 Q Where would the sands that it is your understanding  
15 exist with regard to certain areas of the diesel generator  
16 building fall within this gradation of fines that you refer  
17 to?

18 A I would say wherever there were sands that had more  
19 than five percent fines, five percent passing a 200-mesh sieve.

20 Q What would happen where you had sands where there  
21 were more than five percent fines?

22 A The rate of dissipation of pore pressures, the

eb13

1 drainage through those materials would be slower for material  
2 that had less than five percent, in my estimation.

3 Q And what is the nature of the sands in and around  
4 the area of the diesel generator building at Midland?

5 A I think we have silty sands which would have more  
6 than five percent. I think we have sands between five and  
7 12 percent. I don't know whether-- I do not recall whether  
8 we have sands with less than five percent.

9 Q Based upon what your understanding of the gradatic  
10 of the sands in and around the diesel generator building is,  
11 do you have an opinion, based upon your geotechnical engineer  
12 ing experience, as to the amount of time that would be re-  
13 quired under the surcharge conditions that exist at the dies  
14 generator building for drainage and dissipation of excess  
15 pore water pressure?

16 A The question is directed toward the sands?

17 Q Yes.

18 A I think I have indicated how quickly the sand  
19 drains depends on the gradation. So if I'm being asked to  
20 make a guess of time, then I think I have to know which type  
21 of sands you're talking about.

22 Q Well, the predicate of my question was based upon

eb16

1 your understanding of the gradation of the sands which you've  
 2 described as silty sands which are greater than five percent  
 3 fines and sands between five and 12 percent fines, based upon  
 4 your understanding that that was the type of sand that we  
 5 had, what would, in your opinion, be the time for drainage  
 6 and dissipation of excess pore water pressure under the sur-  
 7 charge conditions?

8 MR. PATON: I'm not sure that the witness indi-  
 9 cated that that was his clear understanding of what the sands  
 10 were because I think he said when he got finished that he  
 11 wasn't sure whether there were any sands less than five per-  
 12 cent.

13 THE WITNESS: To answer the question I think I  
 14 have to address the three types of sands that I have grouped  
 15 that could possibly be there, and I would say that if it is  
 16 less than five percent fines, then the dissipation of pore  
 17 pressure -- the drainage through that material will be very  
 18 quickly.

19 If it were, say, five to 12 percent fines, I think  
 20 there would be some buildup of pore pressures but that would  
 21 rapidly dissipate. And by "rapidly" I'm talking about days.

22 If it's the type of material that has more than 12

eb17

1 percent fines, I think it would take weeks to dissipate.

2 BY MR. ZAMARIN:

3 Q When you say "with five to 12 percent fines it  
4 would take days," are you talking about one or two days?

5 A Yes. But it should be recognized that we have  
6 silts and clays in the fill; which would take much longer.

7 Q With regard to the clays, and based upon your un-  
8 standing of the predominant characteristics of the clays ex-  
9 ing under the diesel generator building, what is your opini-  
10 as to the time for drainage and dissipation of excess pore  
11 water pressure under the surcharge load?

12 A I know there are many factors which affect the t  
13 and that is: how fully saturated they are. That could bri-  
14 up the problem of, if only partially saturated and, under lo-  
15 ing, now causing some of the gas in the air voids to go in-  
16 solution but some gases to remain in the air voids, and if  
17 were only partially saturated and that occurred, then that  
18 would affect the time for the pore pressures to dissipate.

19 So right now I cannot tell you how quickly, unt-  
20 I knew the degree of saturation of the materials that were  
21 involved, until I knew what is the likelihood of sand lens  
22 extending through those areas. There are many factors to

eb18

1 considered.

2 Q You say you would have to know the likelihood of  
3 sand lenses extending through those areas. Is that because  
4 the time for dissipation and time to consolidation varies as  
5 a function of the drainage distance?

6 A Yes.

7 Q And do you know by what mathematical relationship  
8 time relates to the function of drainage distance?

9 A Would you repeat your question?

10 (Whereupon, the Reporter read from the record  
11 as requested.)

12 THE WITNESS: I don't recall the exact mathematical  
13 relationship.

14 BY MR. ZAMARIN:

15 Q In coming to your conclusion that the maximum  
16 drainage head would be 35 feet, did you assume a certain  
17 drainage distance?

18 A I don't think it's proper to label it "maximum  
19 drainage head."

20 Q Label it however you wish then.

21 A It is the maximum pore pressure that could have  
22 developed because of loading.

eb19

1 Q Then in reaching your conclusion of maximum pore  
2 pressure head of 35 feet, did you assume a certain drainage  
3 distance?

4 A No. I think the indication that it's the maximum  
5 head is assuming that there are no readily apparent drainage  
6 paths.

7 Q How does the drainage distance influence drainage  
8 time?

9 A When a soil is loaded and is fully saturated, the  
10 tendency is to squeeze the voids closed which puts the pore  
11 water under pressure. That pressure wants to relieve itself  
12 by draining, by seeping out of those air voids. And so the  
13 longer the distance that it has to drain and develop seepage  
14 resistance affects the time of drainage."

15 Q You're saying that in reaching the conclusion of  
16 a maximum pore pressure head of 35 feet you assumed no readily  
17 accessible drainage paths. Do you think that that's a likely  
18 circumstance with regard to the diesel generator building?

19 A Could we go back to where I said I have assumed  
20 no readily available drainage paths?

21 Q Do you mean you want to hear your answer again?

22 A I want to hear where I made that statement again.

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MR. ZAMARIN: Would you read that answer back, please?

(Whereupon, the Reporter read from the record as requested.)

THE WITNESS: I think the distinction I'm trying to make is the computation for maximum pore pressure-- I think I have indicated what are the assumptions when you calculate that, but they are the assumptions to calculate the maximum pore pressure that you could develop. And I'm saying maximum....The question that you have is when I do that I'm assuming no drainage path. I recognize that is the maximum value, and I recognize there are drainage paths in the fill at Midland which would give me less than that maximum.

So I guess what I'm objecting to is your saying that I concluded that there were no drainage paths.

BY MR. ZAMARIN:

Q I didn't say that. I was simply asking whether you believed that there were no drainage paths with regard to the diesel generator building area at Midland.

A I think I said I felt there were.

Q Based upon what your understanding of what those drainage paths are or are likely to be, do you know how much



eb21

1 less than a 35-foot head would be in fact expected?

2 A It seems we are now repeating a line of questioning  
3 that you had given me before. I think we are. And you are  
4 asking me to give you the pore pressures which I felt are  
5 more reasonable for the Midland site other than the 35 feet  
6 and I think I have indicated in previous testimony that it  
7 would take an analysis to do that.

8 And I think I went through talking about sections,  
9 about reflecting on those sections, soil parameters, soil  
10 stratification and estimating what I thought were the potential  
11 drainage paths to be able to make that kind of analysis. And  
12 I think we're returning to that same line of questioning.

13 Q So are you saying as you sit here now, based on  
14 your expertise in geotechnical engineering, that you cannot  
15 provide an opinion as to what the likely drainage path is with  
16 regard to Midland and therefore, what effect that would have  
17 on the maximum pore pressure head of 35 feet?

18 A As I sit here now, I have not made that computation.  
19 I have indicated to you what I thought would have to be done  
20 to make that computation, and I have indicated in the past I  
21 felt if there are reasons to explain why the pore pressures  
22 did not develop to higher levels that you would have anticipated

eb22

1 then this type of analysis should be made to give reasons why  
2 it never reached that level.

1.490

3 Q Is it true then as you sit here now you are not  
4 capable of doing that?

5 A No, that is not true. I am capable. I have not  
6 done it.

7 Q I see.

8 When I say "doing that" I mean capable of giving  
9 us an opinion based upon your expertise as a geotechnical  
10 engineer as to what effect it would likely have on the 35-  
11 foot head, now as you sit here without going to a calculation

12 A I'm not capable of giving you an opinion because  
13 I have not done that analysis.

14 Q Do you believe that such a calculation of drainage  
15 paths and their effect on the anticipated maximum head can  
16 be calculated based upon the heterogeneous nature of the  
17 soils in and around the diesel generator building?

18 A I think an examination of the conditions that I  
19 have talked about previously could be made and give a good  
20 understanding why the pore pressures never fully developed.  
21 I don't want to indicate that I think this is an exact com-  
22 putation that anyone can do and when completed there would

eb23

1 no questions.

2 I think I had indicated that there would be many  
3 assumptions, assumptions on stratification, assumptions on  
4 soil parameters which would be involved. But I am saying if  
5 the pore pressures never developed to a level that we would  
6 anticipate, there must be reasons. And looking at potential  
7 drainage paths may help explain the reasons.

8 Q Do you know whether time of dissipation varies as  
9 the square of the drainage length?

10 A I'm not positive but I think it does.

11 Q So then if you had a drainage length that was one-  
12 fifth of an assumed length, the time for dissipation would be  
13 one-twenty-fifth of the time that would be calculated for the  
14 assumed length. Is that right?

15 A That's right.

16 Q I take it then that the drainage path length would  
17 have a substantial impact the on the time of pore pressure  
18 dissipation and the extent to which certain piezometers  
19 would record all of that dissipation. Would you agree with  
20 that?

21 A I would.

22 Q Would you agree that the process of settlement is

eb24

1 a decelerating process under constant load?

2 A Yes.

3 Q And by that am I correct in understanding that  
4 there should be maximum settlement at the beginning of  
5 application of a load, maximum dissipation of pore pressure  
6 at the beginning of application of a load, and then no  
7 acceleration in the settlement or dissipation of the pore  
8 pressure under that constant load?

9 A Generally, yes. There could be extenuating circum-  
10 stances which could change the rate of acceleration.

11 Q Tell me what those extenuating circumstances are.

12 A To cause a change in site conditions such as  
13 increasing the level of saturation in the soils where, be-  
14 cause of developing saturation new zones of soils have become  
15 saturated and the saturation effect overwhelms the normal  
16 deceleration of settlement.

17 Q Would there be any other extenuating circumstances  
18 to your knowledge that could--

19 A Not that I recall.

20 Q Are you familiar with the settlement versus log  
21 time plots for the settlement markers on the diesel generator  
22 building during the application of the surcharge and the

eb25

1 removal of the surcharge?

2 A I have some familiarity with them.

3 Q And do you recall that they are essentially of a  
4 somewhat S-type curve showing a second drop?

5 A I'm waiting to see the curve.

6 Q I have here Figure 3 of Consumers Exhibit Number  
7 8 for identification, Kane deposition, as of 10/15/80, and  
8 I show you that. This is for Marker DG-3.

9 (Handing document to the witness.)

10 A Perhaps you would like to indicate on here what  
11 you're referring to as the second drop.

12 Q Well, what I see is the portion before I believe  
13 it is 100 on the log time scale. There's a certain slope and  
14 then that slope decreases. It turns upward -- not upward of  
15 horizontal but it changes slope, doesn't it?

16 A It appears, does it not, to change here and also  
17 here?

18 Q Unfortunately when you say "here," we can't get  
19 it on the record. It's just before the 100 on the log time  
20 scale it changes. Is that right?

21 A It appears to change at the time just before 100  
22 days and then it also appears to change again after 100 days

eb26

1 Q Okay.

2 Describe the change in the slope just before 100  
3 days.

4 A Just before 100 days there's a change in slope that  
5 is somewhat flatter than the preceding settlement pattern.

6 Q And then what happens to the slope just after 100  
7 days?

8 A At 100 days it appears to level off, and then again  
9 immediately after 100 days it appears to go into a new slope  
10 or settlement.

11 Q A steeper slope than we had for that period just  
12 before 100 days, up until just after 100 days?

13 A From the way it is plotted here it would appear to  
14 be slightly steeper.

15 Q Okay.

16 To your knowledge is that a typical settlement  
17 versus log time plot showing primary consolidation and then  
18 entering into secondary consolidation?

19 A I think it would be helpful to define "typical,"  
20 whether we're talking about typical laboratory tests or a  
21 typical field test.

22 Q I'm talking about typical field tests. You

eb27

1 wouldn't expect to find a settlement versus long time plot  
2 for a lab test, would you?

3 A Yes.

4 Q Oh, you would?

5 A Sure.

B2

6 Q Why don't you describe for me then the type of  
7 laboratory test and the type of plot that you would have for  
8 primary and secondary consolidation with regard to lab tests.

9 A Do you have a curve you wish me to indicate it on  
10 or do you want me to draw my own?

11 Q I just want you to tell me what you would do, what  
12 you would plot on each of the ordinates and what the curves  
13 would look like.

14 A We are now talking about a laboratory test--

15 Q Yes.

16 A -- which is plotting either dial deformation read-  
17 ings which is the equivalent of settlement versus the log of  
18 time, and you would anticipate having an S-type curve there  
19 from which you could estimate the end of primary consolidation  
20 and the beginning of secondary consolidation.

21 Q You said you would have what type of deformation  
22 reading? Dial?

eb28

- 1 A Dial.
- 2 Q Dial?
- 3 A Gauge, dial of the laboratory equipment.
- 4 Q Is this a standard type of test and method of  
5 plotting used customarily in good engineering practice?
- 6 A Which one are we referring to?
- 7 Q The one you just described.
- 8 A Dial deformation?
- 9 Q Dial deformation reading versus log of time.
- 10 A It is customary.
- 11 Q It is.  
12 Customary in the engineering field or just cus-  
13 tomary with regard to NRC engineering practice?
- 14 A Customary in the engineering field.
- 15 Q Do you consider it a reliable method of estimating  
16 or predicting settlement?
- 17 A The plot we're talking about was versus log time.  
18 That plot is not used to estimate the amount of settlement  
19 but the time for settlement to occur.
- 20 Q Do you consider it to be reliable in estimating  
21 the time for settlement to occur?
- 22 A There are cases where I would consider it; there



eb29

1 are cases where I would not.

2 Q Would you consider it a reliable method in the  
3 case of the diesel generator building?

4 A Because of the heterogeneous nature of the fill,  
5 it would be difficult to use that to predict the time.

6 Q What kind of a lab test, if any, would give re-  
7 liable predictions as to the time of settlement in a situation  
8 such as the diesel generator building?

9 A The test that we're talking about, the plot of  
10 deformation versus time, would be the best laboratory ap-  
11 proach, the best available.

12 Q Is there a laboratory approach to predicting  
13 settlement?

14 A The amount of settlement?

15 Q Yes, --

16 A Yes.

17 Q -- with regard to a situation like the diesel  
18 generator building.

19 A It's been my experience that it is more accurate  
20 when running the consolidation tests to be able to predict  
21 the amount of settlement than it is for the time for settle-  
22 ment to occur and therefore the laboratory consolidation

eb30

1 test, in my estimation, can reasonably help you to predict.  
2 the amount of settlement.

3 Q Okay.

4 There's an expression I use that is called  
5 damnation by faint praise, and I'm not quite sure what you  
6 said or if that's what you did in that answer.

7 What I understood you to say is that predicting  
8 the amount of settlement was a little more accurate than  
9 predicting the time of settlement using the dial deformation  
10 versus log time, and that it would reasonably help you in  
11 predicting. Is it a reliable prediction of amount of settle-  
12 ment?

2.050

13 A There are cases where it would be reliable and  
14 other cases where it may not be.

15 Q In your opinion would it be a reliable prediction  
16 of the amount of settlement in a case such as the diesel  
17 generator building where you have heterogeneous soil pro-  
18 perties?

19 A Yes. Yes, if the various conditions that exist  
20 under the diesel generator building are appropriately taken  
21 into account.

22 Q Okay.

eb31

1                   What are those conditions, and in what way would  
 2 they be taken into account so as to be appropriately taken  
 3 into account?

4           A        Because of the different types of materials and  
 5 their different thicknesses and their different compress-  
 6 ibility characteristics, you would have to establish by sub-  
 7 surface explorations the thickness of the layers and by  
 8 laboratory testing establish their compressibility charac-  
 9 teristics.

10                   And it would be recognized that there would be  
 11 wide variations. In recognition of those variations you  
 12 would use the laboratory consolidation test to give you a  
 13 range of settlement predictions. The range would develop  
 14 because of the different soil thicknesses and compressi-  
 15 bility characteristics.

16           Q        And what would you do with the range?

17           A        Have an understanding of what I think would be  
 18 the maximum and minimum settlement that could be expected  
 19 under the diesel generator building.

20           Q        Do you have any idea what kind of a range you  
 21 might be talking about with regard to conditions such as the  
 22 diesel generator building?

eb32

1 A I can only put numbers on that after I made that  
2 analysis.

3 Q You don't have any idea now whether it would be  
4 a range of, for example, a half an inch to 25 feet or some-  
5 thing less than that?

6 A Based on the behavior of the preload I would say  
7 it would be less than 25 feet.

8 Q Can you tell me how much less you think it would  
9 be?

10 A Considerably.

11 Q How much? Quantify that if you can.

12 A Less than 10 inches.

13 Q You believe the range would be somewhat less than  
14 a 10-inch range?

15 A Yes.

16 Q Can you as you sit here now indicate how much less  
17 than the 10-inch range you believe it might be, or is that  
18 as far as you want to go?

19 A That's as far as I feel I should go.

20 Q As far as you feel you should go for what reason?

21 A That not having made an analysis I shouldn't be  
22 giving figures.

eb33 C2  
2.090

1 Q Would the locations of the requested borings in  
2 the diesel generator building area provide you with suffi-  
3 cient information to determine this range of predictions?

4 A Are we referring to the six additional borings  
5 in the diesel generator building--

6 Q Yes, we are, or I am.

7 A -- that was requested by the Corps of Engineers?

8 Q Yes.

9 A That information would help. You have additional  
10 borings which you should use to establish the stratification  
11 and the thicknesses of the compressible layers. So it is  
12 not just six borings but all the additional borings you have  
13 completed.

14 Q So you're saying you already have some borings  
15 that would be used and then these six requested borings would  
16 be in addition to those?

17 A That is correct.

18 Q And with regard to those six additional borings,  
19 in your opinion would they be sufficient, along with the  
20 other borings that we have, to calculate the range of pre-  
21 dicted settlement that you refer to?

22 A They should be.

eb34

1 Q Would any five of those borings be sufficient to  
2 make that calculation?

3 A There's a certain amount of judgment on what  
4 borings are enough. The borings that have been located  
5 attempted to do the perimeter of the diesel generator build-  
6 ing. I think some of the borings for the diesel generator  
7 building, the six additional borings, have already been  
8 agreed upon by the Corps to be deleted; that is the borings  
9 that ask for the standard penetration test because of new  
10 information that you submitted to us on September the 14th.

11 Some of the new borings would give you the infor-  
12 mation equivalent to what had been asked by the Corps borings,  
13 so some of the borings could be eliminated but some of the  
14 borings required to take undisturbed sampling would still be  
15 required in those areas.

16 In other words you would have to evaluate the  
17 boring that have been completed plus the additional borings  
18 the Corps is asking for, evaluate the standard penetration  
19 test results, and use a judgment where you would want to take  
20 undisturbed sampling for laboratory consolidation tests.

21 MR. ZAMARIN: Would you read the answer back,  
22 please?

eb35

1 (Whereupon, the Reporter read from the record  
2 as requested.)

3 THE WITNESS: Could I say something?

4 If I had said all the borings, all the SPT borings  
5 in the diesel generator building could be deleted, then that  
6 is an incorrect statement. Some of them, and I think there  
7 are two in the diesel generator building which have been  
8 judged not to be required because of the additional informa-  
9 tion that you have submitted, but it does not relieve the  
10 necessity of taking undisturbed samples in those areas.

11 BY MR. ZAMARIN:

12 Q So it's true, isn't it, that the number of borings  
13 in the diesel generator building area remain the same as it  
14 did with the original Corps request?

15 A No, that is not correct.

16 Perhaps I can explain.

17 Q Please.

18 A Six borings requesting standard penetration tests  
19 were originally requested in the diesel generator building.  
20 You have submitted new boring information in your September  
21 14th, 1980 submittal. Some of those borings are in the area  
22 that the Corps had asked for borings. It has been judged

eb36

1 that they would be adequate to replace the SPT borings  
2 originally requested.

3 And so some of the original 18 borings can be  
4 deleted. When you finish with the other borings in the diesel  
5 generator building then a judgment has to be made, based on  
6 that information: the soil stratification, the blow counts  
7 observed, the type of materials, where undisturbed samples  
8 should be taken.

9 But to answer your original question, some of the  
10 borings are being deleted.

11 Q How many borings is it right now that are being  
12 requested in the area of the diesel generator building?

2.185

13 A I think it is four borings. I think two had been  
14 replaced, but I don't want to be held to the two. Consumers  
15 will be supplied a new boring location map which will tell  
16 which borings that you have completed will take the place  
17 of borings requested by the Corps.

18 But I think four SPT borings are still required  
19 in the diesel generator building. After those four are com-  
20 pleted and the two -- the locations of the two original ones  
21 which had been replaced by your new information are evaluated,  
22 then a decision has to be made where to take your undisturbed



eb37

1 sampling.

2 Q My understanding of the original Corps request  
3 with regard to borings around the diesel generator building  
4 was that there were six locations and there were going to be  
5 two borings at each locations, one to perform an SPT and one  
6 to extract an undisturbed sample. Is that understanding  
7 correct?

8 A No.

9 Q What was it that was asked for in that original  
10 request for borings around the diesel generator building?

11 A Originally six borings that required continuous  
12 disturbed samplings and SPT type information. Following that  
13 an evaluation would be made which would say what areas are  
14 likely more compressible than others, what areas are likely  
15 more affected by a bearing capacity analysis, and then to go  
16 and get undisturbed samples in those areas.

17 So if you had information from the six borings  
18 that was different in all holes then it possibly could result  
19 in six undisturbed sampling borings. But if you could decide  
20 by the completed borings that maybe there were only two or  
21 three types of conditions that actually still existed under  
22 the diesel generator building, then it would only be necess

cb38

1 to do undisturbed sampling in those areas.

2 I'm somewhat puzzled by the interpretation by  
3 Consumers that you do undisturbed sampling everywhere where  
4 you do SPT's. That is not the normal engineering practice.  
5 And that's not what is indicated in our Reg. Guides on Site  
6 Investigations. And I'm puzzled why it's being interpreted  
7 that you need undisturbed samples for every hole for the full  
8 depth of the hole.

9 Q It is your understanding then that that is not what  
10 was requested by the Corps?

11 A That is correct.

12 Q I have here what is page two of two in an attach-  
13 ment to the June 30th, 1980 letter to Mr. J. W. Cook, vice  
14 president of Consumers Power Company, over the signature of  
15 A. Schwencer, S-c-h-w-e-n-c-e-r, Acting Chief of Licensing  
16 Branch Number 3, the subject of which is "Request for Addi-  
17 tional Information Regarding Plant Fill."

18 In Note 3 on that page two of two, in Table 37-1  
19 it says:

20 "Continuous split spoon sampling using  
21 SPT is required. Holes are to be held open using  
22 either casing or hollow stemmed auger. Additional

eb39

1 borings to obtain representative undisturbed samples  
2 for detailed laboratory testing should be located at  
3 the completion and elevation of the split spoon  
4 sampling program. The groundwater level should be  
5 recorded at the completion of drilling in all  
6 borings once the level has stabilized."

7 MR. PATON: Could he see that?

8 MR. ZAMARIN: Surely.

9 BY MR. ZAMARIN:

10 Q I think perhaps when you say that you don't under-  
11 stand how it could have been taken that undisturbed samples,  
12 were required for each of those, where it says here:

13 "Additional borings to obtain represen-  
14 tative undisturbed samples for detailed laboratory  
15 testing should be located at the completion and  
16 elevation of the split spoon sampling program...."

17 perhaps that's the sentence that has been misunderstood by  
18 somebody.

2.270

19 A I guess there continues to be a misunderstanding  
20 with this sentence.

21 "Additional borings to obtain represen-  
22 tative undisturbed samples for detailed laboratory

eb40

1 testing should be located at the completion and  
2 elevation of the split spoon sampling program."

3 I guess the misunderstanding comes from the use  
4 of the word "representative." It is not normal engineering  
5 practice to take undisturbed samples for the full depth of  
6 every hole. We had this same discussion in I think it was  
7 at the end of July with Consumers about when James Wanceck  
8 made his presentation of a million dollar costs for addi-  
9 tional borings that this was not what was intended.

10 We were talking about taking representative un-  
11 disturbed samples and we talked about, at that meeting, of  
12 looking at perhaps taking only the worst condition and the  
13 average condition and testing that. And I thought it had be  
14 made clear at that time that we were not expecting you to  
15 test every sample.

16 I'm really baffled that anybody would think that  
17 we would want you to test every sample.

18 Q Doesn't that sentence that you just read seem to  
19 indicate that what the Corps requested on June 30th, 1980  
20 was undisturbed samples for each of those borings?

21 A What does "representative" mean to the people who  
22 are reading this? I guess that's one question. To me it

eb41

1 means, you know, you have a layer a certain thickness and  
2 it's not necessary to test every sample in that layer. You  
3 would take representative samples out of that layer and test  
4 them. And that is the normal procedure.

5 Q Representative samples being representative of  
6 what?

7 A Of a given soil layer, stratification.

8 Q Okay. I may now be more confused than we were  
9 when we started. Let's go back a bit and-- I'm not a geo-  
10 technical engineer by any means.

11 You say that what was requested was six borings

12 A Six borings with continuous SPT sampling.

13 Q And that there was not a request for the extrac-  
14 tion of undisturbed samples in that June 30th request?

15 A No, I haven't said that. What I have said is -  
16 I've said it I think twice already this morning -- you would  
17 do those SPT borings and identify the conditions that exist  
18 and use your engineering judgment to what of the information  
19 that you now have before you of where there is a concern of  
20 settlement and where there is a concern for bearing capacity  
21 and only in those areas go and take your undisturbed samples

22 If you did those six borings and got very high

2.320

eb42

1 blow counts in all six borings, then it wouldn't seem reason-  
 2 able to me that you would be expected to run settlement  
 3 computations and bearing capacity.

4 It seems to me we should be using engineering  
 5 judgment to -- based on that information, where do we go and  
 6 take our undisturbed samples.

7 Q Do you believe that there is layering in the fill  
 8 beneath the diesel generator building?

9 A Yes.

10 Q And upon what do you base that belief?

11 A From the borings that have already been completed  
 12 MR. ZAMARIN: Why don't we take a brief recess?

13 (Recess.)

14 MR. ZAMARIN: On the record.

15 BY MR. ZAMARIN:

16 Q Could you describe for me what your understanding  
 17 is of precisely what was to be done in accordance with the  
 18 June 30th, 1980 request by the Corps as it related to boring  
 19 in the area of the diesel generator building, and really wha  
 20 I'm asking you to do is to tell me what type of equipment  
 21 would be taken out there, what one would do with it, what  
 22 they would pull out of the soil, if anything, and what, in

eb43

0.350

1 total, could be physically done.

2 A Wouldn't it be easier if I just referred you to  
3 a Regulatory Guide that addressed site investigations?

4 Q I don't know whether it would or not because I  
5 haven't tried to read one of those.

6 But can you tell me? If you don't have that know-  
7 ledge that's fine, but if you can I'd appreciate it if you  
8 would simply tell me just what it is that they wanted some-  
9 one to go out and do, and how they were to go about doing  
10 it.

11 A Could I have the document, please?

12 Q Yes, you may.

13 (Document handed to the witness.)

14 The document we have just given to you is the  
15 June 30th, 1980 letter and its attachments.

16 A That's correct.

17 In Enclosure 1 to this document, the NRC requests  
18 that you complete as a minimum the exploration and testing  
19 program indicated by Table 37-1. And on Table 37-1 it has  
20 five headings. The table is entitled "Request for Additional  
21 Exploration, Sampling and Testing."

22 The first column lists the four site areas where

eb44

1 borings have been requested.

2 The second column attempts to give guidance on the  
3 depth that these borings should extend to.

4 The third column has to do with the sampling and  
5 is referred back to the notes of Table 37-1.

6 The fourth column has to do with the tests that  
7 you would need to run to develop the studies that are listed  
8 in column five which are anticipated geotechnical engineering  
9 studies to be required, and for each of the structures certain  
10 studies are indicated as being needed.

11 For instance, the diesel generator building says

12 "The purpose of the explorations and  
13 testing is to re-evaluate bearing capacity, settle-  
14 ment and piping distortion of the Category I conduits  
15 that are beneath the diesel generator building."

16 To do this it would be necessary to go to the  
17 diesel generator building area and conduct borings. The cost  
18 varies with the drilling outfit that's involved.

19 But the purpose is to take continuous undisturbed  
20 sampling.

21 I assume you know what an SPT test is.

22 Q Why don't you tell me what it is?



eb45

1           A       A standard sized sampler two inch in diameter is  
2 driven into the ground under a select weight hammer, 140-  
3 pound hammer, and is dropped a given distance. That resist-  
4 ance to the penetration of the sampler is measured. The  
5 standard penetration test is the number of blows of that  
6 hammer driving that sampler one foot.

7                   Generally the sampler is driven anywhere from 18  
8 inches to 24 inches. But the first six inches of driving  
9 are normally discarded because of the effect of cuttings  
10 from previous samplings in the same hole.

11                   So this process of driving the spoon sampler with  
12 the hammer is continuously performed in this hole. And at  
13 the end of the hole you would have blow counts for the full  
14 depth of the hole. You would have recovered soil samples in  
15 the spoon samplers for identification and visual classifica-  
16 tion which would give you an idea of the soil type, of the  
17 difference in soil layering and stratification.

18                   You would do this type of sampling in each boring  
19 and where located, you would record the groundwater location.

20                   Then on the basis of those completed six borings  
21 you would evaluate the material types, the thicknesses of  
22 the layer and the blow count data that you have recorded.

eb46

1 The blow counts would be an indication of soil properties.  
2 It would be an indicator. It would tell you whether material  
3 is either soft or loose or very dense, medium dense, and  
4 you would make a judgment, based on that information, where  
5 to take undisturbed samples.

6 The selection of the undisturbed samples requires  
7 a judgment on the person evaluating the boring information,  
8 of recognizing what studies he has to complete, and making  
9 a judgment, where should I take undisturbed samples to get  
10 me the samples that I need to run laboratory tests on to  
11 establish the soil parameters that I need for these studies.

12 It is not normal practice to take undisturbed  
13 samples in every boring at every depth in them. It is normal  
14 practice to make a judgment based on the SPT result where  
15 I should be taking my undisturbed samples.

16 I think I have answered your question.

17 Q You indicated that blow counts would be taken for  
18 the whole depth of the hole. Do you really mean that? I  
19 mean isn't it usually every two or two and a half feet that  
20 you actually do it, or do you actually do it for every depth  
21 throughout the hole?

22 A I don't think there is a set procedure that you

eb47

1 take it every two and a half or you take it continuously.  
 2 You must recognize what is at the site and if you have  
 3 heteogeneous material where you're trying to identify thin  
 4 layers of material because of their impact on drainage, then  
 5 it is common practice to take continuous split spoon samples.

6 If you have a nice homogeneous material that you  
 7 are reasonably assured that its properties aren't changing  
 8 in short depth intervals, then the normal practice would be  
 9 to take sampling at, say, two and a half foot intervals.

10 Q From what you've just said do I take it the Corps  
 11 is asking for the continuous split spoon samples as opposed  
 12 to at some intervals, for example every foot or every two  
 13 and a half feet?

14 A That's correct.

15 Q And from that would you then end up, if you have  
 16 a 25-foot hole, with 25 feet of samples when you pulled them  
 17 out?

18 A If you fully recovered each sample, yes.

2.500

19 Q On the borings that have been determined as no  
 20 longer required at this time -- and you think perhaps it was  
 21 two with regard to the diesel generator building -- the  
 22 elimination of the need for the standard penetration tests

eb48

1 then I take it also eliminates the need for the split spoon  
2 sampling. Is that correct?

3 A That is correct.

4 Q You said that based upon the observation and  
5 evaluation of the recovered split spoon samples and a deter-  
6 mination of soil properties, evaluation of blow counts and  
7 thickness of layers that a judgment would be made of where  
8 to take undisturbed samples, and that that would be based  
9 upon what studies were necessary to complete in order to  
10 establish the soil parameters that one was looking for.

11 Tell me more precisely on what factors on where  
12 to take those samples would be based.

13 Q You would have to first recognize what the SPT  
14 is and that's a measure of the resistance of the spoon  
15 penetrating it. That measure of resistance is an indirect  
16 reflection of soil density, and because of previous data that  
17 we have, we have some idea, because of SPT resistance, what  
18 soil properties we could expect.

19 The extreme would be to take an SPT where it took  
20 no effort for the spoon sampler to penetrate the soil and  
21 in that case you would know, depending on whether it was a  
22 cohesive or cohesionless material, whether the material was

eb49

1 either very loose or very soft, and that penetration re-  
2 sistance would tell you something about the properties of  
3 those materials.

4           And for a concern for settlement, for a concern  
5 for bearing capacity, if you encountered that condition  
6 where you got very little resistance, then you would know  
7 that you should be taking undisturbed samples in those areas  
8 to establish those properties.

9           Q       When you say "to establish those properties,"  
10 to establish what properties?

11           A       You would take undisturbed samples to run labora-  
12 tory consolidation tests to study -- to evaluate the com-  
13 pressibility characteristics of the soil under loading. You  
14 would take the samples, the undisturbed samples to run shear  
15 strength tests to establish the shear strength parameters of  
16 the soil.

17           There could be other conditions that you would be  
18 investigating such as permeability. You would take undis-  
19 turbed samples to run permeability tests on the material  
20 depending on what you felt was necessary to evaluate.

21           Q       For example, if in one of these SPT's you found  
22 a certain level, say blow counts three at, say, 1.0 feet or

eb50

1 15 feet below the surface, what would you do with that?

2 A It would depend on whether it was a sand or a clay  
3 but both of them would indicate low density and would be an  
4 area of concern for any study or any method such as bearing  
5 capacity of settlement that you were going to evaluate.

6 Q Let's assume that it was sand and you had blow  
7 counts of three at a depth of 12-1/2 feet. What would you do

8 A I would attempt to-- If it were sand with three  
9 blows per foot, if I had a concern for liquefaction I would  
10 use those blow counts to permit me to make an analysis that  
11 would determine the margin of safety I have against a lique-  
12 faction type failure.

13 Q Do you have a concern for liquefaction under the  
14 diesel generator building in light of the dewatering of this  
15 plant?

16 A We have a concern for liquefaction. The dewatering  
17 is a remedial treatment to eliminate that concern and that  
18 is being reviewed presently.

19 Q But what I'm talking about is with regard to  
20 this three blows per foot at 12-1/2 feet in sand. You said  
21 if there's a concern for liquefaction you would do certain  
22 studies. Would you have a concern for liquefaction and wou.

eb51

1 you do those studies, for example if these borings were to  
2 be done tomorrow and you were presented with the data of  
3 three blows per foot at 12-1/2 feet?

4 A If upon reviewing the dewatering we could have  
5 assurance that this area would never be saturated because  
6 of a malfunctioning of the dewatering system, then you would  
7 not have a concern for liquefaction. You could have a con-  
8 cern with settlement under seismic loading for the same zone  
9 with those low blow counts.

10 Q Okay.

11 Now you say if you could have assurance that the  
12 sand would never be saturated. Do you mean saturated at a  
13 time when the plant was not shut down or could not be safely  
14 shut down, or just saturated under any circumstances?

15 A Would you repeat the question, please?

16 (Whereupon, the Reporter read from the record  
17 as requested.)

18 THE WITNESS: The concern would vary. You would  
19 have a concern for liquefaction if you could not shut the  
20 plant down. If there is some structure, some component that's  
21 needed to keep the plant in a shutdown case, you would have  
22 a concern.

eb52

1 So it really depends on the entire function of that  
2 system of when you would have a concern.

3 BY MR. ZAMARIN:

4 Q We're talking now about the diesel generator  
5 building.

6 A I'm sorry. I keep thinking we're talking generic.

7 Q That's my fault. We're talking about the diesel  
8 generator building. So would you have such a concern for  
9 the sand never being saturated with regard to liquefaction  
10 potential at the diesel generator building?

11 A Before I would answer that I would want to know  
12 the function of the diesel generator building, the time of  
13 shutdown and in keeping the plant shut down, and if it could  
14 be demonstrated that the plant would not need it -- excuse  
15 me, if it could be demonstrated that it was not a problem  
16 with liquefaction when shut down, then it would be acceptable  
17 in my estimation to conclude and rely on the dewatering  
18 system, that it is a safe remedial measure.

19 Perhaps I'm not making myself clear.

20 If in the operation-- If when the plant is shut  
21 down the diesel generator building is not needed, then I  
22 think it would be acceptable to accept the dewatering system



eb53

1 with proper controls and monitoring that would show that the  
2 water was being kept out of those loose sand areas.

3 Q Do you know whether in fact the diesel generator  
4 building has any function in keeping the plant shut down?

5 A It is my understanding that it is needed for shut  
6 down, but I'm not sure beyond that.

B3  
3.020

7 Q To your knowledge was the basic dewatering scheme  
8 presented to the NRC in July of 1979?

9 A I think I would have to understand what you mean  
10 by "basic."

11 Q Do you know if anything with regard to dewatering  
12 was presented to the staff in or around July 1979?

13 A I do not know about July 1979 because I was not  
14 involved with the project at that time.

15 Q What is your understanding of when information w  
16 regard to the dewatering plan was presented to the NRC by  
17 Consumers or Bechtel?

18 A It is my understanding that information has been  
19 submitted, has been reviewed, and questions have been  
20 generated on the dewatering system and it is expected that  
21 additional information will be supplied on the dewatering  
22 system.

3.030

eb54

1 Q Are you aware of a recent submittal by Consumers  
2 within about the last week and a half to the NRC?

3 A During a conversation yesterday with the Project  
4 Manager it's my understanding two volumes have come in and  
5 it'- my understanding it came in last Friday. I have not  
6 seen those volumes.

7 Q When you say it came in last Friday, your under-  
8 standing is it came in to whom last Friday?

9 A To the NRC. I don't know whether that means that  
10 is when it became docketed or what, but it's my understanding  
11 that's when the Project Manager recognized that it was avail-  
12 able.

13 Q Has any of that information been transmitted to  
14 the Corps of Engineers?

15 A It's my understanding that the arrangement that  
16 we have with Consumers is that you would supply it directly  
17 to the Corps.

18 Q Have you had any communication with anyone at the  
19 Corps with regard to that information and what they are  
20 doing or are going to do or should do with it?

21 A I've had communication with the Corps, but no one  
22 from the Corps has indicated to me receipt of that information.

eb55

1 Q Have you reviewed that information in any way?

2 A I haven't seen it.

3 Q Do you recall ever having read a summary of the  
4 July 1979 meeting at which Consumers presented a comprehensive  
5 discussion of all of the proposed fixes to the NRC?

6 A A summary of the July 29th meeting? I don't re-  
7 call that.

8 MR. PATON: Listen very carefully to the question.

9 MR. ZAMARIN: Do you want it read back?

10 MR. PATON: Yes.

11 (Whereupon, the Reporter read from the record  
12 as requested.)

13 THE WITNESS: I don't recall a July 19th meeting.

14 BY MR. ZAMARIN:

15 Q July 1979.

16 A I'm sorry. The date is before my involvement.

17 I recall having read summaries of meetings, and I'm not sure  
18 what they'd be.

19 Q A while back we were talking about the 35-foot  
20 maximum estimated pore pressure head with regard to the sur-  
21 charge of the diesel generator building. Do you have an  
22 opinion as to whether that figure would be approached in a

eb56

1 situation other than instantaneous application of the sur-  
 2 charge, for example where the whole surcharge was placed  
 3 over a period of six to eight weeks?

4 A It would depend on whether the material being  
 5 loaded was fully saturated. It would depend on the drainage  
 6 path available to the material being loaded. But even  
 7 assuming the worst conditions, the worst conditions being  
 8 fully saturated and no accessible drainage path, you would  
 9 probably not expect, you would not expect that maximum 35-  
 10 foot head to be reached.

11 Q In calculating the 35-foot head, does that assume  
 12 an application of surcharge within a relatively short period  
 13 of time, even instantaneous or, for example, within a day or  
 14 a matter of one or two days?

15 A You're using the term "surcharge"---

16 Q Or load.

17 A It assumes a rapid loading.

18 Q And do you have any idea of how that 35-foot figu  
 19 would be diminished or reduced if, for example, the deter-  
 20 mined load were to be applied over a period of eight weeks  
 21 as opposed to rapid loading, and assuming no readily accessi  
 22 drainage paths and assuming complete saturation of the soil?

eb57

1           A       In my opinion I would recognize that it would be  
 2 lower than the 35-foot but I haven't given any thought to what  
 3 levels below that.

4                    But for the Midland project the rate -- excuse me,  
 5 the head that developed under loading is being influenced  
 6 both by the pond raising and the loading, and the level that  
 7 it rises is not very high. And I'm trying to decipher what  
 8 portion of that is caused by the pond seepage and what part  
 9 is caused by the loading.

10           Q       In your opinion is it possible that some of the rise  
 11 in pore water pressure was not recorded on the piezometers  
 12 because of lag in the piezometer response?

13           A       I think there would be a lag initially but I think  
 14 over a period of one to two weeks that that lag would have  
 15 been overcome or have been made up for.

16           Q       And when you say over a period of one or two weeks  
 17 that lag would have been made up for, are you then assuming  
 18 that the drainage distance, the drainage paths were such  
 19 that there would not have been a more rapid dissipation of  
 20 excess pore pressure than two weeks?

21           A       In some areas, in the sandier areas you would  
 22 recognize it. I would have to understand what the drainage

eb58

1 paths were in I think it is the southeast portion where you  
2 have the more compressible materials for almost the entire  
3 depth.

4 Q So as you sit here now you're saying that you  
5 don't know what the drainage paths are likely to be in that  
6 southeast portion where you have the more compressible  
7 materials, and that you don't know whether you would expect  
8 dissipation more rapid than two weeks for example?

9 A Yes.

3.145

10 Q You indicated that you had a conversation with  
11 Darl Hood about the two volumes that came in recently from  
12 Consumers. Is that right?

13 A Yes.

14 Q What was the gist of that conversation?

15 A That the two volumes addressed the review concerns  
16 expressed in the August 4th letter to Mr. Cook which en-  
17 closed the C rps of Engineers' review comments and questions.

18 Q Is there any other discussion that you had with  
19 Darl Hood?

20 MR. PATON: As relates to Midland?

21 MR. ZAMARIN: I'm talking about that conversation.

22 THE WITNESS: With regard to those volumes only?

eb59

1 MR. ZAMARIN: Yes.

2 THE WITNESS: He had asked me if I had received  
3 my copy and I said I had not.

4 BY MR. ZAMARIN:

5 Q Anything else you recall about that conversation  
6 about these volumes?

7 A Not that I recall.

8 Q Is there anything else you recall in that conver-  
9 sation about Midland?

10 A Several things.

11 Q Will you start with the first that comes to mind?

12 A He said to recommend to you that you forget your  
13 sine die.

14 Q All right.

15 What else?

16 A He wished me good luck today.

17 Q Anything else?

18 A No.

19 Q Did you have any conversations with anyone about  
20 the SALP appraisal for Midland?

21 A SALP?

22 Q Systematic appraisal of Licensee performance

eb60

1 that was recently done and presented to Consumers Power  
2 Company?

3 A I don't recognize SALP and not recognizing it, I  
4 don't know whether I had conversations on that matter or not.

5 Q Okay.

6 Did you have conversations with anyone since  
7 October 16th about Consumers' performance either with regard  
8 to on-going activities at the site or with regard to the  
9 soils issue?

10 MR. PATON: Other than his Counsel?

11 MR. ZAMARIN: If it was with Counsel he can tell  
12 me that. I will see whether you object or not. I'm just  
13 asking for anybody now.

14 THE WITNESS: Would you repeat the question,  
15 please?

16 (Whereupon, the Reporter read from the record  
17 as requested.)

18 THE WITNESS: I must have talked to a hundred  
19 people about Midland and the settlement problem.

20 With regard to Consumers' performance, I'm sure  
21 I had conversations with many people about being puzzled by  
22 Dr. Afifi's deposition where it was felt that Consumers --



eb61

1 that it was necessary only to respond to direct questions  
2 from NRC rather than taking the approach of convincing us  
3 that the remedial measures that you were proposing were  
4 satisfactory and that safety was assured.

C3

5 BY MR. ZAMARIN:

6 Q Anything else that you recall?

7 A Not that I recall.

8 Q Did you take notes at Mr. Afifi's deposition?

9 A Yes.

10 Q Do you have those with you today?

11 A No, I do not.

12 Q Do you have them back at your office?

13 A Yes, I do.

14 Q Would you bring those back with you after lunch?

15 Is it physically possible for you to bring them after lunch?

16 A It is physically possible.

17 Q Then I request that you respond to that.

18 Did you take notes at anybody else's depositions?

19 A I don't think I've been there. I think  
20 Dr. Afifi is the only one where I've been there.

21 Q I don't recall, there have been so many, and so  
22 many people.

eb62

1                   When did it first come to your knowledge that there  
2 was apparently some misunderstanding on the part of Consumers  
3 Power Company about what was requested by the way of boring  
4 information?

5           A        Are we now talking about the June 30th request?

6           Q        Yes.

7           A        You're going on to a different subject than what  
8 we just talked about with regard to being puzzled by  
9 Dr. Afifi's statements?

10          Q        That's right.

11          A        With regard to the June 30th request for addition  
12 borings, I first became aware at the meeting that we had with  
13 Consumers and I can recall conversations with James Wanceck  
14 on that matter.

15          Q        When you say "meeting" are you talking about the  
16 borings appeal meeting?

17          A        No, that was in August I think.

18                   Once you received the request for additional  
19 borings we had a meeting here, I think it was in this room  
20 with Consumers, trying to understand what was being asked  
21 in that request for additional borings.

22                   Following that meeting you appealed and we had t

eb63

1 appeal meeting.

2 Q Was that meeting in July do you think?

3 A I think it was at the end of July.

4 Q And to your recollection did you explain to  
5 Mr. Wanceck that really what was being requested were the  
6 SPT's and not the continuous undisturbed samples, for example  
7 for the consolidation tests in that June 30th--

8 A I thought I had. I also referred him to the Reg.  
9 Guide. I can remember discussions with him, and they were  
10 not just between Mr. Wanceck and myself. Everyone that was  
11 at the meeting was available to hear those discussions.

12 But I can remember discussions, saying to him I  
13 would look at the worst condition and the average condition  
14 and make my judgment on what settlement I could expect,  
15 based on that information.

16 I also recognized at that time that his estimate  
17 of one million dollars or whatever it was to do the work was  
18 including all kinds of testing that was not intended by the  
19 original request, and I remember discussions on that.

20 I also remember bringing up the point about "repre-  
21 sentative" with Mr. Wanceck at that meeting.

22 Q Okay.

eb64

1           You say that you questioned the "representative,"  
2 and that is the interpretation of the Note 3 in Table 37-1  
3 in the June 30th, 1980 letter, meaning that representative  
4 samples were ones that could be identified by the Corps  
5 through you at some date after the SPT's. Is that right?

6           A     No. My recollection of my discussion with being  
7 "representative" was it was not intended to take continuous  
8 undisturbed sampling, and it was not intended to require test-  
9 ing of every undisturbed sample.

10           It was the intention of testing only representative  
11 undisturbed samples.

12           Q     And would the testing of the samples be done of  
13 those split spoon samples that were extracted during SPT's?

14           A     No. You may do testing and the testing would  
15 be classification, moisture content, some of the more basic  
16 tests. But the engineering studies to be conducted would  
17 require the disturbed sampling and tests run on those materials.

18           Q     So the sense then in Table 37-1 where it says:

19                     "Additional borings to obtain represen-  
20 tative undisturbed samples for detailed laboratory  
21 testing should be located at the completion and  
22 elevation of the split spoon sampling program...."

eb65

1 in your understanding is not a direction to take those samp  
2 and locate them at those particular points?

3 A At every point?

4 Q Well, all I see here is where it says the "borin  
5 ....should be located." It seems to be saying go and do it  
6 These should be located there.

7 A I think I have indicated this morning that you  
8 would look at all the information you get from your SPT's  
9 and on the basis of that information choose where to take  
10 your undisturbed samples. I don't think that's inconsiste  
11 with that paragraph.

12 Q Okay.

13 So what "should be located" is indicating at so  
14 later time will "be located" by the NRC or the Corps for :

15 A No, it was intended that you, Consumers, would  
16 evaluate your information and choose the locations to tak  
17 undisturbed samples. Because of the continuing controver  
18 on that, perhaps the best solution would be after the bor  
19 were taken, to get together and make a judgment and reach  
20 agreement where the undisturbed samples would be taken.  
21 way we could eliminate that problem.

22 Q I see.

eb66

1 So what this is saying then is to take the SPT's  
2 and then Consumers should decide then where representative  
3 undisturbed samples should be taken and they should do borings  
4 to take those?

5 A That's correct.

6 Q And was it also intended that the agreement of the  
7 NRC or the Corps would have to be sought with regard to  
8 where these undisturbed samples were to be taken?

9 A It was not agreed or assumed; I think you have  
10 the option of evaluating the information, on choosing the  
11 location and taking those samples. If it becomes a problem  
12 later on then it's a problem. And that's why I'm suggesting  
13 maybe we should both be looking at the same information before  
14 you do it.

15 Q By that I take it that what you're saying is that  
16 if Consumers should go ahead and decide on -- to take these  
17 borings and decide on locations and at some later date, the  
18 staff disagrees with that then Consumers has done it somewhat  
19 at their risk because you'll say "You've got to take them  
20 at other positions."

21 Is that what you're saying?

22 A I think, unfortunately, that's inherent in

eb67

1 everything. It's inherent in every project..

3.310

2 Q So then my statement was correct? Basically  
3 that's what you've said?

4 A That's correct.

5 MR. PATON: The last question was: Was my state-  
6 ment correct? Could I ask that Mr. Zamarin's statement be  
7 read?

8 (Whereupon, the Reporter read from the record  
9 as requested.)

10 BY MR. ZAMARIN:

11 Q We were talking about what you would do if in this  
12 split spoon sampling and in the SPT's you found an area where  
13 there were three blows per foot at a depth of 12-1/2 feet,  
14 and we discussed somewhat the concern for liquefaction.

15 What other tests or what else would you do when  
16 presented with data that showed three blows per foot at a  
17 depth of 12-1/2 feet in one of the borings around the diesel  
18 generator building?

19 A For sand material?

20 Q For sand material.

21 A We have the problem in undisturbed sampling of  
22 cohesionless material such as sands of recovering a good

eb68

1 undisturbed sample. Three blows per foot would indicate a  
2 loose sand, and so there would be a question of whether we  
3 could in fact recover an undisturbed sample.

4           If it were a 12-1/2 foot depth it would appear to  
5 me to be accessible to a test excavation, a test pit excava-  
6 tion to where, rather than trying to take an undisturbed  
7 sample in a loose sand, you may elect to go down with a test  
8 pit excavation and establish the in-place density of the  
9 sand by running tests in the test pit, and you could estab-  
10 lish its in-place density, and then recover enough material  
11 in that zone through your excavation to run the necessary  
12 laboratory tests at the density that you have established in  
13 the field.

14           Q       And what are the necessary laboratory tests to  
15 which you refer?

16           A       It varies with the different structures. If we're  
17 talking about the diesel generator building, we have talked  
18 about settlement, bearing capacity and piping distortion.

19           Q       What kind of a test would you do with regard to  
20 piping distortion?

21           A       It's mainly intended from the standpoint of settle-  
22 ment, differential settlement and the effects that have been



eb69

1 caused on the pipe because of those differential settlements.

2 You could also take material for running shear  
3 strength tests. I think in the analysis of piping stresses  
4 a parameter that you would want would be subgrade modulus.

5 Q Would test pits with hand-carved samples be ade-  
6 quate in your opinion for, say, the top 10 or 15 feet of the  
7 soil around the diesel generator building?

8 A I think-- If we're saying for the top 10 feet  
9 excavate test pits and take out block samples and the block  
10 samples would be more of a cohesive type material and run  
11 in-place density tests which I have just described in the  
12 cohesionless material, then they would be satisfactory.

3.400

13 That is assuming that the test pits or the test  
14 excavations covered the areal extent that the borings would  
15 cover.

16 Q In Table 37-1 that accompanied the June 30th  
17 request for borings it has an indication under Column 4 that  
18 you described before which identifies the type of lab  
19 testing. And in the fifth column it indicates the antici-  
20 pated geotechnical engineering studies to be required.

21 For sands, with regard to the diesel generator  
22 building location, it indicates "drained, direct shear of

eb70

1 both loose and dense specimens, and also relative density."

2 And under the column of "Anticipated geotechnical  
3 engineering studies to be required" I don't see anything  
4 listed.

5 Can you tell me exactly what would be done then  
6 with the results of those lab tests for the sands?

7 A Could I see the table, please?

8 Q Surely.

9 (Handing document to the witness.)

10 A The column that is entitled "Anticipated geo-  
11 technical engineering studies to be required" corresponds to  
12 each of the four structures involved. What you have just  
13 read for sands is covered by the same note for the diesel  
14 generator building which includes bearing capacity, settle-  
15 ment, and piping distortion.

16 I'm interpreting your previous comment to mean  
17 that there doesn't appear to be anything required for the  
18 sands. I am saying the same information that you would  
19 develop for the cohesive soils and for the sands would be used  
20 in these same type studies.

21 Q What would you do if you had in the SPT's data  
22 that indicated three blows per foot at a depth of 12-1/2 feet

eb71

1 in clay?

2 A It would be an indication of a soft clay and there  
3 would be a concern for settlement. There would be a concern  
4 for its shearing strength which would be used in a bearing  
5 capacity type analysis.

6 Q What would you do then?

7 A I would establish the settlement and shearing  
8 strength properties of the clay that indicated the three blow  
9 and use those in the analysis that we talked about.

10 Q Is it possible to have the clay with an SPT that  
11 showed three blows per foot at 12-1/2 feet that would still  
12 have adequate shearing strength properties?

13 A It's possible.

14 It should be recognized that adequate bearing  
15 capacity has several factors. The significant one is the  
16 amount of loading.

17 Q And what are the other factors?

18 A The depth of the footing, the presence of the  
19 groundwater table.

20 Q How does presence of the groundwater table affect  
21 bearing capacity?

22 A The higher the groundwater table -- I'm talking

eb72

1 now if it is within the influence of the sand -- excuse me,  
2 of the soil layer which is being stressed because of the  
3 loading. If we're talking about that zone, then the higher  
4 the water table would be in that zone, the less resistance  
5 to bearing capacity type failure there would be.

6 Q Why is that?

7 A Why? Because excluding whatever factor the water  
8 would have on the shearing strength, excluding that considera-  
9 tion, the fact that the water is there would make the soil  
10 buoyant and reduce the frictional resistance.

11 MR. ZAMARIN: Could you read back the answer,  
12 please?

13 (Whereupon, the Reporter read from the record  
14 as requested.)

15 BY MR. ZAMARIN:

16 Q What effect does the resistance of the water have  
17 actually on shearing strength?

18 A The property of a soil to resist shearing comes  
19 from friction and cohesion. The presence of the water table  
20 reduces the effective weight, the effective stress which is  
21 what permits the frictional resistance to be developed.

22 In other words if you would go to shear a sample

eb73

1 that was dry, you would have a certain amount of frictional  
2 resistance. If you were to saturate that sample, that satura-  
3 tion would reduce the effective weight of the sample and  
4 therefore reduce the frictional resistance.

5 Q Is it then simply the buoyancy effect, the re-  
6 duction in effective weight that affects the shearing strength?

7 A I'm trying to understand the question. Is that  
8 now excluding, now, that water, the presence of water in that  
9 sample does not affect shear strength?

10 Q What I'm saying is, does the presence of water in  
11 a sample affect shearing strength only because of the  
12 mechanism you've just described, and that is because of the  
13 buoyancy effect?

14 A No, it is not the only-way.

15 Q In what other way does the presence of water affect  
16 shearing strength?

17 A There are several ways actually such as in a  
18 compacted fill, the water that is there, the amount of  
19 moisture which is there under compaction permits the soil  
20 particles to go into a certain arrangement. That arrangement  
21 could be different if the moisture content were different.

22 In other words I would not expect a sample to have

eb74

1 the same shear strength at optimum moisture versus dry of  
 2 optimum moisture. And there's a case where it's the moisture  
 3 content difference which is reflecting the changing shear  
 4 strength.

5 Q And the mechanism for that is because of the change  
 6 in the orientation of the soil particles caused by the water?

7 A Yes.

8 Q Are you talking now about a particular type of  
 9 soil, say clay as opposed to sand or sand as opposed to clay?

10 A The discussion about at the optimum moisture and  
 11 dry of optimum would be more a concern with a clay or a silt-  
 12 type material, but it is recognized that moisture at the time  
 13 of compaction of a sand does affect the soil arrangement  
 14 that ultimately results and therefore it also likewise  
 15 affects a sand. It affects it in a way that the ensuing  
 16 density is obtained.

17 Q Would you expect the presence of sand in a soil,  
 18 for example around the diesel generator building, to increase  
 19 drainage rates?

20 A You said the presence of sand in a soil. If the  
 21 sand particles are being mixed with a cohesive material there  
 22 is a limit to where the increased amount of sand will probably

eb75

1 have not a factor -- or would not be a factor. What I'm  
2 saying is if there's enough cohesive material, enough fine  
3 material to fully coat and make a matrix around the sand,  
4 then essentially it would continue to behave as a cohesive  
5 material.

6 There is a limit and the limit would be controlled  
7 by the amount of fines and the amount of sand.

8 Q Would you expect the presence of pockets of sand  
9 to increase drainage rates?

10 A Pockets of sand?

11 Q Yes.

12 A They could, and they could not. If a pocket of  
13 sand were already filled with water and had no free exit to  
14 another sand, and that is what would be inferred by a  
15 "pocket," then it might not have any effect.

16 Q In your opinion could the presence of sand de-  
17 crease drainage rates over that which you would have absent  
18 the presence of sand?

19 A The only condition I could think of where it would  
20 decrease it is where the lenses or pockets of sand are less  
21 permeable than the sand that it's in.

3.630

22 MR. ZAMARIN: Could you read that back?

eb76

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(Whereupon, the Reporter read from the record  
as requested.)

THE WITNESS: I believe your question was a broad  
question. And you can have a sand deposit with different  
sands of permeability. And in responding to your indication  
of sand lenses, I'm saying in some cases it could have an  
effect.

MR. ZAMARIN: Okay.

BY MR. ZAMARIN:

Q What you're talking about then is sand within sand.

A Yes.

Q And I'm talking about sand within other types of  
soil, for example clays. And would you expect the presence  
of sand in any way, that type of a situation, to decrease  
drainage rates?

A I would expect it to decrease drainage rates.

MR. ZAMARIN: Could you read the question back,  
and the answer?

(Whereupon, the Reporter read from the record  
as requested.)

THE WITNESS: I should clarify my answer. The  
question was "decrease the drainage rate." Actually it would



eb77

1 accelerate the drainage rate.

2 BY MR. ZAMARIN:

3 Q Would you expect areas with air voids to have high  
4 permeability?

5 A Would you repeat the question, please?

6 Q Yes.

7 Would you expect areas with air voids to have high  
8 permeability?

9 A Is the question versus soil with no air voids?

10 Q Yes.

11 A Yes, I would.

12 Q All other things being equal would a dense clay  
13 or a loose clay have higher permeability?

14 A A loose clay would have higher permeability.

15 Q If a piezometer, for example in the area of the  
16 diesel generator building in the surcharge program were  
17 located in an area of clay with large air voids, what, if  
18 any, factors in your opinion could prevent the piezometer  
19 from responding to the full theoretical preload level once  
20 the load had been applied?

21 A There are several considerations. Could I have a  
22 repeat of the question, please?

eb78

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MR. ZAMARIN: Surely.

Would you read it back, please?

(Whereupon, the Reporter read from the record as requested.)

THE WITNESS: Could I have it read back from the portion of the question that has what factors would prevent the piezometer from responding?

(Whereupon, the Reporter read from the record as requested.)

THE WITNESS: A clay with large air voids upon loading would be forcing that air into solution and therefore you would be decreasing the voids without significantly raising the piezometer level. That would be one factor.

BY MR. ZAMARIN:

Q Would you nonetheless be consolidating the soil under those circumstances?

A You would. But you would not be expecting the behavior of the S-curve with settlement versus time because that curve is developed on a fully saturated sample.

Q Would you expect something that would approximate the S-curve if that condition existed?

A It seems to me we're talking possibly about a

eb79

1 partially saturated sample that has voids in it, and if that  
2 were the case I would expect the rate of consolidation to be  
3 less than what it would be if it were fully saturated.

4 Q Going back to the question, keeping in mind what  
5 we're really looking at now is the response of a piezometer  
6 if it were located in an area of clay having large air voids,  
7 you've given us the one factor so far that would prevent it  
8 from demonstrating the full theoretical preload level.

9 Are there others of which you're aware?

10 A I can't think of anything more with regard to the  
11 piezometer response.

12 I can think of, if this condition exists, how could  
13 it affect the settlement markers.

14 Q Tell me about that.

15 A Not being fully saturated, the fact that there are  
16 air voids there may be eliminating the fact that the soil  
17 would behave differently if it were saturated and therefore,  
18 if we introduce saturation we may observe a settlement pattern  
19 which is different from what we're observing when it has the  
20 air voids.

21 Q Different in what way?

22 A Different in that it may consolidate at a greater

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eb80

1 rate when saturated.

2 That's part of our concern under the diesel genera-  
3 tor building, that there were zones which, by your explora-  
4 tions, were shown to be soft, that may not have been fully  
5 saturated under the development of the pond, and that's one  
6 of the reasons for our request for borings.

7 Q What evidence do you have that there were zones  
8 such as you described that were not fully saturated under  
9 influence of the pond?

10 A We know the bottom of wall footings at elevation  
11 628-- I think the average elevation that the piezometers  
12 raised to in the diesel generator building during surcharging  
13 was 625, I think. We're trying to understand whether that  
14 625 is because of the excess pore pressures under the loading  
15 but in fact the level of saturation is below 625 and we're  
16 thinking, based on what we observed in the piezometer be-  
17 havior, that the level of saturation that was actually ob-  
18 tained in the diesel generator building may have only gotten  
19 to elevation 621 or 622.

20 Q And upon what do you base the statement that it  
21 may have only gotten to 621 or 622?

22 A The behavior of the peizometers before loading and

eb81

1 after loading.

2 Q Describe the behavior before and after loading that  
3 would lead you to believe that it may have only gotten to 621  
4 or 622.

5 A You're asking me to describe it?

6 Q Yes.

7 You said that the behavior of the piezometers  
8 before and after loading led you to believe that the water  
9 level may have only gotten to 621 or 622, and I'm asking what  
10 behavior was observed that leads you to believe that.

11 A There were a series of piezometers which, just at  
12 the time of loading, were indicating a level around 621 or  
13 622 and then under loading there was an increase and then a  
14 dropoff. And then under removal of the loading there was the  
15 behavior where it dropped and raised back to the level that had  
16 existed before removal and then went down to some level, and  
17 that level appears to be around 622, which we're thinking  
18 is the level of steady seepage as being developed off the  
19 cooling pond.

20 Q You're saying it went down to a level of 622 while  
21 the pond was still being held at 627?

22 A That's correct. And then it continued to rise

eb82

1 following surcharge removal which to us is indicating that  
2 steady seepage is still developing off the pond.

3 Q You say it went down to a level of 622. For how  
4 long a period did it go to that level?

5 A Weeks.

6 Q And in your opinion had it stabilized at that  
7 level?

8 A It wasn't stabilizing. It was still being in-  
9 fluenced by the development of pond seepage and it continued  
10 to gradually rise after surcharge removal.

11 Q Would you agree then that, based upon all the ob-  
12 servations, that the soils, at least below 622, were saturated  
13 during preload?

14 A I could not agree, based on the information I've  
15 seen, that all the soils below 622.

16 Q Do you have any evidence that any of those soils  
17 were not saturated?

18 A I do not have evidence that they were not saturated.  
19 I would like to see evidence that they are saturated.

20 Q The piezometer readings and the behavior of the  
21 piezometers were removed doesn't lead you to conclude that  
22 the soils below 622 were saturated? Is that right?

eb83

1 A It indicates it. But we have the problem with the  
2 loading, the surcharge loading and that loading causing the  
3 pore pressures to develop. And so maybe it's down to 620  
4 or maybe it's down to 618, I don't really know.

5 But I do know taking undisturbed samples in that  
6 zone and saturating them in the laboratory would help us to  
7 answer whether the effect of saturation on settlement could  
8 be answered.

9 Q What reading would you expect in a piezometer that  
10 has been placed in a soil that is not saturated?

11 A Would you repeat the question, please?

12 MR. ZAMARIN: Would you read it back, please?

13 (Whereupon, the Reporter read from the record  
14 as requested.)

15 THE WITNESS: I would not expect a piezometer to  
16 indicate a level that is above the level of saturation.

17 BY MR. ZAMARIN:

18 Q For example, if the soil were dry then there  
19 wouldn't be any reading on the piezometer? Taking that to  
20 extreme, is that correct?

21 A Yes.

22 Q You indicated before that you weren't certain as

eb84

1 what level of saturation there was. But based upon the data  
2 that's available to you, the piezometer data both before,  
3 during and after the preload, is there an indication or a  
4 conclusion based upon geotechnical expertise that one could  
5 make with respect to it having been saturated at least to  
6 elevation 622?

7 A The problem is coming-- You know, if we had not  
8 loaded the deposit then it could be conclusively drawn that  
9 a piezometer that is reflecting it at 622 is essentially  
10 saturated.

11 The fact that we've now loaded it causes the pore  
12 pressures to rise, and what you would be getting in a piezo-  
13 meter that is at a depth deeper than 622 may be reflecting  
14 the pore pressures under that loading," and it doesn't mean  
15 the level of saturation has reached 622. I'm saying there are  
16 excess pore pressures at the level that you're measuring at.

17 Q I would ask you to look at all the data, including  
18 the behavior of the piezometers after surcharge removal, and  
19 ask you whether based upon your expertise as a geotechnical  
20 engineer you can conclude from that that the soil, at least  
21 to elevation 622, had been saturated.

22 A To answer that, you have said to look at all the



eb85

1 data. I would want to go back and look at all of the data.  
2 It is my understanding that there is enough of the data that  
3 would tend to indicate it, that it is around elevation 621,  
4 622 at time of surcharge removal.

5 Q Will you explain the process with respect to the  
6 consolidation tests that the staff wants done with regard to  
7 how those tests will be done, and how you go about making  
8 settlement predictions based on those results?

9 A I'm not sure to what detail I have to go into. I  
10 hope you're not asking me to give you the ASTM procedure for  
11 consolidation testing.

12 Q No, I want you to generally describe the process  
13 and how then the data obtained from that process would be used  
14 to make settlement predictions.

15 A You would run your laboratory consolidation tests  
16 using a standard such as the ASTM standard for consolidation  
17 testing, and in the course of that test you would develop a  
18 plot of void ratio versus log pressure, and that would give  
19 you a curve under that loading and that loading would have been  
20 carried beyond the limits that we would anticipate at Midland,  
21 and on the basis of that curve try and establish the precon-  
22 solidation pressure that was imposed under the surcharge

eb86

1 loading.

2 And if we now, with that preconsolidation pressure  
3 can verify that it exceeds the final loading that we have  
4 computed under the structure, then we could safely conclude  
5 that the amount of settlement should be minimal.

6 Q You left out a little step that I need to understand  
7 stand that, and that is when you do these consolidation tests  
8 in the lab, you get a certain type of data, and then how do  
9 you get-- What is that data and how do you get that into  
10 void versus log P plot?

4.210

11 A During the course of the test you would make  
12 measurements that would permit you to compute the change in  
13 void ratio. The consolidation is causing the void ratio to  
14 decrease. And you would make that computation at the pressure  
15 you applied in your consolidation test. And with that void  
16 ratio and with that pressure you would plot that on E versus  
17 log P curve, and that would give you a curve of that behavior.

18 Q All right.

19 Then how would you go about computing a change in  
20 void ratios?

21 A There are equations that are given in the instructions  
22 for a consolidation test. But it is a measure

eb87

1 the volume decrease during the test.

2 Q And on this measure of volume increase versus log  
3 of time-- Strike that.

4 Is basically what you're doing then before you get  
5 to the E log P plot, taking a changing -- did you say  
6 "changing volume" versus log of time, that this is one method  
7 of doing that calculation, plotting the change of volume  
8 versus the log of time and then taking certain points of off  
9 that and putting those in the E log P plot?

10 A Yes.

11 Q And is that analogous then, at least that step, to  
12 plotting settlement versus log of time?

13 A It is similar, but there are differences. And  
14 depending on your experience, both types of plots are used,  
15 E versus log P or percent consolidation versus log P.

16 Q And isn't also one of the major differences that  
17 what you're doing in a consolidation test where you're taking  
18 this change of volume versus log time and then translating  
19 that or taking those points to create the E log P chart that  
20 you are in effect doing a settlement versus log time calcula-  
21 tion on a one-inch sample?

22 A Not all samples are one inch.

eb88

1 Q All right.

2 What's the range of samples which you expect to be  
3 using for these tests?

4 A I've seen them as thick as one and a half inches.

5 Q Okay.

6 So we'll say on a one or a one and a half inch  
7 sample. Then basically what you're doing is you're doing a  
8 settlement versus log time calculation on a one or a one and  
9 a half inch sample, aren't you?

10 A Yes.

11 MR. ZAMARIN: We'll be in recess until one o'clock.

12 (Whereupon, at 12:00 noon, the taking of the  
13 deposition was recessed to reconvene at 1:00 p.m.  
14 the same day.)

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AFTERNOON SESSION

(1:47 p.m.)

Whereupon,

JOSEPH D. KANE

resumed the stand and, having been previously duly sworn was examined and testified further as follows:

MR. ZAMARIN: Mr. Kane, over the noon hour you have returned to your office and have brought back with certain documents which I requested this morning, those had come into your control subsequent to October 16th, last session of your deposition, and which were within purview of the request to produce and the taking of depositions as modified by Counsel.

Again keeping in mind that you indicated that you did not have time to do an exhaustive search, you have produced some documents.

CROSS-EXAMINATION (Continued)

BY MR. ZAMARIN:

Q Now let me ask you though, did you have time for a comprehensive search of your files in producing these documents?

A Not a detailed one, but I did check all the

eb

1 Q Okay.

2 MR. ZAMARIN: In any event we have been provided cer-  
3 tain documents which I will now identify for the record.

4 One is a document on United States Nuclear Regula-  
5 tory Commission letterhead. In the upper right-hand corner  
6 it bears the notation "J. Kane, received 11/3/80." And it's  
7 a letter from Vollmer to Cook with regard to the decision  
8 regarding additional soil borings and testing.

9 Attached to the front of that is a portion of a  
10 writing tablet page which contains some handwritten notations.

11 And attached to that is a letter dated October 3,  
12 1980, from the Corps of Engineers to Mr. Lear.

13 And attached to that is the transmittal of that  
14 letter and that is the comments on soil boring information  
15 received from Bechtel.

16 You have also provided a telecopy of a draft  
17 letter to George Lear from the Corps, consisting of two type-  
18 written pages and two attachments, one being a site map and  
19 the other-- figure 1 being a site map and Figure 2 being a  
20 site map showing locations of borings. And this draft letter  
21 doesn't bear a date that I can see, other than a stamp on the  
22 second page indicating that it was transmitted to the NRC

eb

1 November 25th, 1980.

2 You have also produced a document consisting of  
3 12 pages containing handwritten notes which I believe you  
4 identified as originating with Darl Hood. And attached to  
5 that is a little note pad page showing Thursday, December  
6 22nd, 1977 as the date. It says:

7 "Joe: Chronology which will be helpful  
8 in preparing testimony, Parts 1 and 2. I think  
9 Darl plans to have these typed up."

10 Signed, Lyman.

11 You have also produced two pages, the first of  
12 which is a routing slip and the second of which is a note  
13 to Darl Hood from Attorney William Paton with regard to  
14 requested information from Consumers as relates to the hearing.

15 MR. PATON: Could we indicate that that document  
16 indicates it was sent to you?

17 MR. ZAMARIN: Oh, yes. We have previously re-  
18 ceived a copy of this.

19 I also have a single page dated 11/13/80, one of  
20 one, which contains the pages of deposition transcripts on  
21 which corrections were noted by you.

22 And a four-page document, the first three pages

eb

1 of which are written on both sides, which constitute your  
2 notes of the deposition of Dr. Sherif Afifi.

3 In addition you have indicated there are two cate-  
4 gories of documents which you have not produced, the first of  
5 which contains legal advice given in preparation for your  
6 testimony at hearing, and that includes a memo involving  
7 input of Counsel, a memo from Darl Hood and Mr. Paton listing  
8 the things you should be addressing in your testimony, and  
9 also notes of meetings with Counsel and others with regard  
10 to that subject, the second category of which contains your  
11 preparation of documents you feel are important to the hear-  
12 ings, and also deposition questions that you have prepared  
13 for Consumers' witnesses.

14 We have requested those documents and at least fo:  
15 the time being a claim of privilege has been asserted in  
16 this regard to those, which I will ask to be stated by  
17 Mr. Paton on the record in a moment.

18 The third item or category of items which has  
19 not been produced is what has been described as a draft  
20 document from one NRC employee to another with regard to the  
21 employment relationship between the NRC and the Corps of  
22 Engineers as it relates to Midland and one other project.



eb5

1 We have asked for a copy of that insofar as it  
2 relates to Midland and have been advised that that is not  
3 being produced because of the claim that it is not relevant  
4 for discovery purposes.

5 BY MR. ZAMARIN:

6 Q Is it correct then that with the exception of the  
7 documents I have just indicated that have not been produced  
8 and the documents which you have produced and I have iden-  
9 tified, that you have no other documents within the purview  
10 of the request this morning, other than those which you may  
11 later find upon a more intensive search of your files?

12 A That is correct.

13 MR. ZAMARIN: At this time then on the record we  
14 would ask for the documents within what was described as the  
15 first category, that is the memo involving information from  
16 Mr. Hood and Mr. Payton listing things you should be address-  
17 ing for the hearing, and also the preparation of documents  
18 you feel are important to the hearings and the deposition  
19 questions for Consumers' witnesses, as well as the draft  
20 document addressing the issue of the employment relationship  
21 between the Corps and the NRC.

22 MR. PATON: With respect to the last document, I

eb6

1 agree with your statement that we don't think it's relevant  
 2 for discovery purposes and by that I mean we don't think it  
 3 would be -- the information contained therein would lead to  
 4 discoverable evidence.

5 With respect to the other documents we're claiming  
 6 a privilege but we're going to take another look at those  
 7 documents tonight and see if we can't work something out with  
 8 respect to them by tomorrow.

4.400

9 BY MR. ZAMARIN:

10 Q Mr. Kane, you indicated that with regard to the  
 11 additional borings that have been requested in the area of  
 12 the diesel generator building that the SPT's and the results  
 13 of the spoon samples that are taken, an engineering judgment  
 14 would be made as to the location, if any, for undisturbed  
 15 samples to be taken for various lab testing. Is that correct?

16 A You used the word "would." I'm not sure whether  
 17 the word should not properly be "should."

18 Q I'm sorry, what word, in what context? Would or  
 19 should what?

20 A Could you repeat your question, please?

21 MR. ZAMARIN: Could I hear the question, please?

22 (Whereupon, the Reporter read from the record

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as requested.)

THE WITNESS: It sounded as though you were saying this "would be done" and it's my understanding our letter to you has indicated this should be done. That is the distinction that I was trying to make.

BY MR. ZAMARIN:

Q You say "this." What do you mean? The borings?

A The borings, the testing.

Q All right.

Now there have been a number of borings already done with regard to the diesel generator building. Is that right?

A Yes.

Q And based upon those borings, are you able to determine from which layers undisturbed samples should be taken?

A I think it would be correct first to indicate that there is a great deal of boring information in the diesel generator building but we should be referring now to those borings after the surcharge program. And those borings which you have taken would permit you to tell where the undisturbed samples should be taken.

eb8

1           It is my understanding from discussions with the  
 2 Corps in the borings that are being deleted, the borings you  
 3 have already completed and submitted to us would permit you  
 4 to determine where undisturbed samples would be taken.

5           Q       And has that determination with regard to where  
 6 those undisturbed samples be taken, if any, been done?

7           A       It has not been done as far as I know by the Corp  
 8 nor NRC. We're expecting Consumers to make that determinat

9           Q       Do you know if anyone within the Corps or the NRC  
 10 has decided, based upon the, I believe, six borings that have  
 11 been taken in the diesel generator building since the sur-  
 12 charge, whether any undisturbed samples need be taken at al

13          A       To my knowledge, no one has indicated a depth  
 14 interval to where undisturbed samples were taken. Our dis-  
 15 cussions were, in looking at the SPT borings, the ones re-  
 16 cently submitted in September, seeing zones which I would  
 17 classify as medium dense and depending upon the results of  
 18 the other four borings, SPT borings, we'll be determining  
 19 whether I would want the sample in that zone.

20          Q       What would it be about the other four borings t  
 21 would either make you want to or not want to take undistur  
 22 samples in those areas?

eb9

1           A       I could find in the other borings to be completed  
2 blow counts and soil conditions that were worse, indicating  
3 a looser or a softer material and I could find in the other  
4 borings to be completed a greater depth of medium dense soils  
5 than I had found at these two locations, and that could en-  
6 courage me to take undisturbed samples at other locations.

7           Q       It would encourage you or compel you to do that?

8           A       In an effort to resolve this difference it would  
9 encourage me as an NRC engineer to do that. I'm not in the  
10 position, in my present position, to be compelled to do that.

11          Q       With regard to the diesel generator building sur-  
12 charge or the piezometers that were located in saturated soil  
13 at a depth where there was no question but that they were  
14 saturated soils, is there anything other than rapid drainage  
15 that would account for observation of less than the 35-foot  
16 estimated maximum pore pressure head?

17          A       The question I understand talks about the soils  
18 being saturated, and the only effect then would be the rapid  
19 drainage and my answer would be Yes.

20          Q       Yes what?

21          A       That that would be the only factor.

22          Q       We also spoke before lunch about this laboratory

eb10

1 testing that you would do, and I believe you indicated that  
2 there would be some correction that would have to be done for  
3 sample disturbance.

4 A I don't recall any discussion before lunch about  
5 sample disturbance.

6 Q All right. Then we'll start afresh on it.

7 You described consolidation tests that would be  
8 run in a laboratory and I believe that you indicated there was  
9 calculation that would be made and then the results of that  
10 calculation would be plotted on an E log P curve, E being a  
11 void ratio and log P being log of pressure. Is that correct?

4.570

12 A That's correct.

13 Q And when you plot on the E log P curve is it  
14 necessary to make any kind of a correction to account for  
15 sample disturbance under the circumstances that are known  
16 to exist with respect to the diesel generator building?

17 A It would be appropriate to use the measures that  
18 are known to adjust the samples for sample disturbance.

19 Q And in addition to sample disturbance resulting  
20 from the obtaining of the samples, wouldn't there also be  
21 disturbance by virtue of the fact that you're dealing with  
22 fill rather than naturally deposited soil?

eb;;

1           A       I don't see the fact that there are different types  
2 of materials as being a reason they are disturbed. No, I do  
3 not.

4           Q       So that in your geotechnical opinion there is no  
5 correction that would be appropriate on the basis of dealing  
6 with fill as opposed to naturally occurring soil?

7           A       Are we talking about sample disturbance now, or  
8 a distinction between compacted fill and normal -- normally  
9 consolidated type soils?

10          Q       What I'm talking about is when you have a E log  
11 P plot there is a correction that is generally made to account  
12 for sample disturbance to bring the curve to a shape that  
13 is appropriate for an undisturbed sample.

14                   What I'm asking you is in your opinion, is there  
15 any correction also that is appropriate where you're dealing  
16 with fill material as opposed to naturally occurring deposits

17          A       There is a distinction in the type of curve you  
18 would expect for a fill, compacted fill and a normally con-  
19 solidated soil.

20                   At Midland we have not only a compacted soil but  
21 we have a compacted soil that has been surcharged and pre-  
22 consolidated, and I would make the correction for sample

eb12

1 disturbance for both types, the type that we have in Midland  
2 and the type that we would have on normally consolidated soils.

3 MR. ZAMARIN: I have marked this sheet of yellow  
4 paper Consumers' Exhibit Number 19 for identification as of  
5 today's date.

6 (Whereupon, the document  
7 referred to was marked  
8 as Consumers' Exhibit 19  
9 for identification.)

10 BY MR. ZAMARIN:

11 Q Could you just sketch on that for me what you  
12 would expect a typical E log P curve, without correction, to  
13 look like for the type of soil you believe exists underneath  
14 the diesel generator building, just the general shape? I'm  
15 not asking for dimensions.

16 (Handing document to the witness.)

17 A I'm going to draw two curves. One is for a nor-  
18 mally consolidated soil and one is for a compacted fill. I'm  
19 not sure what condition the fill in the diesel generator  
20 building is under.

21 Q Instead of two curves may I suggest you make two  
22 graphs, and on the upper one perhaps show for a naturally



eb13

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1 consolidated soil, and then on the bottom one for a compact  
2 soil.

3 (Pause.)

4 Okay, you have drawn and given to me on Exhibit  
5 19 two graphs, the first showing what you believe the E log  
6 P curve would look like for normally consolidated soil, and  
7 the second showing what it would look like for the compact  
8 fill, and you've labeled them as such. Is that correct?

9 A That's right.

10 Q I notice that the curve for the normally consol  
11 dated soil has more of an S-shape, that is, that the center  
12 portion of the curve appears to approach a straight line  
13 whereas for the compacted fill it is more rounded. Was that  
14 intended?

15 A That was intended.

16 Q I also note that on the normally consolidated  
17 curve there is a more gradual or a lesser slope at the  
18 beginning of the curve before it enters the straight line  
19 than on the compacted fill. Was that intended also?

20 A That was intended.

21 Q And I also note that at the bottom or at the e  
22 of the curve for normally consolidated it appears to appr

-b14

1 a straight line, and it appears that if one were to extrapo-  
2 late along the slope as it appears it would continue with the  
3 same slope whereas on the compacted fill it appears to be  
4 approaching the horizontal.

5 Was that intended?

6 A What you said for the normally consolidated is  
7 true. I'm not sure what you're saying about....

8 Q Okay.

9 For example, on the compacted fill it appears that  
10 it is rising, the slope is rising at the end.

11 A That is not intended to rise.

12 Q Okay.

13 Is that intended to look pretty much the same as  
14 the normally consolidated at the end, and that is to have a  
15 downward slope and that is maintaining a constant slope?

16 A Yes.

17 Q Okay.

18 Now the curves that you've given me, which is a  
19 plot of void ratio versus the log of pressure, does this  
20 indicate what you would expect curves to look like prior to  
21 correction for disturbance?

22 A No.

eb15

1 Q This is after correction for disturbance?

2 A I'm sorry, I misunderstood your question. I would  
3 expect them to look like that before correction for dis-  
4 turbance.

5 Q All right.

6 Can you, in another color pencil which I will give  
7 you, sketch on these same plots what each respective plot  
8 would look like approximately after correction for disturbance,  
9 and I will ask you to make the corrected graph in red pencil  
10 which I am providing.

11 (Handing pencil to the witness.)

12 Okay. How about for the compacted fill?

13 A It is more difficult because of the slope of the  
14 compacted fill to be able to correct it for sample disturb-  
15 ance.

16 Q Okay.

17 How would you go about determining whether what  
18 you had underneath the diesel generator building was more  
19 like normally consolidated fill or more like compacted fill --  
20 normally consolidated soil or more like compacted fill?

21 A I would run a consolidation test.

22 Q And that would tell you?

eb16

1 A The behavior would help me. The behavior would  
2 also help me determine whether I could establish the pre-  
3 consolidation pressure.

4 Q You indicated for normally consolidated soil, a  
5 correction in red and there is some difference then between  
6 the — that you would expect the laboratory slope would look  
7 like and the corrected slope.

8 Can you tell me how you would go about predicting  
9 for example, settlement based on this type of a curve?

10 A You would estimate the effective vertical over-  
11 burden pressure that you have now.

12 Q That would be some point along the log P scale;  
13 is that right?

14 A That's correct.

15 Q Okay.

16 A And then under loading, which is to be added by  
17 the structure, you would have some loading increment which  
18 would be added to that and you would determine between those  
19 two pressures what is the change in your void ratio.

20 Q Okay.

21 And is there a formula you would use to determine  
22 settlement?

eb17

1 A Yes.

2 Q And do you recall offhand what that formula is?

3 A There are several formulas. One of them uses  
4 compression index.

5 Q Right off of this would it be-- Strike that.

6 Really what I'm wondering, you say you take the  
7 difference of void ratio. I don't quite understand that. We  
8 have-- For example on the log P scale we can find a point  
9 which would correspond to the load to be anticipated by the  
10 structure. Is that correct?

11 A That's correct.

12 Q And so if we were to arbitrarily pick some point  
13 on this log P scale, and I will indicate that by a dashed  
14 pencil line, I would like you to look at Exhibit Number 19  
15 and tell me how you would go about taking information off of  
16 that graph which would allow you to calculate or predict a  
17 settlement.

18 (Handing document to the witness.)

19 A There are many factors to be considered. What  
20 you're intending to do is establish the pressure that exists  
21 in the soil before you load your structure loading onto it.  
22 That may be affected by an excavation that allows the soil

5.080

eb18

1 to rebound.

2 But assuming you have correctly identified that  
3 pressure, the pressure that exists at the time you're going  
4 to load it -- I can call that P-1 -- that is a correctly  
5 established pressure. And then on the basis of that I would  
6 compute, by various methods, the vertical stress increment  
7 under the loading of the structure that is to be imposed.  
8 That would give me a delta-P, an increase in pressure.

9 I would add that onto P-1 which would take me to  
10 the pressure that I would expect after loading of the structure,  
11 and that would be, say, P-2.

12 The corresponding change in void ratio at those  
13 pressures would be delta-E, the change in void ratio. I would  
14 use that information to predict settlement.

15 Q And when you say "change in void ratio" you're  
16 referring to the beginning void ratio, to the void ratio that  
17 we indicated according to that point on the plot?

18 A The beginning void ratio being the appropriate  
19 void ratio at the correct P-1.

20 Q With respect to a situation similar to that one  
21 such as that of the diesel generator building, can you give  
22 an estimate of what the magnitude in inches of that correction

eb19

1 that you have just sketched out there might be as it relates  
2 to predicted settlement?

3 A Do I understand your question correctly that you're  
4 asking me of what I understand to be underneath the diesel  
5 generator building, could I estimate the magnitude of settle-  
6 ment that could be expected?

7 Q No. What I'm saying is you have gone through and  
8 you have indicated a correction on that E log P plot that  
9 would have to be made to account for sample disturbance. And  
10 what I'm asking you is do you have some opinion as to what  
11 the range of that correction might translate to in inches  
12 of predicted settlement, be it a range of a half to one and  
13 a half inches, for example?

14 A Is your question directed to what is the difference  
15 between an uncorrected and a corrected sample?

16 Q That's right.

17 A It would not be significant.

18 Q What would it be?

19 A I don't know. I would have to look at the exact  
20 curves.

21 Q When you do the calculation with regard to this  
22 lab test, approximately what size sample would you be working

eb20

1 with?

2 A Four inch in diameter, one inch thick.

3 Q So on this one-inch thick sample that you have,  
4 how do you then go about extrapolating or applying that to  
5 make predictions with regard to a 30-foot sample?

6 A You make a direct relationship between what you  
7 observe in that one-inch sample with the thickness of the  
8 compressible layer.

9 Q So in effect would you multiply it by 360?

10 A I'm not sure where the 360 came from.

11 Q 360 is what I think is the number of inches in 30  
12 feet.

13 A If that is the height of the compressible layer,  
14 yes.

15 Q So that any error that you would have as a result  
16 of the sampling disturbance and the difference between the  
17 corrected curve and the curve prior to correction would be  
18 amplified by a factor of 360 when you applied it to the  
19 actual compressible layer. Is that right?

20 A Would you repeat the question?

21 MR. ZAMARIN: Would you read it back, please?

22 (Whereupon, the Reporter read from the record



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as requested.)

THE WITNESS: It's possible.

BY MR. ZAMARIN:

Q Well, isn't it more than possible? Would that happen if you had--

A Suppose there are other circumstances that work the other way, that there are compensating errors.

Q Give me an example of how you would expect to have a compensating error in the laboratory work calculations that you conceive to be done in accordance with the Corps' request for the diesel generator building at Midland.

A We're pointing out a problem. We're taking undisturbed samples and in effect we recognize they're not totally undisturbed and we're trying to correct for that by a procedure that allows for sample disturbance.

Now we're saying that is magnified in the results, and I'm saying there are other considerations in the laboratory test which can compensate for some of that error.

Q What are they?

A I don't know. I would have to look....I can refer you to a Corps of Engineers manual that lists the type of errors you could have in a consolidation test and some of

eb22

1 them would be compensating. If you would like I would refer  
2 you to the manual.

3 Q Okay.

4 A That would list those potential types of errors.

5 Q All right.

6 With regard to the error introduced by sampling  
7 disturbance, whatever that error would be and whatever that  
8 correction that you made would be, would be in effect multi-  
9 plied by 360 times when you went and applied that to a 30-  
10 foot compressible layer. Wouldn't that be true?

11 A Yes.

12 Q Looking then at just the error associated with  
13 sampling disturbance which would be for a 30-foot compressible  
14 layer multiplied by 360, can you estimate in a situation such  
15 as the diesel generator building the number of inches of  
16 which we might be talking after multiplying by 360?

17 A No, I cannot estimate.

18 Q Do you have any idea of whether it's likely to be  
19 in the order of half an inch or more?

20 MR. PATON: I instruct the witness not to guess.

21 THE WITNESS: I accept his advice.

22 BY MR. ZAMARIN:

1 Q I didn't ask you to guess. I'm asking you based  
2 upon your expertise as a geotechnical engineer and every  
3 ounce of experience and knowledge you have in that area to  
4 tell me if you think it would be on the order of a half an  
5 'nch or more.

6 A Without having the actual data in front of me,  
7 I don't want to give an opinion.

8 Q I understand that you don't want to, but I'm asking  
9 you to. And what I'm looking at is I'm looking at a correc-  
10 tion for an E log P curve you sketched for us. You have some  
11 general idea, I would assume, of what the magnitude of those  
12 corrections generally are, and you can either tell me what  
13 the magnitude of that correction would be as it translates to  
14 inches or you can multiply it by 360 and then tell me what  
15 that would be.

16 MR. PATON: Just a minute.

17 I'm instructing the witness that if in your pro-  
18 fessional judgment the answer would be a guess or would not  
19 have an application to the Midland case then you should  
20 answer the question accordingly.

21 THE WITNESS: A great deal has to do with the  
22 extent of sample disturbance. You know, if someone is very

eb24

1 careful in taking samples and has minimal disturbance, that  
2 would be one value.

3 If someone has taken no care and loosened the  
4 sample to where it has very little meaning, it would have  
5 another value. So I don't wish to give a value between that  
6 range.

7 BY MR. ZAMARIN:

8 Q Can you tell me precisely how you'd go about taking  
9 samples so as to minimize sample disturbance?

10 A That question makes me think that either you don't  
11 know or Bechtel has not looked at the Reg. Guides that are  
12 available to them.

13 Q Well, I'm asking you and I want to find out if you  
14 know. Then I will decide whether we agree with that.

15 The question is how do you go about taking samples  
16 so as to absolutely minimize the sample disturbance?

17 A In taking the actual undisturbed sample I would  
18 attempt to push the tube with a smooth push that would  
19 minimize disturbance rather than allowing anything to jar it.  
20 I would remove it from the boring hole as carefully as possi-  
21 ble, trying not to disturb it.

22 When I got it to the surface I would handle it as

eb25

1 carefully as I could and cut off a portion of the end and  
2 seal it with wax to minimize disturbance and loss of moisture.

3 I would transport it to the testing lab as care-  
4 fully as I could, making sure it wasn't disturbed in trans-  
5 port.

6 I would handle it in the lab as carefully as I  
7 could so that in extruding the sample for testing it would  
8 not be disturbed.

9 I would put it in the testing chambers as carefully  
10 as I could and test it as carefully as I could. And then I  
11 would think I would be very careful.

12 Q In that answer you have a lot of you "would  
13 attempt to do things" and you "would do things as much as  
14 possible" and "you would do it as carefully as you could,"  
15 and I take it that even in doing things as carefully as you  
16 could, and in doing them with as little jarring as possible  
17 and with attempting to push as smoothly as possible that  
18 you're still going to introduce some sample disturbance.

19 A that is correct, sir.

20 Q And is there some point, some level of sampling  
21 disturbance at which it is really not possible to tell whether  
22 you have sampling disturbance for which compensation ought to

eb26

1 be made in that sample?

2 A If you got to the point where you were as careful  
3 as you could and you could not tell if there was a sample  
4 disturbance, then I would be inclined to accept the results  
5 of the test as they are.

6 Q What would you have to see before you would apply  
7 some kind of correction? I mean just a handful of dirt in  
8 the lab? At what point between a handful of dirt and some-  
9 thing that looks like a nice solid cylinder of soil would you--

10 A The correction for sample disturbance comes with  
11 the behavior that is exhibited with the curve.

12 Q So what you're saying is if you get a curve that  
13 doesn't have the shape you expect on an E log P plot, then  
14 you go ahead and correct it?

15 A That's correct.

16 Q And is there any other explanation for a curve  
17 other than what you would expect on the E log P plot other  
18 than sample disturbance?

19 A Is there any other explanation for sample dis-  
20 turbance?

21 Q No, is there any other explanation for what you  
22 have drawn as the blue line on this Exhibit Number 19, other

eb27

1 than samples?

2 A Would you repeat the question please?

3 Q Is there any other explanation for what you have  
4 drawn on this plot as the curve in blue on Exhibit 19 other  
5 than sample disturbance?

6 A By "sample disturbance" I think you mean not  
7 properly handling the sample. Is that correct? Are you  
8 asking me is there any other form of disturbance other than  
9 that?

10 Q I'm not asking you that but I will in a minute.  
11 Right now I'm just asking if there is anything else that could  
12 account for the difference between what you've drawn as a  
13 red curve and the blue curve on Exhibit 19, other than  
14 sampling disturbance.

15 A Yes.

16 Q What?

B.300

17 A The fact that in its natural place the sample  
18 has a certain confining pressure and upon removal you will  
19 lose the effect of that confining pressure.

20 Q Anything else?

21 A None that I can think of.

22 Q Is it possible that you would have that situation

eb28

1 where you would lose the confining pressure that the sample  
2 might have in its naturally occurring place and on top of  
3 that you could have sampling disturbance?

4 A It's possible.

5 Q And how would you know if that were the case, if  
6 you would know?

7 A You wouldn't be able to distinguish the difference.

8 Q So you wouldn't know whether to make a correction  
9 in that kind of a circumstance or not make a correction?

10 A You would make the correction but not know which  
11 contributed to the sample disturbance.

12 Q I see.

13 And would the magnitude of the correction be  
14 independent of whether you had one or both of those types of  
15 factors available?

16 A I would think it would be related to what causes  
17 the disturbance.

18 Q So what would you do in that kind of a situation  
19 where you didn't know whether it was the loss of confining  
20 pressure or sample disturbance, or both? Would you just guess?

21 A I wouldn't do anything other than attempt to  
22 correct for sample disturbance according to accepted practices.

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Q Okay.

With regard to the compacted fill, you haven't shown us anything that would indicate how you would go about correcting for sample disturbance. You have indicated a point which I assume is about the 0.42 void ratio.

A Forty percent of the initial void ratio.

Q Okay.

0.40?

A Yes.

Q Can you attempt to show us on Exhibit 19 what the correction for the compacted fill would look like, how you would go about doing that?

A I think I have already indicated that because of the shape of the curve of the compacted fill, it would be difficult to make that correction.

Q How would you go about doing it in the lab?

A It is generally not done in the lab on compacted fill.

Q I see.

A But at Midland we have the added problem to face of a compacted fill that has been preconsolidated, and you do make a correction for preconsolidated soil.

eb30

1 Q And can you show me on a graph what that would  
2 look like and what the correction would look like, and ex-  
3 plain how you make that correction?

5.350

4 A For a compacted fill?

5 Q For a compacted fill such as we have at Midland,  
6 which is also preconsolidated.

7 A I don't know of any tests on compacted fills in  
8 my own experience. I don't know of any compacted fill where  
9 it was necessary to go back and preconsolidate it, or to  
10 preload it. Generally it's placed in adequately enough and  
11 at the required density that you don't have that problem.

12 Q Are you saying then that you don't have any idea  
13 how you go about making the correction for sample disturbance  
14 in that type of a situation?

15 A I have an idea but I don't know what the actual  
16 curve is going to look like. I've given you the range be-  
17 tween the normally consolidated soil and the compacted soil.  
18 I think what we have at Midland is somewhere between the  
19 two, and until I see that curve I don't know what I would  
20 do in the way of correction.

21 Q Are you saying that what you would do is you would  
22 take the curve and correct it back to look something like the

eb31

1 red curve that you have on Exhibit 19?

2 A No, I don't mean anything like that.

3 Q Well, how would you know how to correct it?

4 A I'm not sure the compacted fill at Midland has  
5 this shape and the reason for that is this is a compacted  
6 fill. The question at Midland is we have already recognized  
7 that it is undercompacted, so we're not even sure that Midlan  
8 has that shape.

9 Q How are you going to go about finding out to what  
10 shape it ought to be corrected if you don't know what the  
11 corrected curve should look like for a fill that is either  
12 compacted or undercompacted and also preconsolidated?

13 A I'm not sure I would correct until I saw the  
14 actual curve on the material to know what correction I could  
15 make on it, so I think the first step is to run the test  
16 and observe the curve and hope we can pick up from that  
17 curve that it was preloaded and has a higher pressure indi-  
18 cated by the consolidation test than it presently has under  
19 the existing loadings.

20 Q To what would you look for guidance in determinin  
21 how to correct it, or do I understand you to say that you  
22 wouldn't attempt to correct it?

eb32

1 A I think I have said I am not sure of the shape of  
2 the curve because of the unique conditions that I think we  
3 have at Midland. I would look at the curve and make a judg-  
4 ment whether it was reasonable to correct or not because of  
5 sample disturbance.

6 Q Okay.

7 And upon what would you base that decision as to  
8 whether it was reasonable to correct or not, based upon the  
9 sample disturbance?

10 A The shape of the curve that actually developed.

11 Q And what shape would you expect to see which would  
12 lead you to believe that you ought to correct for sample  
13 disturbance?

14 A If in fact the fill that was placed at Midland  
15 which has been acknowledged to be undercompacted had the  
16 shape more closely aligned to a normally consolidated soil,  
17 then I would make the correction similar to what I would  
18 make for normally consolidated soil.

19 Q And if it had a curve that more closely approxi-  
20 mated that for a compacted fill, then you would not make a  
21 correction. Is that what you're saying?

22 A I would have the same problem I'm having now of

eb32

1           A        I think I have said I am not sure of the shape of  
 2 the curve because of the unique conditions that I think we  
 3 have at Midland. I would look at the curve and make a judg-  
 4 ment whether it was reasonable to correct or not because of  
 5 sample disturbance.

6           Q        Okay.

7                    And upon what would you base that decision as to  
 8 whether it was reasonable to correct or not, based upon the  
 9 sample disturbance?

10          A        The shape of the curve that actually developed.

11          Q        And what shape would you expect to see which would  
 12 lead you to believe that you ought to correct for sample  
 13 disturbance?

14          A        If in fact the fill that was placed at Midland  
 15 which has been acknowledged to be undercompacted had the  
 16 shape more closely aligned to a normally consolidated soil,  
 17 then I would make the correction similar to what I would  
 18 make for normally consolidated soil.

19          Q        And if it had a curve that more closely approxi-  
 20 mated that for a compacted fill, then you would not make a  
 21 correction. Is that what you're saying?

22          A        I would have the same problem I'm having now of

eb33

1 trying to correct a curve for compacted fill.

2 Q When you do a laboratory consolidation test, do  
3 you measure pore pressure.

5.415

4 A No.

5 Q And are you familiar with a plot that is referred  
6 to as a change in height versus log time plot with respect  
7 to consolidation?

8 A Change in height being what is measured during t  
9 test?

10 Q Yes, the delta-H.

11 A I am familiar with plots that have presented  
12 deformation readings which I'm assuming you mean to be the  
13 change in height versus log time.

14 Q That's not what you've drawn here on Exhibit 19.  
15 is it?

16 A These are void ratio versus log pressure curves

17 Q You're sure of that?

18 A I'm sure what I drew.

19 Q Okay.

20 Would you accept-- Strike that.

21 Would you expect more error as a result of samp  
22 disturbance or less error as a result of sampling disturba

eb34

1 or no difference in error as a result of sampling disturbance  
2 if a plot looked more like that for normally consolidated  
3 or more like that for compacted fill?

4 A I would expect more disturbance for a normally  
5 consolidated soil.

6 Q Why is that?

7 A Because with a compacted soil it would have a good  
8 chance of being overconsolidated because of the compaction  
9 effort that you impose in placing the fill which would be a  
10 lot more than it would be with normally consolidated.

11 Q With regard to the soil beneath the diesel genera-  
12 tor building at Midland, would you expect there to be more  
13 or less the same magnitude of sampling disturbance as you  
14 would typically find with normally consolidated soils?

15 A Would you repeat that question, please?

16 MR. ZAMARIN: Would you read it back, please?

17 (Whereupon, the Reporter read from the record  
18 as requested.)

19 THE WITNESS: I think I have indicated that I'm  
20 unsure of the condition that the fill is in under the diesel  
21 generator building. If it is closer to a normally consoli-  
22 dated soil I would expect it to have more disturbance.

eb35

5.490

1 Also it should be indicated that there are various  
2 degrees of disturbance with material type. It's somewhat  
3 easier to disturb a cohesionless soil than it is a cohesive  
4 soil, and in taking undisturbed samples in the portion of  
5 the diesel generator building which is predominantly cohesive,  
6 I would not expect, if properly conducted, a lot of sample  
7 disturbance.

8 MR. ZAMARIN: Okay.

9 BY MR. ZAMARIN:

10 Q I think you had indicated earlier, though, that:  
11 one of the reasons why you would expect less sample disturbance  
12 in a compacted fill is because there's a good chance that it  
13 has already been overconsolidated. I think that's what you  
14 said.

15 A For a well-compacted fill, yes.

16 Q So what you're saying is the reason you don't know  
17 whether you would have more or less or the same sample  
18 disturbance with respect to the diesel generator building is  
19 because you don't know what the soil is like under there.

20 Are you saying that it may be that it's overly  
21 consolidated?

22 A No, I think I'm going the other way, and that is



eb36

1 I think it has been recognized that it was not well compacted  
2 and so it's closer to being -- its behavior is closer to  
3 being represented by a normally consolidated soil.

4 Q Which one of the two plots that you've drawn on  
5 Exhibit 19 looks more like the plot for overly consolidated  
6 soil, the top one or the bottom one?

7 A Well, you'd have to assume the pressures are the  
8 same in both. I would expect different pressures. But I  
9 think I can answer your question by saying a well-compacted  
10 soil has a potential for being overconsolidated.

11 Q You didn't answer the question. Which one of the  
12 two plots would look more like the plot for an overly con-  
13 solidated soil?

14 A Well, if I had the right log P scale I would say  
15 this one.

16 Q "This one," referring to the compacted soil?

17 A That's correct.

18 Q What is your understanding of the meaning of the  
19 term "record samples"?

20 A When a project is under construction it is commo:  
21 engineering practice to take samples that will establish a  
22 record to show that what you've constructed has been proper

eb37

1 constructed and has properties within that structure that  
2 you anticipated in the design.

3 Those record samples can include compaction con-  
4 trol tests. Those record samples can include establishing  
5 design -- or checking the design parameters such as shear  
6 strength, permeability, or any important parameter you felt  
7 necessary in the design of that structure.

8 Q What type of tests does the staff want done on the  
9 samples taken from the dike area?

10 A Could I see Table 37-1, please?

11 Q Sure.

12 (Handing document to the witness.)

13 A Excluding basic classification tests which would  
14 be soil type, natural moisture content, those basic tests,  
15 the tests that are being asked for for the cooling pond  
16 embankments are shear strength tests.

17 Also in undisturbed samples you would be able to  
18 establish the density of the fill in the embankment and  
19 hopefully make a judgment on the percent compaction that was  
20 attained when it was placed.

21 Q Is it customary practice to your knowledge to take  
22 samples such as those after a dike is built in order to run

eb38

1 shear strength tests?

2 A It is not customary practice to take it after  
3 construction. It is customary practice to take it while  
4 being constructed.

5 Q And to your knowledge have the locations for the  
6 borings in the dike area changed since June 30th, 1980?

7 A Yes, they have.

8 Q Do you know why?

9 A Because of a decision made by NRC management.

10 Q And do you know what the basis for that decision  
11 was?

12 A I know what was discussed. I do not know the  
13 basis for that decision.

14 Q You know what my next question is. What was dis-  
15 cussed?

16 A I think we went through, the first day of my  
17 deposition, on one of those same issues and the issue is  
18 there's a portion of the cooling pond, because of its loca-  
19 tion, because it surrounds the ultimate heat sink, because  
20 it surrounds the Category I pipe, that there were members  
21 of the NRC staff who considered this structure to have the  
22 equivalent of a Category I classification.

eb39

1           There is the other portion which doesn't have the  
 2 Category I pipe which is being judged it's not a Category I  
 3 embankment but it does have safety and environmental con-  
 4 siderations. The decision by the NRC management was to rem-  
 5 the borings asked by the Corps in the portion which is not  
 6 readily apparent to be Category I and to move them to the  
 7 embankment that is adjacent to the Category I conduit.

8           Q       Do you mean to say that back in June of 1980 the  
 9 the Corps and the NRC didn't have any concern for the baffl  
 10 dike area or what you refer to as the portion of the embank  
 11 ment near the Category I conduit?

12           A       As far back as I can remember the NRC had conce  
 13 for the entire cooling pond.

14           Q       Why weren't borings requested in the location  
 15 where they are being requested now?

16           A       A judgment was made, based on identification of  
 17 locations by the Corps of where stability, because of  
 18 conditions, conditions being such as height of embankment  
 19 over a former stream area, where stability was more critic  
 20 and on that basis chose the locations that were initially  
 21 identified in the June 30th letter.

22                   It was thought that we, by those borings in th

eb40

1 cooling pond, could demonstrate that we had obtained the  
2 shear strength parameters that were used in design, that we  
3 could satisfy ourselves that the dike materials had the re-  
4 quired compaction. Then we could satisfy ourselves that the  
5 dike was safe.

6 And it was on that basis that initially a certain  
7 number of borings were chosen.

8 Q And certain locations were chosen?

9 A That's correct.

10 Q What you're saying then is that the area in which  
11 they are now being requested is considered, at least by the  
12 Corps of Engineers, to be a less critical area than that  
13 area in which they were first requested with regard to the  
14 dike?

B6

15 A I don't think the proper term is "less critical."  
16 I think the proper term would be the "potential for in-  
17 stability is less." I think anywhere where the dike would  
18 fail would be critical.

19 Q So the potential for instability is less where  
20 the borings are now being requested. Is that right?

21 A Are we talking now about the baffle dike?

22 Q Yes, we are.

eb41

1           A       I think to answer that question we would have to  
2 know whether the conditions-- I'm hesitating because if we  
3 now go out and do the borings and find out that the perimeter  
4 dikes are well compacted and the baffle dike is not, then  
5 obviously the baffle dike becomes the more critical one.

6           Q       Really what I'm wondering is that back in June of  
7 1980, apparently in the minds at least of the Corps of  
8 Engineers, there was nothing of sufficient concern about the  
9 baffle dike to cause them to request some borings over there.  
10 And now we suddenly find out that they want them over there.

11                   And I'm really wondering what kind of a thunderstruck  
12 there was that caused this great revelation and this change  
13 of sentiment on their part, if that is in fact what happened.

14           A       Perhaps it would be best if you talked to the  
15 people who were thunderstruck.

16           Q       Okay. To whom should I talk?

17           A       I would say the person who signed the letter about  
18 the change in the borings, Robert Tedesco.

19           Q       Anybody else?

20           A       I was not at any meeting where the decisions were  
21 made to change the location and so I don't know who else was  
22 involved.

eb42

1 Q Did you have any discussion with anyone with re-  
2 gard to this change in the location of borings, either befo-  
3 or after it was made?

4 A The discussions I had were the decision that wa-  
5 made was to change the boring locations to the baffle dike  
6 and in the area of the Category I pipe and the ultimate hea-  
7 sink. It was directed that three borings be removed and  
8 moved to that area. On that basis we chose new locations o-

9 the baffle dike and the dike around the ultimate heat sink.

10 Q When do you recall this decision having been ma-

11 A My guess, it would have been either late Septem-  
12 or early October.

13 Q Of 1980?

14 A That's correct.

15 Q Were there then some borings that had been re-  
16 quested in other portions of the dike for which requests  
17 were withdrawn?

18 A I thought I had indicated three of them were  
19 withdrawn and moved to different locations.

20 Q And to your knowledge was that based upon any  
21 kind of decision that the Corps was wrong in their concer-  
22 stability in those areas?

eb43

1 A I have indicated I was not at the meetings so I  
2 don't know whether those discussions were made.

3 Q Didn't you ask anybody?

4 A I'm not sure as of today whether the other por-  
5 tions where they have been withdrawn has been totally re-  
6 solved.

7 Q Oh, I see. So by that are you suggesting that  
8 perhaps even though these were moved that there is still some  
9 thought that those are ~~the~~ the ones that are no longer being  
10 asked for will be asked for anyway?

11 A It's my understanding in what has been asked of  
12 you, Consumers, to address the other portions of the dike  
13 with regards to environmental hazards and other safety  
14 hazards, that that information will be looked at, and whether  
15 that could lead to other work in the cooling pond, I don't  
16 know. I have not had any discussions.

17 But it seems to me we would want to evaluate the  
18 information we have asked from you and make a decision.

19 Q There has been some change at least within the  
20 Corps or the NRC with regard to the location of these borin  
21 on the dike. Do you know whether that change was initiated  
22 by the NRC or by the Corps?



eb44

1 A I'm relatively certain it was initiated by the N

2 Q And does that indicate then an agreement with so  
3 position with regard to those borings that was proposed by  
4 Consumers Power Company and its consultants?

5 A Would you repeat the question and explain what y  
6 mean by an "agreement"?

7 (Whereupon, the Reporter read from the record  
8 as requested.)

9 MR. PATON: You say "some position." That's ver  
10 broad.

11 MR. ZAMARIN: Let me get more directly to the  
12 point for you.

13 BY MR. ZAMARIN:

14 Q Consumers and their consultants have disagreed  
15 the need for the borings as requested in the dike area in  
16 the June 30th, 1980 letter. Is that right?

17 A They have disagreed, yes.

18 Q Yes.

19 And the NRC has now changed its position with  
20 regard to at least three of the borings in the dike area  
21 as described in that June 30th, 1980 letter. Is that cor:

22 A That is correct.

eb45

1 Q Does that indicate then an agreement, to your mind,  
2 by the NRC with Consumers Power Company's objection to those  
3 three borings?

4 A I think I've indicated that I'm not aware of the  
5 reasons for changing those three borings. And I think I  
6 would have to be aware of those reasons to be able to make  
7 a judgment whether there has been any agreement reached.

8 Q So you don't have any idea why they were changed?

9 A I think I have indicated to you, because of the  
10 doubts that some people have as to the safety significance  
11 and the proper safety categorization, that that thought was  
12 a thought which prompted them to change the locations.

13 I think in my first full day of deposition we  
14 spent a great deal of time on that matter.

15 Q That's right. And also at that time I don't think  
16 we were aware that there was going to be any change with  
17 regard to the requested borings which were so terribly  
18 important at that time to the Corps of Engineers in the loca-  
19 tions at which they had been requested.

20 A At that time you were not aware, nor was I.

21 Q I understand.

22 (Recess.)

6.100

eb46

1 MR. ZAMARIN: Back on the record.

2 BY MR. ZAMARIN:

3 Q With respect to the requested borings in the dike,  
4 for what purpose are they requested? Is it to determine  
5 slope stability or is it to determine settlement?

6 A The purpose is to permit undisturbed samples to  
7 be taken to establish shear strength which would be used in  
8 a shear stability analysis. It is not a concern for settle-  
9 ment.

10 Q On Consumers' Exhibit Number 11 as of 10/15/80,  
11 the third page thereof under Paragraph Number 8, it talks  
12 about "present state of the art approach."

13 I'll let you look at that. And my question is  
14 what state of the art methods are you referring to when you  
15 talk about the testing requested by the Corps?

16 (Handing document to the witness.)

17 A To which section are you referring?

18 Q Number 8. Do you see the paragraph numbered 8?  
19 It's in there.

20 A Is the question what is meant by "state of the  
21 art"?

22 Q Yes, the question is what state of the art methods

eb47

1 are you referring to in reference to the testing requested  
2 by the Corps?

3 A The laboratory consolidation tests.

4 Q And does this present state of the art approach  
5 to which you refer also apply to any method of correction  
6 which would be used in connection with those lab test calcu-  
7 lations?

8 A I would consider the corrections such as for sample  
9 disturbance to be all part of the state of the art.

10 Q And are there any other corrections other than  
11 for sample disturbance that you would expect to apply as  
12 part of the state of the art?

13 A Is the question directed to laboratory consolida-  
14 tion tests?

15 Q Yes, if that's the only kind of test that you  
16 refer to regarding the request by the Corps.

17 Q The confusing part about it is the document you  
18 refer to I think covers all structures, and that particular  
19 section I think was referring to consolidation tests, so  
20 I'm trying to resolve whether your question now refers to  
21 consolidation tests or to everything that was intended by the  
22 document that you have.

eb48

1 Q Okay.

2 With regard to the borings that are requested, are  
3 there tests other than consolidation tests that are requested  
4 or contemplated?

5 A Yes.

6 Q What?

7 A Shear strength.

8 Q What else?

9 A If you consider the measurement of in situ  
10 density a test.

11 Could I see Table 37-1 again, please?

12 (Document handed to the witness.)

6.180

13 The requested testing includes shear strength test-  
14 ing, relative density testing, consolidation testing, and the  
15 normal classification test.

16 Q And would you reference to present state of the  
17 art apply only to consolidation testing?

18 A The statement that you read in Paragraph 8 was  
19 referring to the state of the art with regard to consolidation  
20 tests, yes.

21 Q And the only correction-- That method that you  
22 would propose with respect to that would be correction for

eb49

1 sampling disturbance. Is that right?

2 A I'm trying to recall the procedures in the test  
3 to where there may be other corrections. I cannot think of  
4 any.

5 Q Did Dr. Peck, to your knowledge, ever state that  
6 the fill underneath the diesel generator building was in fact  
7 placed dry of optimum?

8 A To my knowledge he indicated that it was his under-  
9 standing that it was.

10 Q Was it that he indicated it was his understanding  
11 or did he cite placement dry of optimum as a possibility?

12 A I'm assuming that when the subject was raised  
13 about it being dry of optimum that he had available to him  
14 before that statement data that would help him to decide  
15 whether it was dry or not.

16 Q And is it based solely upon that assumption of  
17 yours that you conclude that Dr. Peck believed that the fill  
18 was placed dry of optimum?

19 A The basis that I have that it was placed dry of  
20 optimum was the conversation that I had with Dr. Peck. What  
21 basis Dr. Peck had for thinking it was dry of optimum I have  
22 never discussed with him.

eb50

1 Q Tell me exactly what it was about that conversation  
 2 that you had with Dr. Peck that caused you to believe that  
 3 he was of the understanding that the fill was placed dry of  
 4 optimum?

5 A I think it was the July 31st, 1980 meeting where,  
 6 in a conversation with Dr. Peck, I had indicated that I  
 7 would have expected a much higher development of pore pressure  
 8 under the surcharge loading than was recorded in the piezo-  
 9 meters and he indicated to me that a possible reason that  
 10 it did not reach the levels that you would anticipate was  
 11 because the material had been placed dry of optimum, had a  
 12 lot of cracks in the material because -- I think I can  
 13 remember the expression -- being placed in slabs.

14 And I remember the expression "macro voids,"  
 15 meaning his classification of the cracks, and under loading  
 16 of the surcharge, the pore pressure did not raise to anti-  
 17 cipated levels because those cracks provided a drainage  
 18 path which did not require the pore pressures to raise to the  
 19 high levels you were interested in.

20 Q Would you expect a distance of layers of soil to  
 21 provide drainage paths?

22 A If the layers were of a permeable material, yes.

eb51

1 Q You just described a conversation you had with  
 2 Dr. Peck and his statement of the possibility and a possible  
 3 explanation for the magnitude of pore pressure dissipation.  
 4 Do you agree with his stated possibility?

5 A If we had a large system of cracks with large  
 6 voids, then it could permit the rapid dissipation of pore  
 7 pressures. But if we had that condition it raises questions  
 8 with regards to your observed settlement behavior.

9 MR. ZAMARIN: Could I have the answer back, please?

10 (Whereupon, the Reporter read from the record  
 11 as requested.)

12 BY MR. ZAMARIN:

13 Q What such questions does it raise, and why?

14 A We have discussed this previously.

15 If the fill were dry with large voids when loaded  
 16 you would expect a closing of those large voids because of  
 17 that loading and therefore, in closing those voids you would  
 18 get a settlement. Then to me there would be a period of  
 19 time while you experienced that settlement that additional  
 20 loading would then take you into the normal consolidation  
 21 process.

22 Your date of settlement versus log time and the



eb52

1 shape of the curve as you are indicating is representative  
 2 of a homogeneous material which exhibits that shape. When  
 3 loaded, that shape I don't feel would be representative of  
 4 a condition where you have large voids that initially have  
 5 to be closed.

6 Q How long do you think it would take to close the  
 7 type of large voids which you are talking about?

8 A It depends on factors. It depends on whether the  
 9 material was saturated.

10 Q What I'm talking about are the type of voids and  
 11 other conditions that Dr. Peck stated to you as a possibility  
 12 in your conversation with him.

13 A I don't think you could give a time. I think the  
 14 extend of the voids, the fact of whether the material was  
 15 dry or was saturated are all factors that you must evaluate.

16 Q Are you aware of any borings or test pit observa-  
 17 tions which indicated that the fill underneath the diesel  
 18 generator building may have been wet of optimum?

19 A I did not see the test pit excavations. It's my  
 20 understanding that test pit excavations were conducted. It's  
 21 my understanding that members of the NRC staff did have the  
 22 opportunity to see those test pits and after having had the

eb53

1 discussion with Dr. Peck about material being placed dry,  
2 in discussing with a member of the NRC staff who had visited  
3 and saw the test pits, he had indicated that there were  
4 cracks in the fill that he had observed.

5 And so the information with regard to test pits  
6 would make me inclined to believe that it was placed dry.

7 Q You're referring of course to Lyman Heller?

8 A That's correct.

9 Q This discussion with Lyman Heller about test pits  
10 and cracks in the fill, did that pertain to test pits in the  
11 diesel generator building, outside the diesel generator  
12 building, or some other area?

13 A To my understanding it pertained to test pits  
14 outside, but I'm not positive of that.

15 Q If borings in the diesel generator building  
16 demonstrated that the soil was wet of optimum and a test pit  
17 in the diesel generator building showed that the soil was  
18 wet of optimum, would that change your opinion as to whether  
19 the mechanism which you described associated with the soil  
20 placed dry of optimum was likely to have occurred?

21 A If the borings and the tests on the samples  
22 recovered from the borings showed that the materials were not

eb54

1 dry but were wet of optimum, it would change my opinion on  
2 whether cracks and large voids existed, yes.

6.350

3 I think we had this discussion before on the  
4 time element of when these tests were run on the samples and  
5 how the moisture content was established were all previously  
6 discussed.

7 MR. ZAMARIN: I'm sorry, could I have that answer  
8 back?

9 (Whereupon, the Reporter read from the record  
10 as requested.)

11 BY MR. ZAMARIN:

12 Q With regard to soil that was not wetted by seepage  
13 from the pond or recharge from the pond, would you expect  
14 any change between the time it was placed with regard to  
15 whether it was placed wet or dry of optimum and the time tests  
16 were run, even assuming those tests were run after the sur-  
17 charge.

18 A Depending on its location in the fill and its  
19 closeness to the groundwater excluding any effect of the  
20 seepage from the pond, you know, by capillary action, you  
21 could expect a change in moisture content in soils.

22 Q Okay.

eb55

1           Wouldn't you have expected that same capillary  
2 action prior to surcharge?

3           A       Prior, and continuing. But the discussion that  
4 I recall we had before about moisture content was if we were  
5 now to look at data of moisture content of the fill, would  
6 that show us that the material was placed wet of optimum,  
7 and I'm saying it depends on how careful those moisture  
8 contents were run.

9           And I think I went through the example of if a  
10 sample sat around for a long period of time and then were  
11 tested for moisture content you could get a wide range in  
12 difference in moisture contents by where you selected the  
13 sample that you tested for moisture content.

14           Gravity would pull down the moisture in a sample  
15 that's sitting down for a long period of time and the bottom  
16 would tend to be wetter than the top. And if the sample sat  
17 around for a long period of time before being tested it  
18 might not give you a reliable moisture content.

19           Q       But what I'm talking about now is soil that was  
20 not wetted or saturated by pond recharge or pond seepage,  
21 and with respect to that soil you wouldn't expect any change  
22 between the time it was placed and the time the tests were

eb56

1 done with regard to moisture content, would you?

2 A At the surface you can expect some drying out. At  
3 the lower levels affected by capillary action you can expect  
4 an increase in moisture. So there are zones within that fill  
5 that could be affected.

6 Q Okay.

7 Now would you expect there to be any significant  
8 change with regard to the moisture content of that soil from  
9 the time immediately prior to the surcharge until today, for  
10 example?

11 A I would expect the moisture content to have  
12 changed.

13 Q In what way?

14 A In that the surcharge should have squeezed out  
15 moisture and reduced the moisture content.

16 Q Okay.

17 If moisture tests run after the surcharge showed  
18 that soil which was not wetted by the pond recharge was not  
19 dry of optimum, would it be your opinion that it was also not  
20 dry of optimum prior to the surcharge?

21 A I think you're having difficulty of -- after the  
22 surcharge of taking the effect out of the pond because the

eb57

1 pond was raised prior to the surcharge.

2 Q I'm talking about soil that was not wetted by the  
3 recharge from the pond when it was raised.

4 A If you can make that distinction.

5 Q That has been the predicate for each of the last  
6 few questions I've asked.

7 A Would you repeat your question now?

8 Q With regard to the soil that was not wetted by  
9 recharge from the pond, would you expect tests-- Strike  
10 that.

11 With regard to the soil that was not wetted by  
12 the recharge of the pond, in your opinion would a test after  
13 the surcharge showing that it was not dry of optimum also  
14 indicate that immediately prior to the surcharge that that  
15 soil was not dry of optimum?

16 A For my own benefit, can I rephrase the question  
17 to say we're assuming this soil was not influenced by the  
18 pond?

19 Q That's correct.

20 A And before the surcharge was imposed it had a  
21 certain moisture content, or after the surcharge? Which of  
22 those conditions?

eb58

1 Q After.

2 A After. It had a certain moisture content after

3 And would I now expect a change in moisture  
4 content from that time? Is that your question?

5 Q Really what I'm asking is if you've got a soil  
6 moisture test done after the surcharge which shows soil th  
7 is not dry of optimum and that is soil that was not affect  
8 by the pond, would it be your opinion that that soil was  
9 also not dry of optimum just prior to the surcharge?

C6

10 A Could you read the question, please?

11 (Whereupon, the Reporter read from the record  
12 as requested.)

13 THE WITNESS: I don't think you can make that  
14 correlation because I think the surcharge would have chan  
15 the moisture content of the material before and after.

16 It's seems to me you're asking is the moisture  
17 content unchanged before and after surcharge if it is un-  
18 affected by the pond seepage.

19 BY MR. ZAMARIN:

20 Q Are you saying that the surcharge would have  
21 changed the moisture content of a soil that was not affec  
22 by the pond?

eb59

1 A It could have, yes.

2 Q In what way would it have changed it, or could it  
3 have changed it?

4 A It could have caused some densification of the  
5 soil because of the surcharge and that densification moisture  
6 content is a measure of the weight of the water over the  
7 weight of the solids. So for a given solid you would have  
8 more solids if it were consolidated so in that regard it  
9 could affect the moisture content.

10 Q Right.

11 And wouldn't that then, however, give you results  
12 in moisture tests after the surcharge which would indicate  
13 a dryer soil than you had prior to surcharge?

14 A Yes. But I thought your question was are they both  
15 dry or are they both the same.

16 Q No.

17 A I agree with your statement that they would be  
18 dryer after the surcharge.

19 Q After the surcharge.

20 So if it is in soil that wasn't affected by the  
21 pond and you run a moisture test after the surcharge, if  
22 anything that moisture test after the surcharge will be



eb60

1 drier than it would have been prior to surcharge. Is that  
2 what you're saying?

3 A If you addressed those other considerations I saw  
4 about running moisture content tests.

5 Q Oh, I see. In other words being careful that you  
6 don't let them sit and dry out and that kind of stuff?

7 A That's correct.

8 Q Have you reviewed any water content data at all  
9 with regard to the soil under the diesel generator building?

10 A No, I have not.

11 Q If in fact the soil was not placed dry of optimum  
12 underneath the diesel generator building, would that change  
13 in any way your opinion and conclusion with regard to what  
14 settlement versus log time curve for the diesel generator  
15 building demonstrates?

16 A It would not introduce the problem of the crack  
17 and so I could expect the behavior to be more representative.

18 Q Are you saying then that it's more likely that  
19 that curve in fact represents the typical primary/secondary  
20 consolidation curve as reflected in the behavior of the soil  
21 beneath the diesel generator building?

22 A It has a better chance of representing the typical

eb61

1 behavior.

2 Q How much better of a chance? I mean is it likely  
3 that it does then in your mind represent typical behavior?

4 A The typical behavior that we see is based on  
5 laboratory tests of essentially a homogeneous material. We  
6 don't have that at Midland. We have soils of different  
7 compressibility characteristics. And so, because of the  
8 conditions we have at Midland, I'm not sure there is a typi  
9 behavior.

10 Q Would you expect there to be dominant soil  
11 characteristics in the soil underneath the diesel generator  
12 building?

13 A Dominant in the sense of causing the most con-  
14 solidation?

15 Q Causing the most consolidation and also exhibiti  
16 engineering properties of the soil which would dominate the  
17 behavior of the soil, or predominate the behavior of the so

18 A I would expect the soils, certain soils to have  
19 dominant behavior when concerned with settlement. But the  
20 fact that they are different with different compressibility  
21 characteristics, you can't just look at the dominant one,  
22 you have to look at the differential settlement between th

6.610

eb62

1 two of them, between the two types of material.

2 Maybe I can give an example. If I have a pipe that  
3 is on a relatively incompressible sand and another portion  
4 of it is on a highly compressible clay, the dominant settle-  
5 ment concern is on the clay but I still must recognize the  
6 difference in settlement between those two portions.

7 Q I see.

8 So really what you're talking about is you have  
9 that concern with regard to differential settlement as oppos-  
10 to primary/secondary consolidation?

11 A That is correct.

12 Q Is it required for good engineering practice in  
13 your opinion as a geotechnical engineer to make a prediction  
14 as to the level to which pore water pressure will rise under  
15 a surcharge prior to the imposition of the surcharge program?

16 A You used certain words, "required," "good engine-  
17 ing practice."

18 Q Right.

19 A I don't know of any guidelines where I could say  
20 this is required good engineering practice. I think there  
21 would be many in the engineering profession which would make  
22 that computation.

eb63

1 Q What is the purpose of such a prediction?

2 A To help you understand, under loading, what you  
3 would expect the piezometers to indicate and to let you know  
4 that what is happening by your piezometer behavior is what  
5 you would anticipate, and it would help tell you when you have  
6 fully dissipated the excess pore pressures.

7 Q If you really don't know the drainage paths or the  
8 drainage layers and other characteristics of the soil which  
9 have an effect upon the drainage and the time of dissipation  
10 and the amount of rise in excess pore water pressure that  
11 you would be able to record or observe on the piezometer,  
12 what good does it do to make that prediction? Aren't you  
13 just guessing?

14 A You have indicated you do not know the drainage  
15 characteristics. You don't know the material types well  
16 enough to make that prediction. I would think with the  
17 borings you have completed that you have a lot of information  
18 that would permit you to know that.

19 Q Really what I'm saying is, though, that since you  
20 have those variables, of what use is that prediction when  
21 you can observe the actual field behavior under surcharge,  
22 that is, settlement versus time?

b7

eb64

1 A Well, given enough time to where there would be  
2 question that you were in secondary consolidation, there ma  
3 not be a need for it. Given a schedule where time is a sig  
4 ficant element, I think not knowing is a piece of informati  
5 which would help you make the judgment in short time schedu  
6 of when to remove the surcharge.

7 So the advantage to me is being able to recogni:  
8 that under loading, both the settlement and the piezometer  
9 behavior as anticipated has now fully dissipated and now I  
10 know that I'm out of primary consolidation.

11 Q Upon what assumptions is the prediction of leve  
12 rise in pore water pressure made?

13 A I don't understand your question.

14 Q Well, there are certain assumptions that you ma  
15 when you predict the level to which pore water pressure wi  
16 rise, for example, drainage path. Are there any others?

17 A Are there factors that affect the height the  
18 pore pressure is going to rise?

19 Q That's right. Are there assumptions that you :  
20 make in arriving at that prediction?

21 A There are others, whether you are fully satura

22 Q What else?

eb65

1 A The rate of loading.

2 Q Anything else?

3 A Not that I can recall.

4 Q And you have a possible range of values for each  
5 of those assumptions. Is that right?

6 A That's correct.

7 Q And you have to somewhat arbitrarily pick one of  
8 those values in order to come up with an expected level of  
9 rise.

10 A You may not have to choose one value; you can look  
11 at the range.

12 Q I see.

13 Do you have any idea what the range of values  
14 would be for the surcharge of the diesel generator building?  
15 Given that it's a maximum of 35 do you know how far down it  
16 would go?

7.020

17 A It could be very low, depending on the drainage  
18 paths that are available and whether you were fully saturated.

19 Q So you may have a range from one foot to 35 feet?

20 A That's correct. It's unlikely you would have  
21 that range in a 30-foot height of cohesive fill.

22 Q Is it more likely you would have between one foot

eb66

1 and 30 feet in that kind of a situation?

2 A No, I would increase the one foot.

3 Q To about what?

4 A I feel the question is what I have answered before.

5 I don't want to make that guess until I've looked at the  
6 potential drainage paths.

7 MR. ZAMARIN: Off the record.

8 (Discussion off the record.)

9 MR. ZAMARIN: Back on the record.

10 BY MR. ZAMARIN:

11 Q Is it required for good engineering practice in  
12 your opinion as a geotechnical engineer to make a prediction  
13 as to the length of time a surcharge such as that placed on  
14 the diesel generator building is to be left in place?

15 A Can we reach an agreement on using "required for  
16 good engineering practice" and just use the term "good  
17 engineering practice"?

18 Q No, I'm saying "required." In other words if you  
19 don't do that have you committed engineering malpractice?

20 A No.

21 Q If you don't do that is it considered to be un-  
22 acceptable practice within the engineering community? That's

eb67

1 what I mean by "required."

2 A I don't think the engineering community is so well  
3 established to have set those guidelines.

4 Q Okay.

5 So your testimony is that, to your knowledge, such  
6 guidelines do not exist within the engineering community.  
7 Is that right?

8 A I don't think our profession is so structured  
9 that it takes away technical judgment to where you would be  
10 free to use this technical judgment. I don't think there is  
11 a set of requirements within our profession that will say you  
12 must do this, you must do that.

13 Q Well, certainly within some limits there are.  
14 There are some that say if you're calculating bearing capa-  
15 city, for example, there are certain factors you have to take  
16 into account, and if you don't take those into account that  
17 that is inconsistent then with good engineering practice.

18 And what I'm asking you to do--

19 A That's not totally correct.

20 If you have experience in a given area and because  
21 of that experience you do not need to run the shear test  
22 parameters and the other information and because of your



eb68

1 experience you're able to correctly predict what is necessary  
 2 for the design to be acceptable, and you do that and you come  
 3 out correct, then I think that would be accepted in the  
 4 engineering profession.

5 Q Okay.

6 And what you have just done is given certain  
 7 criteria which must be met in order for one to say that good  
 8 engineering practice had been used?

9 A I haven't given criteria. I have given my thoughts  
 10 I couldn't go to some place where this is written down.

11 Q Well, let me give you an example.

12 I've been involved in many lawsuits with respect  
 13 to architect/engineer's errors and omissions, and one of the  
 14 basic questions in those cases is whether malpractice was  
 15 committed. And in determining whether malpractice was  
 16 committed you have to decide, or the trier of fact has to  
 17 decide whether what was done by the engineer/architect was  
 18 consistent with the standard of care in the architect's role  
 19 or engineering community.

20 And the standard of care is defined as that which  
 21 is customarily required for good engineering or architectural  
 22 practice, and there are certain things you just have to do,

eb69

1 and if you don't do them or don't have an excuse for not  
 2 doing them such as having the kind of experience you just  
 3 described, then you just haven't done the job right.

4 And really my question is: Is making prediction  
 5 of the length of time a surcharge has to be left in place  
 6 the kind of a prediction that must be made or else you have  
 7 departed from what is considered to be good engineering  
 8 practice, if you have an opinion?

7.080

9 A In my review effort with the Midland project I  
 10 have not tried to step back and examine whether good engin  
 11 ing practice is being followed or not. I've tried to addr  
 12 the issues and whether in my opinion, in my experience,  
 13 there is reasonable assurance of safety.

14 I'm not going to pass judgment on the intention  
 15 or whether others have been negligent with the approach th  
 16 I have used, and I'm not going to answer questions that a  
 17 asking me to judge negligency in others.

18 Q Well, for one thing I disagree with you. You  
 19 answer if you're asked and they are appropriate questions  
 20 but beyond that, we don't need to get them because I'm no  
 21 asking you whether anyone has conducted themselves in any  
 22 particular manner, including a negligible manner.

eb70

1           What I'm simply asking you is if you have an  
2 opinion, based upon your experience as a geotechnical en-  
3 gineer, as to whether good engineering practice requires  
4 making a prediction for the length of time the surcharge is  
5 to be placed on a structure such as the diesel generator  
6 building prior to the imposition of that surcharge.

7           A       Good engineering practice would encourage you to  
8 make that prediction. I don't think in my estimation our  
9 field of engineering is so structured that it would be  
10 required.

11          Q       We discussed a little earlier the E-log P curve  
12 for a compacted soil sample. Do you recall that?

13          A       I do.

14          Q       And I believe that was on Exhibit Number 19.

15                 You indicated that it was difficult on that curve  
16 to indicate a correction or to decide exactly what type of  
17 correction for sampling errors should be made.

18                 Is that because it's difficult to locate the point  
19 of maximum curvature on that curve?

20          A       I'm assuming you're referring to the curve for  
21 compacted fill.

22          Q       Yes.

eb71

1           A       That is part of it. The fact that we don't go  
2 into a straight-line portion of the curve is another portion  
3 of it.

4           Q       So in other words there is not a well-defined  
5 break in the curve as well as not a well-defined point of  
6 maximum curvature?

7           A       That is correct.

8           Q       And that would make it very difficult to correct  
9 for disturbance in that type of a soil and allow considerable  
10 room for error, wouldn't it?

11          A       Faced with the problem of making that adjustment,  
12 my answer would be yes.

13          Q       In your opinion, on a consolidation test and in  
14 that type of the plot, would you expect a compacted soil to  
15 behave or to demonstrate a plot similar to that of a dis-  
16 turbed natural soil sample?

17          A       I think I have indicated that because the materials  
18 that were placed in the foundation of the diesel generator  
19 building were undercompacted, then I am not sure of what the  
20 behavior would be in a consolidation test. I think I have  
21 indicated that if I ran the test and I was able to judge  
22 whether the test results that came from the consolidation

eb72

1 test were closer to a normally consolidated soil, then I  
2 would make the adjustment for sample disturbance.

3 I think I have indicated I would have a problem  
4 such as I have now of adjusting the curve if it came out  
5 looking like a compacted fill.

6 Q Well, my question is:

7 Based upon your experience, would you expect a  
8 compacted soil sample to behave similar to a disturbed  
9 natural soil sample?

10 A I think I have indicated by those curves there  
11 that it would not be that way.

12 Q How many times have you performed consolidation  
13 tests and made predictions, based on a compacted soil sample?

14 A There's a couple of parts to that question. How  
15 many times have I performed consolidation tests?

16 Q No, my comma goes in a different place.

17 How many times have you done consolidation tests  
18 and made predictions, based on compacted soil samples?

19 A By making consolidation tests I'm assuming if I  
20 had been the one who had asked for the test to be run. I've  
21 not worked to any great extent in the soils lab.

22 Q You say not "to any great extent." Have you wor

eb73

1 to any extent in the soils lab?

2 A Yes.

3 Q All right.

4 To what extent, with consolidation tests?

7.150

5 A In the course of both graduate and undergraduate  
6 work I ran consolidation tests. In my experience with the  
7 Corps I required a great many consolidation tests to be run  
8 and use the results of that to make predictions of settlement.<sup>6</sup>

9 " With regard to compacted fill I would say there  
10 would be at least four projects I have worked on.

11 Q Could you name those, please?

12 A Beltsville Dam, Blue Marsh Dam, Tocks Island Dam.  
13 I also think they were run and evaluated for another dam,  
14 Trexler Dam.

15 Q And these were consolidation tests that were done  
16 on compacted soil samples?

17 A That's correct.

18 Q Do you know what the margin of error is in running  
19 that kind of a test and making predictions based upon that  
20 kind of a test?

21 A You would have to define "margin of error."  
22 "Margin of error" with regard to what?

eb74

1 Q Well, for predicting settlement, for example, on  
2 the basis of a consolidation test on a compacted fill sample.

3 A I can only recall one of those projects where we  
4 actually had the field behavior where I could compare the  
5 predicted settlement with what was observed in the field,  
6 and to my recollection it was relatively close. By that, I  
7 think it was within an inch of what was predicted.

8 Q What project was that?

9 A Beltsville Dam.

10 Q And when was that?

11 A Back around 1970.

12 Q Do you still have any records with regard to that?

13 A No.

14 Q Where would one go to find such?

15 A To the Philadelphia District Corps of Engineers.

16 Q What happened in the other places where you did  
17 consolidation tests on compacted soil samples?

18 A Trexler Dam and Tocks Island Dam were designed--  
19 Actually Tocks Island Dam had gotten to the construction plans  
20 and specifications stage and the project was dropped.

21 Trexler Dam had a great deal of design completed  
22 and was dropped.

eb75

1 Blue March Dam has been constructed but I left the  
2 Corps of Engineers before actually doing the construction of  
3 Blue Marsh Dam.

4 Q With regard to the Beltsville Dam prediction of  
5 settlement, you indicated that you believed that the predic-  
6 tion based upon the consolidation test was within an inch of  
7 experience. Can you tell me what the total predicted settle-  
8 ment was?

9 A Based on ten years difference, if I remember  
10 correctly, it was on the order of 12 inches.

11 Q And the actual settlement then was 12 inches plus  
12 or minus one?

13 A I think it was 11 inches.

14 Q Was the consolidation test done on a sample that  
15 was reconstituted in the lab or one that was extracted in the  
16 field after the fill was placed?

17 A The consolidation test was done on our recompact  
18 material. Actually the sample was tested before the con-  
19 struction and was taken from the material that was to make  
20 up the embankment.

21 Q So it was actually constituted in the lab as  
22 opposed to extracted in the field?



eb76

1 A That's correct.

2 I would like to indicate that that was one project  
3 where record samples were taken and samples were available  
4 for running consolidation tests.

5 Q Would you expect the experience then where you have  
6 a sample constituted in the lab to be comparable to one such  
7 as at Midland where you would extract a sample in the field  
8 after the fill had been placed and after the surcharge?

9 A Would you repeat the question, please?

10 (Whereupon, the Reporter read from the record  
11 as requested.)

12 THE WITNESS: I would expect it to be comparable.

13 BY MR. ZAMARIN:

14 Q Would you expect then that the margin of error  
15 would not-- Strike that.

16 Would you expect then that the margin of error  
17 attendant to that type of a test would not significantly  
18 differ between the lab-constituted sample and the field-  
19 extracted sample?

20 A Are we talking about sample disturbance or what?

21 Q What I'm talking about is the reliability, the  
22 margin of error in the prediction of settlement based upon

eb77

1 consolidation tests where, on the one hand, you have a lab-  
 2 constituted sample and on the other hand you have an ex-  
 3 tracted sample taken after the fill was placed and after the  
 4 surcharge was applied to it.

5 A The margin of error is going to be influenced by  
 6 how well you reconstituted the sample to duplicate the field  
 7 conditions, and so there is no one margin of error. It  
 8 depends on how well you have duplicated the field conditions.

9 Q So you're really talking about two totally dif-  
 10 ferent procedures when it comes to evaluating the margin of  
 11 error with regard to a test where you've reconstituted a  
 12 sample with one where you have simply extracted it, aren't  
 13 you?

14 A You're talking about two different procedures for  
 15 doing what?

16 Q For predicting settlement and assuming a certain  
 17 reliability or margin of error with respect to that predic-  
 18 tion.

19 A If you are successful in reconstituting the sampl  
 20 to be representative of what you have in the field, then to  
 21 me the margin of error in predicting settlement would be  
 22 essentially the same because you have produced in the lab wh

eb78

1 is in the field.

2 Q I see.

3 So in your opinion then you would not expect a  
4 lower margin of error where you reconstituted samples in the  
5 lab than you would where you're taking the sample in the  
6 field such as would be done at Midland?

7 A There could be a difference in margin of error but  
8 there are other factors, both in the lab and in the field,  
9 which could more influence that margin of error.

10 Q Such as --?

11 A Such as when you took your sample in the field,  
12 is it representative of the entire embankment. You know, if  
13 you take a sample in the field that doesn't automatically  
14 mean it is the most representative one, so you have problems  
15 in that regard.

16 Q Okay.

17 A.1 that's likely to increase the margin of error  
18 with regard to the field-extracted sample?

19 A I'm puzzled by the question because I think you  
20 could take a reconstituted sample in the lab and better  
21 represent an embankment section than you can with a field  
22 sample if not properly done. I am saying there are many

eb79

1 margins of error in all processes that you're doing.

2 Q Is there any generally accepted engineering  
3 opinion with regard to the reliability of reconstituted lab  
4 samples as opposed to extractions in the field for estimation  
5 of settlement based upon consolidation test?

6 A I think the feeling would be that the field samples  
7 would statistically give you better results than the labora-  
8 tory reconstituted samples.

9 Q In one of your previous deposition sessions we  
10 were talking about the 1.5 factor for the preload. Do you  
11 recall that?

12 A I do.

13 Q And did you refer to that as a margin of safety?

14 A No, I did not.

15 Q That is not a margin of safety, is it?

16 A No. I thought we had discussions where I indi-  
17 cated it was not a margin of safety.

18 Q And would the 1.5 factor-- What we're really  
19 talking about is the higher the number, the higher the ratio,  
20 the faster perhaps that consolidation would occur?

21 A The higher the factor, meaning the larger sur-  
22 charge that you would impose over the final load, would

.7,325

eb80

1 increase the rate of consolidation, yes.

2 Q And the only effect of stress that is needed in the  
3 soil is that which is equal to the design stress?

4 A I'm not sure what you mean by that.

5 Q Okay.

6 - In a preload, if there was no consideration for  
7 increasing the effective stress of the preload in order to  
8 speed up the consolidation, would you only need for that pre-  
9 load program an effective stress in the soil equal to the  
10 design stress of the structure that is to be placed on it?

11 A Could I add onto that "to result in the same amount  
12 of settlement"?

13 Q That's right.

14 A Is that what your question is?

15 Q Yes, the same amount of ultimate settlement.

16 A Excluding the time element, yes.

17 Q And it's not customary to factor into or normal  
18 engineering practice, to factor into that stress determination  
19 environmental loads, is it?

20 A It would depend on the environmental load and the  
21 length that it would be imposed.

22 Q The length that the environmental load would be

jbnl

1 imposed?

2 A Yes.

3 Q Can you give an example of an environmental load  
4 that would be factored into such a determination of the stress  
5 to be applied at preload?

6 A No.

7 Q Is that because you just can't think of any that  
8 would be other than of such a short duration that--

9 A The environmental loads I can think of would be  
10 transient and would not fit that description.

11 Q So therefore they would be factored in because  
12 when you say transient they are such a short-term effect that  
13 they wouldn't have any real effect?

14 A They would not be sustained long enough to cause  
15 the effect.

16 Q Okay.

17 When you're talking about margin of error, if I  
18 can direct your attention to the typical settlement versus  
19 log of time plot, would you consider the difference between  
20 the predicted settlement based upon the assumption that a...  
21 surcharge would remain in place over the life of a structure  
22 and the settlement that would be expected under a lesser

jbn2

1 load, that is, with the surcharge off of the structure, to  
2 be a factor of safety with regard to the predicted settle-  
3 ment?

4 A I wouldn't consider it to be a factor of safety.  
5 I would consider it to be an additional margin of safety.

6 Q In your opinion is the diesel generator building  
7 -- the soil beneath the diesel generator building at Midland  
8 presently in primary consolidation?

9 A I don't know.

10 Q Would you expect an observed settlement of no more  
11 than about .1 of an inch from the time of the surcharge  
12 removal in August, 1979, through September of 1980, to be  
13 consistent with the soil beneath that structure still being  
14 in primary consolidation?

15 A There are several considerations that you must  
16 agree on before you can answer that, such as has the load,  
17 the final structure load been imposed that entire time,  
18 whether there could be any conditions that could develop  
19 that could cause a change and lead to additional settlement,  
20 and there I'm referring to saturation zones that were not  
21 previously saturated and the effect that has on consolidation.

22 Excluding changed conditions and assuming that

jbn3

1 full load has been applied that entire time, then that settle-  
2 ment that you have indicated which is -- what? -- one-  
3 hundredth of an inch?

4 Q One-tenth of an inch.

5 A -- one-tenth of an inch over that period would be  
6 indicative of being in secondary consolidation.

7 Q If the load of the structure, the diesel generator  
8 building, during the period of August, 1979, through September  
9 of 1980 was within 250 pounds per square foot of its final  
10 structural load and that 250 pounds per square foot repre-  
11 senting the live load and there was no condition such as the  
12 saturation zone which you described and the structure had  
13 experienced no more than one-tenth of an inch settlement  
14 during that time period, would you still be of the opinion  
15 that that would indicate that there was secondary consolida-  
16 tion?

17 MR. PATON: I'm sorry, "would you still be of the  
18 opinion"?

19 MR. ZAMARIN: It was after his other answer, I  
20 added the--

21 MR. PATON: Okay.

22 THE WITNESS: The difference between this question



jbn4

1 and the previous one is the 250 pounds per square foot?

2 BY MR. ZAMARIN:

3 Q What I'm asking you is that wouldn't change your  
4 answer to the previous question, would it?

5 A No, it would not.

6 I would like to clarify that. You did say it  
7 included live load?

8 Q The 250 pounds per square foot is the live load.

9 A Is the difference, but that difference is based  
10 on dead load plus live load?

11 Q That's right.

12 A That's correct.

13 Q In your opinion, in accomplishing a preload program  
14 such as was done with the diesel generator building, would  
15 it be better to raise the cooling pond level as the load is  
16 being put on rather than prior to imposition of the load so  
17 as to shut down or close voids in the soil before water is  
18 put in and thereby effect more rapid consolidation?

19 A It's seems to me that was a question that was  
20 asked of me before.

21 Q Not with all these factors all in one question.

22 A Could we go over all the factors again then?

jbn5

1 Q Okay.

2 In your opinion, is it better in a surcharge  
3 program like the diesel generator building to raise the cool-  
4 ing pond level as the load is being put on rather than rais-  
5 ing the pond before the load is put on in order to shut down  
6 or close the voids in the soil before the water is introduced  
7 and therefore effect more rapid consolidation than you would  
8 have if the pond were first raised, the water filled the  
9 voids and then had to be squeezed out?

10 A I still don't think I have the whole question.

11 Q Do you want to tell me what you have, or do you  
12 want the question read back?

13 MR. ZAMARIN: Why don't you read the question back?

14 (Whereupon, the Reporter read from the record  
15 as requested.)

16 THE WITNESS: I don't know whether it's the time  
17 element or not but there are so many considerations in there  
18 that I think I would have to write them down to understand  
19 the variations that you're giving me and to make a judgment  
20 on that.

21 BY MR. ZAMARIN:

22 Q Okay, let me give you the two variations because

jbn6

1 what I'm trying to do by giving you more factors is to demon-  
2 strate what I perceive to be the mechanism that would go on,  
3 and that is if you raise the level of the pond first, you're  
4 going to fill the voids with water and then you've got to  
5 squeeze it out whereas if you raise the level as you are  
6 applying the load, the voids will be closed before the water  
7 is introduced and you don't have to squeeze them out later.

8 So let me just ask you though, in your opinion,  
9 is it better from a geotechnical engineering standpoint to  
10 have raised the cooling pond as the load is being put on, or  
11 would it have been better to have raised the cooling pond  
12 first?

13 A It would have been better to have raised the cool-  
14 ing pond first.

15 Q In your opinion, would that have then caused voids  
16 to fill with water which then would have to be squeezed out?

17 A Yes.

18 Q And in your opinion would that then have slowed  
19 down the consolidation process?

20 A Squeezing the water out of the voids slows down the  
21 process but the reason you would raise the water is because  
22 of its impact on the behavior of the soil upon saturation,

jbn7

1 so if you didn't raise it before, you would have two different  
2 types of settlement behavior, and I think the worst is when  
3 you have saturated.

4 Q The worst is when you have saturated? Is that  
5 what you said?

6 A Certain soils, upon saturation, are more readily  
7 accessible to settling because the saturation allows the  
8 soil structure to go into a new arrangement more readily  
9 whereas if it were dry, the bond that you have in a dry soil  
10 may not be overcome as readily under load as it is when it's  
11 saturated, and that's why you would saturate it before.

12 Q So are you saying then that if you saturated as  
13 the load is being put on that you somehow lose some benefit  
14 that you would have if you had saturated the soil before the  
15 load was put on?

16 A I think you lose some benefit, yes.

17 Q And that benefit was what you just described as  
18 the saturation of the soil allowing more ready reorganizatio  
19 of these particles?

20 A If it is not saturated but yet saturation pro-  
21 duces this condition in the soil to where it more readily  
22 settles, then when you load it and it's only partially

jbn8

1 saturated, then you're not squeezing out water but you're  
 2 squeezing out air, and the water attempting to enter and do  
 3 what it has to do to make it settle more rapidly is com-  
 4 peting with air trying to be squeezed out.

C7

5 The saturation action is promoting greater settle-  
 6 ment than would occur if it were dry and if you are squeezing  
 7 air out of the same voids that the water has to get into  
 8 cause that condition, then I think you have slowed down the  
 9 ultimate settlement that will occur under full saturation.

7.600

10 Q So what you're saying is if you're squeezing air  
 11 out that that's going to slow down the process because that  
 12 then will be exerting a pressure against water that is  
 13 attempting to fill it and that would be a worse case than  
 14 if you had the voids simply having water being squeezed out?

15 A I think it is a worse case if you have a soil which  
 16 is susceptible to significant settlement upon weight, yes.

17 Q And in your opinion is the soil under the diesel  
 18 generator building susceptible to significant settlement upon  
 19 weight?

20 A In my opinion, I don't know. I don't know for sure.  
 21 I think it has the potential if it were placed dry; if the  
 22 fill were originally placed dry then there is a potential for

jbn9

1 significant settlement.

2 Q What soil parameters control the significance of  
3 the soil for settlement upon weight?

4 A It has to do with the particle structure and how  
5 that behaves upon lubrication from wetting and how the soil  
6 reacts upon that wetting. I think I can give an example of  
7 a loess where unsaturated, it could accept a great deal of  
8 loading without settling, but upon wetting will actually  
9 collapse and significantly settle. That's an extreme.

10 I think it is recognized that some fills, when  
11 compacted dry, will tend to indicate a lesser degree of  
12 settlement.

13 Q We don't have anything like loess at Midland, do  
14 we?

15 A No.

16 Q Do ordinary clays such as those normally found at  
17 Midland exhibit that kind of loess-type behavior that you  
18 just described?

19 A Do ordinary clays other than at Midland?

20 Q No, no, like those found at Midland.

21 A Exhibit the behavior such as loess?

22 Q Yes, that you just described.

38

jbn10

1 A No.

2 Q What is your understanding of the function of the  
3 diesel generator building?

4 A That in time of a cutoff of power to the plant  
5 that the diesel generators would be operated to supply that  
6 lost power.

7 Q And what is the function of the building?

8 A To protect the diesel generator buildings  
9 and preserve them in a condition so that when they are ready  
10 they would properly operate.

11 Q I think you said to "protect the diesel generator  
12 building." Do you mean to protect the diesel generators?

13 A Yes.

14 Q And by that you mean to protect them from the  
15 elements, the weather?

16 A The elements. The foundation of the structure  
17 would be such that it would be stable to where the diesel  
18 generators would be kept at a level to where they would  
19 operate properly.

20 Q And the generators themselves are founded on  
21 pedestals. Isn't that right?

22 A That's right.

jbnll

1 Q And are the pedestals part of the foundation  
2 system of the diesel generator building?

3 A No, they are independent at Midland.

4 Q In your opinion would the function of the diesel  
5 generator building be impaired by cracks in the diesel  
6 generator building?

7 A Would the function of the diesel generator build-  
8 ing be impaired by cracks?

9 Q The diesel generator building be impaired by  
10 cracks in it?

11 A It would be impaired by cracks.

12 Q In what way?

13 A It would not have the structural integrity that  
14 has been assumed in design and there would be a question of  
15 whether, because of those cracks, it could withstand such  
16 loading as an earthquake.

17 Q In your opinion would the diese. generator build-  
18 ing function be impaired by overstress?

19 A It would be.

20 Q Under what circumstances?

21 A If when operating the loading that was imposed on  
22 it from any source was large enough to cause the building to



jbn12

1 collapse.

2 Q In your opinion has that occurred?

3 A Where?

4 Q In the diesel generator building.

5 A Has it collapsed in the diesel generator building?

6 Q No; that overstressing.

7 A That is not my part of the analysis, my part of  
8 the review, to evaluate the overstressing.

9 Q Do you have an opinion as to whether it has or  
10 hasn't?

11 A I have no opinion.

12 Q Are you aware of any problem with the diesel  
13 generator pedestals?

14 A The problem with the pedestal are similar to the  
15 foundations of the wall footings in that if the wall footings  
16 are settling they could also affect settlement of the pedes-  
17 tals.

18 Q How?

19 A By causing one area under the wall footing to  
20 settle, it could lead to settlement under the pedestal.

21 Q Is there any indication that that has occurred or  
22 will occur?

jbn13

1           A       We are presently trying to evaluate the behavior  
2 of the pedestals with the wall fittings under the surcharge  
3 loading.

4           Q       Is there any indication that that has or will  
5 occur?

6           A       At this time I'm not prepared to answer that.

7           Q       Do you have any knowledge as to whether there is  
8 any indication that that has or will occur?

9           A       I can answer that it has not occurred. Will occur  
10 depends on the severity of the settlement that you would  
11 expect under the wall footings and the pedestals.

12          Q       Do you presently have any indication that that will  
13 occur?

14          A       No indication at present.

15                   (Whereupon, at 5:02 p.m., the taking of the  
16 deposition was recessed to reconvene at 8:30 a.m.  
17 the following day in Room 422.)

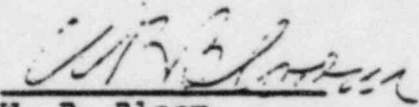
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CERTIFICATE OF NOTARY PUBLIC AND REPORTER

I, William R. Bloom, the officer before whom the foregoing deposition was taken, do hereby certify that the witness whose testimony appears in the foregoing deposition had been previously duly sworn; that the testimony of said witness was taken by me by Stenomask and thereafter reduced to typewriting by me or under my direction; that said deposition is a true record of the testimony given by said witness; that I am neither counsel for, related to, nor employed by any of the parties to the action in which this deposition was taken; and, further, that I am not a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of the action.

  
W. R. Bloom  
Notary Public in and for  
the District of Columbia

My commission expires 14 August 1985