and Edward Keppler

A
B Summary - Aleff Oct 29, 30 + 31, 1980
C " - Davison 1-14-81
D " - Peck 1-13-14-81
E " Horne 10-21-22-80
F " Shaw 12-17-80
G " Gould 1-8-81
H " Hendrie 1-19-20-81
I
J
K List of those sent to Intervenors
L
M
Misc Misc Notes
N Notices - C.P.
O Notices - Staff
P Procedures "
Q
R Tr. Corrections - Hood Oct 7, 8 + Dec 3 80
S " " - Kane Oct 14, 15 + 16, 1980
T " " - Shewmaker Jan 14 81
U " " - Cappucci Jan 22, 81
V
W Copies to LPDR
XYZ

and 2-17-81

1980

	Consumers Witnesses	NRC Witnesses
Oct 7-8		[illegible]
Oct 9		Keller
Oct 14-15 16		Kane
Oct 21-22	Horn	
Oct 22	Cooke	
Oct 23	Keeley	
Oct 29-30-31	Afif	
Nov 17-18		Gallagher
Nov. 19		J. Simpson
Dec 2-3-4		Kane
Dec 3		[illegible]
Dec 4-5		Keller
Dec 10-11	Jarvis	
Dec 11	Thiru	
Dec 16		Gallagher
Dec 17	B. DHAR	
Dec 18-19		H Singh

All Rec'd

1981

		Consumers Witnesses	NRC Witnesses
Jan	6		Keppler
	6		Schindler
	7		Mitra
	8		Huang
	8	Gonbd	
Jan	13-14	Peck	
	14	Davisson	
	16		Keppler
Jan	19		Shewmaker
	19		Otto
	20		Erickson
	22		Brammer
	21-22		Singh
	21		Chen
	22		Cappucci
	27-28	Hendron	
Feb	19		Hood
	20		Thornburg
	20		Gilray
	26		Naidu

all rec'd

ROUTING AND TRANSMITTAL SLIP

		INITIALS	CIRCULATE
1	L. W. Paton, OELD D. Hood, NRR	DATE	COORDINATION
2	J. Keppler, RIII L. Heller/J. Kane, NRR	INITIALS DATE	FILE INFORMATION X
3	J. Gilray, NRR F. Rinaldi, NRR	INITIALS DATE	NOTE AND RETURN PER CONVERSATION
4	A. Cappucci, NRR G. Gallagher IE G. Fiorelli/K. Naidu, RIII	INITIALS DATE	SEE ME SIGNATURE

REMARKS

Attached is updated listing on log of depositions related to the Midland Hrg.

Do NOT use this form as a RECORD of approvals, concurrences, disapprovals, clearances, and similar actions.

FROM (Name, office symbol or location)

Shewmaker

DATE 3/13/81

PHONE 27551

GPO 843—16—81418-1 418-016

5041-101

OPTIONAL FORM 41
AUGUST 1967
GSA FPMR (41CFR) 100-11.206

Shewmaker
3/13/81

MIDLAND HEARING

Prehearing Conferences

12/14/78 Prehrg. Conf. pp 1-233

9/10/80 Prehrg. Conf. pp. 234-408

1/28/81 Prehrg. Conf. pp. 409-690

1/29/81 Prehrg. Conf. pp. 691-826

2/24/81 Corrections to Transcript of 1/28/81

Depositions Of	Date	Pages	Exhibits
G. Gallagher (NRC-IE)	11/17/80	1-116	1-8
	11/18/80	117-345	
	12/16/80	346-528	
K. Naidu (NRC-IE)	2/26/81	1-174	1
G. Fiorelli (NRC-IE)	2/17/81	1-152	1-11
J. Keppler (NRC-IE)	1/6/81	1-164	1-7
	1/16/81	165-248	8-13
R. Shewmaker (NRC-IE)	1/19/81	1-165	1-28
H. Thornburg (NRC-IE)	2/20/81	———	———
D. Hood (NRC-LPM)	10/7-8/80	1-314	1-21
	12/3/80	315-407	
	2/19/81	———	26-32
Transcript Corrections	12/29/80	1-4	
Transcript Corrections	2/17/81	1-6	
L. Heller (NRC-HGEB)	10/9/80	1-139	1-6
	12/4/80	139-247	
	12/5/80	248-353	
J. Kane (NRC-HGEB)	10/14/80	Vol. I, 1-154a	1-17
	10/15/80	Vol. II, 1-209	
	10/16/80	Vol. III, 1-94	
	12/2/80	Vol. IV, 1-185	
	12/3/80	Vol. V, 186-357	
	12/4/80	Vol. VI, 358-406	
Transcript Corrections	12/5/80	1-9	
J. Simpson (USACE)	11/19/80	1-145	1-17

MIDLAND HEARING

Depositions Of	Date	Pages	Exhibits
W. Otto (USACE)	1/19/81	1-165	1-7
R. Erickson (USACE)	1/20/81	1-85	1-4
H. Singh (USACE)	12/18-19/80	Vol. I, 1-215	A, 1-6
	1/21/81	Vol. II, 216-343	
	1/22/81	1-209	
		1-100	
F. Rinaldi (NRC-SEB)	1/6/81	1-162	1-16
P. Huang (NSWC)	1/9/81	1-54	1-3
J. Matra (NSWC)	1/7/81	1-114	1-4
A. Cappucci (NRC-MEB)	1/22/81	1-114	1-14
J. Brammer (ETEC)	1/22/81	1-61	1-4
W. Chen (ETEC)	1/21/81	1-131	1-10
J. Gilray (NRC-QAB)	2/20/81	1-54	1-3
G. Keeley (CPC)	10/23/81	1-87	1 & 2
T. Cooke (CPC)	10/22/80	1-64	1-3
D. Horn (CPC)	10/21-22/80	1-174	1-3
		175-245	
T. Thiruvengadam (CPC) (formerly Bechtel)	12/11/80	1-61	1 & 2
W. Ferris (Bechtel)	12/10-11/80	1-252	

MIDLAND HEARINGS

Depositions Of	Date	Pages	Exhibits
S. Afifi (Bechtel)	10/29/80	1-123	1-6
	10/30/80	124-223	& Includes
	10/31/80	224-261	Informal
			Discovery
			Documents
B. Dhar (Bechtel)	12/17/80	1-160	Informal
			Discovery
			Documents
R. Peck (Bechtel Consult)	1/13/81	1-140	1-5
	1/14/81	141-205	
A. Hendron (Bechtel Consult)	1/27/81	1-165	1-33
	1/28/81	166-230	
M. Davisson (Bechtel Consult)	1/14/81	1-147	1-8
C. Gould (Bechtel Consult)	1/8/81	1-120	1 & 2

SUMMARY OF DEPOSITION OF DR. SHERIF AFIFI (Oct 29)

13-14 Afifi does know the name of the organization he works for.

15&16 Dr. Pecks involvement with quanicasee.

16 The original setttlement prediction was high and was based on lab tests.

17 Greenwood

19 Afifi is still not sure who he works for.

20 Afifi tells the names of persons who working more than 90% of their time on Midland in Ann Arbor.

21 Line 7, Chen's job also Givens.

22 job - Note he coordinates the work between the geo-technical services group in Ann Arbor and Project Engineer groups. This description would indicate that he is the person should have made sure the correct compaction criteria was being applied.

23 Mohan's job

23 The problem at the Administration building was "not in the plant fill but in the new fill that was recently placed".

24 Bechtel decided that it was a isolated problem.

24 Line 24, "obviously the problem is not isolated".

25 Line 23, the first Bechtel decision was "incorrect".

26 He doesn't know why Bechtel arrived at the wrong decision - "I can not spectulate about various factors that caused them to make their conclusions" (he talks about they like they were somebody else).

27 I ask him again why Bechtel arrived at an incorrect decision. Answer " I believe I probably - don't know for sure. I don't know for sure".

27 I ask them if anybody within Bechtel tried to go back an analyze why Bechtel arrived at the incorrect decision. Answer on line 23 I'm not sure if it was analyzed for the second time - I'm not sure if it was.

28 All of the above listed names work for Afifi.

31 W. R. Ferris is the Chief Soil Engineer. Afifi is the Assistant Chief Soil Engineer.

33 Afifi tells the Division of his reporting to "technical matters that are related to soil engineering". His reporting to S. L. Blue seems to be more administrative.

37 Afifi's job with respect to Midland he provides input into such matters as settlement predictions, boring capacity data, soil properties, guidance to field personnel associated with field placement.

38 After referring to Project Engineering team he was asked who was incharge of that group and he answered DHAR and he thinks DHAR is located in the Ann Arbor.

39 He likes the word pre-load as applied to the surcharging of the diesel generator building.

40 The word pre in preload to Afifi means that it was put on before the structure goes into operation.

40 Afifi has no experience other than Midland with surcharging after the structure was partially complete.

41 Percentage completion of the building when the surcharge was placed.

41 He does know an example where surcharging was done after a building was partially complete. Mr. Ferris will give you the details.

42 He got his knowledge from Ferris.

42-43 He recommended surcharging in one case which he explains in great detail starting at 43.

45 He defines surcharge as placing usually fill at the top of a deposit even if surcharge weighed less than the fill anticipated he would still designate it as surcharge.

45 He thinks the surcharge exceeds the stress that will prevail in the ground.

46 Confusing answer as to the participation of Dr. P. K. Chen in the computations revolving the surcharge. At line 22 I think he indicates that the surcharge exceeding the final load by 50%.

47 "The netload for the structure at the bottom tappers off to a small amount which is in the order of 25% or so". Line 8 the Summary of the calculations have been provided to NRC.

47 I asked them where the calculations were made before surcharging was imposed the answer the specifications were made after the surcharge was imposed he didn't know whether any calculations were made before surcharging.

47-48 He did not know whether it would be normally excepted engineering practice to determine calculations before surcharging in order to know the desire level of surcharge - "I don't know" Line 11. Line 16 I don't know the answer to your question.

48-49 Joe Kane's question about whether compressability of clay in silk portions etc. would be more similar to normally consolidated soil or pre-consolidated soil.

49 Answer more similar to pre-consolidated soil (Joe did not get the answer he wanted.

50 Joe's next about a clay layer 25 feet thick.

51 The answer depends on too many factors.

52 He still can't answer.

52 Line 11 Bechtel did run consolidation tests on plant fill material at the diesel generator areas before surcharge was placed in January 79, but they did not make predictions on the amount of settlement. Lines 15-17.

53 Line 14 it would not necessarily be good normal engineering practice to make predictions as the settlement of the building based on consolidation and testing.

53 Line 20 he thinks that he made a prediction about settlement based on the surcharge program in January 79 but he does not recall whether he made a prediction before the surcharge program.

54 Line 15 he clarified his answer that he did not make predictions "of surcharging" I think he means did not make a prediction in January 79 based on surcharging (which he said he did on page 53).

54 Line 19 he did run laboratory consolidation tests on the plant fill material in the diesel generator area before surcharging was placed in January 79 his answer as to why extends from 54 6o 55.

55 He again persists he does not remember if he made a settlement prediction based on those lab tests.

56 Prior to January 79 Bechtel did make a prediction of settlement though it is in the FSAR and it said 2 to 3 inches (line 9).

57 Line 13 Finally he says his "very initial thought" was to predict settlement on the bases of the lab tests because the material appeared to be " enough" - "that was not the ~~favorite~~ favored way to go" (persue this with Ferris, what does that mean).

58 A reference to a document that predicts 6" to 18" inches with settlement at 18 being very .

59 Reference to a meeting where several people kept pushing Dr. Peck, he finally mentioned the figures 6 to 18 inches but Afifi didn't think it was meant to be a prediction.

60 Afifi and Dr. Chen finally made a prediction based on performance of the surcharge program of an inch and ½ of settlement.

61-62 A document dated July 2, 1979 under tab 7 of volume 3 of the 5054f responses - the reference to "practical considerations".

62 Lines 9-12 there were people at Bechtel who wanted to remove the surcharge for scheduled reasons.

62 Line 19 the word practical considerations refers to the schedule but he doen's know how much time specifically the schedule allows for.

63 Line 19 he agrees the full surcharge was held for only 4 months and one week

64 Afifi responded "in practical consideration of the ability to complete the consolidation and predict settlement, at the time I was satisfied that it was there long enough for practical consideration". Line 7 "it would have been nice for other reasons to keep the surcharge longer".

65 Line 8 Its Afifi's opinion that he has reached secondary consolidation. Line 21 Mr. Kane has reasonable doubt that we are in secondary consolidation, he's not sure. Line 25 Mr. Kane's reason is the piezometer behavior at the time.

66 Afifi's explanation of Joe's position - see line 4-10 and the rest of the page through line 8 on page 67.

67 Starting at line 10 questions about the steady seepage off the pond continues through line 11 on page 70 (go over this with Joe).

70 Afifi tells when he thinks he reached secondary consolidation.

71 The surcharge started on January 26 and got to its full height on about April 6, 1979. Afifi is starting his 100 days on January 26 I figured that to be May 1. Line 21 Afifi says he thinks he has secondary consolidation before May 1.

73 I read Afifi a statement from a letter addressed to him dated July 2, 1979 "the longer the surcharge can remain on an area the more - its confused but something like it is more predictable and Afifi agreed.

73 Afifi said a removable optimum - it provided data needed to predict settlement and at the same time did not cause delays in the schedule.

75 Afifi names all consultants, Line 16 and 17 Laughney worked on dewatering.

76 Dr. Peck and Hendren were on board early they were involved with the diesel generator building as well as recommendations for other areas. Dr. Davidson is involved in piling and also the engineering aspect of the auxiliary buildings.

78 Continued discussion of consultants and their areas of expertise.

80 Bechtel imposed a surcharge at the diesel generator building to consolidate the fill. It was the recommendation of Dr. Hendren. There were various options considered. Not to do anything, to surcharge, to use casens or piles, one option was to remove and replace the building.

81 A November 7 meeting (I assume 1978).

82 The cost of removing and replacing the fill was somewhere in the order of 20 million dollars but that might have been just removal. Then he says he is really not sure what the figure represents.

82 Line 22 question as to the soils foundation problem in the electrical pentatration adjacent to the reactor containment. Answer line 24 borings indicated the fill there was inadequate.

83 The fix is to install caissons there is a reference in the "Denver City letter" to replacement of the unsuitable material. Line 21 page 6 of the July 2, 1979 letter references the removable of unsuitable material.

84 Line 21 "At the time it /use of caissons/ appeared to be a rather simple procedure to follow. Specifications for use of caissons.

85 Specifications have not been supplied to the NRC. It is indicated on lines 9 and 10 that they are going to give us a summary instead of the specifications.

85 Line 18 I ask him why none of the consultants had disagreed with any of their plans that I had been asking him about.

86 Line 6 he is not aware of any instances in which the consultants disagree.

86 Line 20 the diesel generator building recommendations came from Hendren and Peck so they stand behind their own recommendation. The original idea may have come from Davidson.

87 Line 5 Afifi does not have any personal disagreement with the recommendations by the Bechtel consultants.

87 He knows of no one in Bechtel who disagrees.

88 Mr. Dhar can explain how the piles will be attached to the service water structure, see lines 9-13. T. E. Johnson is also familiar with that.

89 I start asking about where the foundation is separating from the mud Line 11 - this is Dhar's responsibility.

89 Line 20 there are plans to grout this gap.

89 At the bottom I ask him several questions about a statement from a document in Volume 3 that I have been asking about entitled "Observations Fill Supported Structure" through 91.

92 Line 8 "was anything done to assure that the fill was saturated before the surcharge was placed" (Joe will have to read the answer starting at line 10.

93 I'm pursuing his degree of assurance that the fill will be saturated. Line 13 what is the distance between the diesel generator area and the cooling pond, he estimates it to be five hundred feet for more. How long will the water take to traverse from the cooling pond to the diesel generator building. He does not know.

94 Show Joe this answer I think what he is saying is that when it reached equilibrium it was 627 feet at the cooling pond and 625 feet at the diesel generator building. Ask him to explain the "upward bow".

95 Mr. Ferris is analyzing how long it takes ground water to travel.

97 I switched to his opinion on what caused the extensive settlement problem at Midland, he answers inadequate compaction.

97 100% of the modified is about equal to 95% /implied of the other criteria/.

98 It's his testimony that it really wouldn't make a substantial difference which of these two tests were used /I'm not sure this is consistent with the ultimate conclusion that the use of one of these tests at least partially contributed to the problem/.

99 He agrees it would make some difference. At line 20 he agrees that from this point on we will use the expression the 56 thousand feet pound test and the 20 thousand feet pound test.

101 Line 4 he is not aware of confusion within Bechtel on which test should have been used. Line 13 he thought that confusion was resolved in 1974. I direct his attention to Horn deposition exhibit no. 1 which I characterize as a summary of the document regarding the confusion of the compaction requirement for a plant fill area.

102 I indicated to the project engineer what my interpretation was and what should be the criteria in 1974.

102 Line 22 I asked them again about after reading page 11, 12 and 13 whether there was confusion at Bechtel concerning the proper compaction test between the years 1974 and 79.

103 Line 4 he agrees after reading the short summaries" that it would indicate that there was confusion between 1974 and 1977. Line 15 in 1974 he advised the project engineer what he thought the proper compaction criteria should be.

104 He recommended that to the project engineer and the project engineer did not have an obligation to comply with his recommendation. This is an example for the need of Martinez.

104 Line 13 "was there anybody in Bechtel to your knowledge from 1974 to 1977 who's responsibility it was to be sure that the correct compaction was used at the Midland site". Answer that's somewhere between the engineers and consultants. I can not tell you specifically who should be the one. The project engineer would be the source who has a responsibility. Question you are not sure who has the responsibility? Answer as I interpreted it would be the project engineer who would advise the contractor of what the requirement is that is my understanding.

105 He identifies the project engineer as Castleberry through page 107 which tests apply in which area.

108 The heard of mules question.

108-9 He says that there are two schools of thought, one is to specify the procedure and take what you get and another is to define the end result and leave the procedure up to the contractor. They are both equally used.

109 Do you agree that before surcharging there was less settlement in the middle of the diesel foundation than at the east and west ends of the building.

110 He does not remember. He thinks the southern portion was settling more than the northern portion and that the duct banks were acting as piers. He does not know how long the duct banks were acting as piers.

111 After the duct banks were cut away what happen to the differential settlemcnt?

112 At the top it is not his responsibility to know that.

112 He does believe that some differential settlement remained after the duct banks were cut away. He does not know the plans to eliminate that. It is not within the scope of his professional responsibility to know whether they plan to eliminate it.

113 I ask them about a proposal to delay surcharging area C between the diesel and turbine building (after I show him Volume 3 tab 2).

115 If area C was not surcharged until after the other areas, would that effect consolidation? The difference in timing would not have had a substantial effect on consolidation because area C was mostly sand.

116 Dr. Hendrence express concern over the fact that the surcharge on the service water pipes and requested a lesser surcharge slope in this area. He doesn't know what Dr. Hendren was concerned about.

117 He thinks he referred to the two lines running parellel to the north side of diesel generator building - he does not know whether anything was done about his concern.

117 What shear waive velocity was used in the design for the fill material before surcharge.

118 That should be answered by the Project Engineer.

118 He thinks 13 to 1400 feet per second. Line 15 he says 700 feet per second (I think the 700 feet per second is what he himself determined prior). Line 18 but 13 to 1400 feet was infact used.

119 Line 2 13 to 1400 feet. Line 10 for the design. Line 11 when did you establish 700 feet per second. Line 24 this was to be before the settlement problem was discovered.

120 Line 15 the 700 feet per second was determined by his group long before the problem existed. Line 21 he does not know why the 700 feet per second was not used in the design. Line 22 what is the range of shear waive velocity values which has been measured for the plant fill materials after surcharge.

121 Between 500 and 800 and 1000.

122 I ask him to reconcile the above differences, his answer begins on line 4 Joe will have to help me interprete that.

123 I see his second answer to the same question at line 13.

End of Volume 1 (October 29, 1980)

SUMMARY OF DEPOSITION OF DR. AFIFI
October 30, 1980

Page

127 Johnson and Desmond, consulting engineers, will replace Chuck Gould as a consultant on the underpinning matter for the auxiliary building.

He cannot distinguish the work done by Canonie from the work done by Bechtel with respect to soils. Canonie did the entire dikes around the plant and some work in the extension of the dikes around the plant?

128 Construction would know that. Mr. A. Boos is with the Bechtel construction group at the site.

129 Regarding whether Canonie was cut short prior to the end of their contract period, he would not know that. That would be either Bechtel construction or Bechtel engineering.

130 Afifi would not know when plant fill operations were going on, but the geotechnical group became involved in assisting the remaining work after the discovery of the diesel generator building problem. He was not involved before that.

131 He visited the site two or three times a year. He relies on Wanzek.

132 line 2 and 13 - He indicated that Wanzek's contact with the site was sufficient for him to carry out his (Afifi's) professional responsibilities.

—Does Ferris

At the bottom - he doesn't know whether Canonie or Bechtel placed the plant fill under the diesel generator building.

F

134 A reference to a document that would distinguish Canonie's work from Bechtel's work. He said Wanzek would know about it.

135 I read him a statement at line 13 indicating that the document has been forwarded to geotechnical services for review.

136 He states that the drawing distinguishing Bechtel and the Canonie work is in the geotechnical group files under the custody of S. L. Blue.

Farnell refuses to let NRC look at it without a formal document request. Brunner interrupts to say "Let us know what you want, and we'll get it for you."

139 line 15 - He identifies NRC staff deposition exhibit no. 3 as the document which he advised others what he thought the correct compaction criteria was.

DEPOSITION OF DR. AFIFI
October 30, 1980

Page

141 I am asking Afifi whether the document, in fact, cleared up any questions.

142 line 20 - Afifi finally admits that "it appears that the action was not taken."

143 "When did you find out that your letter was not being followed?"

Reading the entire page indicates that it was two years before he found out his recommendation was not being followed.

144 line 21 -"I didn't know for sure until two years later whether my recommendation was accepted or not." "Did you attempt to find out if it was accepted?"

145 "No."

line 14 - It is not Afifi's duty to verify which compaction criteria is to be used.

line 20 - It was his duty to make a recommendation.

146 lines 9 through 12 - He makes a recommendation and then his responsibility ends.

There is no way I can force the project to do something the project would not accept.

147 lines 18 through 21 - If he wanted to find out about correct compaction criteria at the site, all he had to do was ask.

149 In the middle he tells his basis for concluding that 100 percent of one compaction test is approximately equal to 95 percent of the other. His answer seems to be because Dames & Moore substituted one for the other.

150 Concerning equipment qualification.

line 21 - He does not know whether the equipment qualification requirements were met. (I assume he is talking about the testing applicable to the period of time before the diesel generator building problem was discovered.)

151 He clarifies there is a qualified procedure for the compaction equipment. (He clarifies at line 9 that he is not talking about a qualified piece of equipment.)

DEPOSITION OF DR. AFIFI
October 30, 1930

Page

line 18 - When he referred to qualified procedures, he was talking about lift thickness and number of passes.

line 25 - I asked, after the discovery of the problem at the diesel generator building, were these qualified procedures followed.

152 line 3 - "Yes."

line 7 - He did not know if they were followed prior to the discovery of the problem, nor does he know whether there were, in fact, procedures (line 13).

152 line 17 - Ask Joe about this statement - "I believe that in Q-listed areas, the sands were qualified. I don't believe we qualified the equipment for Q-listed placement of clay."

154 line 16 - There is a possible local void under concrete mud-mat elevation 590 to 589 at boring AX-9.

156 The proposed remedial action is shown in the fourth column of the table and indicates pressure grouting. To his knowledge, that has not been done yet.

156 To know whether pressure grouting is needed, line 20 - "You just simply continue to pump grout until you cannot accept any more grout, in my opinion."

158 I press Afifi on whether there are any other voids or possible voids within 50 feet of the reported one.

line 14 and 15 - He responds that none were reported.

159 line 5 - He does not know.

line 16-18 - They do not plan to require additional borings to investigate whether there are other voids or possible voids.

160 I ask him the same question, again, about their plans for the future, and this time he says, at line 8, that he does not know whether they plan other borings.

161 He does not know the values of the modulous of subgrade reaction, but Dahr would know that.

162 He indicates that the information, if it exists, would be in a calculations file, and I asked Farnell for an index to that file.

DEPOSITION OF DR. AFIFI
October 30, 1980

Page

164 Afifi did not know whether anybody at Bechtel has reevaluated the value of the modulous of subgrade reactions for input into seismic analysis of structures founded on inadequately compacted soil at the Midland site. (line 8.)

166 Is there a problem with inadequately compacted soil under the electrical penetration areas of the auxiliary building? "Yes." The remedy is to install caissons at both extremities of those two electrical penetrations.

"Do you agree that that remedy would transmit half the load from the electrical penetration rooms onto the proposed caissons in the remaining half on the control tower?" He does not know--that's a structural question.

167 Lines 11 and 16 - There would be some load transfer to the control tower.

168 He agrees that some load would be transferred to the control tower, but he does not know how much and he thinks someone else should answer the question. (lines 13-15.)

The settlement of the control tower, if any, will be small because the material is good.

226 Line 2 and 3 the study of the most probable causes for errors in placement of the fill was done under the direction of Mr. Martinez. It was presented to the NRC at a meeting in July 1979 (that information is at the bottom of 225).

227 Line 21 I ask him about the status of the plan to use caissons in piles.

228 Line 2 We have conducted computations on bearing capacity and settlement and coordinated with the consultants.

228 I am referring to deposition exhibit 2 page 2 item IIIa2 discussion of surcharging under structures other than the diesel generator building.

229 Still on Staff exhibit 2, item IIIa3 dewatering Afifi says that's in another group under geotechnical.

230 I'm continuing to go through the document deposition exhibit 2 which is labeled "problem alert" to ask him how many of these things have been done.

232 He repeats his theory about 2 schools of thought on compaction.

233 In explaining his answer he states that he does not know who did the fill he heard that some was done by and some was done by Bechtel.

234 He reads item A near the bottom of page 2 I have asked him does he agree with each of those recommendations. He agrees with concept A (234 Line 2).

234 Line 13 he agrees with Item B. He concludes his answer at 235 Line 13 agreeing with most of the recommendations.

237 Lines 15 and 16 he seems to say that Bechtel has excepted these recommendations with respect to Midland. Lines 17 through 19 he doesn't know whether these recommendations have been excepted with respect to other projects.

238 I show him Staff Exhibit 2A which is the reference to the rejection of the "problem alert".

240 Line 14 through 17 Afifi's only knowledge of rejection by Bechtel is what's contained in deposition exhibit 2a.

241 I ask him about meetings between Bechtel and Consumers with respect to the Staff's request of June 30 for additional borings and lab tests.

242 I show him exhibit C Volume 3 to the 5054f responses entitled Consultant Communications.

245 He recalls suggesting a compromise "I felt would provide the Staff with additional information it would not lead to confusion".

245 Lines 20 through 24 he tells exactly what he proposed.

246 That suggestion was limited to the diesel generator building. But see lines 13 through 17 he suggested further borings in connection with the service water structure in the auxiliary building. He also had a suggestion with respect to the dikes see 246-247.

248 I asked him why he didn't give the Staff any notes his answer was "I don't usually keep notes". He also said on line 17 he does not have a personal file concerning the Midland soils problem.

249 At the first meeting where he made his suggestions there were only Bechtel people present. Make sure that's what lines 1 through 3 means. I asked him did anyone agree with his suggestion and he said Mr. Widener was to convey that information to Consumers (he doesn't really say at this point that Widener agreed with him. I think later he said that Widener did not disagree with him. His suggestions were not carried out. I asked him why they were not carried out his answer is as follows:

> I believe that the reason is that, whether I technically strongly felt was needed, or whether I have attempted to compromise.

He thinks that is the reason why.

250 He explains his answer a little better. He says he would not have initiated the request by himself. I asked him whether his suggestion arose more from a desire to compromise or more from his technical judgment. After a long pose he said it was difficult to separate the two "very difficult".

251 Line 10 with respect to the compromise which he described if it is important to know whether he discussed it with Ferris read 251 again.

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251 Last line I asked him whether the decision not to comply with this suggestion was made by Consumers Power.

252 He doesn't know. He thinks Widener conveyed that information to Keely. The meeting he has been describing took place in early August /somewhere in here I think he said that Ferris did not disagree with him but I don't think that I have found it in the transcript yet/

253 There was another meeting including both Bechtel and Consumers and he made this same suggestions again. Widener did disagree with his suggestions. This meeting was a few days after the previously one. Keeley was there and maybe .

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254 Line 4 his suggestions were not accepted. Line 15 Ferris did not disagree with him.

255 Is it considered normal procedure for Bechtel to take record samples in the construction of water retention structures. Line 8 he didn't know because he has not been involved in many Bechtel dams.

256 Is it generally accepted engineering practice to take record samples in the construction of water retention structures. Answer I am told that in many projects it is not. He did recall discusses with Ferris the subject of taking record samples for the cooling pond dikes at Midland. Line 24 "the discussion was if record samples were taken of the dikes that the NRC was - the question would have had the answer without having to resort to doing the borings".

257 Read lines 7 through 10 Ferris may have implied that the record samples should have been taken. See also line 14.

258 Additionally with respect to the dike Ferris made a possible compromise suggestion that two borings be drilled in the Southwest corner of the dike an another alternative to get some samples and get some tests?? (That's what the transcript says). Line 7 they took the soutwest corner because there was a report of 1 and ½ inch settlement in that area, but we were not sure of it. I refer him to Volume 4 of the 5054f responses, Tab 93 second page. Page 259 Dahr said that pipes stresses for straight pipes don't exceed the allowable but the stresses and elbows and bends do. Lines 5 through 10 he has some vague recollection of statements like that. The organization responsible for over stressing and pipes and is he thinks project engineering. Under the chief design engineer for that organization I asked hime to read Tab 93 second page item 3 second sentence. I reference to the "reference elevations" used were questionable.

260 He doesn't know what that means. Line 12 he doesn't know whether there are sections of pipe where allowable stresses are exceeded. He agrees Mr. Dahr said that but he has know first hand knowledge. He doesn't know what Bechtel plans to do in respect to Mr. Dahr's statement.

from Joe Kane

INDEX OF DR. DAVISSON'S DEPOSITION

Subject: Summary of Dr. Davisson's Deposition

Involvement - Past and Future

Page	Line	
9	18	Began in Spring 1979. Reason - To look at support for SW structure
10 11	17 5	Bechtel gave him no instructions or advice in meeting NRC requirements or regulations
14	11	Now share responsibility of underpinning work for AUX. Bldg. w/others
16	11	Spent 10 full days in 1979. Includes review of info from borings and lab program
18	20	Spent 10 days in 1980. Spent 2 days in 1981 (day before and day of deposition)
23	6	In two year period - never gave written report. Gives advice which Geotech incorporates in memos and minutes of meeting.
24	3, 7	Davisson does not do design details. He recommends possible approaches to problem. Bechtel evaluates approaches, determines feasibility. Interaction w/Davisson required.
24	21	Not responsible for structural details of how pile is connected to structure.
40	20	On his concern for pile design - has been addressing them and expects to continue in future.
42	24	Expects to do consulting for Afifi in future - one aspect would be method of installation (Pg. 126, line 12).
64	10	Was not his job to study low blow counts and effect on compressibility, low shear strengths and liquefiable materials.
65	22	No responsibility for impact of underpinning on adjacent safety related piping (e.g., settlement)
69	4	Not responsible for evaluating effect of stress cracks on structure integrity.
72	16	Not responsible for criteria if cracking should develop in reaction to underpinning. Is project's structural responsibility.

Page	Line	
79	11	Expects to be involved w/Q-A assurance manual (procedures).
81	6	Either Davisson or his representative expects to be involved in monitoring the pile installation and testing.
89	23	Responsible for load carrying capacity and portions of deflections for piles under seismic loads.
90	10	Davisson does not have criteria on deflection of piles under seismic. His responsibility is to furnish information on pile stiffness under certain conditions. Bechtel projects is responsible for establishing deflections.
122	3	Corbel design is not his responsibility. It is Bechtel's project structural area.
128	13	Not involved w/decision to surcharge DGB.
128	19	Was not aware DGB had cracks before surcharging or of concern to widen cracks.
129	6	Not involved in decision to remove surcharge from DGB.
136	3	Not aware of settlement problem w/borated water tanks.
144	19	Uncertain of his future responsibilites in reviewing details proposed by contractor for electrical penetration area and feedwater isolation valve pits.

Summary of Dr. Davisson's Deposition (Cont.)

Comments on NRC

Page	Line	
11	18	Cat. I structures must function for "doomsday" requirements (earthquake, tornado)
12	3	along w/normal structure design requirements
53	22	Magnificantly overdesigned SW structure-combination bomb shelter and pill box.
54	11	SW structure is new and designed for "doomsday" type loadings
62	4	Under "doomsday" loadings.
106	18	Discusses check that representation to NRC about redriving piles be made.
109	3	"Spoonfeeding the NRC" - refers to resolving details of load transfer system which in real world could be left to subcontractor.
110	1	Unhappy w/NRC requirements. Are unreasonable.
110	3	Unhappy spectacle of regulation by lower-level NRC employee. Bad taste
111	1	Requirements would not have been imposed if NRC higher level had decided.
113	5	No use for borings that are being imposed.
114	7	Boring request is an indefensible position. Just using brute force.
115	17	Davisson has trouble with competence of COE as NRC consultant. Based on boring request that came forward.
117	24	Does not know NRC requirements for pilings at Midland

Summary of Dr. Davisson's Deposition (Cont.)

Important Statements w/Regards to Dates and Availability of Information

Page	Line	
39	23	Based on December 1980 meeting, it appears there is now a better definition of pile loads.
45	25	Bechtel is in process of refining final design of piles (As of Deposition Date 1/14/81).
73	5	On March 25, 1980 Afifi transmits tech specs to Davisson (Is Exhibit 3) for furnishing, installing and testing closed end pipe piles for service water structure.
79	14	QA procedures w/respect to installation of piling do not exist as of 1/14/81.
94 95	22 7	Recent information on seismic load to be resisted by piles came to Davisson in December 1980.
96	7	Chen transmits revised tech specs to Davisson on 12/8/80 (Is Exhibit 6).
118 119	20 7	Davisson in fall of 1980 reviewed settlement estimate of piles at SW structure.
124	8	OPEN question (as of 1/14/81) needing resolution - how many installed piles can be concurrently pretested - Depends on reaction that the structure can withstand.

Summary of Dr. Davisson's Deposition (Cont.)

Bechtel's Procedure for Installing and Testing Piles @ SW Structure

Page	Line	
43	6	What are concerns on installing piles? Davisson - need procedure that is consistent with an acceptable load test to have assurance piles will have capacity after being driven - this is a QC procedure.
44	8	How would you test the pile to demonstrate load capacity.
also 47	2	Pile is driven, filled w/concrete, build deadload reaction above it (platform w/weights) insert hydraulic jack between platform and pile, use jack to apply load, observe settlement by various means, record pile settlement vs. time and load history.
45	1	How far will piles be driven into till? To a practical or refusal criterion for the hammer-cushion pile system - probably 20 blows/inch final driving resistance.
45	8	Davisson had someone make determination on driving criteria - this is basis for 20 blows/inch.
46	21	Procedure to be employed to avoid damaging walls of SW structure - predrilling.
47	8	Pile Load Test to be conducted, not in final location, but at adjacent representative nearby location (within 50 feet).
48	5	Pile Load Test will include both live load and seismic load.
48	13	Pile Test will be run to determine negative skin friction. Pile to go thru fill and stop at till. Test to be Pull Out to determine ultimate uplift load which will be used as measure of negative skin friction.
79	24	Piles at service water structure to be tested individually to 150% of the load.
80	1	No group loading of piles is contemplated.
87	14	Contractor who drives piles will be looked to as author of QA-QC operation in conjunction w/Bechtel procedures. Considerable effort will be needed.

Summary of Dr. Davisson's Deposition (Cont.)

Bechtel's Procedure for Installing and Testing Piles @ SW Structure (Cont.)

Page	Line	
96	7	Davisson's comments on current tech spec draft dated 12/8/80 from Chen
97	9	Is not final draft.
98	13	Project is reworking draft of tech spec. Several comments @ meeting on proposed December 1980 draft included:
101	23	Writer of spec lacked knowledge on operation of hammer - For example valve mechanism.
104	5	Incorrect to indicate in draft that rigid leads extend 2 feet above where pile enters ground since driving will be from top of SW structure.
104	15	A ridiculous requirement to limit handling stress to 21,000 psi
105	2	Davisson recommended against using bitumen to reduce negative friction because a "great deal of care" needed to install piles w/bitumen - Prefer to Eat load.
107	11	Need to correct percentage anchor piles in load test would take (from 300% to 100%).
107	22	Correct wording on pullout test - pile driven only in fill, not till.
108	14	Need to rewrite paragraph on transferring load (109, 3 Spoonfeed NRC).
120	5	Need to revise spec since limit of six foot drop (Section 11.5) and vibration (Section 11.6) can not reasonably be met.

Summary of Dr. Davisson's Deposition (Cont.)

Bechtel's Procedure for Installing and Testing Piles @ SW Structure (Cont)

Page	Line	
122	22	Step by step procedure for underpinning SW structure.
123	4	Pile requirements as of mid-December 1980 are to have a compression ultimate test load = 300 tons.
123	8	300 ton load made up of net usable load of 270 tons plus 30 tons negative skin friction allowance. 270 ton load arrived at by having total load of 180 tons (includes earthquake) times 1.5 safety factor = 270 tons.
123	11	Factor of safety = 1.5 is consistent w/Bailly.
123	14	Several pile sections under consideration for 300 ton load. Both 14" and 16" and varying wall thicknesses (Pg. 41, line 3 need cross sectional area of steel to drive for needed load capacity).
123	18	Piles would be predrilled to till (approx. elev. 600).
123	19	Piles fabricated to length to stick up in air pass roof line so that leads in hammer can be operated above structure.
123	24	Drive piles to bearing in till.
124	2	Cut piles at elevation suitable for working below corbel.
124	5	Construct corbel in meantime and concrete piles.
124	6	Preload piles and pretest before fastening into the structure.
124	10	Unsure at present on how many piles can be pretested concurrently - depends on reaction that SW structure can make available. Obviously can not pretest all 16 piles or would tilt structure out of the ground.
124	13	Object of preloading - apply a series of load coupled w/a series of hold intervals on these piles.
124	23	Talking in terms of 210 ton load and cycling load several times. Then will hold load (perhaps 210 ton) constant and observe settlement versus time until relationship of settlement versus time develops that reasonable engineering can extrapolate in the future.

Summary of Dr. Davisson's Deposition (Cont.)

Bechtel's Procedure for Installing and Testing Piles (Cont.)

125	5	After test, pile will be Locked Off at a predetermined load into the structure. Purpose of preloading and cycling is to get rid of creep and consolidation deflections before the pile is locked off. This occurs for all 16 piles.
125	12	Whatever Bechtel structural details are needed for covering the heads of the piles will then be constructed.
125	16	Explain process of jacking in and locking in. Corbel (really pile cap) is in place.
125	21	Set of details have to be designed to allow insertion of jack and jacking of load against pile cap in manner that shim plates, spacers and shims can be inserted and welded in place before load is released from jacks.
126	2	Part of the control technique for effecting load transfer is to be able to observe the differential displacement between pile and gap and observe at what point a given load is attained. One can shim until upon release of the jacks this differential displacement is attained. Once attained, it can be welded in position and locked off final. (See Exhibit 8).
141	22	It will take several months to transfer the load to the piles.

Summary of Dr. Davisson's Deposition (Cont.)

Pile Design

Page	Line	
42	19	Now in stage where they need to drive a pile and load test and verify design assumptions. Load test is final determining factor on adequacy.
52	3	Structural group of project has ultimate responsibility for design of underpinning.
52	12	Dames and Moore original investigation at Midland gives information on till into which the piles will be driven.
52	20	Information Davisson used from Dames and Moore report was description of till, results of SPT (exceeded 100 blows), his experience w/similar material on other projects.
139	1	Calculations establishing pile capacity have little value - these theories will result in a fairly wide variety of answers out of a group of competent engineers - full knowledge of fact that this is state of the art and best information will be obtained from tests.
139	19	If lab strength test were to be run - would you make test on soil in undrained or drained condition? His method of installation, as described, clearly provides you with a drained condition for each and every pile.
141	8	In the event of earthquake will condition of soil at pile tip be undrained? Yes - pardon me, take that back. It would be drained or at least on a reload.
141	16	What will cause soil to be drained? The method of installation and pretesting, longtime hold. I mean, for certain it will have been preconsolidated to 210 ton load and anytime it now exceeds 180 ton we will see it at least on reload or recycle.

Summary of Dr. Davisson's Deposition (Cont.)

Midland-Bailly Comparisons

Page	Line	
116	4	In your opinion are NRC requirements in Midland - do they exceed the requirements for Bailly?
117	16	First of all, they are different projects for different purposes. However, Davisson has been assuming the
also 118	5	requirements would reasonably be consistent. He has not heard that NRC has said what the requirements would be.
117	24	He does not know what NRC requirements are for pilings at Midland

Comments on Other Structures (DGB, Elect. Penet. Area, Feedwater Isolation Valve Pits)

Page	Line	
128	13	Not involved in decision to place surcharge in DGB area
and 129	8	Not involved in decision to remove surcharge.
129	22	Davisson's professional judgment is time that preload was left on is adequate for future projection of settlement.
131	19	Davisson judgement that secondary consolidation was reached under surcharge is based on shape of settlement versus log time curve.
143	9	At what stage is the development of the remedy for the Electrical Penetration Area?
143	21	He and Mueser-Rutledge are waiting for a little more definition what might be doing.
144	9	Specs have been developed and technique worked out between Gould and project and sent for bids.
144	15	Some details are to be contractor designed details - so design is not finished. Still a lot of work.
144	21	Davisson doesn't know if his responsibilities will include review of contractor details. Discussion with project on that matter has not been held yet.

Summary of Dr. Davisson's Deposition (Cont)

Davisson's Knowledge on Cracking and Piping

Page	Line	
31	12	He is unaware of any cracks requiring analysis. If cracks existed the analysis would be done by Bechtel's project.
33	15	Eliminating shrinkage cracks - it is his opinion that it would not be difficult to analyze reinforced concrete structure for stress cracks.
72	2	Expects jacking of pipe piles will close stress cracks that resulted from settlement of the cantilevered portion of SW structure.
65	8	He is unaware of pipes running under the SW structure.
65	21	Expects negligible effect on pipe settlement due to impact of underpinning.

Comments on Request for Borings

Page	Line	
58	2	Definitely don't need borings.
58	15	No conceivable use for additional borings at this point.
60	3	There is possibility one might find some use of information obtained from the borings in assessment of SW structure. Just not on table now.
114	10	Instead of borings - next piece of information requires is to drive some piles and run some blow tests and see what that provides us with. Much more useful than anything Mr. Kane could conceivably come up with.
138	18	In response to question 411 (page 136, line 12) Bechtel's reply does not serve a useful purpose (page 138, line 9) but a political purpose (line 13). Same foolishness as NRC request for borings.

Deposition

by

Donald E. Horn

October 21-22, 1980

TABLE OF CONTENTS

Cooling Pond - 1

Page	Line	
235	5	He's not aware of damage to rip rap at the dike within the past year.
235	12	There were problems around the dike in the last two years but he doesn't know what kind of problems.
235	14	Canoni built the dike around the cooling pond.
235	23	Discharge lines from the surface water to the emergency cooling pond are Cateyory I listed.
236	3	It's not within his technical compentence to know whether dike failure would adversely affect those discharge lines.
236	8	Horn was responsible for that portion of the dike that was Q listed.
236	12	(Q listed to Horn means subject to Appendix B.)
236	16	The northeast part of the dike was Q listed; all of north plant and part of the west plant dike, too.
236	20	This refers to dikes throughout the site.
237	3	Other than part of the northeast dike around the cooling pond, he had no responsibility for the dike around the cooling pond.
237	17	Don Sibbald of Consumers would have overseen the Canoni work on the dike.

Horn's Background and Experience - 1

Page	Line	
4	13	Horn's been employed by Consumers for nine and a half years.
4	20	He has a B.S. in Civil Engineering.
5	7	He had no college course work in quality assurance or quality control.
5	20	He had two courses in soil engineering.
6	1	He graduated in 1971 from Michigan Technical College.
6	24	He began work for Consumers in July 1971.
7	3	His first job was as a soil engineer at the Ludnigron Pump Storage Project.
7	10	He was in charge of dikes.
7	21	He was the consumer representative for "soil placement for cost and schedule of the reservoir."
8	4	There was no formal QA program involved with this project.
8	16	The only QA work associated with the project was auditing the work for the compliance with specifications.
9	7	How compliance items were reported and fixed.
9	16	He was with the Pump Project a little over two years.
9	24	He was working on the Pump Project full time.
10	9	He stopped work on the project in December 1973.
13	16	After December 1973 he worked on the Midland Project.
13	23	He worked at Midland as a Field QA Engineer.
13	25	He was 24 years old at the time.
14	4	He had no one working for him in that capacity.
14	7	He worked as a Field QA Engineer four years.
14	13	He supervised one person at the end of this period.
18	23	Horn corrected record to say he worked at Midland approximately three years.

Horn's Background and Experience - 2

Page	Line	
19	2	These activities included concrete, reinforcing steel, coatings, soils.
19	13	For each of these areas, he reviewed the specifications, performed audits and walk-through surveillance of concrete work.
19	16	He did the same for soil work.
19	21	Specs he reviewed weren't supplied by Bechtel.
189	5	Horn gives qualifications for someone in his position.
189	10	He has all the qualifications except for not being a certified civil engineer.
189	13	He's not a registered or certified civil engineer (the terms are synonymous).
190	5	He did attend a QA/QC seminar in 1974 and training in nondestructive testing. He's also received training in regulatory guides and attended a concrete seminar.
190	24	In all, he's spent 100 hours in course work.

Page	Line	
64	13	In 1977 Horn became a QA group supervisor and then acting civil group supervisor.
65	10	After January 1977 his job changed in that some of his former responsibilities were given to someone from IE and TV.
66	5	He had fewer responsibilities because of an organization change--more people were added.
66	15	While in the QA engineering group, Horn reported to the QA superintendent.
67	19	His name is Jerry Corley.
68	8	Horn told Corley the status of QA program implementation at the site.
68	12	He told him about lack of compliance with QA implementation.
68	18	Most serious problem during that period in Horn's opinion was the missing rebar.
69	1	Most serious soils problem was implementation of soils specification, i.e., NRC and audit findings that specs weren't complied with per those spec requirements.
70	2	Basis of soil problem was insufficiently compacted material.
70	4	Horn doesn't know when that was determined.
70	12	Horn's not sure if QA deficiencies contributed to insufficient compaction.
71	11	Paton introduces Exhibit No. 2--cover letter of 8/12/80 to Mrs. Barbara Stameris.
73	3	Horn helped prepare an Audit Report 7732 of 11/4/77.
73	13	Horn defines difference between an audit report and a nonconformance report.
83	2	Bechtel didn't take retests or rework the area based on this audit finding report.
83	7	Construction and fill work were proceeding at this time.

Page	Line	
83	24	Horn speculates Bechtel didn't act because they didn't have a "tracking mechanism on failing tests to assure themselves that the retests were performed--the rework was performed. That is why we had examples of still having non-conforming material."
84	10	If Bechtel had properly implemented a QA program, they would have had this information revealed to them in 1974.
80/81		Horn was not aware of the results of some tests taken in 1974, even though they're within the scope of his responsibility.
80	14	He wasn't aware of these non-conformance tests because he didn't review all of them.
81	17	U.S. Testing had the results of these tests in 1974.
81	23	Bechtel knew about these test results too in 1974.
84	24	Horn didn't detect Bechtel's oversight until October 1977.
85	15	It was missed because the scope of audits vary and this problem fell outside the scope of audit in 1974.
86	21	Horn admits this QA approach is deficient.
88	5	It's deficient in that it's not picking up problems when they occur.
89	23	The problem was with Consumer's QA program.
90	3	Horn thinks that if Consumers had been doing more hands-on work, the program would be better.
90	19	Horn and Don Blumenthal were QA people for Consumers.
91	1	Blumenthal worked there approximately one year.
91	22	Horn has heard that $10 million would be required to fix soil problems at the site.
92	24	Horn says that reviewing these audit reports for specific items they were reviewing far earlier would have turned up the problem sooner.
93	6	The QA program left the frequency of review up to Horn.
95	2	Horn can't conclude that the non-conformances indicated on page 5 of 12 of Report F-7732 contributed to the insufficient compaction at the site.

Page	Line	
95	6	He can't recall any non-conformance that did contribute to the compaction problem.
95	16	He believes the problem was caused by reliance on testing as opposed to inspection.
95	25	He helped prepare the answer to staff Q23.
96	11	He doesn't recall disagreeing with anything in the document.
96	19	Answers to this Q23 addressed the causes of insufficient compaction at the site.
96	23	Approximately 25 root causes were identified.
103	21	Horn modifies his thinking about reasons why tne QA problem missed the compaction problems. He now says lack of hands-on inspection was most important reason and not scope of audits.
104	8	Horn became aware of not enough hands-on inspection while preparing 50.54(f) in 4/79.
105	3	Horn also concluded the need for more hands-on inspections after the DGB settlement problem.
107	10	Hands-on inspections possibly would have revealed lift thickness problems, reliance on testing, lack of adequate QC inspection.
110	17	Horn determined the amount of QA hands-on inspection required.
111	1	Not enough was performed because Horn didn't have the time to spend on it for soils work.
111	18	Horn wasn't aware of the magnitude of the soils problem at that time or he would have spent more time on it.
115	11	When he began work at Midland in 1973 Horn considered himself a qualified QA person.
115	21	In period prior to DGB settlement, his two supervisors were Jerry Corley (1973-1977) and Walter Bird (since January 1977).
11[illegible]	3	He didn't discuss with either of them how much hands-on inspection was needed.
116	16	Mr. Corley did not give him directions in this area.
117	6	Horn believes there was insufficient staffing in the soils area for adequate hands-on inspections.

Page	Line	
117	14	Horn recommended to his management that the problem be righted in late 1979 or early 1980.
117	19	He became aware of the DGB problem in August 1978.
118	19	In December 1979 Horn told Corley that he needed three or four QA people in the engineering section.
118	24	He had one person in the QA section at that time.
119	2	The three or four people would have been needed because of the merger of Consumers and Bechtel QA sections.
119	23	Paton asks Horn about the design criteria for settlement of the DGB. Horn says they're between 2.8 and 3.2 inches for a 40-year lifespan.
120	3	Horn was made Civil Group Supervisor (acting) in January 1977.
120	25	He remains in that position now.
121	9	He's now a Civil Group Supervisor in the QA engineering section.
121	13	His responsibilities involve soils.
122	1	In October 1980 the Consumer and Bechtel QA groups merged.
122	11	This new group is supervised by Bird of Consumers.
123	15	Horn expects to supervise two people in the near future.
143	7	When Horn's additional QA person gets on board, he'll evaluate the program again.
144	10	Horn lists qualifications for the new QA person: 5 years construction experience; 3 years in nuclear; degreed engineer; member of professional engineering groups.
144	20	A requirement that the person have a QA/QC background.
144	25	Approximately three years of QA/QC work.
146	2	Horn sees no similarity in situation that led to soils problem and the backlog of unresolved NRC items and non-compliances.
146	13	He is receiving sufficient support from management on the QA program.

Page	Line	
146	15	Yes answer based on acquisition of new people into QA, and access to management to resolve problems.
148	3	Horn distinguishes between walk-through surveillance, over inspection, and hands-on inspection. Over inspection began in 1977.
154	5	After work stopped because of insufficient compaction, they began testing to the D-1557, Method D. They then brought a geotech engineer on site full time.
154	14	There was a geotechnical engineer on site prior to that time on a part-time basis.
154	25	In 1973 there were two. After 1974, no permanent geotech engineers were there.
155	7	He was a Bechtel employee.
155	24	In Horn's opinion, the fact a geotech engineer wasn't there at all times meant that Bechtel design criteria C-501 wasn't being observed.
156	6	There wasn't compliance for 1975-1977 and part of 1978.
156	13	He recalls that fill work under the DGB was done from 1975-1979.
156	20	For three years of this work no geotech engineer was continually on site.
156	25	Horn first became aware of this fact in 1975.
157	4	He was not aware at the time of the requirement that there be one onsite continually.
157	22	He can't remember when he first became aware of the requirement.
158	4	He learned about the requirement while performing an audit.
158	11	The audit was performed in 1975 or 1976.
159	2	There were times when fills were being performed in non-dike areas that Horn was aware of the geotech engineer requirement.
160	1	When Horn first read C-501 he thought the geotech engineer requirement applied to someone less qualified than the geotech engineer they had onsite earlier and now have onsite.
161	3	Horn says that the geotech engineer onsite must take tests.

Page	Line	
161	19	Horn felt the testing requirement was being met by the continual presence of U.S. Testing personnel.
168	20	Horn believes that Bechtel's design criteria C-501 is applicable to the Midland project.
169	4	Complete compliance with those criteria did not take place at Midland.
169	7	Right now, the onsite geotech engineer directs but doesn't perform field tests.
169	13	That is, the site's not in compliance now.
170	19	Horn believes that they were never in complete complaince with this requirement.
171	25	Filling operations are going on now onsite.
173	2	Karl Kleinhart is the qualified soils engineer at the site full time.
173	5	He now supervises filling operations.
173	9	U.S. Testing is performing inplace density tests.
173	19	Kleinhart supervises U.S. Testing work.
174	1	Aside from fact that Kleinhart doesn't personally perform inplace density tests, the project is in compliance with criteria C-501.
178	2	Horn clarifies previous testimony after contacting his supervisor; based on their talk, Horn believes the guidance in the last paragraph of page 24 of C-501 is being complied with. The geotech engineer is directing actual testing and determining test frequency. He's reviewing and approving all soil test reports.
179	17	Consumers has been in compliance with this requirement since a little time after settlement of the DGB.
180	4	Prior to then (in 1973-74) they may have been in compliance with that requirement.
180	10	Horn has been in contact with Gene Gallagher of Region III I&E forty or fifty times when Gallagher was conducting inspections.
180	25	Horn didn't always provide Gallagher with requested information and/or documents.

Page	Line	
181	8	Horn checked with his supervision about whether to provide certain documents.
181	22	One instance was when follow-up documents to 50.54(f) Question 23 were requested.
182	15	The documents were to verify the corrective action completed on the action items stated in the response.
182	22	All items in Question 23 are not closed out.
182	24	Gallagher asked Horn to bring those documents to Midland for review.
183	9	The request was made in October 1980.
183	14	Horn checked with Bird on the request.
183	21	Bird refused the documents.
184	2	Bird said Gil Keeley refused to release them.
184	13	Horn asked if copies could be sent to the site and was told "no."
184	18	Horn has always been cooperative with Gallagher.
185	12	He did so because "it was Consumer's policy to help NRC as much as we could to provide the information."
186	25	Horn thinks NRC ought to be provided with the same information that he is.
187	6	Horn tried to give Gallagher as much information as possible and tried to answer the questions he felt were being asked.
187	16	He gave him more information than he specifically asked for.
191	6	Consumers is supportive of the QA program.
194	12	They have approximately forty QA people in the field to implement the program.
195	10	The QA program has both Bechtel and Consumers people in it.
195	18	Consumers also has approximately fifteen contractor people in the program.
195	21	Approximately eight are Consumers people and the remainder from Bechtel.

Page	Line	
196	10	The QA program had two organizations: (1) one this year removed the auditing section and (2) one in August was when Bechtel and Consumers were combined.
196	19	Before the reorganization there were approximately twenty people in Consumers QA organization.
196	22	Approximately the same number of Bechtel people were assigned to the Midland Project.
197	4	There were then approximately ten contractor people assigned to Midland.
197	21	Under both the old and the new QA program there were approximately forty QA people on Midland, i.e., manpower for both was the same.
197	25	This represents an improvement to Horn because previously there was duplication of effort.
198	8	Initially, Horn said one of the reasons the QA program was improved was because of more people.
200	9	Horn says the QA program experienced an increase in manpower of from one in 1973 to forty now.
200	19	Horn thinks that manpower is costing Consumers more after the reorganization than before.
200	21	He can't estimate these costs.
201	5	Procedure changes in QA since 1973 include increased procedures, more specific procedures, and more hands-on inspection.
201	14	Horn thinks that Consumers should have conducted more inspections in the soils area in the past.
201	21	Consumers is doing appropriate hands-on inspections of soils today.
202	1	Horn believes that backfill mainly around piping excavation and around piping currently underway.
202	4	It's being done by the IE and TV groups.
202	18	There are three people in the IE and TV soils group.
202	25	They are John Croy, Bob Sevo, and Bob Davis.

Page	Line	
203	12	Other organizations involved at the site on soils work are SAI and U.S. Testing and some others he can't recall.
204	5	The people from orgainizations other than Consumers or Bechtel are hired because of their QA/QC backgrounds.
204	15	They do short-term jobs.
205	21	The QA job has improved because of the new organization.
206	2	He defines quality control.
206	21	Paton reads two statements and asks Horn if the second one means that the QA people ought not to be hampered from making decisions by cost considerations.
207	2	Horn says yes.
207	6	It also means they should not be affected by schedule.
207	9	No one discussed schedule with him that he can recall.
208	5	Horn did consider cost when he thought about imposing a stop-work order.
208	7	It affected his thinking in that "By continuing work, I did not feel that there would be an additional high cost impact on continued work."
208	20	The schedule at Midland is to have Unit 2 done by 1984 and Unit 1 by 1985.
209	2	He doesn't recall when that schedule was established, but it changes.
209	17	They're under contract with Dow Chemical to provide steam to them from Unit 1.
209	20	Horn believes it is important for Unit 1 to go into commercial operation prior to December 1985.
210	1	This importance has never affected QA decisions.
231	20	Assessing the qualifications of Bechtel QA personnel was within his area of responsibility during the plant fill period in the non-dike area.
232	1	He did consider one person as unqualified and he was removed from soils inspection.

Page	Line	
232	25	The requirement this inspector was not familiar with involved fact that structural backfill be placed within three feet of a structure.
233	4	Horn has heard of Management Analysis Corporation.
233	9	They audit Consumers QA program.
233	13	He's not sure whether or not they've completed their work.

Soil Compaction Requirements - 1

Page	Line	
20	13	Soils specs he reviewed were from Bechtel.
21	1	He did check the specs against the PSAR and FSAR.
21	9	He doesn't recall whether finding noncompliance in comparing soil specs from Bechtel with the PSAR.
21	13	He recalls a spec requiring 95% compaction of soils--that "means you have 95% of a standard compaction test."
21	20	Bechtel specs stated what a standard test was.
21	22	He doesn't recall if the PSAR specified what the standard test was.
22	2	The Bechtel spec specified two standard tests: (1) ASTM D-1552 (2) Bechtel Modified Proctor
22	15	There was confusion as to which of these tests was applicable.
22	22	He doesn't recall whether correspondence to clarify this matter went from Bechtel Ann Arbor to the site.
23	2	Horn used the Bechtel modified Proctor for compaction testing.
23	4	He used that test "because telecons had been written to state that was to be used."
23	25	The Bechtel project engineering people told the Bechtel QA people to use that test.
24	9	Horn didn't find in Consumer's PSAR a requirement for the Bechtel Modified Proctor.
24	18	Exhibit No. 1--"Investigation Report" of 3/22/79 and signed James G. Keppler.
25	1	Horn has seen Exhibit No. 1 and identifies it as an I&E report.
25	4	It's report of soils investigation Region 3 performed at the site, at Ann Arbor, and in Jackson.
26	19	The Bechtel specs that referred to the two compaction tests were C-208, C-210, and C-211.
27	25	Spec C-208 was for testing soils, concrete, steel.

Page	Line	
28	8	Spec C-210 covered soils placement.
28	12	Spec C-211 also covered soils placement.
28	14	C-210 was done under subcontract by Canoni and C-211 was more about structure backfill placement.
28	24	C-210 involved work in the power block area and to the cooling pond dikes.
29	24	Bechtel performed QA on soil placement in the power block area.
30	2	They used Spec C-211 in performing that work.
30	15	Difference between the ASTM and Proctor soil compaction tests is that with the ASTM test you obtain 6K foot pounds; with the Proctor you obtain 20K foot pounds.
30	21	The ASTM test would be more conservative.
31	2	Both were used by Bechtel.
31	9	Bechtel used the Proctor test for evaluation work and the ASTM test only for information.
32	1	ASTM test was not used to evaluate soils placement, only as information.
32	10	Paton gives Horn Exhibit No. 1 after quoting from it "The following is a summary of the documentation regarding the confusion of the compaction requirements for plant area fill" on pages 11, 12, 13.
32	20	Horn has read this document more than once.
33	14	The passage pertains to correspondence between Bechtel employees.
33	22	Horn would have seen the correspondence before it was summarized in this Exhibit.
34	18	Horn was aware of confusion in Bechtel about which compaction test ought to be used.
34	20	He doesn't recall when he first learned of this confusion.
35	18	In 1976 or 1977 Horn recalls a telecon between Jon Hook and Rao about confusion over which test to use.
36	11	Horn may have given Gallagher some or all of this correspondence.

Page	Line	
39	19	Horn interprets Item 1 on pages 11 and 12 of Exhibit 1 to mean that "Subcontracts was addressing field engineering on their concern on the soils and the backfill for the planter fill and berm to be compacted to 95% compaction and received four roller passes with the 50-ton rubber tire roller."
40	11	Subcontracts is the organization within Bechtel that arranges for subcontracts and they review documents from subcontractors.
40	21	The subcontractor involved in Item 1 was Canoni.
40	25	Item 1 specifies the Modified Proctor Method, ASTM 1557, Method D.
41	20	That test involves 20K foot pounds.
44	8	At the time he was field QA engineer at Midland, Horn wasn't aware of any confusion on the percent of compaction required.
44	19	Bechtel didn't always tell him there was confusion "in these letters and things like that."
44	24	Bechtel should have informed him of these matters.
46	10	It was Horn's responsibility to know whether Bechtel was complying with compaction requirements.
46	18	He knew in 1974 that Bechtel was confused on compaction requirements.
47	8	The confusion was clarified then.
47	17	Referencing the 10 items on pages 10, 11, 12, and 13, the last item is dated October 1977. The confusion in Item #1 was clarified then.
47	21	Further confusion is enumerated in Exhibit No. 1.
49	17	The confusion dealt with "whether the soils had to be compacted to 95% compaction and obtain or have four roller passes placed on it."
50	3	Horn has looked at the PSAR/FSAR since 1974 for what it said about proper compaction at Midland.
50	12	Horn can't recall the PSAR requirements for percent of compaction.

Page	Line	
51	20	He can't recall whether the PSAR references a Darnes and Moore report "Foundation Investigation and Preliminary Exploration for Borrow Materials."
52	8	He has read the report, however; it dealt with boring data and soil placement.
52	18	He believes the report contained tests for compaction requirements.
53	8	Eventually, Bechtel decided to use the solution Method D-1557, involving 56K foot pounds.
56	12	In 1979 Horn complained that Bechtel wasn't providing him with sufficient information for him to perform his duties regarding qualification test of compactions equipment.
57	4	Gene Gallagher has requested that Bechtel send a report on backup information for the qualification of equipment to be used at the site. Horn had to contact Afifi before the report was sent.
58	7	Horn complained to Afifi either in 1979 or 1980, he can't recall.
59	6	He first asked Afifi and a month later asked Jim Wanzeck for the report.
60	3	Mostly Bechtel provided Horn information in a timely manner.
60	13	In the course of placing fill in the power block area, they used the 20K pound compaction test.
60	18	This is the Bechtel Modified Proctor Test.
60	23	The word "Proctor" doesn't appear in the name of the other test.
61	2	The word "Proctor" sometimes appears in the title of the 56K pound test too.
61	10	When Horn hears "1557, I think of that Proctor Test."
61	14	During construction the 20K test was used.
61	25	This test failed, a fact reflected in Horn's reports.
62	7	Horn notes that it's not the standardized tests that fail, but the field tests.

Page	Line	
62	16	Frequency of field tests in power block area: 1 in 10 to 1 in 100. One test/cubic yard of material placed to one test in 100 cubic yards placed.
		In large areas, one test in every 500.
73	25	Audit report F-7732 contains nonconformance items.
74	3	It contains three closed and three open findings.
74	7	Open findings: (1) against Spec C-210 (2) same (3) against Spec C-211.
74	19	Horn cites moisture and compaction deficiencies.
76	5	Tests noted under "Plant Area Fill" are in the power block.
76	7	They don't represent QA deficiencies.
77	20	These tests don't show compliance with compaction requirements.
77	25	The QA program reveals a lack of compliance with the compaction requirements.
78	10	The audit report covers 1974-1977.
78	25	The tests in the report are examples of insufficiently compacted material.
79	10	Horn doesn't have an opinion about whether the nonconformance in this audit report contributed to insufficient compaction at the site.
79	17	Horn says test results show insufficient compaction because the spec requirement when these were taken was 80% of relative density and the tests in the report are below that requirement.
148	13	Lift thickness problem defined as putting in higher lifts than compaction equipment was capable of compacting.
149	10	Horn had the material cut down and compacted.
149	22	He didn't issue a formal stop-work order.
150	1	He did actually stop work until the problem was resolved.
150	13	This happened approximately twice a year.

Page	Line	
150	24	He seriously considered issuing a formal stop-work order after DGB settlement and after he performed an audit of soils in 1980.
152	9	Horn considered the stop-work order on the advice of Mr. Margulio, not on his own.
153	16	Stop work was imposed by Ben Margulio but it wasn't a format stop-work order. It was imposed on Consumers.
154	5	After work stopped, they began testing to the D-1557 Method D. They brought a geotechnical engineer on site.
210	6	U.S. Testing ran compaction tests for Bechtel and did not fail to report deviations from specified requirements.
210	10	Exhibit No. 3, letter of 2/1/78 from Bechtel to U.S. Testing.
211	8	The letter states that U.S. Testing did not identify deviations from specified compaction requirements. Horn disagrees with this and says, "I do agree that U.S. Testing had repeated erroneous selection of compaction standards, and therefore it did not indicate in the reports that the compaction requirements had been met or had not been met."
211	20	Horn thinks that the erroneous selection of compaction standards was significant to the lack of compaction of the fill at the site.
211	25	The accurate selection of compaction standards by U.S. Testing was within Horn's QA responsibility.
212	14	Horn has not heard of a law suit between Bechtel and U.S. Testing.
212	19	During construction of the administration building, settlement in excess of that expected was noticed.
212	21	He doesn't recall the cause.
213	1	He doesn't recall when he learned of it.
213	21	He learned of the problem about one year before learning about the DGB.
214	10	When he first learned about the administration building problem he didn't attempt to discover its cause because it was outside his area of responsibility.
214	18	Bechtel and Consumer's project management people tried to discover the cause.

Page	Line	
215	2	He's not aware that Consumers took any adverse actions against anyone at Consumers for this problem.
215	8	Ditto for Bechtel.
216	13	To solve the problem, material was removed. As it was being removed, it was compared to proctors taken previously. They took borings per the document Paton showed Horn and they had meetings with the test lab.
217	3	Bechtel determined the cause of the problem, though they may not have told Consumers.
217	13	Horn says it wasn't within his area of responsibility to find the cause.
217	24	Bechtel was concerned that the problem at the administration building might be more widespread.
218	4	He's not sure whether anybody at Consumers was similarly concerned.
219	9	The problem was caused by the erroneous selection of proctors by U.S. Testing.
219	18	Bechtel then took borings at other locations.
220	2	They learned that there wasn't insufficient compaction of backfill in those areas.
220	6	Borings were at admin building, south of DGB, one by chlorination building.
222	5	Horn can't answer as to whether those borings satisfactorily isolated the problem.
222	25	He does recall people at Consumers discuss the adequacy of these two tests but he can't recall specifically who said anything.
223	18	Hindsight observations were to the effect that these tests weren't enough.
224	5	Horn thinks the settlement problem at the DGB and that at the administration building are connected.
224	12	He says they're possibly caused by the same problem.
225	11	There was no QA applied to the administration building.
225	14	They did learn from the settlement problems at the admin building.

Page	Line	
225	25	He can't recall anyone linking sinking of the administration building with a more widespread problem at the site.
226	20	He can't recall anyone at Consumers responsible for communicating with Bechtel on this subject.
227	8	He then recalls that the Consumers contact would be Tom Cooke or Don Sibbald.
227	18	Don Sibbald said the results Bechtel obtained from the borings were adequate.
227	25	Paton asks Horn if he's familiar with Criterion 16 of 10 CFR, Part 50, Appendix B.
228	20	He says yes, that one of the purposes of Criterion 16 is prevention of repetition of nonconformances.
228	21	NRC Exhibit 1, Horn looks at list of five items on pages 2 and 3.
229	7	He doesn't agree with their wording.
229	16	Item 1: He disagrees to the extent of saying that it is possible lack of supervision of plant fill contributed to inadequate compaction of foundation material.
230	22	Item 2: He agrees with that statement that corrective actions related to plant fill were insufficient, as evidenced by deviations from spec requirements.
231	3	Item 3: Certain design basis and construction specs related to foundation type, material properties, and compaction requirements weren't followed--He agrees with this.
231	8	Item 4: He agrees that there was a clear lack of direction and support between contractors, engineering office, and construction site, as well as within the contractor's engineering office.
231	12	Item 5: He agrees that the FSAR contains inconsistent, incorrect, and unsupported statements about foundation type, soil properties, and settlement values.
233	14	Exhibit 1, page 12, paragraph 6.
235	2	In his opinion, the procedure of having a herd of mules walk over the fill to achieve 95% compaction would be unacceptable, a proposal suggested in Exhibit 1.

Statements by Attorneys for the Record

Page	Line	
242		Paton asked Mr. Hood, at Mr. Zamarin's request, to send a notice to NRC employees to refrain from asking Consumers employees to prepare information specifically for the purpose of this litigation.
242	23	Mr. Zamarin states that by putting the information on the record, they in no way are implying that Mr. Gallagher was doing anything improper.
243	18	Paton states that there is no specific agreement that Mr. Horn's deposition be left open. He suggests that if the attorneys cannot reach an agreement, that the matter be brought to the Board's attention.
244	1	Zamarin states for the record that the reasons for adjoining the depositions of NRC personnel sine die was because they weren't completed and to complete them then would cause a conflict with travel plans.

Unresolved Safety Issues

Page	Line	
126	6	At present he has one assistant and cannot get to a backlog of work until he gets more staff help. Some of the backlog involves unresolved NRC issues.
127	12	Horn answers it's appropriate for work at the Midland site to go forward despite a backlog of noncompliance, unresolved safety issues with NRC.
127	18	He doesn't believe this backlog will contribute to future soils problems.
129	5	Some of the non-compliance issues involve soils, one on structural steel, one on concrete, one on compaction equipment.
129	11	Horn says non-conformance issues are different from NRC unresolved safety items.
129	13	One unresolved safety item involves not having "qualifications requirements for grouting personnel for grouted anchors."
131	25	Horn refers to nine or ten noncompliance items in the Keppler report.
133	6	As to whether this backlog is acceptable, Horn says it's not.
133	23	Although his supervisor is aware of these items, Horn hasn't reported on them to him.
134	5	Both Horn and his supervisor are pushing to clear up the backlog.
136	11	He's never gone over his supervisor's head to get the backlog resolved.
137	15	If his supervisor went up the chain of command with this issue it'd be to Hank Leonard or Jerry Corley.
138	1	Mr. Bird is aware of the backlog too.
138	12	Bird's monthly report to the vice president of Midland carries these items--VP Jim Cooke.

Zamarin's Questions

Page	Line	
238	9	Relative to the Horn's thinking about issuing a stop-work order on soils placement, the cost impact from such an order would stem from going back and redoing work if it was later found that it's necessary.
238	19	Consumer Exhibit 1, "Oral Communications Record dated 12/2/80." Its record of a phone call Horn had with Mr. Gallagher in which Gallagher requested information from Spec C-210.
239	10	Gallagher wanted the information because it was missing from previous investigations.
239	15	The information was missing because one of the inspectors Gallagher was with had thrown out the information.
239	20	Gallagher wanted two kinds of information: (1) identify persons who prepared, checked, and approved Spec C-210 and identify the group they were affiliated with.
240	11	Consumer Exhibit 2--record of information provided to Gallagher, except for group they were with.
240	20	The information was requested for this hearing.
241	1	The second request from Gallagher was that the verification packages from Ann Arbor be sent to the site so it could be reviewed.
241	23	Consumer's Exhibit 1 is not verbatim; it's Horn's recollection of the conversation.

Deposition

by

Bimalendu Dhar

December 17, 1980

TABLE OF CONTENTS

Auxiliary Building - Caisson Design - 1

Page	Line	
9	6	Dr. Gould supplied Bechtel with information about design of the caisson supports for the Auxiliary Building wing area.
9	12	Gould supplied the basic scheme and details for the caissons.
9	15	Gould supplied information about what kinds of caissons should be used, then approximate length, and then load carrying capacity.
9	23	Dhar recalls that load carrying capacity is 13 caissons per 4000 kips.
10	13	Dhar can't recall who other than Davisson reviewed Gould's work.
10	25	Gould's report or written summary is in the Civil files under Dhar's supervision.
11	5	Gould made two presentations to NRC: July 1979 and February 1980.
11	17	Gould's written summary supplied to NRC.
14	1	To best of Dhar's recollection, Gould's input to the spec for underpinning was not submitted in writing.

Page	Line	
14	24	Dhar distinguishes between whether Gould's was in the form of "input" - "technical details that goes into the specification for particular work - and the specification itself - "to incorporate all that input in a form which can formally be issued as a specification to control a piece of work."
15	11	Gould provided input to specifications, according to Dhar.
15	14	Then Bechtel put the specification together.
15	20	This input was "written on a piece of paper" and "verbally" in meetings.
16	6	The written information was "informal," not in a letter.
16	13	Dhar can't recall how much of Gould's input was written and how much oral.
16	20	This would have been given to John Hook.
16	24	Hook worked for Dhar.
17	13	Gould's input was supplied to Bechtel sometime in 1979.

Page	Line	
17	17	Gould's inputs were also given to Davisson.
17	20	Bechtel did use Gould's input for specs.
17	25	This happened in mid-79.
18	22	Dhar recollects "I am not sure whether I heard it or read it that it was given to Dr. Davisson," i.e., the specs.
19	4	The input from Gould wasn't given to Davisson.
20	9	Dhar remembers talking to Davisson once in '80.

Auxiliary Building - Electrical Penetration Area - 1

Page	Line	
26	13	Paton asks Farnell to provide NRC with specs and drawings for underpinning both the electrical penetration area of the Auxiliary Building and the service water structure.
26	19	Dhar doesn't think these are complete at this time.
26	24	Dhar's not familiar with what's been supplied to NRC about the caissons in the electrical penetration area.
26	25	He delegated that part of the work to Shing Lo.
29	11	Dhar understands that Consumers asked Bechtel to complete design and do analyses in response to various questions and to assure that remedial actions result in a safe structure and then issue the necessary documents for construction.
32	13	Dhar thinks the information supplied to NRC about caissons in the electrical penetration area is sufficient for NRC to review it for the safety of the facility.
33	1	The concept involves providing caissons at the extreme end of the electrical penetration area.

Auxiliary Building - Electrical Penetration Area - 2

Page	Line	
33	5	The concept also includes providing a pier under the parapet that's adjacent to the electrical penetration area and tie it to the caissons to take lateral loads.
33	10	This concept uses the strength of the structure to stand between the caissons and the control tower.
34	2	Dhar believes NRC has sufficient information to examine the design of the caissons.
34	20	Dhar believes the word "design" refers to installing the caissons at that location and the loads on it.
34	24	Settlement would be important too.
35/36	3	And load bearing capacity.
37	11	Dhar says Bechtel doesn't have a final design for the caissons.
37	15	Although not final, the caisson design's not preliminary either.
38	20	Dhar has conferred with Lo about information sent to NRC but Dhar's not familiar with the details of what was sent.

Auxiliary Building - Electrical Penetration Area - 3

Page	Line	
39	3	They talk at least once a week.
40	22	The caisson information was provided to NRC sometime in '79.
41	2	Dhar thinks the information was submitted during a meeting with NRC in February 1979.
41	7	The information may have been submitted in response to NRC question 12.
42	9	Dhar did comment on Davisson's input to the specs and the issues addressed were resolved.
42	17	The Geotechnical Group would know most about the details - Afifi and Shing Lo.
43	7	One detail in Davisson's work needing resolution dealt with the spec for how the concrete would be poured.
43	21	Dhar can't recall any disagreements he had with Davisson on the piles.
43	25	Ditto the caissons.

Auxiliary Building - Electrical Penetration Area - 4

Page	Line	
44	2	Dhar had no input on retaining Davisson.
44	3	Paton shows Dhar Table 12-1 of Q.12 regarding underpinning the electrical penetration areas of Auxiliary Building with caissons.
44	24	Dhar has read the table.
46	19	Farnell notes that Consumers made available to NRC many documents from Bechtel, including documents from the Civil Group.
47	11	Dhar's responsible for the Civil Group files.

Borated Water Tank

Page	Line	
156	19	Dhar recalls cracking of the ring beam foundation for the borated water storage tank.
156	24	He doesn't recall cracking of the tank itself.
157	10	No seismic analysis has been done for this crack.
157	15	Analysis has been done to evaluate effect of settlement on the ring foundation.
157	18	It's still underway.
157	22	The analysis started sometime in 1979 and is continuing.

DGB - Buried Piping - 1

Page	Line	
124	20	Dhar can't recall if he was involved in the analysis of stress on buried pipes under the DGB.
124	23	Mr. McConnell might have been in charge.
125	7	Regarding dispute between Bechtel and NRC about stress on pipes under DGB, Dhar recalls a question on duct banks in latest round of questions from NRC.
125	16	Bechtel's Plan Design Group told Dhar, which he repeated at a meeting, that bends and elbows on some pipes were already overstressed.
125	18	Mr. Tulloch may have told him this.
126	25	Analysis of stress on pipes is responsibility of a mechnical engineer - except for seismic stress, which is responsibility of the Civil Group.
126	3	Seismic stress on the buried piping is Dhar's responsibility.
126	9	Dhar thinks some of the pipes, ducts, and conduits beneath foundation of DGB may be Category or Class 1.

Page	Line	
126	16	Dhar doesn't know at what depth these Class 1 materials may be located.
126	21	Nor does he know any of the bedding or backfill details of the excavations for piping, ducts or conduits.
127	1	Dhar is the head of the Civil Group at Bechtel.
127	6	Mr. Rao in this Group would know about bedding and backfill.
127	11	Dhar discussed these with Rao and remembers that there's sand backfill around the piping.
127	16	Dhar's present responsibility is limited to seismic stress for buried piping.
128	3	He's responsible specifically for steel piping that belongs to an ASME class.
128	11	Other than for seismic concerns, Dhar's responsible for "Even some of the Category 1 may show up on the Civil drawing, and we would provide the burying details. For pipes ... not the responsibility of Plan Design, we will route them and we will procure them."

Page	Line	
128	21	For pipes they write the specs on, they're responsible for installation and construction support.
129	8	They provide elevation information, too.
129	13	He doesn't know whether pipes under foundation of DGB were installed at the intended elevation.
129	17	Staff Exhibit 3, December 17, 198 , "Teletype Message" which states that a yard pipe analysis has not been completed but that because of an excavation that will be made, a 21 inch deviation from design elevation should be corrected. It then lists the affected pipes.
130	10	Dhar recalls that this quote refers to the condenser line.
130	16	He doesn't recall whether any other deviations in elevation occurred.
130	23	Dhar feels an error was made to cause the 21 inch deviation.
131	18	Deviation from intended elevation may make a difference in seismic stress, depending on where pipe is located.

Page	Line	
131	22	It could affect seismic analysis by being located in a different soil layer with a different modulus from that originally calculated.
132	6	He can't say whether the pipes mentioned in Exhibit 6 were affected by Dhar's seismic stress analysis.
132	9	Bechtel installed the pipes under the DGB.
132	13	He doesn't know whether Canonce would have installed them.
132	17	Dhar recalls that an analysis by his group was done for the condenser line before the surcharge was applied.
133	1	The analysis was to determine the effect on the condenser line of ground settlement - to determine stress on the line from settlement.
133	8	Settlement caused by the surcharge.
133	13	The analysis showed that the line would be overstressed.
133	16	As a result, the pipes were cut at the end of the turbine building.

Page	Line	
133	19	The field was instructed to reconnect them and they were, after the surcharge was over.
133	23	No later stress tests have been conducted.
134	8	Dhar doesn't believe the pipes are overstressed now.
134	15	Pipes would have been overstressed if they had not been disconnected.
134	19	At the time of the analysis, the pipes were not overstressed; the analysis predicted future stress.
135	3	The analysis was based on estimate of settlement.
135	10	Dr. Peck estimated the settlement to be between 6 and 18 inches.
135	16	Paton asks Dhar to identify Figure 19-1, Volume 1 of 50.54(f) responses of 4/24/79.
135	21	Dhar identifies it as a survey pipeline profile by Goldberg, Zoino, and Dunnicliff (GZD).
136	9	The diagram shows one pipe (or line) under the DGB.

Page	Line	
136	12	9 pipes are shown on the figure.
136	15	Dhar can't tell from the diagram whether any pipes are overstressed.
138	17	Dhar says that underground pipe profiles are done using a "bug," which travels along the invert (or bottom) or the pipe. Instruments record differences in elevations between the "bug" and the reference elevation.
139	13	The pipe profiles in Figure 19-1 indicate these pipes are under stress.
139	15	The stress was caused by pipe curvature.
139	19	He doesn't know if they were installed that way.
139	22	The curvature of the pipes may have been caused by settlement.
139	25	But he can't say for sure.
140	4	The elevations in Figure 19-1 were where the pipe was to be laid.
140	8	The pipes are not now at those elevations.

Page	Line	
140	12	GZD profiled all pipes in the vicinity of the DGB.
140	18	He has heard that not all pipes were profiled in the power block area.
140	21	The criteria used to determine that it wasn't necessary to profile a pipe was whether adjacent pipes have the same bearing condition.
141	9	He doesn't know whether all pipes have been profiled.
141	14	Nor does he know whether all Category 1 piping has been measured or surveyed for settlement.
141	21	He doesn't know if stresses in any of the profiled pipes exceeded total allowables.
142	3	He was told that some pipes, elbows, and fittings exceeded allowables.
142	18	He's not reviewed computations made by E-Tech or Bechtel of pipe stresses.

Page	Line	
142	21	Dhar's group has been involved in computations of pipe stresses due to seismic events on buried piping.
142	24	Mr. McConnell's been responsible for these computations.
144	16	Staff Exhibit 4, 12/17/80, Calculation Coversheets" 1 through 5.
144	23	Except for the condenser line, Dhar doesn't recall an analysis of the effect of the surcharge on buried pipe.
145	13	Dhar says that an analysis before settlement wasn't necessary unless ductile pipe, like stainless steel, was involved.
146	14	Figure 19-1 illustrates that some pipes underwent differential settlement.
146	17	Differential settlement that causes pipe curvature introduces stress.
146	22	Figure 19-1 has examples of where differential settlement has caused pipe curvatures.
146	24	Dhar hasn't conducted investigations to determine the amount of stress in these curvatures.

Page	Line	
147	2	Dhar believes Bechtel's Plan Design Group is conducting these analyses.
147	10	Dhar doesn't know whether Bechtel or Consumers submitted to NRC an evaluation of Category 1 pipes in vicinity of DGB before the surcharge.
147	14	Dhar recollects that some more recent pipe profiles than those taken in Figure 19-1 were taken.
147	20	GZD did the profiling after the surcharge was removed.
147	23	Dhar has reviewed profiles done subsequent to the surcharge.
		He recalls that there was no great difference between the two (between Figure 19-1 and subsequent analyses).
148	18	He doesn't recall the difference between the two.
148	25	He doesn't know whether profiles made after the surcharge were submitted to NRC.

Page	Line	
150	3	Dhar says he can't determine from Pipe Profile 26-OHBC-54 of Figure 19-1 whether approximately 9 inches of settlement occurred before the full surcharge was placed.
150	21	Dhar says he'd guess that Figure 19-1 shows pipe profiles from before the surcharge.
151	7	GZD was asked to make these profiles so Bechtel could evaluate the condition of the underground piping.
151	19	Dhar can't determine whether additional settlement of the pipes in vicinity of the DGB will occur.
152	1	Dhar does anticipate some settlement over the next 4 years of pipes in the foundation of the DGB.
152	A	He won't speculate without an analysis on what additional settlement would do to current stresses on pipes.
152	17	Dhar can't positively say whether additional settlement will aggravate current stresses.
153	21	He can't recall if Bechtel plans to monitor pipe profiles in the future, except for borated water lines.

Page	Line	
153	25	The borated water lines are underground.
154	10	Bechtel's monitoring borated water lines at NRC's recommendation.
155	6	Dhar is shown meeting notes with a cover note signed by Afifi which references K. Weidner saying that "he had already suggested that the Project request the Field to cut the pipe at certain points to check stresses."
156	2	Dhar says that if calculations show the pipes overstressed, then this would be one way of checking stress.
156	9	He doesn't recall the pipes being cut for stress checking, other than the condenser line.

DGB Cracks - 1

Page	Line	
85	21	There are seismic Category 1 valve pits in the fill adjacent to the east and west sides of the generator building.
86	8	He doesn't recall whether cracks exist in these pits.
86	18	He doesn't recall if there were changes in the rattle space for piping during the DGB surcharge, although the gap was measured before and after surcharging.
87	7	Dhar's aware of cracks at DGB; they could have been caused by shrinkage and settlement compounded by fact that concrete didn't gain enough strength.
87	24	Some cracks were caused by settlement.
88	7	He first became aware of this fact in November 1978.
88	10	The east wall had cracks caused by settlement.
89	6	Dhar can't sketch pattern of cracks.
89	8	Dhar can't be sure when he last saw the cracks, or whether they've stabilized, etc.

Page	Line	
90	17	Dhar delegated responsibility for the soil settlement problem to Shing Lo.
92	2	Dhar has not observed any see-through cracks at the site.
92	15	Dhar thinks that an examination of the DGB is necessary to determine the cause of the cracks, whether they're detrimental to the structure, width of the crack, whether there's exposure to damage to the rebar.
92	19	Some re-analysis has been done in response to NRC requests.
92	23	Dhar doesn't know if more reanalysis will be required.
93	7	Bechtel had planned this type of analysis before NRC's request.
93	10	Some was done prior to NRC's request.
94	6	Dhar says their preliminary examination shows these large enough to require repairs.
94	11	He doesn't remember the width of the cracks.

Page	Line	
94	13	Dhar says if the rebar is exposed by the crack it could weather and corrode.
95	18	The crack might also indicate the state of stress on the rebar.
96	23	Bechtel hasn't done any tests to find rebar stress.
97	11	He doesn't know whether any Bechtel plans to test for rebar stress.
97	15	Bechtel's Chief Engineer, Ted Johnson, would know if these tests are planned.
98	1	Dhar and Johnson have discussed rebar stress at crack sites.
98	19	The conversation consisted of Johnson saying that it's difficult to determine the amount of stress in rebar adjacent to a crack.
99	14	In his professional opinion, Dhar believes that because the cracks are no wider than 30 mils and because they were caused by settlement stresses (which are self-limiting) he doesn't consider them detrimental. Thus, no further investigation into stress on rebar adjacent to cracks is necessary.

Page	Line	
99	25	Johnson agrees with that assessment.
100	19	Bechtel did supply its response on the rebar to NRC.
101	2	Bechtel based its conclusion on the seriousness of the cracking on fact that the cracks were formed in the concrete when it didn't gain its complete strength; therefore the stresses were low in the concrete to crack it and therefore the stresses on the rebar were low also.
101	9	The concept "self-limiting" applies to the cracks in the DGB but not to the service water structure.
101	17	"Self-limiting" applies to stresses caused by deformation, not mechanical load.
103	14	An analysis was made to evaluate the settlement of the surcharge at the DGB prior to placement of the surcharge.
103	16	The analysis was made to determine the capacity of the internal walls to resist a lateral load.
103	21	The estimate was that the settlement would be from 6 to 18 inches.

Page	Line	
104	8	Dr. Peck made this estimate.
104	25	For design of the DGB, no particular modulus of subgrade reaction was used prior to settlement.
105	4	"My recollection is that the analysis was done using the conventional method where you do not require a subgrade modulus."
105	9	No value was necessary for the structural analysis.
105	12	After the surcharge at the DGB was done, another structural analysis was done.
105	18	A modulus of subgrade reaction value was used for the second analysis.
105	21	It was Shing Lo's responsibility.
107	9	Dhar summarizes his understanding of the surcharge at the DBG.
107	23	Dhar doesn't think the cracks in the DGB changed significantly during surcharging.
108	1	They did undergo some change, he recollects.

Page	Line	
108	11	He recollects that some cracks were smaller as a result of the surcharge.
108	15	Cracks became smaller on the east wall.
108	18	He doesn't recall whether the surcharge aggravated differential settlement.
109	25	Dhar says question of whether or not the surcharge increased stress on pipes and conduits under the DGB is not his responsibility.
110	7	Dhar tries to answer this question by saying "If the pipe is restrained and the surcharge will deflect the pipe more, then it could increase the stress on the pipes."
110	16	He doesn't know whether structures with cracks have exceeded elastic limits.
111	9	No elastic analysis has been made.
111	11	He doesn't know if one will be made.

Page	Line	
111	15	He doesn't know the range of differential settlement the DGB can safely withstand.
111	22	Bechtel has done a simulation of future differential settlement of the DGB.
111	25	Shing Lo would have performed that analysis.
112	6	Results of this analysis not presented to NRC yet because they're incomplete.
112	8	Analysis should be finished in next couple of months.
112	22	There's no index of computer runs used to analyze DGB stresses.
113	6	There's a record of computer runs.
113	15	That record is part of the Civil calculation index.
114	6	Only the computer runs in final form would be in the calculation index.
115	4	Dhar doesn't know how often this index is updated.

Page	Line	
116	1	The Civil calculation file has an index.
116	11	Those computer runs not finalized would be with their originator - they would not be indexed.
116	18	Dhar says he needs the effective shear wave velocity of the foundation material to do a seismic analysis.
116	23	Also, he'd need the building configuration.
117	1	And the poisson's ratio.
117	8	And the damping ratio.
117	14	Check McConnel's Seismic Group would make these calculations.
118	2	A soil stratification profile would be calculated from the effective shear wave velocity.
118	9	The shear wave velocity for different layers at the DGB was calculated.
118	18	Dr. Afifi provided them with the shear modulus.

Page	Line	
118	19	The value of shear modulus varies with strain.
119	1	The Geotech Group provided Dhar with one shear wave velocity for the shear wave velocity he performed.
119	6	He got one shear wave velocity for each layer.
119	15	He doesn't know whether seismic analysis of DGB takes variation of shear modulus with strain into account.
119	18	Chuck McConnell would know.
120	6	Soil parameters used in reanalysis of DGB after removal of the surcharge were done by Prof. Woods. He did some in situ shear wave velocity measurements.
120	21	Dhar says that shear wave velocity was lower than 500 feet in one case.
121	12	Bechtel had adopted shear wave velocities of 1350 feet per second before the surcharge.
121	17	After surcharge removal, shear velocity measurements substantially lower than 1350 ft/sec were obtained.

Page	Line	
121	22	Dhar won't make any conclusion about effectiveness of surcharge from that information.
122	2	He can't make a conclusion partially because of lack of expertise and partially because "before we measured the shear wave velocity, Bechtel assumed a lower limit shear wave velocity of 500 ft/sec as written in response to a NRC question."
122	10	The upper limit was 1350 or 1360 feet.

Dhar's Background and Responsibilities - 1

Page	Line	
3	14	Staff Exhibit 1, Dhar's resume.
3	24	Dhar now works for the Ann Arbor Power Division.
4	8	He's an engineering supervisor at Bechtel.
4	10	He supervises 85 people in Ann Arbor and 30 at a job site.
4	18	The 85 people report indirectly to him thru intermediary supervisors.
4	22	He's Group supervisor, Civil Structural Group.
5	1	He spends all of his time on the Midland project.
5	13	He's worked full time on Midland since 1976.
6	8	Dhar's job makes him responsible for analysis, design of all structures, preparation of engineering drawings, specs, and licensing documents.
105	25	Dhar has delegated most of his Midland responsibilities to Shing Lo.

Page	Line	
106	3	Mr. Los has in turn delegated some of these responsibilities.
106	17	Dhar spends his time at Midland on the reactor building, seismic analysis, supporting construction, etc.

Page	Line	
71	2	Dhar attended a meeting in Bethesda on December 5 to hear the presentation of Western Geophysical in support of the site specific response spectra.
71	15	The staff (NRC?) wrote to Consumers suggesting site specific response spectra.
71	22	As to whether that's appropriate, they haven't received specific directions from Consumers.
72	5	In the last two years, the staff has decided it doesn't consider Michigan techtonic province an acceptable criteria for a finding of seismic motion.
72	15	Staff therefore believes that "some modification is to be done to the seismological input to the Midland design, and in their last letter staff defined the criteria that would be acceptable to the staff for this purpose."
72	19	This appeared in a letter from Robert Desco to V. P. Cooke of October 14, 1980.
72	25	Whether to incorporate the new seismic information from the staff into a future seismic structural analysis is under consideration.

Page	Line	
73	8	Dhar said the floor response spectra for the DGB was generated on the assumption that the shear wave velocity would not be lower than 500 feet per second. This analysis performed after soil settlement problem was discovered.
73	16	Dhar doesn't know whether the soil shear wave velocity for the DGB will not be less than 500 feet per second for the life of the plant.

Service Water Structure - Control Tower

Page	Line	
159	16	Voids appear under the control tower.
159	18	He recalls a void under the service water slab, which is sitting on backfilled sod.
159	21	There's a plan to grout the void under the control tower.
159	25	He doesn't know whether treatment of the gaps have been reported to NRC.

Dewatering Service Water Structure - 1

Page	Line	
73	21	Alternative solutions at the service water pump structure that Bechtel considered were (1) to remove and replace the fill under that part of the building and (2) to strengthen the structure.
74	4	They didn't consider the cost of removal and replacement of the fill.
74	6	That alternative was rejected "based on the expert opinion that the problem of dewatering the area with the high pond level, the investigation of that was not pursued."
74	11	Bechtel now plans permanent dewatering of the area.
74	18	At the time they rejected the idea of replacing the fill, they didn't know they would permanently dewater the area.
74	21	Nor did they perform any structural analysis for the alternative of strengthening the building.
74	24	The judgement to pursue the remedy described was based on "preliminary analysis of that particular fix, feasibility of the scheme, and the practicality of construction."

Dewatering Service Water Structure - 2

Page	Line	
75	5	Asked by Paton of "practicality" indicated a concern for money, Dhar said he doesn't remember very clearly.
75	12	A task force made the decision about which alternative to use.
75	17	A Consumer staff member was on the task force.
75	23	He names Task Force members.
76	9	Dhar says his knowledge of dewatering is limited so he can't make the determination of whether the replacing the fill alternative would be preferable now that a permanent dewatering system has been planned for the site.
77	9	Dhar doesn't recall up to what level dewatering would have to take place for fill removal and replacement. So he doesn't know whether this alternative is feasible.
84	22	Dhar says the permanent dewatering system isn't designed to withstand a SSE.
85	1	That's because the sand would liquify.

Service Water Structure - Pile Installation - 1

Page	Line	
7	3	Dhar says that Dr. Davisson works for Bechtel for design of piles for remedial actions for the service water pump structure.
7	15	Dhar doesn't know if Davisson is reviewing documents for caissons in the electrical penetration area. Dr. Afifi would know.
8	2	To best of Dhar's knowledge, Davisson is reviewing the carrying capacity of the caissons, the load-carrying capacity.
8	19	Davisson is reviewing Chuck Gould's work.
20	21	Davisson is to give Bechtel input about types of piles, factor of safety, and review pile specs and design at the service water structure.
21	7	Bechtel did supply NRC with a paraphrased version of the specs based on information from Gould.
21	19	Dhar thinks the summary of details was given to NRC in response to a question.
21	24	Bechtel is responsible for the piles at the service water structure.

Service Water Structure - Pile Installation - 2

Page	Line	
21	25	Within Bechtel the Geotechnical Group would provide the Civil Group with the pile capacity and the Civil Group would make calculations to measure that those capacities aren't exceeded.
22	9	This work's in the process of being finalized.
22	22	Dhar thinks the pile capacity assessed by the Geotechnical Group is 280 tons.
22	25	Dhar thinks the remedy at the service water structure will require 16 piles.
23	9	Dr. Davisson recommended pile pipe - closed in pile pipe - filled with concrete.
23	13	Recommendation was received in 1979.
23	19	Davisson's information on factor of safety for dead load is 2.5 and for SSE or extreme wind, it's 1.5.
24	6	Dr. Afifi of the Geotechnical Group is responsible for coordinating with Davisson.
24	9	Davisson hasn't completed his Midland work for Bechtel.

Page	Line	
24	23	Davisson has yet to review the specs on completion of the design, and he'd review pile drawings.
25	5	He'll also review the spec for load bearing capacity.
26	4	Dhar's not aware of any other work Davisson is doing at Midland.
48	22	Dhar says the problem with the fill at the service water structure is that some of it under the north part isn't adequately compacted.
49	2	To his knowledge, there's no excess settlement at the service water structure.
49	5	The proposed remedy is to drive piles near the north end of the structure and construct corbels from the north wall of the structure and jack the pile against the corbel and lock it off at predetermined load.
49	16	The present scheme calls for 16 piles.
49	18	They haven't yet been ordered.
49	21	Bechtel would order them.

Page	Line	
49	23	They're 14 inch diameter.
50	2	The diameter is subject to change when calculations are complete.
50	12	Dhar defines "spring constant" as the deflection of the pile for a given load.
51	6	Geotech made a preliminary estimate of pile length.
51	11	They get from Dhar "the input of the top eleveation of the pile" and the location.
51	18	The load to be imposed is determined by a back-and-forth arrangement between the Geotech Group and Dhar's staff.
52	6	Dhar would first provide a rough estimate of the load to be imposed.
52	10	The Civil Group determined that the load was approximately 100 tons.
52	13	The Geotech Group then determines the approximate size of the pile - that would give Dhar's group the ultimate capacity of the pile and the spring constant.

Page	Line	
52	22	After receiving information on the size and capacity of the piles, Dhar's group determines jacking load and seismic analysis and determines loads on the pile to check for required safety factors.
53	3	He can't remember how far the piles went into the glacial till.
53	5	That will be determined based on actual driving records.
53	12	Dhar's not familiar with details of the Geotech Groups preliminary determinations for how far the piles will go into the glacial till.
53	14	He's not familiar with the details of how they do this.
53	17	They use boring records to make this determination.
54	1	They made this determination sometime in the summer or fall of 1979.
54	23	Dhar can't recall whether NRC received any information about estimates of how far the piles will be driven into the till.
54	25	Dhar thinks that piles will be driven into the till.

Page	Line	
55	20	Maximum vertical static loads on piles at the service water structure would be about 100 tons.
56	1	The final load could be less than that.
56	4	Maximum dynamic load on these piles would be about 180 tons.
56	11	Final figures will take another two months to compute.
56	20	Dhar hasn't arrived at any preliminary conclusions about the margin of safety for dynamic loads.
57	13	The Geotech Group has made long-term estimates of pile settlement, but Dhar doesn't know what these are.
57	20	Dhar defines his understanding of "acceptance criteria" - "For a structure to be acceptable I would consider that the calculated stresses due to the imposed load should be less than the allowable stresses."
59	10	Dhar defines "factor of safety" - "I would consider factor of safety to be the ultimate capacity of the pile divided by the load on the pile under a particular condition."

Page	Line	
59	23	The concept of stress, of allowable versus actual stress may not apply to the piles. "That is applicable to the structure."
61	3	"As a structural engineer, the acceptance criteria of the pile - the concept of the factor of safety could be used as an acceptance criteria of the pile."
61	11	Dhar hasn't allowed or "taken credit" for whether the piles under the service water structure will have lateral loads imposed.
61	22	He doesn't know whether lateral loads will be imposed.
62	6	Nor does he know whether lateral loads will be applied in the event of an earthquake.
63	15	"Bechtel did not consider lateral loads to be imposed on the pile."
63	19	They didn't consider lateral loads because "the piles are very flexible compared to the structure which is founded on original soil, and therefore does not carry any part of the lateral load."

Service Water Structure - Pile Installation - 8

Page	Line	
64	15	"We have concluded that the piles would not resist any lateral load."
65	5	The pile would be connected to the corbel with a shim.
67	18	Dhar thinks a SSE would impose lateral loads on the structure.
67	18	ASSE would have a small initial effect on the Corbel.
68	7	To Dhar's knowledge, no one at Bechtel has said that the piles would resist some lateral load.
68	17	Dhar's opinion is that the pile will not resist any lateral load.
69	18	Prior to discovery of the settlement problem at Midland, Bechtel performed a structural analysis for the service water structure.
70	2	This analysis is incomplete because it's based on spring constants done by Geotech which have yet to be verified.
70	12	"Based on the assumed properties, the second analysis has been completed."

Page	Line	
70	17	Dhar modifies this to say "Based on the stiffness we got from Geotech, it has been completed."
70	19	He doesn't know the details of how this was completed.
77	20	Bechtel plans to use longitudinal bolts at the service water structure.
77	23	He doesn't know how long they are.
78	8	Dhar doesn't see how these bolts will be subject to bending.
78	12	They've performed no analysis of possible bending stress on the bolts.
78	17	Dhar says that one other alternative was considered, a variation on the pile scheme: underpinning, putting the pile under the building.
78	22	They did not then consider the option of a foundation under the north section supported by the tail other than piles.
79	2	They have considered this option since.

Service Water Structure - Pile Installation - 10

Page	Line	
79	11	This suggestion came from Gordon Tuveson of Bechtel's Civil Group.
80	1	For the record, Paton notes that over the lunch break, Dhar provided Paton with a stack of documents 6 inches high that were on his desk and in his files, all of which pertain to Midland.
80	25	Mr. Tuveson's suggestion was to investigate the origin of the ground surface in relation to the cantilevered part of the building and what it would take "to extend the foundation of that building into the original sun."
81	8	This was suggested as a contingency plan.
81	15	Dhar has no plans for preservice inspection of the bolts to be used for the service water structure.
81	18	There are no plans for inservice inspection of the bolts during the life of the plant.
82	6	Bechtel's in the process of calculating if the piles underpinning the service water structure will provide adequate vertical support after an operating basis earthquake.

Page	Line	
82	15	These calculations were begun in the spring of 1979.
82	20	The calculations are taking a year and one-half, which is longer than usual.
83	8	This would be true for the SSE also.
83	20	Dhar defines pretensioning: stretching a bolt to a predetermined value before putting it in service by a predetermined force.
84	13	Dhar is sure that concrete at the interface between the corbels and the service water pump structure will resist bearing pressures developed from pretensioning bolts.
102	1	Staff Exhibit No. 2, a one-page scheme to fix service water structure.
102	4	He doesn't recall where he got it.
102	10	The scheme shows no space between the top of the pile and the bottom of the corbel.
102	13	Any such space would be occupied by a shim.

Structural Gaps and Voids - 1

Page	Line	
158	7	Dhar's not aware of any gaps in foundations of Category 1 structures at Midland.
157	10	He is aware of gaps that have been grouted.
158	17	He's not aware of voids in the foundations of Category 1 structures that have been grouted.
158	22	He is aware of voids under foundations that have not been grouted.
158	25	Voids are not grouted but gaps have been.
159	2	These gaps are located under DGB foundation.
159	4	The grouting was done in 1980.
159	9	It was done with an epoxy grout.
159	16	The voids are under the control tower.
159	18	He recalls there was a void under the service water slab, which is sitting on backfilled sod.

Page	Line	
159	21	There is a plan to grout the void under the control tower.
159	25	He doesn't know whether treatment of the gaps have been reported to NRC.
160	3	Bechtel has not completed sealing any cracks in any Category 1 structures.
160	6	Nor have they started sealing cracks in Category 1 structures.
160	9	There are no treatments other than sealing that can be used for cracks at Category 1 structures.
160	17	Epoxy grout or regular grout would be used to seal the cracks.

Deposition

by

Charles H. Gould

January 8, 1981

Contents

Caisson Testing - 1

Page	Line	
96	21	Item 5-A, p. 2: Concerning load testing, one caisson under each electrical penetration area at 2 times capacity would mean for dead load, live load, and earthquake load.
97	3	Given these loads, design capacity is represented at 4,000 kips; that would be 500 lbs each for 8 caissons. If the caisson were a design load of 500 kips, it would be tested at 1,000 kips.
97	14	Item 5-B says "Load test each caisson individually at 1.5 times design capacity." Design capacity here also refers to dead, live, and earthquake loads.
97	19	One specifies 2 times design capacity and the other 1½ times capacity because "each caisson or each jack pile or each underpinned member is preloaded and pretested before it is put into service." This isn't done with driving piles. There, you test one and if it passes, you drive the others into the same resistance. In underpinning, each pile is load-tested because the structure pre-exists; so if the foundation member weren't preloaded, the building settling on the new foundation member could induce settlement in the structure and crack it.

Page	Line	
99	2	The factor of 2 came from Peck and Davisson who thought they'd like to see a long term load test to look at soil and pile behavior and the test in Section A is the long-term load test that we normally associate with driver pilings and to check for creep.
99	24	He selects the first caisson installed to test by a factor of 2 so they won't have installed too many should a problem arise.
100	16	Item 5-C, p.2.: The electrical penetration area foundation slab would withstand the pressure from the test specified in 5-C.
100	17	This was determined by Mr. Dhar.
100	18	Dr. Peck recommended 1.5 instead of Dhar's one times design capacity. This discrepancy was an oral mistake, which was corrected at the hearing in Dr. Peck's presence.
101	2	Dr. Peck's present opinion is one times design pressure.
102	7	Gould was told that the foundation slab can withstand the pressure, imposed by the test.
103	10	Gould says it's extremely unusual to do a group load test.

Page	Line	
103	14	To test them all to at least 1.5, Gould concludes that to test them as a group to 1 is very conservative.
104	5	Gould won't predict what group behavior would be if each caisson was tested to 1.5 times design capacity.
104	25	Gould argues that to refer to an individual caisson "failing" a load test is inappropriate. He calls it "unsafe settlement."
105	9	That's because "In the trade one inch-gross one-inch movement at design load is frequently defined as failure. We're not talking about any kind of such movements."
105	14	Gould quotes extensively from Specification 7220-C-95 about loading and the EST.
105	19	A satisfactory EST is defined as causing caisson movement of less than 1/10 of an inch in a 5-minute period under a load equal to 1.0 times design load.
105	25	A full Load Test (FLT) is defined as causing caisson movement of less than 0.05 inches in one-hour period under a load 1.5 times design load.
106	10	Extensometers are used to measure movement.

Page	Line	
106	13	After installation of one group of caissons and before another group's installed, one caisson from the original group in tested. If it doesn't pass, another is chosen at randon and this continues until all caissons pass.
107	4	Criteria for these tests was originally developed on the Washington Subway System.
107	12	He's never seen ASTM criteria for jack pilings or jack caissons.
107	20	Afifi's made a longterm prediction for caisson settlement.
107	25	The conclusions were well within the elastic behavior characteristics of structure.
108	6	Predictions were made in August 1980.

Control Tower Aux. Bldg. - 1

Page	Line	
108	20	If there were no soil settlement problem in the area of the Aux. Bldg., a good bit of this load would be on the control tower.
108	23	Even after this remedy, the bulk of the 4,000 kip load will be on the control tower.
110	7	Gould's not sure whether a calculation was made to determine if the control tower has the capacity to carry 4,000 kips.
110	15	"Functioning as a proposed cantilever, that analysis had been made."
110	18	Made by Bemil Dhar.

Design - Electrical Penetration Area - 1

Page	Line	
8	17	He met with Bechtel in March/April 1979 in Ann Arbor.
9	1	At meeting, potential problem with wing area of the Aux. Bldg. was discussed; solutions discussed - underpinning, grouting, tunneling.
9	17	He's referring to electrical penetration area.
9	23	One scheme, discussed later, involved "sky hook" connected to turbine building or containment structure.
10	2	Tunneling scheme would have involved removing all soil from under the electrical penetration area and replacing it.
10	9	He doesn't remember a Dr. Davisson at this meeting.
12	6	Gould recommended against tunneling because of "ground loss" problem.
12	8	"Ground loss" concern was that ground could be lost outside of the tunnel that could cause or induce settlement in the structure and cause damage to the electrical penetration area adjacent structures.
12	20	He also recommended against grouting because "it's nondeterministic."

Design - Electrical Penetration Area - 2

Page	Line	
13	7	Costs were not considered because remedial measures were required
16	8	Consumers eventually pursued underpinning to solve the problem.
16	12	No cost estimates were made of this option by Gould
16	15	Someone at Bechtel did make those estimates, though, of underpinning solution.
22	11	At Ann Arbor meeting with Bechtel in March 1979, they said that problems at Aux. Bldg. electrical penetration area involved low blow soil samples under the bldg.
22	14	This information was not codified; it was unanalyzeable.
24	14	Gould vaguely recalls that the Aux. Bldg. problem had to do with compaction tests.
25	8	He could speculate but right now he doesn't know what caused the Aux Bldg. problem.
25	11	He says that to perform work he was asked to perform, he doesn't have to know what caused the problem provided that a positive and not a passive solution is used.
27	19	Gould was asked to advise Bechtel about a method for underpinning the Aux. Bldg.

Design - Electrical Penetration Area - 3

Page	Line	
27	27	This was necessary because the soil underlying the building was a questionable settlement characteristics.
28	1	He doesn't know why it had these settlemental characteristics.
28	4	He's not read any other depositions for this case.
28	6	He has discussed his work with Dr. Davisson; he can't recall how often.
28	10	He first met Davisson at the job site in April 1979.
28	14	He was a Bechtel consultant at that time.
28	17	He last talked with him in July 1980.
28	20	He's not provided Bechtel with any information about the project since September 1, 1980.
28	23	He and Davisson did discuss Gould's recommendations.
29	11	Davisson expressed no objections to Gould's recommendations.
29	19	Questionable settlement also characterizes that DGB, the service water structure, and some tanks.
30	2	The administration building too.

Design - Electrical Penetration Area - 4

Page	Line	
30	13	In addition to soil of questionable settlement characteristics, the problem also involved earth with manmade obstructions, water, contiguous structures, and two Category I structures: the DGB and the Aux. Bldg.
30	24	Because of two Category I structures, the quality of the fix must be perfect.
31	9	Gould says fill under electrical penetration area ought to be called heterogenous.
31	12	It's not called random fill because sampling shows placement sequence.
32	8	Bechtel and Consumers determined nature of fill by soil sampling.
34	17	Gould explains process of elimination by which he assesses what's the best solution for a given underpinning problem.
35	8	"In my discussions with Bechtel, we come to the conclusion that the fix had to be positive, subject to verification and instructions in total."
35	20	At least one of the other two remedies was rejected because he couldn't be sure about how much of a fix he had to make.
36	4	Two fixes were under consideration at this point: structured and underpinning.

Design - Electrical Penetration Area - 5

Page	Line	
36	12	He claims no expertise in the structural area.
36	20	Structural fix via cantilever action is being examined concurrently .
37	4	Possible underpinning solutions are still being examined.
37	7	The next consideration involves a perfect final fix for the Aux. Bldg. with no damage.
38	18	Underpinning work with Category I structures is specialized work. Only two firms in U.S. could do it: Mergentine and Spencer and White and Prentis.
39	8	The next step involves mass replacement, i.e., replace existing material under Aux. Bldg. with something like concrete or lean concrete.
39	15	The final concept involves the end support method and mass replacement under the valve pit.
39	20	"End supports" means caissons.
39	21	Paton shows him letter of August 3, 1979 by Gould to Afifi' with 3 page attachment.
40	4	Gould says it's his letter.
40	14	This letter contains a recommendation Gould made to Bechtel for a proposed remedy to Aux. Bldg.

Design - Electrical Penetration Area - 6

Page	Line	
40	21	His recommendation was to penetrate the base of the electrical penetration room and install caissons from that location. This was not feasible structurally because it would have destroyed the torsion box.
41	9	To make this recommendation, he had to know if the fill material had water in it and, if so, how to get it out. The found that the fill had manmade objects in it. He also had to know what the blow count of the material was and its behavioristic characteristics.
41	18	By behavioristic characteristics, Gould's referring to the approach to soil mechanics based on observed behavior of the soil - a scheme popularized by Dr. Terzaghi.
42	1	Glacial till is 30 ft below elevation of bottom of the structure, which was considered suitable for founding the caissons.
42	10	The glacial till under electrical penetration is sloped because it was all by man, not nature.
42	15	It was cut for the Tendon Gallery.
42	21	The caissons will be jacked into the till and cleaned to a minimum penetration into the till.
42	24	Gould's report indicates 5 foot penetration into till.

Design - Electrical Penetration Area - 7

Page	Line	
43	10	The slope of the till, as it affects how the caisson will penetrate the till, would be handled as a field problem.
43	19	There are cost considerations for how far caissons are jacked into the till.
44	6	The field tests for caisson penetration of the till would involve an add-on price per foot and preparation of "the bottom of these caissons for inspections, at which time I would have entered the caissons " and kept records of these depths.
45	8	As to whether each caisson would be at the same level, the specs. permit variations; those close together would go to a common elevation or flat plain; those spread out would vary in founding elevation.
46	1	In order to compare bids of the two firms bidding on the job, the 5-foot penetration into the till was used. When we see these proposals to Bechtel we'll know if we have a tip elevation variation problem.
46	21	If they're all close together, they might be in an area where there's no slope to the till.

Design - Electrical Penetration Area - 8

Page	Line	
47	17	Gould testified that he presented the content of this report to NRC on July 18, 1979
47	21	He gave NRC no more information about his proposed remedial actions after July 18, 1979 or before December 6, 1979.
47	25	He had no ideal of whether any information conveyed to Bechtel was conveyed to NRC before December 1979.
48	5	He only found out on January 7, 1981 that NRC had issued an order modifying construction permits on December 6, 1979.
48	9	Gould didn't know from any source about the December 6, 1979 order until the day before his testimony.
48	9	Coincidentally, Gould had been attending a meeting in Ann Arbor on December 6; the meeting broke off abruptly half way through.
48	25	In retrospect, he speculates that the meeting broke up because of the order, but he didn't know about the order at the time.
49	7	Prior to January 7, 1981 Gould had no knowledge that NRC ordered Consumers to terminate any soils work at Midland.
50	13	Gould considers himself an expert in construction of underpinning.
51	10	Gould came up with conceptual plans for the caissons at Midland

Design - Electrical Penetration Area - 9

Page	Line	
51	14	The detailed design would they be left to Bechtel's contractor within the guidelines in the specifications.
51	25	If Mergentine's bid had been accepted, he would have provided those techniques (caissons) within the necessary constaints.
53	8	Hansen Engineering, as consultant to Mergentine, had done the design for the caisson.
53	18	Bechtel's specs required that all calculations and shop drawings be completed and submitted prior to start of construction.
53	23	This isn't normally done without a contract.
54	4	Mergentine doesn't have a contract with Bechtel
54	10	Hansen did and was paid for the work because they've been a consultant to Mergentine since Mergentine's been in business.
55	10	Mergentine submitted its proposal to Bechtel in September 1979.
55	12	It was for design and construction.
55	17	The proposal included drawings
55	20	It didn't include calculations but indicated the sequence of operations.
55	24	Calculations weren't included because they weren't required in the invitation.

Page	Line	
56	17	Gould was asked to run a school for inspectors and to supervise installation of the caissons.
56	25	This function was all in the context of his being hired as a consultant
		Gould prepared the 3-page document, "Remedial Measures for Electrical Penetration Areas and Isolation Valve Pits," on August 3, 1979.
57	14	When he prepared this, he didn't know about the design information prepared by Hansen.
57	17	Mergentine submitted a proposal to Bechtel in September 1979 that included design information from Hansen.
58	1	Gould says he did not have Hansen's information prior to submitting his own 3-page report.
59	9	Gould recommended that the caissons be jacked into the till a minimum of 5 ft to be sure they passed the frost line.
59	18	He wanted them below the frost line so they'd rest on undisturbed till.
60	16	He was going to load test these caissons.
61	3	The 5 foot figure was established for purposes of evaluating the bid. "It just insures me that each bidder has included the excavation of a 5-foot till."

Design - Electrical Penetration Area -11

Page	Line	
62	3	The caissons proposed could be belled or straight sided.
62	13	When Gould refers to "we" or "I" in the testimony, he's referring to himself as a Bechtel consultant and not to himself as a Mergentine employee.
62	24	He doesn't know if Bechtel ever submitted to NRC the design information they obtained from Mergentine who got it from Hansen.
63	3	The bottom elevation for the caissons depends on whether they're straight-sided or belled.
63	17	For straight-sided, the minimum was 5 ft below the bottom elevation of the Tendon Gallery
63	25	If visual examination showed that elevation as satisfactory, that would be the founding elevation.
64	2	The North/South gravity lines would be 15 ft into the till at that point.
64	19	The description of the two balancing caissons is in Gould's attachment to the August 3, 1979 remedial measure.
70	6	The maximum load to be carried ty the caissons would be approx. 4,000 kips. The controlling value is a moment of 325,00 foot kips.
70	11	Bechtel's engineers made the calculation - it was very conservative.

Page	Line	
70	29	4,000 kips is for the total maximum load.
71	13	Gould says he verified the 4,000 kip figure because of his knowledge of the weight of the building 8,300 kips.
72	2	He's not certain that this figure includes seismic loading.
72	5	There will be no horizontal loads imposed on the caissons - they'll go into the concrete mass in the valve pit.
72	21	Dhar's group has made the analysis of horizontal load.
79	3	If there were a problem of how to hook the needle beams to the isolation valve pit, they'd hook it to the walls and there'd be no problem.
79	18	Regarding basis on which low bidder was to be chosen, basis for measure and payment for Aux. Bldg; "they were to be paid a lump-sum for that."
80	10	Gould further characterizes the IFB: "So I'm saying this penetration, the magic of it, there is no magic: that you simply have bidded on a lump-sum, hard-money basis to a certain depth and then based on an engineering determination, after evaluation of their specific method, we determine the founding elevation and you're proposed a vehicle for payment, either increasing or decreasing the lump-sum payment."

Design - Electrical Penetration Area -13

Page	Line	
81	19	Gould wouldn't characterize his 3-page attachment to the August 3, 1979 letter as a final design for "Remedial Measures for Electrical Penetration Areas and Isolation Valve Pits."
82	18	The contractor would there supply a detailed design.
83	6	Bechtel has made changes to the concepts in the attachment with his knowledge.
83	12	Dr. Davisson's expertise is in driven jack piling (as opposed to jack piling).
84	11	Dr. Davisson's function at Midland was to do with fixed at the service water structure involving driven piling.
84	18	Dr. Davisson's responsibilities have to do with soil mechanics.
84	25	Gould has consulted him on Aux. Bldg. problems.
85	3	Davisson did comment on Gould's proposed fix for the Aux. Bldg. in a meeting in Denver.
85	13	No one at the meeting objected to Gould's fix.
85	19	Gould has discussed bearing capacity and factors of safety with Davisson.
85	22	They were trying to determine zone of influence for bearing capacity of caissons to define bearing strata.

Page	Line	
86	18	He got his values for bearing capacity and how they fit factors of safety from Peck and Hendron.
87	1	The value selected by Hendron, Peck, Davission, and Gould was chosen because it would be safe and produce reasonable results.
87	8	Values are cited from p.3 of enclosure to August 3, 1979 Bechtel letter: "Design of caisson is based on very conservative trip pressure at 25 kips per foot or straight-sided caissons." "The bearing strata pressure is limited to 20 KSF, or straight-sided caissons." "If bottom of jacked caissons are belled in the glacial till, design tip pressure is reduced to 17.7 KSF."
88	9	The conservative 25 kips provides a trip load intensity of approximately 1/10th that normally associated with jack piling. The degree of conservatism was used because "we wanted large-diameter caissons so that the miners could deal quickly and effectively with the conrete obstructions."
88	21	These caissons would be large enough to let a man be able to work at its tip. Inherent in such a tip is low bearing intensity.
89	17	These large diameter caissons would allow for slow settlement to match the control tower settlement.

Design - Electrical Penetration Area - 15

Page	Line	
89	20	The purpose was to avoid differential settlement.
90	6	As far as Gould knows, Davisson is principally concerned with the driven piles in the service water structure.
90	13	Exhibit No. 2, a sketch showing relationship of the drift to the Turbine Bldg., the feed water isolation valve pit, and the containment structure.
90	23	Gould has sketched plan view.
91	2	Sketch shows planned location of the access shaft to be installed from the surface to depth of 7 ft. below bottom of isolation valve pit.
92	8	Drawing shows earth support in the drift.
93	12	Grouted zones will be grouted with cement or chemical materials if it won't take cement.
93	17	They also add a "horse collar" earth brace too. "We put in one at the surface where we're at and one 4-foot back. And then behind that we tuck in wood lagging, which is usually 3 inches thick and 12 inches wide..." any irregular surfaces are tightly backfilled.
94	6	"Once an excavation is started, it must be worked continuously and without cessation until the lagging is in place and the lateral ground support restored."

Design - Electrical Penetration Area - 16

Page	Line	
95	6	The grouting precedes the excavation from where the access shaft passes below the bottom of the isolation valve pit. The grouting tubes are inserted horizontally to 7 ft beyond furthest extent of anticipated excavation.
95	16	The height of each section of the jacked caissons would be up to the contractor but could not exceed 5½ feet.
95	20	That limit has to do with the height of the drift and the lengths of the jack.
110	25	The finished project cost of Gould's proposed remedy of August 1979 would be $5,000,000.
111	3	These costs include labor, material, overhead, etc.
111	17	This would entail sizeable Bechtel costs.
111	25	He can't estimate what cost to Bechtel would be.
112	10	As long as Mergentine and Spencer-White are concerned, there's no need to fear they'll compromise on the qualifications and experience of the workers involved.
113	8	In Gould's opinion, he wouldn't entrust the job to anybody but Mergentine or Spencer-White.
114	1	Gould feels that once the initial two caissons are installed, the job will be "a piece of cake."

Design - Electrical Penetration Area - 17

Page	Line	
115	2	Care must be exercised with these two caissons because of "the control ground loss as the caissons are advanced through the mixed fill."
115	11	When the fill's removed from under the turbine building, loss of ground or foundation will be prevented by jack pilings and/or jack caissons, at the contractor's option.
116	2	If jack pilings were used, they'd be installed concurrently with the caissons under the Aux. Bldg. He made it clear to the contractors in the December 6 meeting that the caissons under the Aux. Bldg. had priority.
116	18	These caissons had priority because it's for a Category I structure
117	4	These caissons wouldn't be installed before the drift excavation is widened.
117	17	"All the jack piling or jacked caissons under the Turbine Bldg. will be installed prior to excavating the mass excavation under the isolation valve pit."

Design - Electrical Penetration Area - 18

Page	Line	
117	24	Question about whether or not the drift excavation will be widened beyond its original elements: Gould says in the Mergentine plan, the drift down the Turbine Bldg. wall from the "access shaft in a single drift catching the first caisson that they encountered along the wall line and then establishing a separate drift for each caisson in sequence, starting from the access shaft towards the center of the building."
118		Mr. Farnell asks what Gould means by a "perfect fix" for the Aux. Bldg. Gould says it means Category I quality.
		Mr. Paton asks how Gould learned about a public meeting on proposed remedial fixes.
119	2	After the December 6, 1979 meeting Mergentine assumed he'd be hearing about the award and so called Gould (even though he'd promised not to talk to Gould during this period). Gould called Afifi and was told about public hearings; Gould subsequently called Mergentive back and told him that pubic meetings were going to be held.

Dewatering Aux. Bldg. - 1

Page	Line	
73	3	Gould was current till June 1980 on status of dewatering in area of the Aux. Bldg.
73	15	One of the last tasks he did for Bechtel before going to work for Megentine was on the transfer mechanics for the horizontal seismic load.
74	19	Installation of dewatering germane to the Aux. Bldg. began in the fall of 1979.
74	23	It was temporary.
75	1	The dewatering system "was overdone, the control they were expecting of the system and the maximum number of parts per mil that they could pump out of the ground." There were technical problems getting the system operational.
75	14	They "took a particle-size quantity, parts per mil that's normally applied to long-term pumping and applied it to short-term pumping." The system was "overdone."
76	1	Consequently, in June they were having trouble getting the dewatering system to work.
76	9	To his knowledge, no water had been removed.
76	15	These remarks apply strictly to the Aux. Bldg.

Employment History

Page	Line	
4	20	Gould's resume marked Exhibit No. 1.
5	8	He hasn't discussed with Bechtel that he's testifying in the Midland proceeding.
5	15	Gould first became aware of need for remedial work at Midland Aux Bldg. in March 1979.
5	19	Someone from Bechtel contacted him, but he can't remember who.
5	25	Contact was made to discuss underpinning.
6	10	A mutual friend, Ken Ware, made the initial contact by phone.
6	16	He had no knowledge of problems at the site prior to that call.
6	21	Gould previously worked at Robert Ginna NPP
6	24	It is the only other nuclear facility he's worked at.
7	3	At Ginna, he worked for secondary subcontractor in installation of water intake structure.
7	16	He wasn't conscious of standards in his work at Ginna.
7	21	He defines a Category I structure.
10	14	He wasn't connected with Mergentine at this point - Bechtel meeting in Ann Arbor, March/April 1979.
10	17	He's now being retained by Bechtel in this proceeding.

Page	Line	
11	4	His contract with Bechtel is officially terminated because of his job at Mergentine.
11	7	Bechtel's not now talking to Mergentine about contracting for work at the site.
11	11	Mergentine hopes to bid on remedial work at Midland.
11	15	His work is primarily at Aux. Bldg.
11	21	He has had some work at the service water structure, but most has been at Aux. Bldg.
11	25	90% Aux. to 10% service water.
16	21	Gould saw cost estimates for underpinning during the budget stage of the project. After that Mergentine came into the picture and Gould aksed that he not be involved in the commercial part of projects - after that he was privy to no cost information.
17	6	Mergentine has submitted a bid on the underpinning work.
17	11	Bechtel conrolled that bid.
17	24	This happend in October 1979.
17	25	After it was cancelled, Chas. Mergentine wrote to Bechtel saying he wanted back the money he'd invested in the design.

Page	Line	
18	14	The bid was accepted "but it was never consummated" rather than being rejected.
18	24	The bid was approved but a contract wasn't made.
19	12	Mergentine hopes to submit more bids on the project.
19	17	Gould opines that no contract resulted from the original bid because NRC had stopped it.
20	1	Gould speculates that Mergentine may ultimately get the contract.
20	14	Gould went to work for Mergentine in September 1980.
20	23	Bechtel hired Gould as a consultant a month or two after they sent the contract out.
21	1	The Bechtel job ended on August 31, 1980.
21	7	Mergintine submitted the bid to Bechtel in Sept. or Oct. of 1979.
22	19	Gould was consultant to Bechtel at Midland from March 1979 - August 1980.
23	1	He estimates he spent 200 manhours on the project (± 50).

Tech Specs-Electrical Penetration Area - 1

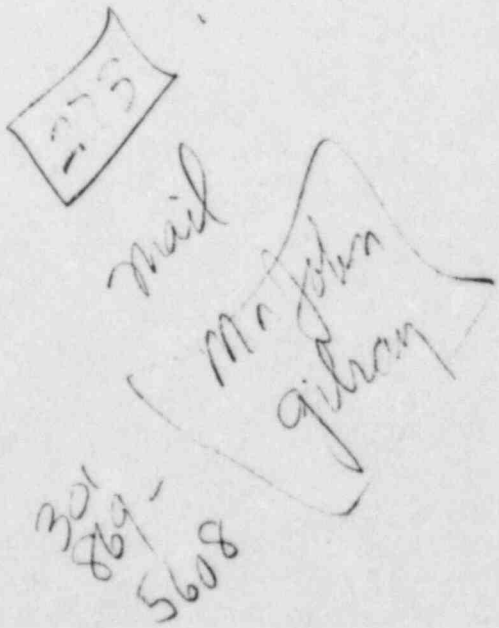
Page	Line	
66	4	Gould does plan to monitor disturbances to existing structures and construction operations while remedial measures are used to replace suspect soil bearing capacity with structural elements.
67	1	Gould had detailed specs on how to monitor these disturbances but changed them to a general specification, making the contractor responsible in Spec. 7220-C-95(Q), Rev. 0, Sec. 1.1.3 K.
67	7	This information's from Exhibit D, Tech Specs, August 1979.
67	14	Gould didn't submit this document to Bechtel. He'd draft sections, but "detailed specification writing is not my bag."
68	1	Regarding the nature of that spec, (Section 4.2) says that as a minimum "The subcontractor shall submit the following procedures in detail, including hold points and specification points) to the contractor's satisfaction."
68	10	The subcontractor referred to would be either Mergentine or Spencer.
105	14	Gould quotes extensively from Specification 7220-C-95 about loading and the EST.

Summary of Deposition

from

Alfred J. Hendron

January 27 & 28, 1981



Contents

Auxiliary Building - 1

Page	Line	
46	16	Hendron has reviewed lab results and fill data for borings under auxiliary building.
46	23	He's also attended some discussions and reviews on auxiliary building.

Bearing Capacity - 1

Page	Line	
209	14	Hendron computed bearing capacity of the DGB.
209	25	He did compute a safety factor for the DGB.
210	7	Figures arrived at by standard bearing capacity equation.
210	15	Triaxial samples from different borings to set parameters for bearing capacity.
211	3	Samples were taken from places other than under the building footing.
211	9	He did look at soil types and characteristics that were present beneath footings of DGB; and at soil descriptions and densities and water content.
211	13	Strength parameter used to compute bearing capacity: for states bearing capacity angular resistance on order of 29 or 30°, "but if you got a particular number it seems like to me like the factor for safety was up around 6, 7, or 8."
211	25	Samples for which these parameters were derived came from borings outside of the building.
212	12	The characteristics of the soil under the DGB footings were established from samples in the test pit.
216	7	Hendron can't cite a written procedure for the method used to compute seismic bearing capacity in clay soils.
216	20	He may publish his method when hearing is over.
216	22	Exhibit No. 32 on which there's a note written to Prof. Hendron from P.J. Chen.

Cracking DGB - 1

Page	Line	
50	13	Hendron didn't speculate about magnitude of cracks beyond which structural integrity of building might be compromised prior to surcharging.
52	12	Hendron can't say whether surcharging widened or narrowed an observable crack in side of DGB.
52	19	Significant change in crack had to do with fact that whole end of DGB was held up by a duct bank later severed.
53	4	Hendron's comments confined to structural cracks at DGB.
53	6	This crack was in northeast corner of east wall.
53	10	Surcharging has not caused an increase in the number of cracks says Hendron.
70	11	Cracking of the DGB wouldn't necessarily impair the building from withstanding a safe shutdown earthquake.
70	16	If the building were at the point of collapse, it would withstand such an earthquake.
97	14	NRC Exhibit No. 6 "Crack Mapping Figure 40, Rev. 5 from Consumer's 50.54(f) responses to NRC. Hendron's not seen it before.
97	21	Sometimes by its angle you can tell whether it's a structural or shrinkage crack.
98	21	Hendron says he'd not necessarily know about the directional change of a crack on a crack map unless he knew where the concentrated loads were applied.
98	1	A 45° angle crack would suggest a structural crack.
99	7	Jones circled cracks on Exhibit No. 6: Hendron can't say whether these are structural cracks; more evidence needed.
99	14	Nor can he tell by width of crack whether or not it's structural.
99	21	He's seen shrinkage cracks 28 miles wide in reinforced structures.
100	1	Hendron might or might not recommend surcharging the DGB if he knew beforehand it had structural cracks. He'd consult with other engineers.

Page	Line	
100	12	Hendron was aware of concentrated loads from duct banks on the east side of the DGB.
100	19	Prior to surcharge, Hendron was aware that east wall of DGB had a crack.
100	23	He doesn't know whether Bechtel looked for further cracks in DGB before surcharging.
101	7	He remembers Bechtel talking about inspecting the building and that they didn't find any of significance.
101	19	Hendron says Bechtel people felt cracks in DGB were capable of withstanding the surcharge whatever deformations occurred.
102	2	He can't remember who told him this.
185	1	Hendron can't recall any changes in crack width because of surcharging.
185	12	Hendron's seen worse building cracks than at Midland because of compacted fill, namely at the Carrfork Project.
208	18	Hendron doesn't believe that cracking in the DGB cracking would inhibit it from withstanding static loads.
208	22	Ditto seismic loads.

Dewatering System - 1

Page	Line	
60	11	He did have input into recommending dewatering system at site to preclude liquifaction problems.
60	15	He's not reviewed dewatering plans at site.

DGB Differential Settlement - 1

Page	Line	
37	7	Hendron's observed differential settlement at DGB.
37	10	Hendron's reviewed test results of soils beneath DGB.
41	10-16	Hendron asked to comment on quality of soil construction at site and say that when a fill has settled 2 to 4 inches under its own weight, "something went wrong and I cannot say whose fault or what it might have been, but, there were some bad fills there."
42	11	Hendron says there's been some differential settlement at administration building as well as DGB.
42	19	Hendron thinks differential settlement under DGB occurred because of higher percentage of sand under north end of building.
43	23	Jones asks if it's normal engineering practice to alleviate possibility of differential settlement if loose sand is discovered prior to building construction.
44	1-4	Hendron answers: "There may not be any changes necessary if compaction in both of them is significant enough. It's good enough such as you don't develop any large differential or total settlements in either, in either areas."
45	1	Hendron knows of no overall stability problems at the Midland site.
45 46	23 1	Hendron worked "probably 30 days a year" at Midland for a period of 2-1/2 years.
46	13	Hendron has reviewed in detail lab tests and fill data for DGB.
52	1	The structural people did not set a specific value for an amount of settlement beyond which structure of piping would be endangered.
58	24	Hendron's not aware of placement of lean concrete in the fill at Midland.
59	4	Hendron can't answer whether lean concrete in fill would cause differential settlement because he'd need information about the soil geometry.
59	9	Indiscriminate placement of lean concrete under structures would be grounds for checking for possible future differential settlement.
59	16	Hendron wouldn't say it's preferable not to put lean concrete in fills under a building.
59	23	Hendron's aware of brine removal at site.

Page	Line	
60	4	He doesn't know of any direct relationship between brine removal and settlement at site.
199	25	Rebound will begin only when there's a reduction in effective stress or PSAR.
201	5	Hendron assumes that settlement has occurred somewhere at the site as a result of the temporary dewatering operation.
201	17	Dewatering hasn't yet caused settlement in the DGB.
201	25	Dewatering could cause some settlement of DGB.
202	7	Hendron won't comment on whether he believes it's still necessary for DGB foundation soils to meet PSAR compaction requirements.
202	11	"Technically, there is no reason necessarily why they would have to meet the compaction requirements."
202	17	Hendron's not contending that the density at the DGB now would be equal to or greater than the density expected in ASTM 15-50.57(d) method D.
203	2	Preloading has not necessarily established the same strengths in the soil as would have been achieved via ASTM.
203	17	Hendron can't say whether it's necessary that the PSAR criteria for sheer strength be met to assure the plant will operate safely. It's possible that the specs would give strength 2 to 3 times higher than necessary for safety.
204	13	"In my judgment the foundation in the loadings where they set now have an adequate factor safety for the bearing capacity."
204	21	Hendron's basing his opinion on "a factor safety in about three."
205	2	Currently, the soil at Midland would exhibit a factor safety greater than three.
205	5	His conclusion's based on basis of tests and on basis of density to those samples as compared to average densities documented under the building.

Exploration & Testing DGB - 1

Page	Line	
47	4	Hendron expects to be involved in readings of borros anchors at DGB and other things that may come up.
47	22	Hendron defines "observational method": it's when you use observations in field to learn behavior of soil structures.
48	2	This method was used for surcharging of DGB.
48	9	This method used at DGB by installation of survey points and debanker points to monitor compression of DGB soils. Purpose was to keep track of those versus time Hendron says they didn't devise.
48	21	Advance alternative means for problems that may develop when structure's being observed, but that they mainly had in mind preloading the structure, etc.
143	10	NRC Exhibit No. 23, Fig. 27-1, "Typical Laboratory Time-Settlement Behavior Under Constant Pressure."
144	3	This systematic drawing is based on many one-dimensional lab consolidation tests, says Hendron.
144	12	Jones cites ~~Zaile~~ Kane Exhibit No. 8, "Discussion of Applicant's Position on Need for Additional Information for Midland Units 1 and 2," page 3, Fig. 3.
146	17	This figure isn't the best example to tell whether the settlement marker was in secondary consolidation.
148	4	Hendron disputes point that its contradictory to say lab consolidation tests are unreliable to predict future settlements but then rely on such tests to plot typical curves to compare with field observations for determining secondary consolidation.
148	21	He says field measurements have already been compared to a typical curve and that's why he's picking the secondary slopes off the field curve.
149	7	Hendron says it's normal practice to wait until the rate of deformation under a given loading increment becomes very small when running consolidation tests.

Fuel Oil Tanks DGB - 1

Page	Line	
60	21	He can't remember location of fuel oil tanks for DGB.
60	25	He doesn't remember checking soils under fuel oil tanks.

Hendron's Background & Experience - 1

Page	Line	
4	2	Jones enters Hendron's resume as NRC Exhibit #1.
4	11	Hendron worked for U.S. Corps of Engineers from 1963 - 1965.
4	16	Hendron didn't do surcharge work with the Corps.
4	21ff	Hendron's projects with Corps: wave propagation in soils through sand, blast generators, and experiments on soil structure and interaction.
5	7	Hendron did no work with Shannon and Wilson on surcharging.
5		Hendron's previous surcharging experience: Carrfork West, Salt Lake City by Bechtel for the Anaconda Project.
6	15	Record of Carrfork Project in long technical letters to Anaconda by Hendron.
6	19	Carrfork Project involved ore-processing structures/buildings.
6	22	These structures contained flotation tanks.
7	1	The structure was completed, other than for flotation tanks, prior to surcharge removal.
7	19	Hendron surcharged several structures for the Anacondamoly Project before the buildings were built.
7	25	Prior to surcharging, Hendron took no borings at Carrfork Project.
8	4	Hendron made no predictions about expected settlement at Carrfork prior to surcharge.
8	7	There were borings prior to surcharging at Anacondamoly.
8	15	Predictions were made at Anacondamoly on basis of test fill.
8	20	Borings weren't taken after surcharge removal because settlement had stopped and rebounding occurred.
9	7	Hendron used time settlement curve at Anacondamoly to determine expected settlement.
9	12	This curve came fairly close to actual settlement.
9	24	Hendron said there was concern at Carrfork over effects of settlement on structural integrity of the completed portions of the building.

Page	Line	
10	3	This concern alleviated by the sequence in which the preload was placed around the building.
10	9	Hendron says no threshold for differential settlement was necessary to protect structural integrity of building.
10	14	No computations on building stresses were done prior to surcharge.
10	19	The soil at Carrfork was homogenous horizontally but not vertically. The layers corresponded to storm and mud flow alluvial deposition down the valley.
11	7	Concern at Carrfork for differential settlement with that kind of hydrogenaety was in getting settlements finished before more sensitive parts of structure and flotation tanks were built.
11	15	Carrfork differential settlement was on order of 5 inches.
11	18	5 inches isn't significant because it doesn't cause any new cracks in the building.
11	23	These are Hendron's only experience with surcharging prior to Midland.
12	2	In neither of these projects was there a concern for bearing capacity of the building.
12	9	Hendron's had no experience either with placing caissons or piles under a substantially completed building.
13	8	Hendron's involvement with Midland began in the fall of 1978. He was one of two consultants. The other consultant was Peck.
13	17	Hendron's responsibility involved recommending solutions to differential settlement.
13	22	Hendron's consulting experience is mainly in rock and soil mechanics.
14	5	Hendron's concentrated on DGB at Midland; at least 90% of time.
14	13	Hendron's not worked on Service Water Pump structure or on Service Water Tanks.
14	19	Hendron's been in meetings where auxiliary building was discussed.
15	3	Remaining 10% of Hendron's time spent on questions in meetings on other structures.

Page	Line	
15	6	He performed no computations other than for DGB.
15	14	He has looked at others' computations concerning dynamic stability of slope by pipes in cooling pond.
16	7	Hendron hasn't personally performed soil tests at Midland.
16	12	Hendron did request Bechtel and Consumers perform full-scale field tests during and after surcharging.
16	19	All tests and monitoring he requested were done.
17	10	Hendron has read some transcripts from the discovery at Midland.
17	14	Hendron did read some of Afifi's transcript.
18	9	Hendron considers himself an expert in field of geotechnical engineering.
18	12	Hendron considers Afifi an expert, too.
19	22	Hendron had no real disagreements with what he read of Afifi's transcript.
20	15	Hendron helped prepare questions for one of the partners, whose name he can't remember.
22	11	Hendron talked by phone to Afifi concerning responses to questions since August 1980.
23	9	Hendron was consulted on Afifi's answers as to whether he agreed to certain assumptions and analyses.
23	18	Hendron has discussed Midland with following consultants: Walter Ferris, Ralph Peck, Dr. Afifi, and Tom Davisson.
45	23	Hendron's worked "probably 30 days a year" at Midland over a 2-1/2 year period.
62	4	He had no responsibility for deciding what soil information should be sent to NRC.
62	9	He didn't recommend that information be removed from the 50.54(f) responses.
62	11	Nor did he recommend additions.
62	25	He remembers editing answers to some questions sent to NRC.

Page	Line	
63	4	His changes were incorporated.
70	2	Hendron says he's been trained as a civil engineer.
70	5	As such, he's familiar with various structural analyses performed on buildings.
214	18	Exhibit 31, letter to Consumers Power from P.L. Castleberry.
215	13	Hendron signed the consulting services agreement referred to in the letter.
215	18	He thinks the agreement specifies in a general way his work responsibilities.

Hendron's Knowledge of NPPS

Page	Line	
54	12	Hendron's familiar with safety functions of DGB.
64	19	He's not familiar with how power from the diesel generators reaches its destination.
64	20	He doesn't understand safety function of borated water tanks.
64		He has rough understanding of function of cooling pond and piping.
65	5	He doesn't understand safety function of electrical penetration areas.

Miscellaneous

Page	Line	
61	6	He's not aware of studies of dike failures at site.
63	22	He can't remember whether he had input to preloading borated water tanks by filling them with water.
65	22	He says a soil slide could occur if the pond retaining wall failed during an earthquake.
61	3	He's not aware of transmission lines supported by fill at site.

Page	Line	
60	17	He doesn't positively understand "Q listed."
61	14	He's heard of NRC SRP in passing.
61	22	He's not familiar with specific sections of SRP.
66	3	He's familiar with 10 CFR Pt. 100, Appendix A.
66	6	He didn't use that document in his recommendations at Midland.
66	15	Hendron became familiar with 10 CFR 100 Appendix A in work on different plants.
67	7	He became familiar with Appendix A "probably when it first came out."
67	19	Hendron's familiar with other building codes for structural design.
67	24	He's familiar with term "safe shutdown earthquake."
68	1	He defines term.
68	14	He didn't consider this concept when designing remedial action for the DGB.
68	17	Hendron believes it's a good idea to comply with federal regulations to assure the safety of nuclear plants.
69	10	He didn't personally conduct research to discover federal regulations applicable at Midland.
69	12	Nor did he request anyone else do it for him.
69	15	Nor did anyone give him any information about applicable federal regulations.
208	8	He's not familiar with Reg. Guide 1.1.1, "Site Investigations for Foundations of Nuclear Power Plants."
214	6	Hendron has no opinion on whether the auxiliary building or the borated water tank ring supports meet NRC code requirements.
214	9	Ditto for DGB.

NRC Requests for Borings - 1

Page	Line	
24	21	Hendron's aware that NRC and Corps of Engineers have requested borings at Midland.
27	5	Hendron recalls that approx. 20 borings were requested.
28	10	Hendron is concerned that borings at dike could cause hydraulic fracture.
28	16	Hendron says danger of fracturing can be minimized.
29	4-15	Fracturing's not only problem; Hendron says you could hit permeable zones in the foundation or otherwise provide the water an escape route
30	3	Hendron doesn't recall specs in ASTM 15-57.
30	18	Hendron believes most cooling ponds at nuclear plants have failed because of piping in the foundation.
30	20	He fears what you do with these borings if you enter the foundation and not necessarily what you're going to do within the compacting.
31	5	Hendron says he'd check potential problem of piping in permeable layer at site carefully because there's "a natural layer of sand in depth."
32	20	Hendron says borings may or may not cause this piping effect if you connect previous layers not previously connected with full end of the reservoir.
33	3	Hendron says the piping problem is a function of the type of soil compacted, not of compaction energy.
33	6	Fine sands and silts cause this problem.
33	12	Hendron says you should always grout borings shut to prevent this problem.
33	16	The erosion problem would exist only for time borings are open.
33	19	Hendron's familar with the California Dam Safety Inspection Program; he knows program entails extensive borings and testing of existing dams.
34	4	He's unaware of hydraulic fracturing as result of these test procedures.

NRC Requests for Borings - 2

Page	Line	
35	6	Hendron says he's not a boring contractor in response to how much the 18 borings at Midland would cost (those requested by NRC and Corps of Engineers).
36	1-2	Hendron says he'd never bid on a lump sum basis for the 18 borings requested at Midland.
36	8	He'd not make a lump bid because the major expense might come in analyzing test results after boring.
36	16	Hendron describes one way of taking borings to minimize danger of hydraulic fracturing.
36	17	Drilling without regular drilling fluid; only method he's familiar with.
44	10	Borings wouldn't be necessary to test for proper compaction because you assume that proper monitoring would give better information.
44	16	Hendron says it's possible that improper compaction could go undetected if proper monitoring hadn't taken place.
53	16	Hendron's not concerned that boring tests requested by NRC would indicate larger settlements in the future than predicted by surcharge fill data.
53	24	Hendron strongly objects to the suggestion he was concerned about costs of borings requested by NRC.
54	11-15	Hendron doesn't believe these additional tests are necessary; settlement information is already good.
54	20	Hendron admits that it's possible such borings would tell whether DGB soils have entered secondary consolidation.
54-55		Hendron thinks that field data'd be more reliable than lab data because (1) decisions made on materials under DGB aren't the same, (2) displacements that can be measured on things like borros anchors over a long gauge length is more accurate than in lab test. The field data is first priority information while lab data is second-class information.
57	2	Field tests are inherently better.
57	21	Hendron doesn't think use of alternative methods is necessary if you have a structure in place.

Page	Line	
57	25	Most soil engineers would agree with this practice.
58	16	Hendron thinks mistakes in preload method could be avoided by fact that engineers would rely on a group of instruments, not just one.
131	12	Hendron doesn't think that the NRC request to take undisturbed samples and perform lab consolidation tests on plant fill foundation soils was reasonable way to resolve questions.
131	14	Nor with respect to forming the curves referred to.
131	21	Hendron doesn't think NRC's method is good because it's a question of sample disturbance; when one tests and makes consolidation tests in the lab, you can't define preload pressures within the accuracies needed.
132	8	The best way to check on secondary consolidation is to rely on all types of information, not just one type.
132	23	Taking borings shouldn't be considered in decisions regarding settlements.
142	22	He wouldn't consider taking borings and running consolidation tests to estimate future settlements even if all data wasn't available from settlement markers, borros anchors, and piezometers.
143	7	Borings and consolidation tests aren't as reliable as field measurements in an actual field structure, says Hendron.
189	2	To check soil strength after surcharging, borings would be an acceptable method.
189	9	Borings in combination with samples and tests.
189	14	Plate bearing tests can also be run to determine soil strength.
190	3	He doesn't believe that it's necessarily desirable to take borings to establish soil strength at Category I structures because these calculations are all made before the fills are placed.

Page	Line	
86	11	Before surcharge, estimates of expected response of piezometers before and after surcharge: Casa Grande piezometers were used, the response time for which was adequate.
86	19	No numerical predictions were made about anticipated rise of water in piezometer during the surcharge program; rise could have been as high as 15 feet.
87	4	None of the piezometers reached 15 feet, however.
87	8	No particular reason why more definite predictions weren't made about possible height of piezometers.
87	14	Likewise for estimates of amount of settlement.
90	3	Hendron can't recall piezometer measurements for period 3/2/79 to 8/15/79.
90	12	He can't recall major changes in settlement reading for that period, either.
106	2	NRC Exhibit No. 7, DGB geometric elevation versus time for piezometer No. 40.
106	15	Exhibit No. 7 shows range is just right at or below lake level 627.
106	23	Exhibit No. 7 indicates surcharge removal should begin around the middle of August '79.
107	2	In general he'd expect the decrease in piezometer level to be more in the shape shown from 1st of September on. There should have been a gradual rise back up to the lake level rather than the apparent jump back up.
107	18	This behavior may be because it is more directly connected to something else when the water level went down rather than the lake level.
107	20	The effect would be of draining that area to some other place.
109	11	Back to Exhibit No. 7, the rise in piezometer elevation probably not a result of pore pressures not totally dissipated.
109	17	The surcharge was removed over a period of time, not all at once.
110	3	Fact that surcharge was removed over 1-1/2 month period could account for the rise.

Page	Line	
152	5	The piezometers installed prior to surcharging were sealed so they were reading pore pressures about the depth of certain soil layers, and "open standpipes for a hole, vertical holes,"
152	19	Hendron would anticipate excessive pore pressure if the plant fill was only partially saturated when the surcharge was placed.
153	1	He'd anticipate that settlement would occur faster if the fill was partially saturated.
153	20	It's possible that the fill could have been partially saturated if there was essentially no change in the piezometric levels from 4/79 to 8/79.
154	14	NRC Exhibit No. 24. Hendron draws plot of chemical behavior anticipated of a piezometer in the DGB foundation soils, assuming excess pore pressure when the surcharge was removed.
156	9	If the soil was 100% saturated, Hendron would expect larger amplitude swings.
156	20	Hendron indicates possible effect of pond seepage on diagram.
157	21	Caption for Exhibit No. 24: Possible Typical Piezometric Elevation vs. Time for piezometer beneath surcharged area from beginning of surcharge (Point A) to removal of surcharge (Point B).
158	8	Jones asks why Exhibit No. 24 doesn't coincide with the action of piezometer No. 40.
158	15	Could be interpreted several ways: "One is during the same time to make a similar sketch, we have to put the lake level on here at the same time, and it was approaching 627..."
158	20	"We could interpret ... that excess pore pressure is zero ... since it was dissipated practically as it was put on."
159	1	Hendron goes on referring to Exhibit No. 24: "One way of explaining that is above this particular point we placed a one layer of surcharge removed which gave us this, and it equalized to lake level."
159	15	"The only other explanation is that this piezometer, due to the fact that you have got high and it's a fairly deep one."

Page	Line	
159	18	"If this one is hydraulically connected to sand seems that come closer to being connected to the river way downstream ... this piezometer will be registering something below lake level ..."
160	7	There was a 1-1/2 foot increase in piezometric elevation from May, June, July 1979.
160	16	If the pore water pressure was initially above reservoir there should be a decline in piezometric levels.
160	22	Exhibit No. 25: Memo from Dr. Afifi.
161	24	One "J.V.E." did not compute the temperature corrections in this memo.
162	1	Nor did "W.R.B."
162	5	Exhibit No. 26, letter to Hendron from S.S. Afifi, signed by P.K. Chen (7/3/79).
162	16	Handwritten comments on cover are Hendron's.
162	19	Quoting handwriting: "It is not clear on calculation of sigma bar [sigma 2 bar]. Did they use capillary tensions or not?"
163	2	Capillary tension wasn't used.
163	4	Their use would have given a better estimate of what would occur during shakedown.
163	12	Exhibit No. 27, a letter from NRC's A. Schwencer to J.W. Cook.
164	4	Handwriting on Table 37-1 is not Hendron's.
168	5	Exhibit No. 28, Supp. Table 27-1, "Piezometers Information, Installation Date."
168	23	Types of soil encountered were described when piezometer borings were made.
169	5	For first 16 piezometers, nearby borings were used to obtain soil type.
169	13	Hendron hasn't kept logs of adjacent borings or results of lab tests to compare for identified soil types.
169	19	Hendron's not surprised to learn that there are layers or small seams of sand encountered at various depths.

Page	Line	
171	8	Hendron's examination of boring logs indicates that there were previous sand layers here and there. "This is one of the reasons why it consolidated fast, we believe."
171	17	Under these conditions, use of piezometers to determine when to remove the surcharge did not lead to unreliable conclusions.

Page	Line	
171	23	Hendron thinks there are some Class I water pipes beneath the DGB.
172	1	He can't recall their diameter.
172	5	He can't recall their elevation.
172	25	Hendron won't make a qualitative judgment on the effects on pipes if they were in most compressible layer because this layer could still be stiff by some standards.
174	18	Hendron had no concern that pipes at site might be subjected to differential settlement because of the heterogeneous fill and thus subjected to included stress due to the surcharge. However, the utility was told to check on loads along a pipe where it entered an adjacent structure. They were also told to do a profile along the pipe.
175	8	Hendron knows that Consumers attempted a longitudinal profile of the pipes.
176	1	The structural people didn't submit estimates about settlement or distortion limits beyond which the building would be overstressed.
176	25	He was not personally aware of any figure indicating the limit beyond which a stress problem might occur.
177	11	He's not seen calculations on whether DGB or pipes exceeded calculated stress because of settlement.
180	2	Hendron hasn't seen calculations about whether DGB meets building codes.
180	25	If piping under DGB is overstressed, Hendron would leave its correction to structural people.
181	20	No specific remedial actions were suggested for possibility that piping could be overstressed because of surcharging.
182	4	Hendron doesn't know if stress predictions were made prior to surcharge.
182	5	Nor does he know if as of today if tolerable limits for effect of differential settlement on piping have been set.
182	8	NRC Exhibit No. 29, Fig. 19-1, "DGB Survey Pipeline Profiles by GD."

Page	Line	
182	23	Hendron doesn't know instrumentation used to establish these pipeline profiles.
183	7	Hendron believes the safety of the DGB Building and piping have been improved by the surcharging program.

Page	Line	
75	17	Hendron's generally familiar with the analysis done on a building to decide whether it can withstand an earthquake.
75	22	Structural engineers would have to know about stiffness of foundation materials to conclude a building can withstand a certain kind of earthquake.
76	3	Hendron discusses how to determine a valye for stiffness.
76	25	Were borings used in stiffness tests? "Sheer wave velocities can be made in between borings. They can be made by either crossover uphold techniques, seismic techniques."
77	5	Borings would be used to set off a charge; you also need a hole to set off a sheer wave generator.
77	21	It usually takes a week for a structure to rebound when you unload.
78	1	He's not sure if Bechtel or Consumers sent information about DGB withstanding an earthquake to NRC.
193	10	No seismic event occurred while the DGB was surcharged.
212	22	Hendron discusses state of art regarding predictions of settlement resulting from seismic shakedown.
213	22	The method he described would only be used on grannular soils, not clay soils.
217	12	Contains suggestion from Hendron on vertical spring constant for DGB.
217	16	He can't recall when he proposed it.
217	21	He thinks it was in the winter of 1980.
217	24	Hendron describes the method he suggested; take settlement information on four corners of the DGB, pass a plane through, write an equation for the plane through 3 points and see how the 4th fell out of the plane; do this around the building.
218	14	Hendron can't identify the person who's supposed to have reacted to this proposal.
218	19	The reaction states "informal conversations project has stated that the structure will not withstand stresses induced by this approach."

Page	Line	
219	10	Hendron can't interpret this meaning because "it's been filtered through too many people."
221	8	Vertical Data Spring Constants for footings of DGB was an approximation Mr. Chen was asked to make by the structures people "so they could count for interaction between the building and the forces on the footings, is there a function of this difference in the soil, to see if the building tries to distort the maximum distribution which is the function of the soil." The structures people suggested they might try, if they could estimate out-of-plane displacement, to see what that would do to the structure.
221	24	Any out-of-plane movement would have caused bending stresses on the building.
222	1	It would not necessarily cause cracking.
222	7	If the building couldn't withstand bending stresses it might not necessarily indicate anything about the ability of the building to perform its function.
222	11	It wouldn't necessarily indicate anything about capacity of the building to withstand a seismic event.
223	9	Bechtel's structural group at Ann Arbor could answer if the recommended plane calculations were made.

Page	Line	
93	24	References Exhibit #4, which states that if "suitable means is developed for making reliable temperature corrections to readings of the precise settlement gauges, we believe that removal could ... begin in August." Hendron says temperature corrections were made to the borros anchors by Mr. Donacliff's firm.
94	3	Hendron thought such readings were necessary.
94	10	He can't tell whether or not these temperature corrections were made prior to surcharge removal.
94	21	He won't speculate on whether or not corrections were made prior to surcharge removal and says to ask Dr. Peck.
95	8	As it turned out, there weren't significant changes in the movement.
95	12	You would have known this only if you approximated the change and expansion of those parts of the borros anchors above ground and estimated temperature changes and length of rods.
95	18	Hendron doesn't know when Mr. Donacliff's firm made temperature corrections prior to surcharge removal.
96	8	Hendron's not aware that John Donacliff expressed concern that the temperature corrections for 4 of 9 borros anchors might not be reliable as late as 2/9/80.
96	12	He did hear something within the last month about Donacliff's remarks from Afifi.
96	16	To Hendron's knowledge, the monuments and markers at Midland weren't used for the surcharge program; but borros anchors were used as a backup.
102	12	He's familiar with settlement markers and monuments at the site.
102	22	Hendron describes how settlement markers are, in general, placed.
103	11	He's not familiar with a settlement rod would be installed on a pedestal.
103	16	He doesn't know when the markers and monuments were installed.
103	19	Nor does he know if most were installed.
103	23	He can't remember whether they were installed in fall '78 or early '79.

Page	Line	
103	25	They were installed to monitor how the building moved before and after the preloading.
104	4	Those monuments and markers that haven't been destroyed are still being monitored.
104	10	Jones makes available supplemental figure 27-79 from Rev. 10 (10/80) of 50.54(f) responses concerning settlement markers.
105	9	When you integrate strains from bottom to top you risk larger settlements in one depth than others. Maximum settlement occurs at ground surface.
105	14	Grade settlement at site occurred in upper 15 or 20 feet.
108	7	Exhibit No. 8, Fig. 27-83 from Rev. 10 to 50.54(f) responses of 10/80, "Borros Anchor 4." It's settlement versus graph time for borros anchor.
110	12	NRC Exhibit No. 9, Supp. Fig. 27-113; Exhibit No. 10, Fig. 27-115, and Exhibit 11, Fig. 27-118. Settlement versus time charts for borros anchors from Rev. 10 to 50.54(f) responses and for anchors 41, 43, and 46, respectively.
111	6	Hendron isn't sure whether these anchors have been monitored since '79.
111	12	Nor does he know if monitoring information for those monitored since 1979 have been provided to NRC.
111	21	Hendron believes Borros Anchors 61, 62, 63 and 64 are still alive.
112	1	It's most important to monitor the anchors with the longest gauge length.
112	11	He doesn't know why information on anchors currently being monitored hasn't been sent to NRC.
112	16	No settlement has been recorded on anchors 61, 62, 63 and 64 since the fall of '79.
112	20	They have exhibited slight rebounding.
113	4	Most rebounding has been short, not steady since fall '79.
113	9	This rebounding would have occurred shortly after surcharge removal.

Page	Line	
113	13	He can't tell whether differential settlement occurred under DGB wall footings where foundation soft spots were abridged.
114	21	Non-uniform readings between borros anchors wouldn't necessarily indicate a need to investigate its cause.
115	7	Borros anchors 61 thru 64 were monitored directly.
115	11	NRC Exhibit No. 12, "Settlement versus Logarithm of Time During and After Surcharge" for marker DG 4.
117	13	The only anchors monitored directly throughout the surcharge were those outside of the surcharge area.
117	19	Exhibit 12: Hendron would have to go through the surveyor's notes to determine how the points were plotted on that exhibit.
118	1	To make estimates from temporary markers to arrive at points on a plot you shoot from a marker when you can see it last to another marker, whether they give an offset and refer everything to that.
118	7	This method is called an "offset type of measurement."
118	10	Jones says that note at bottom of Exhibit 12 says that temporary markers at 664 feet, zero inches were used to estimate the settlement of the permanent markers.
119	1	NRC Exhibit No. 13, Supp. Fig. 27-64 for Marker DG 16 and "Settlement versus Logarithm of Time."
119	13	The change in height of settlement marker at approx. BA 200 could be referred to as rebound behavior, but Hendron thinks that rebound can't be that high.
119	19	It looks to be approx. 1 inch.
119	25	This one-inch change might be explained by damage to the marker during fill removal.
120	9	Hendron would expect something like a quarter inch rebound as reasonable.
120	13	The DG Markers generally showed an eighth to a quarter inch rebound.
120	18	He doesn't know how the temporary markers were connected to the permanent markers.

Page	Line	
121	2	Hendron thinks that that portion of Exhibit 12 that concludes that the fill has reached secondary consolidation is a critical period.
121	8	Hendron would be concerned if the most important portions of the settlement versus log curve for all DGB settlement markers were estimated; this isn't the only means for measuring displacement.
121	15	If all DGB settlement markers had been estimated during this period he would have been concerned, but this wasn't the only piece of information.
121	20	The other information included borros anchors 61 thru 64 piezometer measurements.
122	3	These four anchors were the only ones installed in June '79.
122	11	Hendron doesn't see how the behavior at BA 200 of Exhibit 13 could be rebound behavior caused by excess pore pressure.
122	14	Excess pore pressure should give settlement.
122	24	After removal of the surcharge, rebounding occurred several weeks later.
123	2	He can't remember rebounding occurring over a longer period.
123	13	He would not expect rebounding behavior as much as a year later.
123	14	NRC Exhibit No. 14 Fig. 27-62 for Marker DG-14.
123	18	Exhibit No. 15, Fig. 27-151 for Settlement Plate PL-15.
123	21	Exhibit No. 16, Fig. 17-173 for Settlement Plate PL-51.
124	17	In these charts, the DG markers show greater rebound than the settlement plates.
124	23	This isn't necessarily the reverse of how it should be.
124	25	That's because removing the surcharge doesn't remove weight of the building. They're both not too differently influenced by the surcharge weight being removed.
125	6	So the rebounding should be similar.
125	9	The DG marker rebounds appear greater because of something to do with this adjustment that was made.

Page	Line	
125		Hendron doesn't know whether the rebound reading for removal is too high.
128	1	You can expect slightly more rebounding when there's negative pore pressure that's gradually increased positively than when there's no pore pressure at all.
129	17	Settlement versus logarithm of time plots can be used to predict both if soil's in secondary consolidation and to predict future settlements.
130	7	The portion of the plot in Exhibit 14 that's critical for these predictions occurs between March '79 and August '79.
131	1	Hendron denies that the DG markers were estimated during this period.
132	24	Exhibit 11, Plot for Borros anchor 46.
133	12	Hendron has no explanations for rebound behavior between 4/79 and 8/79 reflected in anchor 46.
133	16	NRC Exhibit 17, Fig. 27-120, a Settlement vs. Time Plot for Borros anchor BA-48 and Exhibit 18, Figure 27-120 for Anchor 47.
134	14	Anchors 47 and 48 show small rebound for 4/79 to 8/79, for which Hendron has no explanation.
135	17	Exhibits 19, 20, and 21 are Settlement vs. Time Plots for borros anchors 29, 30, and 31.
138	16	Hendron says that you would expect an area that had rebounded more to recompress more if an additional load were added.
138	20	Exhibit 22, Fig. 27-76, Settlement vs. Log of Time for DG Marker 28.
139	8	Hendron says there's no apparent movement between PL 300 and 400 BAs.
140	2	This plot indicates that the settlement behavior or secondary consolidation is zero.
140	6	Hendron doesn't know how DG Marker 28 was destroyed after 2/9/80.
140	12	Hendron doesn't know whether the loss of Plate 1 in March '79 resulted in the settlement of the large diameter circulating water line over which it is floated.

Page	Line	
140	20	He doesn't know if any settlement monitoring plants were established to take place during preparation for Category I structures at Midland.
141	4	Hendron would like monitoring to continue on the DGB.
141	8	He doesn't know if there are settlement monitoring plans for piping and conduits.
141	13	Hendron thinks it's possible to place monitoring equipment on pipes and conduits during plant preparation.
141	22	It would be desirable to monitor settlement during plant preparation as long as there aren't surveying errors.
151	3	If you estimated what'd happen to the shape of the settlement log time curve if the curve began with date of placement of settlement rather than with the surcharge, it'd be over to the right.
194	6	Borros anchors are used to demonstrate secondary consolidation.
194	13	He can't remember whether borros anchors 61 thru 64 were placed in glacial till.
164	20	As such, they could be used to indicate you're in secondary consolidation and for benchmarks.
194	25	These anchors give total compression of the soil column between the anchor and the building.
195	6	Hendron explains how borros anchor functions.
196	14	NRC Exhibit No. 30, a schematic drawing of borros anchor function.
198	6	Borros anchors 61 thru 64 should have been located at the 4 corners of the DGB.
198	21	These anchors were installed in June '79.
199	2	It's irrelevant what the stress is at the tip of the borros anchor.

Page	Line	
16	12	He requested that Bechtel and Consumers perform full-scale field tests during and after surcharging.
37	2	Hendron has visited Midland site.
41	21	He wasn't there when surcharge was placed so he can't comment on that job.
51	1	Hendron says you do consider effects surcharging will have on building components before you place the surcharge.
51	5	It's also necessary to look at effects of surcharging on structures within the soil.
51	9	Effects of surcharge on piping beneath building are considered by construction engineers on project.
64	6	In Hendron's experience it's normal practice to have the magnitude of the surcharge exceed the live load expected on the structure.
70	22	Hendron hasn't reviewed any structural analysis data taken since the surcharge program.
71	4	Hendron says no piezometers were installed at Carrfork prior to surcharge because there was no water level within 100 feet below the building.
71	10	Same was true at Anacondamoly project.
71	13	The Anacondamoly project's not in the published literature.
71	19	Hendron's read some publications about projects where surcharging took place on completed structures.
71	21	He can't recall specific projects.
72	13	Hendron did preload beyond anticipated dead loads on two structures he worked on on which surcharging was done on standing structures.
72	16	He doesn't know whether the preload was beyond the applicable live load anticipated for those projects.
72	20	He acknowledges that the loads would exceed the live load.
72	22	He's somewhat familiar with Navedors DM7 Design Manual.

Page	Line	
73	1	He's not familiar with design guidance in DM7 on preconsolidation by surcharge.
73	4	Thus, method in DM7 wasn't used at Midland.
73	7	The surcharge at Midland was to be higher than any anticipated loads..
73	12	They were trying to equal or be above certain dead loads and live load building spread over the building area.
73	16	They wanted to be above predicted loads by as much as possible; past ratios have been from 1.15 to 1.5.
73	23	The roof on the DGB would be one limiting factor against going too high.
74	2	There was a ceiling on the building when the surcharging began.
74	11	NRC Exhibit #2, diagram by Dr. Peck that summarizes loads used in predicting magnitude of surcharge.
75	12	Hendron thinks the preload at Midland was adequate for the load anticipated.
78	6	To evaluate effectiveness of a surcharge, you need to look at whether deformation has stopped after surcharge removal and be certain you're past primary settlement.
78	15	Two methods to determine whether you're past primary settlement (1) settlement time curve settlement, log time curve, and (2) piezometer measurements.
78	24	Hendron has not checked loading stresses used on Exhibit #2.
79	7	Hendron says primary settlement can stop and then start again if the loads have changed.
79	12	Vertical stresses on Exhibit #2 computed by variation of Boussinasq stress distributions.
79	19	On Exhibit #2, the stress increment for structural loads at 629 feet is on the order of 3.3 or 3.4 kips/sq. ft.
80	2	That was Hendron's understanding of the load at the time of the surcharge placement.
80	5	Exhibit No. 3, Table 41A, "Settlement Summary of DGB," under column III, surcharge load marked as 2.2 kips on 3/22/79.

Page	Line	
80	24	Hendron says discrepancy may be due to fact not all loads put into the building.
81	12	Hendron believes correct load is whatever can be documented with the loads actually there.
81	17	It's his understanding it's 3.4 kips/sq. ft.
82	1	Hendron says magnitude of surcharge on DGB was 6.4 kips.
82	5	Hendron can't say whether the curves 2 and 4 on the chart represent the full live load on the DGB.
82	10	He says it depends on what kind of live loads you think you have before you can compute the magnitude of the surcharge using live loads.
83	15	Hendron notes there are two categories of live loads: short and long.
83	25	He's familiar with the term "seismic shakedown."
84	1	He defines seismic shakedown in sand.
85	2	Broad rather than detailed estimates were made at Midland about amount of settlement anticipated before the surcharge was begun.
85	18	He estimated 4 to 8 inches.
85	22	Actual settlement fell short by a little.
86	1	Specific estimates of rate of settlement weren't made.
87	17	Although he was asked "when can we take surcharge off" he didn't feel unduely pressured to remove it as soon as it possibly could be.
88	1	No one gave him a date by which surcharge would have to be removed.
88	2	Exhibit No. 4, letter of 7/2/79 from Afifi to all consultants: Jones cites sentence referring to practical considerations for not permitting an indefinite delay in removing the surcharge.
89	1	Hendron says that can't be construed as undue pressure.
89	5	The practical considerations that don't permit an indefinite delay in removing the surcharge: (1) to have it on long enough to gather

Page	Line	
		data to assure you're past primary, and (2) to establish the slope of the secondary portion so you can draw a line and extend it.
183	24	The surcharge reduced differential settlement between the various portions of the DGB.
184	6	He's not aware of calculations on whether or not surcharging increased or decreased induced structural stresses on area piping.
184	10	He thinks the surcharging reduced stresses in the east end of the DGB because it resulted in cutting the duct bank.
185	1	He can't recall any changes in crack width because of surcharging.
185	12	He has seen buildings crack worse than Midland because of compacted fill, usually at the Carryfork project.
185	25	Hendron says the fill soil for the DGB was of optimum moisture.
186	3	Based on information from borings and water contents from the test pits.
186	7	He doesn't know if this data's been passed to NRC.
187	8	A surcharge would be effective even on soil dry of optimum.
188	16	You'd want a soil with higher strength under a seismic or static load.
188	20	Soil of low strength under seismic load is subject to stresses that approach its final strength.
190	16	Some triaxial tests were done at Midland to predict soil strength prior to surcharge.
190	16	These tests were done in anticipation of the surcharge of the DGB.
190	24	Calculations were based on strength tests conducted in various places.
191	3	Some of them were taken near the DGB.
191	11	Heterogeneous materials may or may not make extrapolating values difficult; for strength tests, you look at water content and density for a particular strength result.
191	24	Personally he'd prefer samples and soil tests to plate load tests for determining soil strength.

Page	Line	
192	3	Triaxial tests in the lab allow more controlled conditions.
192	15	He'd prefer borings of the DGB soil to test sheer soil strength to plate bearing tests.
193	10	No seismic event occurred while the DGB was surcharged.
193	14	Borings for soil strength tests could also be used to run consolidation tests, too.
205	21	Hendron says that tests taken before the surcharge indicated a strength of three with a factor of three or greater.
205	24	He feels present factor of safety is adequate for seismic loads.
207	20	Hendron says the only measurement of whether or not sand was compacted prior to surcharging is the indirect Dutch code measurements and standard penetration tests.
208	3	Surcharge won't make big change in density of the sand.
223	19	Exhibit 31, p. 10, calculations for input to structural engineers going back to the building.
224	4	Hendron didn't write note at top of page that assumes a uniform load equals 2.2 kips on foundation.
224	7	He doesn't know whether 2.2 kips was used.
224	14	Exhibit No. 32, memo from P.A. Chen to Hendron, 10/20/80.
225	3	Hendron did prepare document and calculations.
225	21	Altho not in Hendron's handwriting, "This is something I had a lot to do with preparing, that preparing that actual handwriting is Professor Martin's. I asked him to do this for me."
226	17	Hendron went thru all the calculations but he also wanted a teaching colleague to go through them also.
227	3	Hendron explains process for checking calculations: He makes the calculation and it's Bechtel's responsibility to check and sign them.
228	7	Hendron discusses his conclusions about the Error Analysis for Exhibit 32.

Page	Line	
228	24	"Biggest source of errors are in sampling techniques and attributing ... thickness ..."
229	5	He reviewed the document that was prepared by Prof. Martin.
229	8	He agrees with its conclusions.
229	15	He presented these results at a meeting with Mr. Knight from NRC in Sept. '80.
230	7	The document contains the maximum achievable accuracy for the field test.
230	10	The field tests could be roughly 100 times more accurate than the lab tests, where there's instrumentation in the field.

NOTE:

The contents of this package are maintained in a three-ring notebook by William Paton titled Deposition Summaries and T.R. Corrections