CONSUMERS POWER COMPANY

MIDLAND UNITS 1 AND 2

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES

STATUS SORT: PARTS I AND 2

Bechtel Power Corporation

October 8, 1980

MIDL.. .. UNITS 1 AND 2

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES

LEGEND

Status Codes:

1 Complete, verified by quality assurance

2 Reported complete, not yet verified

3 Due, but not complete. Dates have been reforecast. Original due dates are in parentheses.

4 Not yet due

5 Insufficient documentation in 50.54(f) files to establish or verify status

RESPONSIBLE ORGANIZATIONS:

PD Plant design
PS Pipe stress
LS Licensing
GT Geotechnical services
CE Civil engineering services
FE Field engineering
QA Quality assurance
QE Quality engineering

CPCo Consumers Power Company
CPCo QA Consumers Power Company quality assurance
CPCo PMO Consumers Power Company project management organization

Notes:

1. Commitment dates for action items indicated by asterisks (*) have been transmitted to the NRC. These dates will not be changed without a formal transmittal to the NRC.

2. Questions 1 through 22 action item numbers are basically the same as those used by the diesel generator building task group, but have been modified to acknowledge action items/commitments made in all revisions of the responses.

3. Question 23 action item numbering is based on the Response to Question 23 submitted to Consumers Power Company via BLC88460, J.A. Rutgers to G.S. Keeley, dated November 14, 1979. These action item numbers have been modified to acknowledge action items/commitments made in all revisions of the responses.

4. Questions 24 through 35 action items were identified for the first time in the April issue of this status report and will be referred to by the action item numbers established in that issue.

References (applicable to Part II only):

A. Letter from G.S. Keeley to J.A. Rutgers, CPCo Serial 8548, 3/27/80

B. Commitments made in February 1980 meeting with NRC, Midland, Michigan

MIDLAND UNITS 1 AND 2

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES

PART I: COMMITMENTS FROM QUESTIONS 1 to 35

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
1-5*	Review specifications not included in the specificity study initially	1-5 I-8	0 0	QE		790629	5	See Item 23-10
1-19*	Complete in-depth review of soil test results	I-17		GT		790731	5	
6-5	Monitor the piping between the BWST and the auxiliary building	6-1	1	CE			5	Ongoing activity
6-6	Evaluate the settlement from Item 6-3 in accordance with the procedure described in Question 17	6-1	1	PS			5	Complete monitor upon load test
7-2	Make results of continuity checks and settlement surveys available						5	See Item 7-1
7-3	If further corrective action is required, determine corrective measures						5	See Item 7-1
13-9 (13-2)	Review piping system for seismic response from Item 13-6	13-2	0	PD	A. Patel		5	
15-3	Prepare additional response to the NRC					791231	5	

Show Schedule

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
4-6	Monitor the non-Seismic Category I condensate storage tanks	4-4	5	GT CE	J. Wanzeck S. Rao	801130	4	Load test ongoing; results will be evaluated by geotech and civil
4-8	Fill the BWST with water to perform a full-scale test of subsurface material	4-3	3	GT CE	J. Wanzeck S. Rao	801130	4	See Items 6-1, 6-3, 6-6, and 31-1. Dwg C-1148 issued for construction. Load test to start in 10/80
6-9	Determine long-term settlement based on the measured settlement of the loaded tanks	6-2	3	GT			4	Geotech to review load and predict long-term settlement based on Items 4-6, 4-8, and 4-9
8-3	Review and modify the monitoring frequency for the diesel generator pedestal markers after 1 year of operation	8-2	0	CPCo		850101	4	
12-5	Pressure grouting of void below the mud mat of the control tower as required	Tbl 12-1	0	CE	R. Zao	801231	4	
13-7 (13-1)	Review structural design for seismic response from Item 13-6	13-2	0	CE		801031	4	
13-8 (13-2)	Review Seismic Category I equipment for seismic response from Item 13-6	13-2	0	CE	B. McConnel	810201 (801231)	4	
13-10 (13-2)	Review electrical system for seismic response from Item 13-6	13-2	0	CE	B. McConnel	810201 (801231)	4	
13-11 (13-3)	Conduct a seismic reanalysis for the service water pump structure	13-2	0	CE	B. McConnel	801031	4	
13-13 (13-3)	Review Seismic Category I equipment for seismic response from Item 13-11	13-2	0	CE	B. McConnel	810201 (801231)	4	
13-14 (13-3)	Review piping system for seismic response from Item 13-11	13-2	0	PD			4	
13-18 (13-4)	Review Seismic Category I equipment for seismic response from Item 13-16	13-3	0	CE	B. McConnel	801231	4	
13-19 (13-4)	Review piping system for seismic response from Item 13-16	13-3	0	PD			4	

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
13-20 (13-4)	Review electrical system for seismic response from Item 13-16	13-3	0	CE	B. McConnel	801231	4	
13-21 (13-5)	Investigate the effect on underground utilities for differential building displacement resulting from Items 13-6, 13-11, 13-16	13-5	0	CE PS	B. McConnel	810131	4	
17-4	Profile the borated water lines by optical means	17-1	2	CE			4	Tracked by Item 6-5
23-37*	Consistent with the intent of Items 23-35 and 23-36, QA will review nonconformance reports which were open as of November 13, 1979, or became open prior to implementation of the improved Project Quality Assurance Trend Analysis program as stated in Item 36.	23-33	5	QA		801231	4	
23-40* (31)	Design documents, instructions, and procedures for those activities requiring inprocess controls will be reviewed to assess the adequacy of existing procedural controls and technical direction. Engineering review is scheduled for completion by October 24, 1980, and field engineering and quality control review is scheduled for completion by November 28, 1980.	I-11, 23-20, 23-30	4	FE,QC		801128	4	Project engineering to provide list of design documents to FE and QC to start this item
23-41*	QCIs in use will be reviewed to ascertain that provisions have been included consistent with the revised control document, SF/PSP G-6.1, Quality Control Inspection Plans.	I-18, 23-22, 23-25	5	QC		801115	4	See Item 23-34

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
23-42* (31) (40)	Design documents, instructions, and procedures for those activities requiring inprocess controls will be reviewed to assess the adequacy of existing procedural controls and technical direction. Engineering review is scheduled for completion by October 24, 1980, and field engineering and quality control review is scheduled for completion by November 28, 1980. Any revisions required will be completed by January 23, 1981.	I-11, 23-22, 23-30	4	PE, FE,QC		810123	4	
23-43*	The impact of Item 41 on completed work will be evaluated, and appropriate actions will be taken as necessary.	23-22, 23-25	4	QC		810115	4	
24-1	Determine final number of observation wells	24-21	5	GT		811031	4	Ongoing activity
24-2	Develop frequency for monitoring the observation wells	24-21	5	GT		810131	4	Ongoing activity
24-3	Develop system and schedule for monitoring sand removal	24-22	5	GT		810131	4	Ongoing activity
24-4	Evaluate results of temporary dewatering system to verify design bases	24-8	5	GT		811031	4	Ongoing activity
25-3	Revise seismic analysis for service water pump structure using soil properties determined by the recent investigation and any foundation modification	25-5	5	CE			4	Tracked by Item 13-11

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
1-21A	Modify QCIs based on Item 1-21	NA		QC	E. Smith	801115 (800901)	3	See Items 23-19A, 23-34, and 23-41
1-23	Incorporate scientific sampling plans for inspection	I-20		QC		801115 (791019)	3	See Item 23-34. Committed statements not yet compiled with
13-6 (13-1)	Conduct a seismic reanalysis for the diesel generator building	13-2	0	CE	B. McConnel	801115 (801015)	3	
13-12 (13-3)	Review structural design for seismic response from Item 13-11	13-2	0	CE		801231 (800831)	3	
13-15 (13-3)	Review electrical system for seismic response from Item 13-11	13-2	0	CE	B. McConnel	810201 (801231)	3	
13-16 (13-4)	Conduct a seismic reanalysis for the auxiliary building	13-3	0	CE	B. McConnel	801215 (800815)	3	
13-17 (13-4)	Review structural design for seismic response from Item 13-16	13-3	0	CE	R. Zao	801130 (800930)	3	
14-7	Analyze the BWST foundation for variable foundation properties	14-2	5	CE	R. Zao	801231 (800831)	3	Analysis ongoing
14-8	Compare allowable versus calculated forces and moments at critical sections for auxiliary building electrical penetration area and service water pump structure	14-5	5	CE		801231 (800831)	3	Analysis ongoing
15-2	Expand the Midland project structural design criteria for Seismic Category I structures to include the differential settlement effect.	15-2	0	CE	D. Reeves	801130 (800831)	3	Design criteria in CPCo review
17-5	Analyze buried piping considering the probable ultimate settlement. Provide unique resolution for any unacceptable stress conditions for the portion of the system	17-3	5	PS	J. Legette	810131 (800801)	3	Report on method for analysis being reviewed
17-6	Investigate the excess rounding of profile data	Tbl 17-2	2	PS	J. Legette	810131 (800801)	3	Same as Item 17-5

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
18-1	Perform reexamination of the stresses in all Seismic Category I connecting piping between buildings as a normal iteration of design. Consider stresses induced by differential settlement after connecting pipe and anticipated future settlement	18-1	0	PS	J. Legette	810131 (800801)	3	Same as Item 17-5
18-2	Perform final analyses to demonstrate the margin of acceptability for additional differential settlement beyond that expected for the life of the plant	18-2	5	PS	J. Legette	810131 (800801)	3	Same as Item 17-5
18-3	Design piping connecting from the diesel generator building to the pedestals which will accommodate the expected future settlement	18-2	5	PS	J. Legette	810131 (800801)	3	Dependent on 17-5
19-1	Profile pipes in the vicinity of diesel generator building after removal of preload and evaluate as described in the Response to Question 17	19-1	0	PS	J. Legette	810131 (800801)	3	Dependent on 17-5
19-3*	Perform a complete evaluation of safety-related piping after completion of the preload program	19-3	0	PS	J. Legette	810131 (800801)	3	Dependent on Item 18-1
20-1	Analytically check the Seismic Category I systems affected by settlement for pump and nozzle loadings and verify that they are within specified or vendor-accepted limits	20-1	5	PS	J. Legette	810131 (800801)	3	Dependent on Item 18-1
20-2	Verify piping support loads for systems subjected to settlement-induced loads	20-1	5	PS	J. Legette	810131 (800801)	3	Dependent on Item 18-1
20-3	Prepare additional response to the NRC					810131 (800801)	3	
20-4	Evaluate active valves affected by settlement for imposed loads and reactions; compare to the allowable for operability	20-1	5	PS	J. Legette	810131 (800801)	3	Dependent on Item 18-1

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
23-19A*	This action modified to include necessary revision to QCIs resulting from evaluation of surveillance and review callouts	I-18		QC	E. Smith	801115 (800901)	3	To be completed when Item 23-41 is completed and QC Procedure G6.1 is approved by CPCo. See Item 1-21A
23-20*	Field Instruction 1.100 will be supplemented by establishing requirements for demonstrating equipment capability, including responsibility for equipment approval, and providing records identifying this capability.	23-18	5	PE		801231 (791204)	3	Awaiting equipment qualification report from geotechnical services based on CPCo NCR
23-25*	Quality assurance will issue a Nuclear Quality Assurance Manual amendment to clarify the requirement that procedures include measures for qualifying equipment under specified conditions.	23-18		QA		801017 (800902)	3	Awaiting issuance of remaining NQAM procedures needed for the CPCo/Bechtel QA integration
23-28*	Civil/Structural Design Criteria 7220-C-501 will be modified to contain the requirements that a duct bank penetration shall be designed to eliminate the possibility of the nonspecific size duct interacting with the structures.	23-15	5	CE	D. Reeves	801130 (800831)	3	Design criteria in CPCo review
23-30* (39)	Engineering will clarify specifications and construction will prepare procedures (governing the soils compaction equipment) to implement the requirements of the Nuclear Quality Assurance Manual as stated in Item 25	23-18	5	CE/PE		801230 (800912)	3	Dependent on compaction report and NQAM
23-31*	Design documents, instructions, and procedures for those activities requiring inprocess controls will be reviewed to assess the adequacy of existing procedural controls and technical direction. Engineering review is scheduled for completion by October 24, 1980.	I-11, 23-20, 23-30	5	PE	C. Russell	801131 (801024)	3	

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
23-33*	The quality assurance audit and monitoring program will be revised to emphasize and increase attention to the need for evaluating policy and procedural adequacy and assessment of product quality. A specialized audit training program will be developed and implemented to ensure guidance for this revised approach.	23-35	5	QA		800912	3	Action completed except developing audit training program
23-34*	Control Document SF/PSP G-6.1 will be revised to provide requirements for inspection planning specificity and for the utilization of scientific sampling rather than percentage sampling.	I-20, 23-22, 23-24	5	QC		801115 (800915)	3	SF/PSP G-6.1 has been submitted for review. See Item 1-23
23-39* (30)	Engineering will clarify specifications and construction will prepare procedures (governing the soils compaction equipment) to implement the requirements of the Nuclear Quality Assurance Manual as stated in Item 25.	23-18	5	PE		801231 (801017)	3	
23-44A*	The audit committed to in our response to Question 1, Part b and described in Part 2, Section 5.0 will be conducted once during the FSAR rereview (commencing March 17, 1980) and again after completion of the rereview (commencing September 1, 1980).		4	QA		801231 (800901)	3	See Item 1-4
23-47*	See Item 23-4	23-9, 23-25	4	PE		801231 (801031)	3	
26-1	Analyze the effect of differential settlement of the diesel generator building in accordance with ACI 349 as supplemented by Regulatory Guide 1.142	26-2	5	CE	R. Zao	801031 (800930)	3	

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
33-1	Fill the diesel fuel oil tanks with oil prior to preoperational testing	33-2	5	CE		810831 (800829)	3	See Items 4-9 and 6-4 Will be accomplished just prior to preoperational testing

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
4-7	Remove unsuitable material in the tank farm and replace by compacted fill	4-3	3	GT	J. Wanzeck S. Rao	791130	2	
15-1*	Evaluate the differential settlements in accordance with provisions of ACI 318-71 for Seismic Category I structures founded partially upon natural soil and partially upon fill material	15-1	0	CE		791231	2	Superseded by Items 26-1 and 26-2. See Item 14-6
17-2	If future profiles show any extreme conditions, analyze the piping system and make necessary repairs	17-3	0	CE		790901	2	Superseded by Item 17-5
19-2	Take additional gap measurements between embedded sleeves and pipes when surcharge is removed. Coordinate this information with the profile data	19-2	0	CE			2	Closed by Rev 5
23-35*	Control Document SF/PSP G-3.2. Control of Nonconforming Items, is being revised to improve the definition of implementing requirements for identifying repetitive nonconforming conditions.	23-33	5	QC		800815	2	See Item 1-24. PSP G-3.2 Rev. 6 issued 6/10/80
23-44*	FSAR sections are being rereviewed as discussed in the Response to Question 23, Part 2.	23-7, 23-11	4	PE		800931	2	See Item 1-2
23-45*	U.S. Testing will be required to demonstrate to the cognizant engineering representative that testing procedures, equipment, and personnel used for quality verification testing (for other than NDE and soils) were, and are, capable of providing accurate test results in accordance with the requirements of applicable design documents.	I-18, 23-27, 23-31	5	CE		801001	2	Report submitted to QA
23-46*	A sampling of U.S. Testing's test reports (for other than NDE and soils) will be reviewed by the cognizant engineering representative to ascertain that results evidence conformance to testing requirements and design document limits.	23-28, 23-31	5	CE		801001	2	Report submitted to QA

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
23-48*	CPCo will implement overinspection for soils placement, utilizing a specific overinspection plan.	I-11, I-16	4	CPCo-QA		NA	2	(1) Ongoing activity
23-49*	CPCo will perform overinspection of the U.S. Testing soils testing activities and reports, utilizing a specific over-inspection plan.	I-17	4	CPCo-QA		NA	2	(1) Ongoing activity
23-50*	CPCo project management and QA review field procedures (new and revised) and CPCo QA reviews QCIs (new and revised) in line with Bechtel before release.	I-19	4	CPCo-QA, CPCo-PMO		NA	2	(1) Ongoing activity
23-51*	In 1978, CPCo implemented an overin-spection plan to independently verify the adequacy of construction and the Bechtel inspection process, with the exception of civil activities. Rein-forcing steel and embeds were covered in the overinspection.	I-19	4	CPCo-QA		NA	2	(1) Ongoing activity
23-52*	CPCo reviews onsite subcontractor QA manuals and covers their work in the audit process.	I-19	4	CPCo-QA		NA	2	(1) Ongoing activity
23-53*	An ongoing effort is improving the "sur-veillance" mode called for in the QCIs by causing more specific accountability as to what characteristics are inspected on what specific hardware and in some cases changing "surveillance" to "inspection."	I-19	4	QC		NA	2	See Item 23-19A
25-1	Revise seismic analysis for diesel generator building using the soil properties determined by the recent investigation and any foundation modi-fications	25-3	5	CE			2	Tracked by Item 13-6
25-2	Revise seismic analysis for auxiliary building using the soil properties deter-mined by the recent investigation and any foundation modifications	25-3	5	CE			2	Tracked by Item 13-16

(1) Bechtel verification of this item is not required.

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
26-2	Incorporate in the Midland project standard design criteria the effect of differential settlement of structures which are founded partially or totally on fill	26-1	5	CE			2	Tracked by Item 15-2
27-1	Prohibit final piping connection to the diesel generator building before 12/31/81	Fig 27-9	5	PD	R. Tulloch	800731	2	
31-1	Perform full-scale load test by filling the BWST with water	31-2	5	GT CE		801130	2	Tracked by Item 4-8

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
1-1*	Perform a final review and update of PSAR commitment list	1-3	1	LS		800101	1	
1-2*	Review sections of the FSAR determined to be inactive	1-4	1	LS		800101	1	Superseded by Item 23-44
1-3*	Review EDP 4.22	1-4	0	QE		790629	1	
1-4	Audit action items 1-3	1-4	0	QA		801101	1	Superseded by Item 23-44A
1-6*	Complete review of the Dames and Moore report	I-6		GT		790629	1	
1-7*	Complete review of pertinent portions of FSAR Sections 2.5 and 3.8	I-6		GT,CE		790629	1	
1-8	Correct settlement calculations	I-6		GT		791101	1	
1-9	Schedule audits of the geotech sections on a 6-month basis	I-7		QA		790504	1	
1-10*	Review drawings for possible effect of vertical duct bank restrictions	I-7		CE		790106	1	
1-11*	Complete actions in response to DRVCL audit	I-7/8		QE		790518	1	
1-12*	Revise EDP 4-49 to incorporate clarifications and instructions for use of SCN	I-8		QE		790504	1	See Item 23-4
1-13	Schedule audits of each design discipline calculations on a yearly basis	I-8/9		QA		790504	1	
1-14	Reevaluate construction equipment used for compaction	I-11		FE		791204	1	See Item 23-20
1-15	Assign field soils engineer and soils engineer from design section	I-11		FE		790501	1	
1-16*	Review construction specifications and procedures to identify equipment requiring qualification	I-11		FE		790629	1	See Item 23-8
1-17*	Review field procedure FPG-3.00 to ensure clarity and completeness	I-11		FE		790531	1	See Item 23-7A

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
1-18	Revise PQCI C-1.02 to provide inspection rather than surveillance and to record inspections	I-16		QC		800801	1	
1-20*	Perform in-depth audit of U.S. Testing	I-18		QA		790531	1	See Item 23-15
1-21*	Review all active QCIs for surveillance callouts	I-18		QC		790629	1	See Item 23-19
1-22*	Evaluate documentation (review) call-outs on QCIs	I-18	1	QC		790629	1	Superseded by Item 23-19
1-24*	Complete in-depth review of the Bechtel trend program	I-22		QA		790601	1	See Items 23-18, 23-35, and 23-36
1-25*	Conduct QA training	I-22		QA		790601	1	Superseded by Items 23-16 and 23-17
3-1*	Clarify the Response to Question 362.12 in FSAR Revision 18	3-1	0	LS		790531	1	
4-1*	Provide criteria for permissible residual settlement	4-1	3	GT CE		791231	1	
4-2*	Provide details of treatment of loose sands	4-2	0	GT CE		790831	1	
4-3	Take dynamic modular measurements upon removal of preloads for diesel generator building and other buildings	4-3	3	GT		791031	1	
4-4	Use data of Item 4-3 to evaluate the seismic response of the structures	4-3	3	CE		791130	1	Partial Requirement of Items 13-6, 13-11, 13-16
4-5	Prepare additional response to NRC for Items 4-1 and 4-2	NA		CE		790831	1	
4-9	Fill the diesel fuel oil tank with water to perform a full-scale test of the foundation soil	4-2	0	GT			1	See Item 6-4
5-1	Monitor the settlement of the structures (which were subjected to preload) during the life of the plant to provide a record of performance	5-1	0	GT			1	Ongoing activity, requirements in Dwg C-994, Spec C-76

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
6-1	Construct and fill the borated water tank to make a full-scale test of the foundation soils	6-1	0	GT CE			1	Tracked by Item 4-8
6-2	Delay the piping connections to the BWST until most of the settlement has taken place under the test load	6-1	0				1	
6-3	Use settlement data from BWST to allow conservative piping connection design		0	NA			1	Tracked by Item 4-8
6-4	Evaluate the load test result of the diesel fuel oil tank and provide precise corrective measures if required	6-2	0	GT			1	See Item 4-9
6-7	Remove all unsuitable material in the tank farm area and replace with suitable compacted fill	6-1	3	GT			1	Tracked by Item 4-7
6-8	Monitor the non-Seismic Category I condensate storage tanks	6-2	3	GT			1	Tracked by Item 4-6
7-1*	Perform continuity check on duct banks after completion of preload program	7-3	3	FE		791130	1	
8-1	Establish a requirement to realign diesel generators if manufacturer's tolerance for pitch and roll are exceeded	8-2	0	CE		800304	1	Requirement shown in Dwg C-1011, Note 4
8-2	Monitor the diesel generator pedestal markers on a 60-day cycle throughout the construction phase.	8-2	0	CE		NA	1	Ongoing activity. Requirements in Dwg C-994 and Spec C-76. Included in Item 5-1
12-1	Complete one additional boring in the middle of diesel fuel oil tank area	12-1	0	GT		790423	1	
12-2	Complete three additional borings in the auxiliary building control tower area	12-1	0	GT		790531	1	
12-3	Complete Table 12-1 for soils investigation and planned remedial measures; respond to NRC	Tbl 12-1	1	CE		790531	1	
12-4	Provide supporting soil condition for Seismic Category I utilities	Tbl 12-1	0	CE		790531	1	

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
12-6	Provide a detailed description of planned corrective actions in Interim Report 6 of MCAR 24	Tbl 12-1	1	CE		790630	1	
12-7	Perform a continuity check on one conduit in each duct bank made with a hard-fiber rabbit prior to cable pulling	Tbl 12-1 Pg 4	1	FE		800630	1	See Item 7-1. Ongoing activity. See field procedure FIR 4.500
12-8	Measure the gaps between embedded sleeves and pipes entering the service water valve pits when the surcharge is removed	Tbl 12-1 Pg 5	3	CE			1	
13-1	Complete seismic reanalysis of diesel generator building to account for current lack of compaction	13-1	0	CE		791031	1	Superseded by Items 13-6 and 13-7
13-2	Review diesel generator building design and Seismic Category I equipment piping, and electrical systems to the enveloped seismic responses	13-		CE		791231	1	Superseded by Items 13-8 through 13-10
13-3A	Conduct a seismic reanalysis to account for revised soil structure interaction of service water pump structure	13-2	0	CE		791231	1	Superseded by Items 13-11 through 13-15
13-3B	Review structural design and Seismic Category I equipment, piping, and electrical systems and incorporate the seismic responses of the reanalysis for the service water pump structure	13-2	0	CE		791231	1	Superseded by Items 13-11 through 13-15
13-4A	If significant change of foundation properties of the auxiliary building result, conduct a seismic reanalysis;			CE		791231	1	Superseded by Items 13-16 through 13-20
13-4B	Review structural design and Seismic Category I equipment, piping, and electrical systems and incorporate the seismic response of the reanalysis for the auxiliary building			CE		791231	1	Superseded by Items 13-16 through 13-20

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
13-5	Underground utilities - Investigate the change in differential displacement separately for buildings founded on fill pending results of seismic reanalysis					791231	1	Superseded by Item 13-21
14-1	Review the estimated settlement upon completion of the load test program of the BWST	14-1	5	GT		810131	1	Tracked by Item 4-8
14-2	Analyze flexible buildings for differential settlement based on stiffness at the time of distortion. Evaluate forces due to arching or distortion according to Question 15	14-2	0	CE			1	Superseded by Item 26-1. See Item 14-6
14-3*	Map significant cracks in auxiliary building, feedwater isolation valve pits, and ring foundation for the BWSTs	14-3	0	CE		790630	1	
14-4*	Analyze buildings affected by differential settlement for observed differential settlement plus predicted differential settlement	14-4	0	CE		790831	1	Superseded by Item 26-1. See Items 14-2 and 14-6
14-5	Prepare additional response to the NRC	14-		CE		790831	1	
14-6*	Analyze the diesel generator building for variable foundation properties by finite element model	14-2	3	CE		791231	1	
16-1*	Perform soil borings in areas of buried pipes	16-1	0	GT		790831	1	Deleted in Rev 5. Requirement to perform borings is in Dwg C-1146
17-1*	Evaluate impact of the failure of buried non-Seismic Category I piping on safety-related structures, foundations, and equipment	17-1	0	CE		790629	1	Deleted in Rev 2. Evaluation was not requested by NRC.
17-3	Prepare additional response to the NRC					790629	1	

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
23-1*	Consultant reports other than Dames & Moore were considered in accordance with the guidelines provided in NRC Regulatory Guide 1.70, Revision 2. Consultant reports were not attached to the FSAR, but portions of consultant reports were extracted and incorporated into the FSAR text itself. Those portions incorporated into the FSAR become commitments. Therefore, disposition of recommendations in consulting reports has been adequately accounted for in the preparation of the FSAR. Verification that those portions of consultant reports determined to be commitments and incorporated into the FSAR have been adequately reflected in project design documents is being accomplished via the FSAR rereview program described in the response to Question 23, Part 2. The two Bechtel QA audit findings reported in our April 24, 1979, response (Paragraph D.1, Page I-8) have been closed.	I-8, 23-7	4	PE		790518	1	
23-2*	On April 3, 1979, Midland project engineering group supervisors in all disciplines were reinstructed that the only procedurally correct methods of implementing specification changes are through the use of specification revisions or specification change notices. This was followed by an interoffice memorandum from the project engineer to all engineering group supervisors on April 12, 1979.	23-8, 23-24	4	PE		790312	1	
23-3*	Engineering Department Project Instruction 4.49.1 was revised in Revision 2 to state, "Under no circumstances will interoffice memoranda, memoranda, telexes, TWXs, etc be used to change the requirements of a specification."	I-8, 23-9, 23-24	4	PE			1	

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
23-4*	A review of interoffice memoranda, memoranda, telexes, TWXs, and other correspondence relating to specifications for construction and selected procurements of Q-listed items will be initiated. The purpose of the review will be to identify any clarifications which might reasonably have been interpreted as modifying a specification requirement and for which the specification itself was not formally changed. An evaluation will be made to determine the effect on the technical acceptability, safety implications of the potential specification modification, and any work that has been or may be affected. If it is determined that the interpretation may have affected any completed work or future work, a formal change will be issued and remedial action necessary for product quality will be taken in accordance with approved procedures. The foregoing procedure will be followed for all specifications applying to construction of Q-listed items. For specifications concerning the procurement of Q-listed items, the foregoing procedure will be implemented on a random sampling basis. The sample size has been established and the specification selection has been made.	23-5, 23-9	4	PE			1	
(21)	Review and acceptance criteria for the specifications will be defined by March 14, 1980.							
(47)	The review of construction and selected procurement specifications is scheduled to be completed by October 1980.							

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
	If the acceptance criteria are not met, the review will be expanded to include other specifications for Q-listed items. At that time, a revised completion date will be established.							
23-5*	A study was completed which examined current procedures and practices for the preparation and control of the FSAR in view of these experiences. Procedural changes will be initiated by the revision of or addition to the engineering department procedures. This action is scheduled to be completed by January 31, 1980.	23-11	5			800131	1	
23-6*	An interoffice memorandum dated April 12, 1979, was issued by geotechnical services to alert personnel of the need to revise or annotate calculations to reflect current design status.	23-13	4	GT		790312	1	
23-7*	Field Instruction FIC 1.100, Q-listed Soils Placement Job Responsibilities Matrix, has been prepared and establishes responsibilities for performing soils placement and compaction.	I-11, 23-18, 23-20, 23-30		FE			1	
23-7A*	Review Field Procedure FPG 3.000 to ensure clarity and completeness	I-11		FE			1	See Item 1-17
23-8*	Construction specifications, instructions, and procedures were reviewed to identify any other equipment requiring qualification which had not yet been qualified. No such equipment was identified.	I-11, 23-18	5	FE			1	See Item 1-16
23-9*	A dimensional tolerance study was completed using the reactor building spray pump and ancillary system as the study mechanism.	I-8	4	FE			1	
23-10*	Engineering reviewed specifications not previously reviewed for the specificity or tolerance studies.	I-8					1	See Item 1-5

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
23-11*	A specific review of the FSAR and specification requirements for the qualification of electrical and mechanical components has been made as part of the corrective action relating to CPCo's 50.55(e) report on component qualification.	I-8					1	
23-12*	Quality assurance will schedule yearly audits of the design calculational process for techniques and actual analysis in each of the design disciplines.	I-8					1	
23-13*	Audits of ITT Grinnell hanger design and CPCo relay setting calculation have been conducted.	I-8		QA			1	See Item 1-13
23-14*	Bechtel project engineering will review design drawings for cases where ducts penetrate vertically through foundations. The possibility of the duct being enlarged over the design requirements and the effect this enlargement may have upon the structure's behavior will be evaluated by June 1, 1979. Proper remedial measures will be taken if the investigation shows potential problems.	I-7					1	
23-15*	An in-depth audit of U.S. Testing operations, covering testing and implementation of its QA program, will be conducted in late April or early May 1979, by Bechtel project QA and engineering.	I-18		QA			1	See Item 1-20
23-16*	An in-depth training session will be given to Midland QA engineers covering the settlement problem and methods to identify similar conditions in the future.	I-22	4	QA		791130	1	See Items 1-25 and 23-17
23-17*	An in-depth training session will be given to all CPCo and Bechtel QA engineers and auditors to increase their awareness of the settlement problem and discuss auditing and monitoring techniques to increase audit effectiveness.	I-22	4	QA		800229	1	See Item 1-25 and 23-16

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
23-18*	An in-depth review of the Bechtel trend program data will be undertaken by Bechtel QA management to assure the identification of any other similar areas that were not analyzed in sufficient depth in the past reviews.	I-22	4	QA			1	See Item 1-24
23-19*	Quality control instructions will be evaluated to ensure that the documentation characteristics which are to be inspected (i.e., surveillance and review callouts) are clearly specified.	I-18	4	QC			1	See Items 1-21 and 1-22
23-21*	See Item 23-4		5	PE		800314	1	
23-22*	Guidelines for surveillance of testing operations will be developed and included in field instructions for the onsite soils engineer. Engineering/geotechnical services will develop the guidelines by November 30, 1979.	23-27	5	GT		791130	1	
23-23*	Engineering will revise Engineering Department Procedure 4.22 by December 1, 1979, to clarify that engineering personnel preparing the FSAR will follow the requirements of Regulatory Guide 1.70, Revision 2, Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (September 1975). Specifically, Regulatory Guide 1.70 (Pages iv and v of the Introduction) requires that such consultant reports only be referenced with the applicable commitments and supporting information included in the text (third paragraph, Page v). Such a requirement would preclude repetition of this circumstance.	23-7, 23-46	5	PE		791130	1	
23-24*	To preclude any future inconsistencies between the FSAR and specifications, Engineering Department Project Instruction 4.1.1 will be revised to state that all specification changes, rather than just "major changes," will be reviewed for consistency with the FSAR.	23-11	5	PE		791130	1	

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART I: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
23-26*	In view of Item 6, geotechnical services will revise Procedure FP-6437 by December 31, 1979, to require that calculations be annotated to reflect current design status.	23-13	5	GT		800328	1	
23-27*	Engineering Department Procedure 4.37 will also be revised by December 31, 1979, to require that calculations be annotated to reflect current design status.	23-13	5	QA		791227	1	
23-29*	The civil standard detail drawings will be revised to include a detail showing horizontal and vertical clearance requirements for duct bank penetrations. The detail will address any mud mat restrictions.	23-15	5	CE		791231	1	Shown in Dwg C-141
23-32*	Guidelines for surveillance of testing operations will be developed and included in field instructions for the onsite soils engineer. Engineering/geotechnical services will develop the guidelines by November 30, 1979, and field engineering will prepare the instructions by February 29, 1980.	23-27	5	FE		800229	1	
23-36*	Control Document QADP C-101, Project Quality Assurance Trend Analysis. is being revised to improve the definition of implementing requirements for identifying repetitive nonconforming conditions.	23-33	5	QA		800124	1	See Item 1-24
23-38*	A study was completed by October 31, 1979, to examine current procedures and practices for the preparation and control of the FSAR in view of these experiences. Procedural changes will be initiated by the revision of or addition to the engineering department procedures.	23-11	5	LS		791130	1	

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART 1: COMMITMENTS FROM QUESTIONS 1 to 35 (Continued)

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
2-0	No Action Item						-	
9-0	No Action Item	NA					-	
10-0	No Action Item	NA					-	
11-0	No Action Item	NA					-	
21-0	No Action Item						-	
22-0	No Action Item						-	
28-0	No Action Item						-	
29-0	No Action Item						-	
30-0	No Action Item						-	
32-0	No Action Item						-	
34-0	No Action Item						-	
35-0	No Action Item						-	

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART II: COMMITMENTS FROM SUPPLEMENTARY QUESTIONS

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
S-6	Continue involvement of CPCo/Bechtel consultants for reviewing remedial actions	B					5	
S-7	Monitor service water pump structure and pile displacement during jacking operation to verify pile dynamic stiffness used in seismic analysis	B		GT CE	B. McConnel		5	

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART II: COMMITMENTS FROM SUPPLEMENTARY QUESTIONS

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
S-1	Advise Bechtel to commence dewatering and underpinning activities	A		CPCo			4	After favorable SER
S-2	Develop settlement time rate criteria for all Seismic Category I structures	A		GT		810331	4	
S-3	Monitor concrete cracks for service water pump structure and auxiliary building electrical penetration areas and the feedwater isolation valve pits before and after installation of piles and caissons	B		CE		801031	4	Due date is for incorporating requirement into drawing

MASTER LIST OF COMMITMENTS TO NRC ON 10 CFR 50.54(f) RESPONSES (Continued)

PART II: COMMITMENTS FROM SUPPLEMENTARY QUESTIONS

Item	Description	Page	Rev	Resp Org	Responsible Engineer	Due Date	Status	Status Remarks
S-4	Monitor concrete cracks in the BWST valve pits and repair any observed crack exceeding the ACI code limits	B		CE		800630	2	Due date is for incorporating requirement into drawing. Dwg C-1148 has been issued.
S-5	Grout the local gaps between diesel generator building footing and mud mat	B		CE		800407	2	Grouting requirement in Dwg C-1147
S-8	Envelope pile stiffness for the seismic analysis of service water pump structure	B		CE	B. McConnel		2	Completed seismic model. See Item 13-11.
S-9	Check the limited clearance between the service water pipe at the building penetration	B		PD CE	R. Tulloch	800731	2	See Response to Question 45

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48105

November 2, 1979

BLC- 8404

CONSUMERS-POWER CO.
RECEIVED
NOV 06 1979
Site Mgr.
Midland Project

Consumers Power Company
Midland Project
3500 E. Miller Road
Midland, Michigan 48640

Attention: T.C. Cooke

Subject: Consumers Power Company
Midland Plant - Job 7220
Stainless Steel Pipe Attack
File: 0270, M-5000

References: 1) Letter T.C. Cooke to R.L. Castleberry, CSC-4198, 7/6/79
2) Letter L.H Curtis to R.C. Bauman, BLC-8260, 10/4/79

file B1.7

Gentlemen:

This is a partial response to Reference 1. In Reference 2 we reported that the corroded sample of 6-inch stainless steel pipe had been sent to our San Francisco office for failure analysis. That failure analysis is now substantially complete. A formal report is being prepared and will be transmitted to Consumers Power Company when it is complete. This transmittal to CPCo is scheduled for November 22, 1979.

Three samples of backfill sand were analyzed, two from the area near where the corroded pipe was excavated (Samples 1 and 2), and another from a nearby "clean" area (Sample 3). The samples were all very similar in makeup except for the presence of calcium carbonate in Samples 1 and 2. No compounds unusual for sand were noted, and nothing was discovered which would be corrosive to stainless steel.

Chemical analysis of the pipe showed that it meets the requirements of ASTM A-312 TP 304. Metallographic examination showed no manufacturing defects. The corroded area of the sample had suffered fairly uniform surface corrosion. The most severe corrosion is in very localized areas in which pitting has occurred through almost two-thirds of the pipe wall thickness. There is very little corrosion product remaining, either in the pits or on the surface. Analytical testing of the corrosion products showed them to be iron oxides and adherent particles of sand, with minor amounts of nickel and chromium, and trace amounts of chloride. The laboratory noted a light-colored calcium carbonate deposit on the pipe.

Calcium carbonate was also present in sand Samples 1 and 2. The laboratory is evaluating means by which the calcium carbonate from the sand was able to dissolve and redeposit on the pipe surface. Although the deposits would tend to set up differential aeration cell corrosion, it is unlikely that this form of corrosion could cause severe pitting without the help of an external corroding agent or a stray electrical current.

We have been unable to identify the mechanism causing the severe corrosion of this pipe sample. Our laboratory believes that further investigation and testing would produce no more substantial conclusions than those already reached. We can state with confidence that the backfill sand is not responsible for the corrosion of the pipe sample. We consider the corrosion of this pipe to be an isolated incident, and recommend at this time that no further work be done to determine the cause of the corrosion. Also, based on the evidence that this is an isolated incident, we do not recommend any further inspection of other buried stainless steel pipe. Should any other instances of this pipe corrosion be noted in the future, we will reevaluate this position at that time.

Very truly yours,

for L.H. Curtis
Project Engineer

JOA/ht
10/22/5

cc: R.C. Bauman
S.L. Blue
L. Curtis
L.A. Dreisbach
W. Keyser
D.B. Miller
T.J. Sullivan
Com Log

GSK

7/31/80

To File 0485.16

From TRThiruvengadam TRT

Date September 24, 1980

Subject MEETING WITH NRC STAFF AND
CORPS OF ENGINEERS ON SOILS
JULY 31, 1980
FILE: 0485.16 UFI: 00234(S) 71*01 SERIAL 9830

CC SHHowell
JWCook
DBMiller/TCCooke
TRThiruvengadam
JEBrunner
JARutgers, Bechtel
KWeidner, Bechtel
MMiller, IL&B

The following are meeting notes of a meeting between NRC Staff, NRC's Consultants, Consumers Power Company, Bechtel and Bechtel's Consultants.

Place	NRC Offices at Bethesda, MD
Date & Time	July 31, 1980 - 8:30 AM
Subject	Soil/settlement issues - 50.54(f). Specifically, recent requests from Corps of Engineers for additional soil borings and laboratory tests on samples taken and interpretation of results.
List of Attendees	See Attachment 1.
Agenda	See Attachment 2.

1. Opening Remarks (G S Keeley)

Meeting was called by CP Co's request primarily to update NRC and its consultants on investigations done since last submittal and to discuss the technical justifications and need for requesting additional borings and

laboratory tests on samples by Corps of Engineers in the recent letter from A Schwencer of the NRC to J W Cook of CP Co dated June 30, 1980.

2. Summary of Total Investigative Program (J Wanzek) (Attachment 3)

To date a total of 255 borings were made since late 1978, out of which boring logs for 199 borings have already been submitted to NRC. The logs for remaining 56 borings are being checked and will be given to NRC in the next submittal. Most of the borings belonging to the latter case were done for construction dewatering effort in order to repair a duct bank and install a valve pit. A drawing with all the locations for borings and including test pits was shown. The investigations done since the preload programs were circled in green pen to differentiate these recent borings from those taken prior to the completion of the preload program. The majority of the borings were of the standard SPT type; namely, SPT every 2.5 ft for the first 10 ft and 5 ft afterwards. When the soil samples were taken, only specific tests that were needed were performed. For the 56 borings, the standard penetration blow counts were recorded. Some of the boring logs requested by the Corps in the letter referenced earlier were companion holes, mainly for observing the drawdown during operations. Though these holes were identified in the drawing as to their locations, no samples were taken in these borings.

Question: Were any surprises encountered in the results of borings performed after preloading? When were the additional borings in diesel generator building area performed?

Response: No surprises were encountered. The information was similar as before, if not better. The additional borings, for cross-hole tests, were done during December of 1979. The preload was taken off approximately four months earlier.

The test pits (seven of them) were dug in the areas shown in the drawing. Two plate load tests were performed in the tank farm area.

Thirteen dutch cone probe tests were performed with the assistance of Dr R D Woods of University of Michigan in the diesel generator building area. Four cross-hole tests with 21 borings were performed, with the assistance of Dr R D Woods, in four areas as indicated in response to question 35. Laboratory tests performed on selected samples, when required, consisted of shear strengths, consolidation, compaction, Atterberg limits, grain size and clay minerology (with the assistance of Professor Gray of University of Michigan).

Load Tests

1. The preload program on diesel generator building is actually a full scale load test. At present, equipment is being installed in the building.
2. Condensate Storage Tanks: Load test is in progress.
3. Diesel Fuel Oil Tanks: Load tests have been completed. The tanks have been filled for a period of more than three months. Insignificant settlements were observed during the load test and there was no significant rebound after the load was removed.
4. Borated Water Storage Tanks: Load test on these tanks are planned for the near future. There is still some construction work being done on these tanks.

Pump Tests (Dewatering)

Drawdown during construction dewatering for the repair of a duct bank and valve pit work were monitored. Four to six feet of drawdown was measured with no measurable effect on settlement. This aspect will be covered later in this presentation.

Question: (Hood) Last February during a site visit it was observed that the service water pipe entering the pump house structure was supported on wedges. A concern was expressed at that time that if the wedges were removed and if the building or the pipe settled, there is a possibility that the pipe would get hung up on the building, resulting in unacceptable stress levels in the pipe. Has this situation changed and has a program been established to monitor this pipe and other pipes in similar situations?

Response: These wedges have since been removed. In one of the pipes, after the wedges had been removed a movement of 1/32" was measured. Borros anchors installed in the vicinity of service water pipes showed no significant settlements during construction dewatering.

Question: (Heller) How deep were the excavations for the repair of the duct bank? Were any geotechnical tests or investigations conducted during the excavations?

Response: The depth of the excavations were in the range of 18 feet. No geotechnical investigations were conducted. Only borings for dewatering were made.

Update On Investigation Since Last Submittal

Settlement observations made on diesel generator building structure is as shown in Attachment 4. The latest settlement reading, as of June 12, 1980, shows no significant increase in settlement. In comparison, the projection of original slope; namely, the predicted settlement curve, indicates the conservatism in the settlement prediction. Predicted versus measured settlement is shown in Attachments 5 and 6. Again, the comparison demonstrates the conservatism in the prediction.

Question: (Hood) The small break in measured settlement plot in Attachment 4 - does that indicate rebound?

Response: No. Slight rebound immediately after preload removal was observed. However, the break in the curve is not due to rebound. It is due to change in reference bench marks. Again, it doesn't mean data is lost, it merely indicates change in datum.

Question: (Hood) Are differential settlements between condensate pipe line and condensate tank being monitored?

Response: No. Condensate tank is a Nonseismic Category I structure. Only the settlement of condensate tank is being monitored as a part of overall monitoring program.

Question: (NRC) The settlement prediction in Attachment 4 - does it include settlement due to permanent dewatering?

Response: No. The settlement due to permanent dewatering has been computed separately. This has been addressed in Response to Question 27. There was a drop in water level of about 4 ft at the diesel generator building structure due to pond lowering and construction dewatering. There was no settlement observed due to this drawdown. Furthermore, the Borros anchors located adjacent to the service water pipe lines and pump house structure showed only small settlement.

Question: What is the schedule for starting the dewatering operation?

Response: CP Co was ready to issue the contract bids for temporary dewatering on December 6, 1979, however, due to the NRC order issued on December 6, 1979 on remedial action, CP Co has not started temporary dewatering or remedial action.

Question: (Corps) If the dewatering and underpinning operations are done simultaneously or in quick succession, wouldn't dewatering result in settlement of footings of adjacent buildings which could cause additional load on the caissons?

Response: Dewatering is intended to be done down to the glacial till. There will be sufficient time gap between the completion of dewatering and start of transferring load to the caissons.

Question: (NRC) Would the dewatering of the plant area cause inflow from outside sources such as Dow chemical pond? Is there a need for a monitoring program to assure the proper functioning of the cut-off wall in the plant dike?

Sufficient information on plant dike, such as cross-sections, materials used and relative elevations of Dow's chemical pond, etc, is not provided in FSARs.

Response: As a part of dike monitoring program, the dikes are observed for undue seepage. No such seepage has been observed so far. When the groundwater elevation at the plant site was at 623 (±) and elevations of chemical pond on the west end and river on the east being considerably lower no undue seepage was observed. This lack of water movement established the proper functioning of the cut-off wall and, therefore, no special monitoring program is intended. In addition, a few piezometers located on either side of the plant dike confirm the observation stated above.

Remarks (G S Keeley)

CP Co would like to discuss the requests made in NRC's letter dated June 30, 1980, specifically items (1) to (4) in the letter. CP Co would also reiterate the guidance given previously by the NRC that the original requirements in PSAR would not be changed now, and the FSAR would be accordingly revised once the 50.54(f) issues are resolved.

Response: (Hood and Corps)

The statements made in Items (1) to (4) in the letter are to be construed only as comments on responses provided CP Co.

Statement: (Peck) Concerning Items (1) to (4) of the Referenced Letter

There is no doubt that if one goes into the fill now and measures the common properties which are normally used as control properties, such as density, moisture content, etc, one will find considerable scatter in the properties. These are all index properties. The overall control property is compressibility. Stressing the soil by overloading it including the effects of dewatering, allows the compressibility to be measured thereby allowing a reasonable settlement prediction to be made. One of the reasons why the pond water level was raised prior to the completion of the preload was to saturate the fill as much as possible. At that time, the water table was two to four feet beneath the footing level. The capillary action in the zone above the water table would be preserved, sands and clays would consolidate. With regards to the request for additional soil borings in order to obtain an independent verification of the predictions for future settlement, independent results could be obtained from the results of new borings and tests. However,

settlements computed from the results of new borings and tests need not necessarily result in a correct prediction. The answer we want to verify is already known from the preload program. During the boring process there would be sampling disturbance which would result in predications of much higher settlement than would actually be observed. There would also be considerable scatter in test results. Some borings will show stiff material and probably an equal number of borings may show soft material. In order to obtain reasonable conclusions, one would have to treat the data statistically. The settlements computed on these bases would turn out to be too large and the question is what does this data mean, since the preload program has already answered the question. Now, one can turn the tables and ask a question that with soil data having considerable scatter, such as those that would be encountered here, what one would do if settlement prediction is required, one would most surely require proof load testing. In our case this has already been done. There has been no significant settlement in the last eleven months. Except for the pedestal, the structure is almost fully loaded and contact pressure at the bottom of the footing is probably near the maximum value and with this situation no further settlement has been observed. The final soil pressure under the pedestal is going to be considerably less once the diesel generator is placed than that experienced during the preload. Furthermore, during temporary dewatering that is scheduled to be performed for underpinning operations under auxiliary building wing walls, the water table would be lowered almost to the same level as under the permanent dewatering scheme. By this means, the real settlements of the structure would be known before the plant actually goes into operation.

The settlement predictions due to dewatering are not going to be based on information from tests done on soil samples but instead on actual readings taken from drawdown during temporary dewatering programs over a very large area. The entire approach has been based on performance of the soil under fully loaded conditions and the settlements will be known and can be predicted with great accuracy before the plant goes into operation.

Such an approach in settlement prediction is not without precedents for nuclear power plants. In the Kewanee plant, currently in operation, a 40-ft clay layer was encountered. Extensive sampling of the soil was done and the computations from laboratory tests showed a prediction of settlement of 15 inches, which is definitely not a reasonable number. There was evidence that the clay was precompressed by glaciation since a fairly thick layer of till had to be removed to reach the clay layer. One clay layer above the rock was very uniform in moisture content which indicated that it is lacustrine, however, strength values varied widely. From such observations the magnitude of the preconsolidation load was computed and a settlement value of 1-1/2" was predicted. The structural foundation consisted of a raft foundation, which was poured in sections. Very accurate settlement measurements were taken. The measured settlement turned out to be 1-1/2" as predicted for the foundation. At its completion, the structure experienced an additional settlement of 0.15" On the basis of sampling and testing, the predictions would have been ten times higher.

As another example, for the Quanicassee plant, originally proposed and later cancelled by CP Co, borings and sampling indicated 10" to 15" of settlement of thick deposits of clay and granular material. A limited dewatering program was carried out, wherein the water table was pulled down to. the rock level, thereby loading the deposit by removing the buoyancy. Piezometers responded in predictable fashion, deposits behaved elastically and a direct measurement of confined modulus resulted in a measured settlement of 1.5" which was 1/8 to 1/10 of the settlement prediction obtained from conventional sampling techniques. These examples show that the best possible sampling techniques and subsequent laboratory testing and theoretical computations will result in computed settlements which could be very high. By the preloading program the best possible answer was obtained. One will put themselves in a considerably difficult position if one has to go back and start taking samples and predict settlements based on laboratory tests and find that the predictions are orders of magnitude higher than what was observed.

Question: (Hood)

Recognizing that this is the state of the art at that point in time, is it possible to use the observations made in Kenwanee and Quanicassee to refine the sampling techniques and methods of computations so that this can be applied to cases such as Midland?

Response: (Peck)

Standard techniques consisting of sampling, laboratory testing and theoretical computations don't work well on overloaded clays, stiff soils and compacted fills. Such methods are good for materials such as homogenous clays and soft soils.

Question: (Hood)

Why can't results from field experiences such as Kewanee be the source for a great deal of research in the field of soil mechanics in order to devise means to improve the predictions?

Response:

Yes, considerable research is in progress. Considerable advancement has been made in many areas such in sampling techniques, however, not in all aspects of soil mechanics. It should be realized that soil mechanics by no means is an exact science. It is still an art in many areas.

With reference to Item (4) of the referenced letter, it should be pointed out that there was no simultaneous raising of water table and the preload surcharge. Once the final preload was achieved, both levels were constant for the entire period of surcharge. Water level was raised to eliminate capillary as much as possible and to saturate the clays. This enabled the piezometers to react well. By raising the water level three to four feet, the effective load was slightly reduced due to buoyancy effect, however, this was a reasonable price to pay for the benefits stated above.

Questions: (Corps)

If some fill was placed dry of optimum, what would be the effect?

Response: The effect would not be crushing as it could not be that dry. However, it would have been distortion; ie, change in shape. This would have been noticeable in time lag in settlement similar to creep phenomenon. The bending and distortion shows up in secondary consolidation, which is included in the prediction.

Question: (Corps)

If some fill were placed wet of optimum, what would be effect on strength?

Response:

This question is difficult to address directly. Settlement curves have shown that settlements have been stabilized for the last 11 months. Building footings are now experiencing the soil pressure very close to their final value. With the additional load there has been no settlement. Even in brittle clay, with a nonlinear settlement curve, the curve tends to fall over. There is not a slightest indication of this behavior. Therefore, the factor of safety is considerably higher than 1.0.

The present data indicate some rebound following removal of the surcharge, therefore the foundation contact pressure is less than under the surcharged conditions. The factor of safety must be at least one and is clearly greater than this. There is experience (Fargo grain elevator) that even in stiff materials there is nonlinear behavior at loads above about 80 percent of the ultimate. Therefore, the factor of safety is clearly significantly larger than one since nonlinear behavior has not been recorded. The factors of safety beneath the generator pedestals will be even greater because the current pressure is less beneath them.

Question:

All the preloading has been at the surface, where influence would be to impart maximum stress near the surface and decrease in stress with depth. However, stress due to dewatering will have the opposite distribution. Minimum near the top and increasing with depth. Won't this induce more settlement?

Response:

The part of the material compressed most due to surcharge is the upper part. Borings made earlier showed that the top 15 feet formed the poorly compacted fill. Fill below elevation 615 (±) had high blow counts, indicating good compaction. The deeper the soil layer, the greater is the overburden stress. In e-logp curve, more $\triangle$ p produces less $\triangle$ e. Therefore, one would expect to see little settlement due to drawdown. There may be areas wherein the dewatering would induce stress more than the preload. However, the effect of this would be observed during temporary dewatering.

Question: (Corps)

Settlement plot indicates that contact pressure under footings may not be uniform and wouldn't this cause overstress of soil exceeding bearing capacity and overstress of the structural elements.

Response:

Most of the settlement of the diesel generator building was due to the settlement of the fill. The building just went along for the ride. Because of the differential settlements observed, contact pressure may not be the same. However, the building was surcharged both inside and outside uniformly. Initially a portion of the building was hung up on a vertical duct bank. Once this was removed, the building settled uniformly. The stress in the building was evaluated by analyzing the building with variable foundation modulus.

Response: (Afifi)

Regarding the question of safety factors against bearing capacity failure, the issues have alrady been addressed in response to Question 35. Consolidated undrained triaxial shear strength tests were conducted on samples of plant area clay fill, in areas such as transformer, condensate tanks, taken during the 1978 exploration program. See attachment 7 for a plot of undrained shear strength versus confining pressure from these tests. Based on undrained shear strength from the normally consolidated envelope a factor of safety 3 for dead and live loads and greater than 2 for dead plus seismic loads have been calculated.

Question: (Corps)

How can one be sure that such confining pressures exist.

Response:

It is more likely that very high confining pressure exists in the field due to lateral stresses arising out of surcharge.

Question: (Corps)

The borings from which these tests were done and the depths at which these test samples were taken are not currently available. Could this be provided?

Response:

Yes. The requested information will be provided in our next submittal.

Question:

Modulus of elasticity was computed based upon the unloading curve. Shouldn't this be computed on the basis of a reloading curve?

Response:

The lab tests usually show a hysteresis type of curve for unloading and reloading. This is primarily due to side friction in the sample testing process. However, in the real situation, there is very little difference between unloading and reloading curves.

Question: (J Kane)

We would predict considerable rise of pore water pressure immediately after surcharging. However, piezometers didn't indicate this. Could this be due to bridging and arching of clay over rigid sand seams? Also in fourteen piezometers, recovery of pore pressure was noticed after the load has been taken off. How would one explain this phenomenon?

Response:

The rapid dissipation of pore water pressure is anticipated earlier because borings indicated sand layers and seams and clay would have macro voids which are typical of compacted clay fill. The surcharging process took several days and pore pressures were being rapidly dissipated during the surcharging operations. The surcharge causes excess pore pressure to be driven off, which results to a certain extent in negative consolidations and the reason as to why fourteen piezometers showed recovery of pore pressure was the reflection of the pond.

Question: (Heller)

Can't additional testing be done with refined sampling techniques?

Response:

It is possible, however, the reason for not doing it is not to get into a statistical argument because of unavoidable scatter in test results.

Question: (Heller)

The factor of safety for bearing capacity is known only to be at least equal to 1.0. Is it 1.2, or greater?

Response:

Shear strength at footing level may show a lot of scatter. Any compaction of sand layers observable from blow counts in a boring with SPT would be obscured in the scatter of the N values. The bearing capacity factor of safety may need some confirmation. For this purpose, load tests on larger masses of soils are preferable.

Question: (Heller)

The more heterogeneous the soil, the more samples it would require. It still would be possible with adequate samples to reach an independent conclusion.

Response:

The question is what is needed to be known. The preload has given the answer one needs to know. A lot of money has been spent on this preload program. The main purpose was to consolidate the fill and in the process obtain the required answer.

Question: (Corps)

This is not an ordinary structure, one has to be 100% sure, hence the need for additional borings.

Response:

The testing program outlined by the NRC will not erase the doubts so that one can be 100% sure. It will introduce more doubts and raise more questions which cannot be explained with the current state of knowledge.

In summary, there are three basic issues:

1. Dewatering: The effects of dewatering can readily be observed and measured, before the operation of the plant, by starting the temporary dewatering operations soon.
2. Bearing Capacity - (factor of safety): This could be more expeditiously determined by large scale direct tests, such as plate load tests.
3. Adequacy of Surcharge: This is a false concern since evidence of reality (settlement measurements) is quite sufficient.

<u>Discussion of additional borings adjacent to auxiliary building electrical penetration areas, service water pump structure and retaining walls.</u>

Presentation (T R Thiruvengadam)

The referenced letter requested additional borings with extensive laboratory tests adjacent to electrical penetration areas, service water structure and Category I retaining walls. The purpose of this investigation would be to verify the design capacities of caissions and piles for vertical load carrying capability and stability of retaining wall. Caissons will be driven into the till layer. The caissons will be typically,

four feet in diameter such that it enables a person to get down and inspect the till before concrete is placed. Furthermore, the caisson will be load tested to 1.5 times its design load and also has rigid settlement criterion. Similarly, the piles for service water structure also will be driven well into till until refusal. The designs capacity of the pile will be determined from a pile load test. Preliminary capacities for caisson and pile were established from initial recommendations made by Dames & Moore Report. Caissons and piles are designed to carry only vertical load and lateral loads due to earthquake are transmitted through a different system. Skin friction on caissons and piles will be very small since most of the settlement in fill due to its own weight have taken place already. The settlements reported in retaining wall were observed immediately after construction. Since then, no significant settlement has been observed.

Question: (Corps)

Are there any boring and test data from Dames & Moore Report that could provide data in lieu of information that could be obtained from borings requested by the NRC for auxiliary building and service water pump structure.

Response:

The data from Dames and Moore Report will be investigated for such a case. However, in order to provide meaningful information, boring data in the vicinity of the caissons would be required. Due to the presence of adjacent structures, even a new boring would have to be located 20 to 30 feet away from the edge of the auxiliary building.

Statement (Corp)

A boring at that distance would be adequate.

Cooling Pond Dike

Presentation (Wanzek and Sibbald)

The letter requested several borings in cooling pond dike. CP Co's position is that it is not necessary, not only because it is a Nonseismic Category I structure, but also for the following reasons:

1. Extensive stability analyses of the dike slope are provided in the FSAR.
2. The dike was built under a different specification, which is a method specification. This specification relied on the method of compaction such as number of passes of rollers, lift thickness, etc, and compaction test results.
3. The dike was built by a different contractor. It was a large structure, heavy equipment was used with very little use of hand held equipment for compaction and therefore resulted in better control.
4. Monitoring of the settlement monuments, 27 in number, show no significant settlements. The pond has been filled for two years with no adverse conditions noted.
5. Scheduled semiannual inspections are performed by walking the entire dike area to observe seepage, stability problems, erosion, etc.
6. Piezometers located in the dike which are read monthly show stable levels.
7. Several borings in the dike area, during construction, showed considerably better material than in the Category I fill.
8. Drilling holes at this stage might result in a potential for damage due to hydraulic fracture resulting in dike failure.

Conclusion

After all the detailed technical discussion NRC and their staff reiterated their requirements for additional borings and testing. CP Co stated that, based on the recommendations of their consultants, we don't feel the additional borings are needed or justified. CP Co stated that it would provide the information on borings already taken as well as other information requested in this meeting by a submittal on or before September 15, 1980.

Consumers Power Company

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

January 25, 1980

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

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

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

1. J. Wanzeck should clarify the slide shown in Washington to indicate the day the tank foundation was placed and it should be noted that this is a six month settlement update only. This can be accomplished possibly via an MCAR update or old question response update.

2. The alledged quarter inch diesel fuel oil tank settlement needs to be verified or deleted from wherever it was supposedly reported to the NRC. (J. Wanzeck)

3. S. Afifi, in the response to Question 4, should explain that table 4-1 is a projection (show totals only) and not what the structure can stand. He will also relocate this table to Question 27.

   S. Lo should verify that "to date" settlement plus additional future settlement will cause no problems to the diesel generator structure in the response to Question 14.

4. S. Afifi will indicate how we arrived at the half-inch figure for settlement caused by vibration of the diesel generator pedestals due to operation of the diesel generators. In response to Question 27, Dr. Woods analysis to include his method of calculation will be utilized.

5. S. Afifi will delete the word "clay" from the third line under note on table 4-1. (Renumbered 27-). He will also include the total settlement graph instead of only the portion utilized for predictions.

6. Table 4-1 footnote 2 (Renumbered 27-) - S. Afifi will explain how the settlement of the borated water storage tank is based on measurements of the Diesel Generator Building settlement here and in the response to Question 31.

7. The individual best fit curves projecting diesel generator settlement allow no margin for standard deviation on the best fit. Therefore, this appears to be unconservative. We need to amplify the fact that the curves assume the surcharge remains and that the worst data points are utilized for total settlement. This also would, of course, include something on the worst settlement being utilized for differential settlement calculations and their affect on the structure and connections. S. Afifi will add some discussion to amplify the conservative aspects and a statement on the piezometer in response to Question 27.

8. Our outline of response to Question 27 states: Item B. basis for accuracy. The outline will be changed and one sentence will state that the basis for accuracy is conservatism. We do not appear to be getting the response across on the borated water storage tanks. It is necessary to show that the soil is adequate in more concise terms. S. Afifi will add emphasis to the acceptable quality of the soil and that filling the tanks is only being done to verify the settlement prediction. It will be noted that this is not a soils problem; rather it is more like normal practice. We also have to verify that the tank foundation is adequate and that we will not have the problems which could arise if the foundation should somehow fail and you would have a subsequent stretching of the bottom membrane of the tank followed by a tear in the tank wall. All loads must be considered in this analysis. We should also state that we do not have the same degree of randomness in the soil as was present in the Diesel Generator Building. S. Lo will provide analysis to show that the tank foundation will be able to withstand seismic events. S. Afifi will do more research on the overload test necessity.

9. Our response to Question 33 needs to be amplified to include the effect of bouyancy on the load tests and what effect the lack of water (if any) from site dewatering will have on the tank settlement. Possibly there will be a retest after dewatering (S. Afifi).

10. B. Paris will address whether or not there will be any effect on the ultimate heat sink pond seal due to site dewatering in response to 24. f. and note why we are using timers instead of float switches in the pumps in response to 24 c., utilizing Loughney's input. The basis for the gradation of the gravel pack material will also be addressed by B. Paris in the response to 24. d. The slide for the individual wells freeze protection on the riser pipes will be shown by B. Paris on the response to Question 24.

11. S. Lo, K. Wiedner and T. Johnson will show that all past loads have been accounted for in the analysis of the future settlements of the Category I structures in response to Question 28 and 29. The NRC questioned whether the stress induced by differential settlement in the past was now locked

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

12. A response on the Q-ducts has to include an analysis as a category one structure. It was noted that this may not have been used as criteria in 1970, however, in 1976 this was checked per BC-TOP 4. This will be included in our response to Question 30. (S. Lo)

13. The response for 24. c. will include an analysis for the concrete service water pipes in the cooling pond and any other concrete pipes embedded in the class one fill. In the 24. c. response, B. Paris will also note that concrete pipes are generally away from critical structures and discuss probability failures.

14. After considerable discussion, it appears that the NRC is desirous of having Bechtel's proposed detailed method of analysis for the seismic event (Question 25). Bechtel will provide their normal analysis for new soils conditions under affected category I structures. (M. Rothwell)

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

15. Miscellaneous:

A. General

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

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

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

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

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

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

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

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

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

F. Response to Question 17 (Riat)

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

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

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

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

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

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

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

J. Response to Question 20 (Riat)

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

T. C. Cooke
Project Superintendent

TCC/ps

Attachment: Attendees List

CC: CAHunt
GSKeeley
DBMiller
KWiedner (Bechtel)
SAfifi (Bechtel)
ABoos (Bechtel)
BDahr (Bechtel)
LCurtis (Bechtel)
LDavis (Bechtel)

Attendees

1/16/80

Name	Organization
Darl Hood	DPM/NRR
Joe Kubinski	COE Detroit Dist.
William Paris Jr.	Bechtel - Geotech
Jo Wanzeck	Bechtel - Geotech
S. S. Afifi	Bechtel
W. R. Ferris	Bechtel
M. O. Rothwell	Bechtel
Karl Wiedner	Bechtel
Gil Keeley	Consumers Power
T. C. Cooke	Consumers Power
F. Schaufig	NRC-SEB
J. J. Zabritski	Consumers Power
S. Lo	Bechtel
T. E. Johnson	Bechtel
John F. Horton	COE NC Division Chicago
James W. Simpson	Army Corps NCD Chicago
William Lawhead	U.S. Army COE, Detroit
R. E. Lipinski	NRC-SEB
Gene Gallagher	NRC Region III:IE
Ross Landsman	NRC Region III:IE
Daniel M. Gillen	NRC NMSS
A. J. Cappucci	
R. O. Busnak	NRC/DSS/MEB
H. L. Brammer	NRC/DSS/MEB
Ray Gonzales	NRC/DSE/HMB
J. P. Knight	NRC/DSS
R. E. Jackson	NRC/DSS/GSB
J. G. Spraul	NRC/NRR/OAB
R. E. Shewmaker	NRC/IE/RCI

1/22/80

M. Rothwell	Bechtel
S. Afifi	Bechtel
J. Wanzeck	Bechtel
B. Paris	Bechtel
S. Lo	Bechtel
T. Cooke	Consumers Power Company

To File

From TCCooke/RMW

Date August 7, 1979

Subject MIDLAND PROJECT GWO 7020
PRE-MEETING WITH CONSULTANTS
File: B3.0.3 Serial: CSC-4274 UFI#-00234-S-

Consumers Power Company

INTERNAL CORRESPONDENCE

CC Attendees
GSKeeley, P14-408B
DBMiller
KCBrooks (2)

Attendees:

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

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

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

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

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

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

pp

Bechtel Power Corporation

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Ann Arbor, Michigan

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File C-425.16
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TELECOPY
BLC-8021

August 15, 1979

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

Subject: Midland Units 1 and 2
Consumers Power Company
Bechtel Job 7220
DIESEL GENERATOR BUILDING
REMOVAL OF SURCHARGE
File: 0614/2801

References:
1) BLC-6801 dated 11/16/78, P. Martinez to G. Keeley
2) Meeting Notes of Consultants Meeting on 5/10/79
3) Meeting Notes of Consultants Meeting on 6/18 and 6/19/79
4) Meeting Notes of Consultants Meeting on 6/28/79, Denver, Colo.
5) Summary of Presentation to NRC dated 8/10/79
6) BEBC-3176 (teletype) dated 8/13/79, R.L. Castleberry to J.F. Newgen

Dear Mr. Keeley:

The purpose of this letter is to advise you that the intent of the preload program has been achieved, and the surcharge can now be removed. On November 16, 1978, we advised you in a letter (Reference 1) of our

intent to carry out our consultants' recommendation to preload the diesel generator building and equipment foundations. The placement of surcharge inside and around the diesel generator building was completed in April 1979. The surcharge consisted of sand as shown in Drawing 7220-C-1141 issued for construction on January 10, 1979.

During the meeting with the consultants on May 10, 1979 (Reference 2), the surcharge depth of 20 feet was considered adequate. It was recommended by the consultants that the surcharge be maintained at that level for approximately 6 additional weeks to allow prediction of long-term settlement.

In the first part of June 1979, additional instrumentation was installed to obtain precise settlement data and measurement of rebound. During a mid-June meeting (Reference 3), the consultants concluded that on the basis of available data at that time, prediction of future settlement could not be made, and it was requested that the settlement readings be continued to improve the data base.

During a late June 1979 meeting (Reference 4), the consultants concluded that the surcharge could be removed in August, provided that the settlement trend continued after proper temperature corrections have been made. The temperature correction devices were developed by the staff of Goldberg-Zoino-Dunnicliff & Associates. The adequacy of the surcharge program has been summarized by R.B. Peck, one of the consultants at the presentation to the NRC on July 18, 1979, as follows (Reference 5).

> "The results of the preload procedure have been convincing. The observed pore pressures were smaller than actually anticipated, and they dissipated rapidly. Hence, primary consolidation was accomplished quickly, and the curve of settlement as a function of the logarithm of time became linear shortly after the completion of placement of the fill. Therefore, it is possible to forecast the settlement that would occur at any future time by simple extrapolation, on the assumption that the surcharge will remain in place. Even this amount of settlement would be acceptable. However, the projected settlement determined on this basis is an upper bound because the surcharge will be removed, and the real settlements will certainly be smaller."

It was R.B. Peck's judgment that foregoing circumstances eliminate any uncertainties concerning the settlement behavior of the diesel generator building resulting from the underlying clay fill.

On August 2, 1979, consultants R.B. Peck and A.J. Hendron, Jr. were provided with the latest precise settlement data and calculations for establishing residual settlement. On August 10 and 13, 1979, A.J. Hendron concurred, in a telephone conversation, with Bechtel's findings that the rate of settlement has decreased to such an extent that for the last 6 weeks there has been essentially no settlement, and that sufficient data have been obtained to allow prediction of long-term settlement by extrapolating the available settlement data. Calculations based on present data indicate that the residual settlement over a period of 40 years due to secondary consolidation of clay will be less than 1 inch. A copy of this confirmation letter from the consultants will be provided as soon as it is received. Because of the favorable settlement characteristics of the surcharge, the design intent of the PSAR in regard to prediction of long-term settlement has been met.

In conclusion, the preload operation has been successfully completed. The acceptance criteria have been met by providing a reliable residual settlement prediction. Structures, components, and utilities will be designed to accommodate the long-term settlement. Removal of surcharge will commence on August 15, 1979. Construction has been instructed accordingly (Reference 6).

Very truly yours,

P.A. Martinez
Project Manager

AG/bm
8/15/1

cc: D.B. Miller
T.J. Sullivan
B.W. Marguglio
W. Bird
T.C. Cooke

TO BWMarguglio, JSC-220A

FROM CSKeeley, P-14-408B

DATE September 17, 1979

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

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

Consumers Power Company

INTERNAL CORRESPONDENCE

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

GSK/cg

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

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

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

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

GSKeeley/cg
9/17/79

CC (SHH
(BWM
[redacted]
JJZ
JLB
DBM
MIMiller, IL&B
JARutgers, Bechtel

MIDLAND PROJECT
DATE 12/19/79

		INITIAL
	GSK	
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	JTP	
	CMG	

Manual
File (0485.16)

TELECON RECORD

Date December 18, 1979 - AM

Participants	Company
J J Zabritski	CP Co
D Hood	NRC

Subject Settlement Issue 50.54(f)

Discussion D Hood indicated that he still has not had a detailed discussion with Bill Ohmstead (NRC Legal) over the questions CP Co asked him in the December 11, 1979 telephone call. He said he planned such a discussion for today.

Hood indicated that if he gets the green light from Bill Ohmstead to hold technical meetings with CP Co, he would try to arrange a technical meeting. However, he indicated that because of people availability over the holidays that he would probably have difficulty in setting up such a meeting until the first part of next year.

I also advised Hood that Questions 4 and 14 of the original 23 questions would not be provided to the NRC until mid-January 1980. (The original commitment in the 50.54(f) response was December 1979.) He had no comment.

In discussing the Order, Hood indicated that some of the new questions were pertinent to the Order while others were not and that we should address the pertinent questions when we filed our amendment to the CP as the Order requests us to do. He also agreed with me that a meeting would also be necessary to determine just exactly what the Staff wanted and expected to see in such an amendment.

JJZabritski/cg
12/19/79

MIDLAND PROJECT
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Manual:
File: 0485.16

TELECON RECORD

Date 12/13/79 AM

Participants	Company
JJZabritski	CPCo
D Hood	NRC
GSKeeley	CPCo

Subject Soil Settlement Issue

Discussion: JJZabritski asked D Hood if he had the answers to CPCo's questions of 12/11/79 on a meeting to discuss certain 10CFR50.54f questions. D Hood indicated that due to the unavailability of key personnel he doesn't have the final answers. However, as an interim report he stated that when we reply to the Order we should also include our responses to the outstanding 10CFR50.54f questions (24-35).

GSKeeley replied that those responses that include analysis will take months to answer. However, if the staff wanted partial answers, perhaps we could provide certain responses with the Order response. D Hood indicated that we should to so.

JJZabritski asked Hood if he could get back to us before the day was over on the subject of a meeting.

CC: SHHowell
BWMarguglio
CSKeeley
JJZabritski
JLBacon
Mike Miller, IL&B
DBMiller
JARutgers, Bechtel

J J Zabritski

MIDLAND PROJECT

DATE

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Manual:

File: 0485.16

TELECON RECORD

Date 12/11/79 12:55 PM

Participants	Company
GSKeeley	CPCo
JJZabritski	CPCo
JARutgers	Bechtel
D Hood	NRC

Subject Soil Settlement Issue

Discussion: GSKeeley asked D Hood if the Order eliminated the need to respond to the latest 50.54f questions or if the questions would take a different form. such as, FSAR questions. D Hood responded by thinking that we should still respond to the 50.54f questions as it was logical to do so, and the staff still needed to follow up on the answers. However, once the Order became effective, D Hood thought that we would be in a different mode of operation and really didn't know how follow up would occur.

GSKeeley indicated that if we respond to the questions, we feel that there is a need for clarification of the following questions: 25, 26, 28 and 29 and requested that D Hood try to set up a meeting next week to discuss these. In addition, CPCo would discuss how we would respond to Question 35 and the four others. D Hood indicated that he was not sure how the outstanding Order would effect having a meeting but that he would check it out with his management and OELD (Legal Department) and get back to Jim Zabritski as to the feasibility of a meeting.

GSKeeley asked that if there is a hearing on this issue and it doesn't get scheduled for awhile are we dead in the water as far as technical discussions go? GSKeeley also stated that it was agreed at previous meetings on this issue that we would keep the NRC updated via 50.54f and 50.55e reports and when the issue was resolved put it in the FSAR. With this in mind, could the Order be modified to allow this activity to go on? D Hood stated that he would have to discuss these issues with his management before he could respond.

GSKeeley told D Hood that he would be calling NRC Region III to work out what sampling and test activities would be allowed under the Order and to determine if a letter between CPCo and Region III would be required. D Hood agreed that all activity of this nature should be worked out between NRC Region III and CPCo and he need not be involved.

GSKeeley also asked D Hood how much design detail, analyses detail and commitments would be required to satisfy the staff's Order. D Hood responded by stating that we should not get the Order and the 50.54f questions mixed up. The staff doesn't need the complete analysis to resolve the Order. D Hood elaborated by postulating a question: What if the subsurface conditions were known at the time of the PSAR review? All the staff would have asked for was the acceptance criteria. In other words, what is our yardstick for acceptability and how did we arrive at that criteria. For example is 1" or 1/2" of settlement acceptable? There is not a direct correlation with the new 50.54f questions and the Order. It is just coincidental that they came out in the same time frame. The Order is asking for acceptance criteria. As an example, D Hood indicated that the Diesel Generator fuel oil tank had no advance criteria of what degree of settlement was acceptable. He said that CPCo needs to set the criteria and get the staff to agree to it and then go out and perform the work to see if it meets the acceptance criteria. GSKeeley told D Hood that we did not necessarily agree with this statement.

CC: SHHowell
EWMarguglio
GSKeeley
JJZabritski
RCBauman
JLBacon
Mike Miller, IL&B
DBMiller
JARutgers, Bechtel

JJ Zabritski

CC SHHowell
BWMarguglio
[redacted]
JJZabritski
RCBauman
JLBacon
MIMiller
DBMiller
CP Rutgers

MIDLAND PROJECT
DATE 12/6/79

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Manual:
File: 0485.16

TELECON RECORD

Date December 6, 1979
12:30 PM

Participants	Company
GSKeeley	CP Co
RCBauman	CP Co
JJZabritski	CP Co
KRKline	CP Co
DHood	NRC

Subject Stop Work Order on Soils

Discussion G S Keeley told D Hood that we had heard through V Stello that a stop work order on soils would be issued on Midland. D Hood said yes, however, it is in the approval circuit and expected out shortly (probably today).

G S Keeley indicated that we had heard that it was because of: 1. Lack of Procedures; and 2. "Material False Statements." D Hood said no on lack of procedures but that the "material false statement" refers to the FSAR statement cited in the NRC audit report on the soils problem. He said that this forms Appendix B of the Order. Appendix A of the Order refers to responses relative to 50.54(f). D Hood indicated that the order only pertains to corrective action relative to the soils area. CP Co will have 20 days to reply and that the order calls out for a hearing. D Hood said that the Order calls for an amendment to the Midland Construction Permit to require specific staff action relative to the soils issue. D Hood indicated that investigative work relative to the soils area could continue.

G S Keeley indicated his disappointment in that the NRC Staff appeared in past meetings and visits to be satisfied with the corrective action CP Co has been taking and then an Order like this is issued.

TELECON RECORD

Date December 6, 1979
12:30 PM

G S Keeley also asked if the Order specifically gets into QA aspects. D Hood said that the full reasons would become apparent when we received the Order.

D Hood said he would notify us when the Order is issued and telecopy it to us.

J J Zabritski

J J Zabritski/cg

United States Testing Company, Inc.

1415 PARK AVENUE
HOBOKEN, NEW JERSEY 07030 (201) 792-2400 (212) 943-0488

program audits
vendor surveillance
concrete testing
on-site inspection
nondestructive testing
environmental evaluation
training programs

File: C-208-222/1015.900
October 1, 1979

Bechtel Power Corporation
P. O. Box 2167
Midland, Michigan 48640

Attention: Mr. J. F. Newgen

Subject: Midland Project Job 7220
Subcontract 7220-C-208
U.S. Testing's Response to "Geotech Review of U.S. Testing Field and Laboratory Tests on Soils

Dear Mr. Newgen:

Please find attached United States Testing's response to the Bechtel report "Review of U. S. Testing Field and Laboratory Tests on Soils" dated July 1979.

You requested that we respond solely to the summary contained in Section 8, however, we feel it is necessary to respond to all the sections, which in itself details Section 8.

Our response appendices the Bechtel report in so far that it closely follows its logic, answering questions or making statements on each particular point. This U. S. Testing report is not meant to point fingers in any direction but only to indicate, to Bechtel, some of the problems and concerns we faced.

If you have any questions, do not hesitate to contact me.

Very truly yours,

UNITED STATES TESTING COMPANY, INC.

M. Anselmo
Project Engineer

MA:hg
Attachments

MIDLAND UNITS 1 & 2
JOB NO. 7220

REVIEW OF U.S. TESTING FIELD AND LABORATORY CONSTRUCTION TEST DATA ON SOILS USED AS FILL

BECHTEL ASSOCIATES PROFESSIONAL CORPORATION
July 1979

TABLE OF CONTENTS

REVIEW OF U. S. TESTING
FIELD AND LABORATORY CONSTRUCTION
TEST DATA ON SOILS USED AS FILL

This review of the quality control tests of the earth fill at the Midland Site was made as a result of settlement of the fill supported diesel generator building in excess of that predicted. Soil samples obtained in borings indicated that soil conditions beneath the plant structures are not compatible with the quality of fill that could be expected based on the results of the control tests made by U. S. Testing Company. All fill was accepted as it was being placed based on the results of the field tests performed by U. S. Testing Company.

The review showed many discrepancies in the test results as outlined in the following paragraphs. Review comments are based on the requirements of the technical specifications for fill placement and to subcontract entered into by U. S. Testing Company.

1. Use of Laboratory Test Compaction Curves

Table 9-1 of specification 7220-C-208, Page 143 required one field density and moisture content test be taken for each 500 cubic yards of fill placed. It also required one compaction, grain size, and specific gravity for each 10,000 cubic yards of material. This gives a ratio of 20 field density tests to 1 laboratory compaction test. Although 20:1 is not a strict upper limit, it is a guideline; should density tests be taken more frequently than one per 500 cubic yards of fill the ratio could be higher. The actual ratio is shown in Table A attached. In fact, some of the laboratory compaction tests were used to determine percent compaction for several hundred field density tests taken over a period exceeding two years. Even though no time requirements for the period of use of laboratory tests are specified, it is unlikely that any borrow source in this area would be of such uniform character that such extended use of a compaction curve, truly representative of a large quantity of material, would be applicable. Listed below are selected laboratory test data results indicating the wide range of soil properties that were reported. Such a wide range is typical for soils of the kind used in the fill making prediction of maximum density, based on visual inspection extremely difficult if not impossible without testing.

TEST	MIN. DENSITY (lbs/Ft^3)	MAX. DENSITY (lbs/ft^3)	OPT. MOISTURE (percent)
*BMP269		127.3	10
*BMP278		117.0	15.2
*BMP279		140.8	5.7
**RD24	100.9	119.2	
**RD55	90.2	109.7	
**RD61	109.3	125.3	

*BMP refers to proctor type test.
**RD refers to relative density test run by dry method.

2. Questionable Retests

A field density test that fails to meet requirements of the specification should have been reported to Bechtel who then would have required reworking of the area and retesting.

Of the 668 "failing" tests which were marked "cleared" by another test, in over 10% (72 tests) of the results, the clearing of the "failed" density test was apparently resolved by merely using another laboratory compaction curve with either lower maximum density, which resulted in in the percent compaction being increased sufficiently, or different optimum moisture content which caused the fill to meet the requirements of the specification. The possibility exists that soil was removed after a "failing" test and replaced by different material, but the records do not indicate this and it is not possible from the record to determine if a new density test was made. In other cases, tests labeled "failed" were incorrectly cleared though the same laboratory standard was referenced. For example, in some cases retests to clear a "failed" test were not taken in the same area or at the approximate same elevation. More than 40 retests were over 20 feet from the "failed" test location (as recorded in the test reports) and some were over 200 feet from the original test location. In general, if after a "failing" test the whole area is reworked, the density test location is not too critical assuming that the correct laboratory compaction curve is used for comparison. However, in the plant fill work areas were relatively small, and soil characteristics showed considerable variation necessitating retesting in the immediate vicinity of the "failing" test. Retest should be taken in the lift or soil layer that has been reworked. Almost 50 retests were taken at different elevations, some up to 10 ft. from the "failed" test. It should be noted that Bechtel field personnel gave the locations for retesting. This was not a U. S. Testing responsibility. Two retests were dated prior to the time the original test "failed". Over 130 "failing" tests were marked as ("non Q") and never recorded cleared, as they were outside the saftey related area.

Table B is a compilation of notes relative to questionable clearing of failed tests.

3. Theoretically Impossible Test Results

Soils cannot be more than 100 percent saturated; therefore, all field density test data points, when plotted as dry density versus moisture content, must be below the zero air voids curve as defined by the specific gravity of the material. Specifications do not require examination of the zero air voids curve, but it is considered common practice relative to compaction plots. There are numerous cases in the U. S Testing Company data where points plot above the zero air voids curve. Figure 1 attached shows a typical laboratory compaction test curve with field test results plotted on it. Many of the field test results are to determine percent compaction plot above the zero air voids curve. Provided the specific gravity is correct this is not possible so that all such points must represent erroneous data.

The fact that a large number of test results plot above the zero air voids curve tends to make all test results questionable.

Also, referring to Figure 1 it would appear that soil density varied widely. Specifications called for compactive effort results as defined by ASTM D 1557 which is 56,255 ft-lb/ft^3 energy. This was modified to a laboratory test compactive effort of about 20,000 ft-lbs/ft^3 energy, often referred to as Bechtel Modified Proctor (BMP). Laboratory compaction test curves should be related to the same effort as that called for in the field for use in comparing with field density tests to determine percent compaction. According to plots of field data shown on Figure 1, density varied from about 108 lb/ft^3 to about 130 lb/ft^3. It is doubtful that the soil classification or other properties would be similar for such a wide variation in density. It is noted that 100 percent of modified Proctor (ASTM D 1557) which is difficult to obtain, is rated at 56,255 ft-lb/ft^3 energy. The curve plotted on Figure 1 is at about 20,000 ft-lb/ft^3 energy. For comparative purposes it was determined by U. S. Testing in 1974 that 100 percent of specified effort (20,000 ft-lb/ft^3) is approximately equal to 95 percent of the maximum density as determined by ASTM D 1557 (56,255 ft-lb/ft^3) Reference Figure 8.

4. Repeated use of Questionable Laboratory Test Data

Some laboratory compaction test data were used repeatedly even though they continued to show suspect field test results. This could be indicative of questionable laboratory data or the fact that soil was not being placed or compacted according to specifications. Either case is a cause for concern.

Several specific gravity calculations are in error, such as for BMP 273 and 274. In the case of BMP 273, the zero air voids curve passes through the laboratory compaction curve. In another example, BMP 297, the laboratory compaction curve is invalid due to calculation errors, yet was referenced by field density tests 22 times.

Table C is a compilation of notes relative to questionable test data.

5. Limits of Accuracy and Acceptability for Test Data

Figures 1 through 7 attached will be referenced in discussing limits of accuracy or acceptability for field test results as compared to laboratory test data. The figures show plots of compaction data for BMP 278 which are typical of all test results.

Specified laboratory compactive effort was 20,000 ft-lbs/ft^3 and field compaction effort was originally specified at 56,255 ft-lbs/ft^3 but was changed by Revision 5, dated 7/8/75, specification 7220-C-210, Section 13.7, Page 57 to also be equal to about 20,000 ft-lbs/ft^3.

The specified 20,000 ft-lbs/ft^3 effort establishes a compaction curve relating moisture and density for a specific soil. Moisture was specified for field placed fill to be within ± 2 percent of optimum moisture as determined by this effort. Density was specified to be greater than 95 percent of the maximum density. As compactive effort is increased in the laboratory test, maximum density will be increased and optimum moisture content will decrease. This change can only occur in the field to the extent that the field moisture content will permit it. Once field compaction is such that the fill density is significantly higher than about 105 percent of maximum, the specified tolerance from optimum moisture content in the laboratory compaction test may no longer be applicable for field control. A + 2 percent numerical value of moisture content acceptable at the specified compactive effort would be too wet at a higher effort since the zero air voids curve defines the absolute maximum that can be achieved, indicating that higher densities for that soil are impossible. Therefore, if the record shows high densities for such material, the data are in error. This was apparently overlooked.

Plots of field data for compaction test BMP 278 are shown on Figures 1 through 6. The title of each figure gives the assumptions made in plotting data for the figure. In comparing figures 3 and 4 it is seen that a majority of field tests were made using the nuclear device. The two test results shown on Figure 4 for the sand cone method indicates one test result on each side of the zero air voids curve. The one falling above the zero air voids curve (shown on Figure 4) is designated by U. S. Testing Company as the only passing sand cone test (shown on Figure 6).

For a field test result to be valid as well as "Passing" it must fall within a well defined area on the plot containing the laboratory compaction curve. This area or window of acceptability is shown for a hypothetical compaction curve on Figure 7a that would meet requirements of Specification 7220-C-210. It is defined by horizontal lines at 95 percent and 105 percent of specified density, vertical lines through ± 2 percent of optimum moisture content, and a line parallel to the zero voids line indicating saturation about half way between the compaction curve and 100 percent saturation (zero air voids curve). The practical upper limit of 105 percent of specified density is not defined in the specifications. It was arbitrarily chosen as numbers greater than this give increasingly invalid comparisons between field test results and the specified laboratory compaction test curve. Therefore, if all data points fall within the defined window there would be no reason to assume that they are wrong. However, when many data points fall outside the designated area there is something wrong with the information and then all data points become suspect. A review of all data indicates that about 25 percent of the cohesive soil test results fall within this area.

Figure 7B shows an area where field test results would be acceptable, in theory even though not in strict accordance with the specifications. Figure 7B was arrived at by expanding Figure 7a to include test results up to a compactive effort related to ASTM D 1557 (56,255 ft-lb/ft^3) which is considered to be a practical upper limit. About 40 percent of all cohesive soil test results would plot in this area.

6. Accuracy of Test Equipment

Almost all (over 95%) field density tests on cohesive soils were made using the Nuclear Density device. Specification 7220-C-210 section 12.4.2 page 42 indicates this to be acceptable for moisture content determination provided that the results are compatible with those obtained by ASTM D 2216. Similarly, section 12.4.4 says density determined by the nuclear device is acceptable when results are compatible with density as determined by ASTM D 1556.

In a letter from U. S. Testing to Bechtel (dated May 30, 1974), the average deviation of the nuclear device from oven-dry moistures was +.12% for a set of 30 tests. However, the standard error of estimate is 1.8% for the data with the range of differences being from - 3.2% to +3.9%. Thus, accuracy of the nuclear device is questionable, and could translate into errors of about $\pm$ 4 pcf in the dry density calculation. (It should be noted that errors in the moisture content tend to shift the position of test results on a moisture density plot approximately parallel to the zero air voids curve, assuming the in-place wet density is correct, and thus do not explain the large number of points which plot outside the zero air voids. Compare Figures 1 and 9).

No reliable correlation between sand cone and nuclear density tests were carried out therefore there is no basis for determining if U. S. Testing would have performed better using the sand cone procedure.

However, it is clear that a large number of the nuclear density tests are wrong. This can be explained by considering the wet unit weight may have been wrong or both the moisture content and unit weight may have been wrong. A reliable correlation with properly conducted sand cone tests should have revealed this, but it was not apparently done.

7. Relative Density Tests

Cases were noted where densities in material classified on the data sheet as zone 3 (sand) were compared to the maximum densities in proctor type tests and other cases where densities in clay soils were compared to the maximum density in relative density tests. An error must exist in the record in such cases either in the classification of the soil on data sheet or in comparing field test results to inappropriate laboratory test data. In general, it appears that relative density tests were used in controlling density of sand fill. There were a significant number of arithmetic errors on calculation sheets even though there are signatures on the sheets indicating they had been checked. Over 100 errors were found in calculations, of relative density from 8/15/79 through 12/78 (not all of these errors change the acceptability of the test results).

ASTM D 2049 section 7.1.2 Wet Method states: "Note 2 - While the dry method is preferred from the standpoint of securing results in a shorter period of time, the highest maximum density is obtained for some soils in a saturated state. At the beginning of a laboratory test program, or when a radical change of materials occurs, the maximum density test should be performed on both wet and dry soil to determine which method results in the higher maximum density. If the wet method produces higher maximum densities (in excess of one percent) it shall be followed in succeeding tests." An example of wet and dry relative density is shown on Figure 10. U. S. Testing Company apparently did not do this frequently enough, or on a broad enough range of non-cohesive soil types. As a consequence many field density test results exceed 100 percent of maximum dry laboratory relative density. As an example, for laboratory test RD55 a total of 566 field tests were made. Of this total, 364 tests were greater than 100 percent compaction. The highest relative density found was 142.2 percent with the majority of tests over 100 percent falling in the range of 100 percent to about 130 percent. Since the difference in maximum density between wet and dry methods is about 4 to 5 lbs/c. ft. (based on recent data) any test result greater than about 115 percent (based on the dry method) is suspect.

Even if the wet laboratory test method data were available for all sands, it appears an unacceptably high number of field test results would greatly exceed 105 percent relative density even based on the wet maximum.

8. Summary

In summary, there are five major faults contained in the Midland Compacted Fill Density Test Reports as follows:

1. erroneous field density test data.
2. incorrect soil identification
3. incorrect (or questionable) laboratory test data.
4. calculation errors
5. improper or incomplete clearing of "failed" tests.

Items 4 and 5 represent existing faults in the data which could be corrected. However, as a result of items 1 through 3, there is no rational means of determining which test results are valid and which are not. Since more than one half of the test results for relative density and percent compaction fall outside the possible theoretical comparison limits, it must be concluded that these test results are suspect and should not be used alone for acceptance of plant area fill. Therefore, other means of testing have been established and employed to determine if the fill in any given area is acceptable.

Also in item 4 it should be noted that on many occassions the inplace density was divided by the maximum density from the relative density test to get percent compaction, these tests were also used to clear other pricing tests.

TABLE A

Listing of All Classifications Referenced in Plant Area Fill Soil Test Records Which were Used for 20 or More Field Density Tests

Classification	No. of Tests
B200	90
B251	31
B252	22
B254	42
B255	57
B260	68
B261	36
B262	165
B269	227
B270	226
B271	141
B274	37
B276	21
B277	158
B278	82
B297	22
R015	20
R016	61
R024	248
R030	54
R035	59
R038	39
R039	28
R040	35
R041	69
R042	103
R043	48
R044	71
R045	43
R049	63
R054	118
R055	566
R059	65
R061	589
R063	42
R065	59

Note: Spec. 7220-C-208 gives a ratio of approximately 20 field tests to each laboratory test.

TABLE B

Notes on Questionable Clearing of Failed Tests

1. Test number MD 245 fails due to high moisture. Cleared by MD 246 which references a proctor with higher optimum moisture content (OMC) such that the ±2% of optimum requirement is met.

2. MD 205 fails with moisture content 6% above the OMC. Cleared by MD 215, which references a relative density lab standard, and is itself still 6% away from the OMC of the proctor referenced by MD 205.

3. MD 223 fails because of high moisture. Cleared by MD 228 which has actually a higher moisture content and lower density, but references a different proctor; the retest passes and clears the failure.

4. Both MD 844 and 886 fail because of high moisture and low density. They are cleared by MD 888 which references a new proctor with lower maximum density and higher OMC than the first.

5. MD 251 fails due to moisture being too high. Cleared by MD 253 which uses a higher OMC proctor.

6. MD 668 clears MDR 634, but the two tests show no correspondence in location, moisture, density, or lab standard.

7. MD 771 failed, being too dry. Cleared by MD 782, which has almost identical moisture content and dry density but uses a new BMP with lower optimum moisture.

8. MD 2384 clears MD 2342, referencing a different proctor with an OMC which fits the in-situ conditions. However, the dry density of MD 2384 is way too high to fit the original soil classification, and in addition, it falls outside of the zero air voids curve for the classification which it has been changed to.

9. MD 556 clears MD 554 by using a BMP with lower moisture requirements. The field densities differ by 24 pcf and would seem to be different material.

10. MD 558 clears MD 555 but has too high a density to be the same soil as MD 555. It also uses a different proctor.

11. MD 566 and 568, classified as BMP 262 cohesive soils, are cleared by MD 569 which is classified as RD 33 and has totally different soil properties than the two failures.

12. MD 1317, 18, 19 and 20 fail and are all cleared by MD 1477 taken over 5 weeks later. There is poor correspondence in the soil properties and the proctor is different from failing to passing test.

13. MD 2965 clears MD 2963 with a different proctor through the test results would have been passing with the original BMP.

14. MD 1388, classified as BMP 278, is cleared by MD 1461, classified as RD 55.

15. MD 170, classified as RD 24 is cleared by MD 173, classified as BMP 234.

16. MDR 287 fails with a relative density of 77%. Cleared by MDR 291 which has .1 pcf lower density but arbitrarily rounds up the relative density to 80%; it passes and clears the failure.

17. In all of the following field density tests on sand, the passing test has approximately the same or lower density than the failures, but references a lower maximum density RD lab standard:

MDR 343	clears	MDR 339
MDR 514	clears	MDR 507
MDR 513	clears	MDR 508
MDR 515	clears	MDR 509
MDR 516	clears	MDR 510
MDR 522A	clears	MDR 521
MDR 558	clears	MDR 556, 557
MDR 480	clears	MDR 473
MDR 555	clears	MDR 525, 527, 534
MDR 533	clears	MDR 526, 530, 531

18. MD 2384 clears MD 2342, but is at 7' lower elevation.

19. MD 123 clears MD 122, but is at 10.5' lower elevation.

20. MD 149 clears MD 142, but is at 10' higher elevation.

21. MD 1694 clears MD 1693 but is 43' away from the site of the first test.

22. MD 3114 clears MD 3102, but the two tests are 68' apart.

23. MD 186 clears MD 183 though it is 110' away.

24. MD 1209 clears MD 1207 and MD 1205, yet is 183 ft. away from the failures.

25. MD 1097, dated August 4, 1977, cleared by MD 1048 dated July 16, 1977.

Note: This table gives typical observations and is not meant to be all-inclusive.

TABLE C

Notes on Questionable Test Data

1. The first field density test to reference RD 24 (5/75) has a relative density of 170.6%. The standard continued to be used, however, with relative densities greater than 100% occuring repeatedly.

2. Similarly for RD 30, the first two tests (9/75) have 114% and 122% relative densities, yet the standard was used for 10 months, 54 tests, with 52% of the results over 100%.

3. During the first two weeks of use (7/76), RD 41 was referenced 22 times with 12 tests over 100% relative density (6 tests over 110% and 3 over 120%). The standard was used for 5 months, however, with over 40% of the results over 100%.

4. The first test using RD 55 (8/76) has a relative density of 119%, with the field test being made the same day as the standard and, thus, assumedly the same material. These results would throw doubt on the lab standard, yet it was used for two full years and 566 tests, with 64% of the results over 100% relative density.

5. Even high density structural backfill standards such as RD 61 (maximum density of 125.3 pcf), used 593 times, show over 25% of the tests having greater than 100% relative density.

6. The first seven tests referencing BMP 269 (scattered over a two month period around 7/76) all fall outside the zero air voids curve. This classification was used for 1 1/2 years, referenced 227 times.

7. The first two tests referencing BMP 270 (7/76) fall 6 pcf above the zero air voids curve. Continued use of this proctor for over 2 years resulted in 226 tests with 82 outside the theoretical maximum.

8. For the first month (4/77) all BMP 278 tests fell on or outside the zero air voids curve. For the next month, over half the tests did the same, or have greater than 105% compaction. The standard was used over half a year, with 43 out of a total of 82 tests outside the zero air voids curve.

Note: This table gives typical observations and is not meant to be all-inclusive.

MOISTURE-DENSITY FOR BMP 278

SPECIFIC GRAVITY = 2.65
ALL TESTS

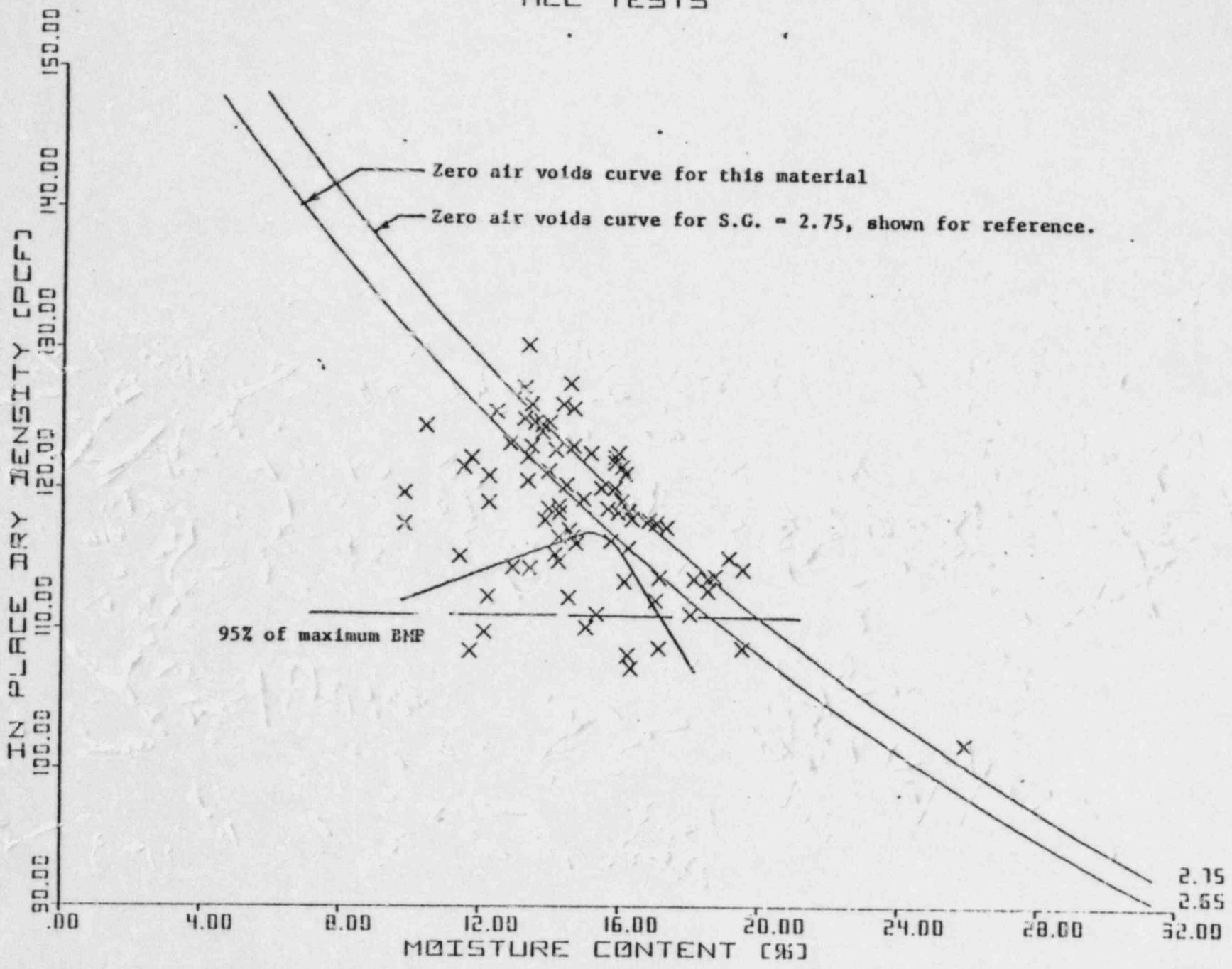
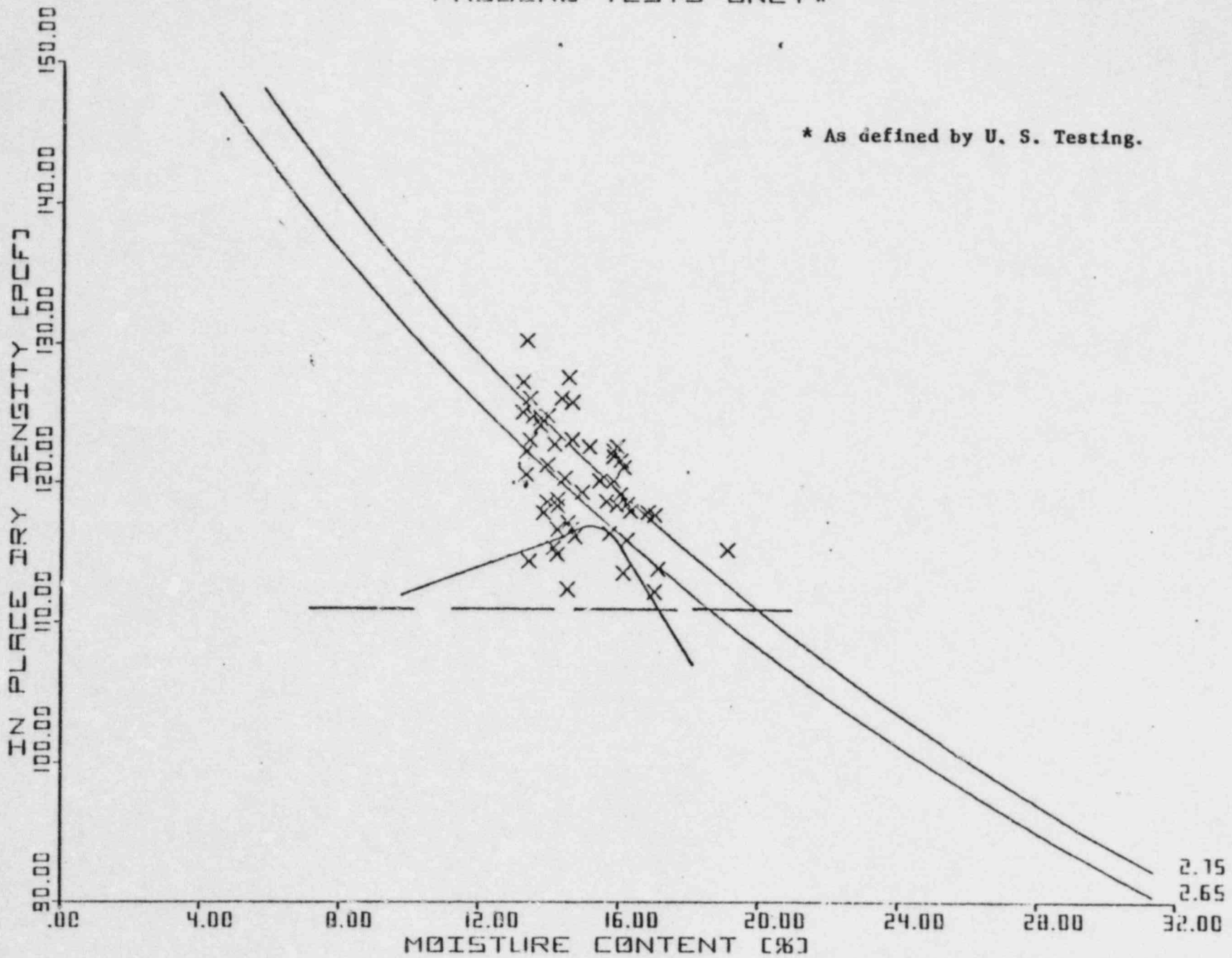


FIGURE 1

MOISTURE-DENSITY FOR BMP 27&

SPECIFIC GRAVITY = 2.65
PASSING TESTS ONLY*



* As defined by U. S. Testing.

FIGURE 2

MOISTURE-DENSITY FOR BMP 278

SPECIFIC GRAVITY = 2.65
NUCLEAR DENSOMETER TESTS

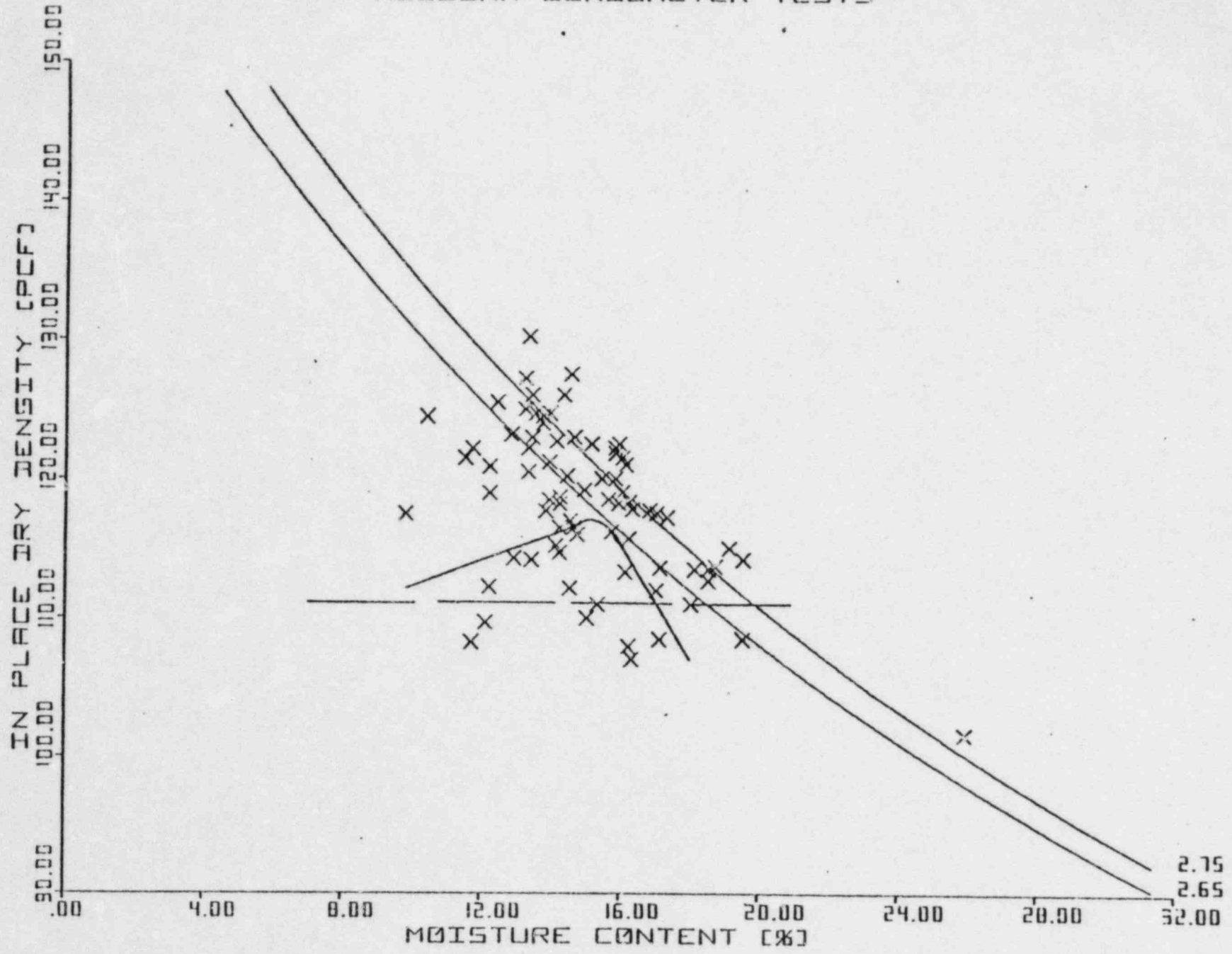


FIGURE 3

MOISTURE-DENSITY FOR BMP 27B

SPECIFIC GRAVITY = 2.65
SAND-CONE TESTS

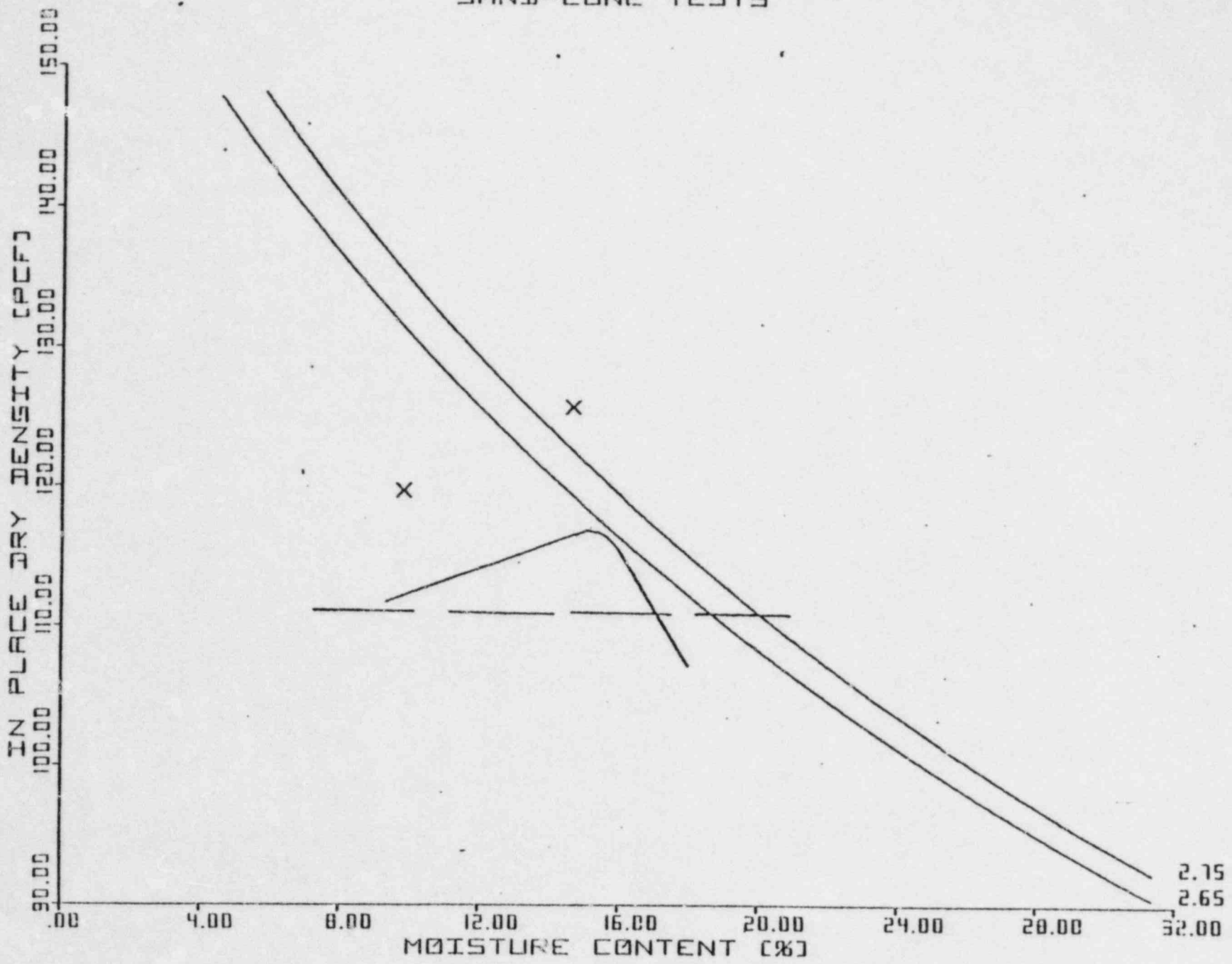


FIGURE 4

MOISTURE DENSITY FOR BMP 278

SPECIFIC GRAVITY = 2.65
NUC. DENS. PASSING TESTS*

*As defined by U. S. Testing

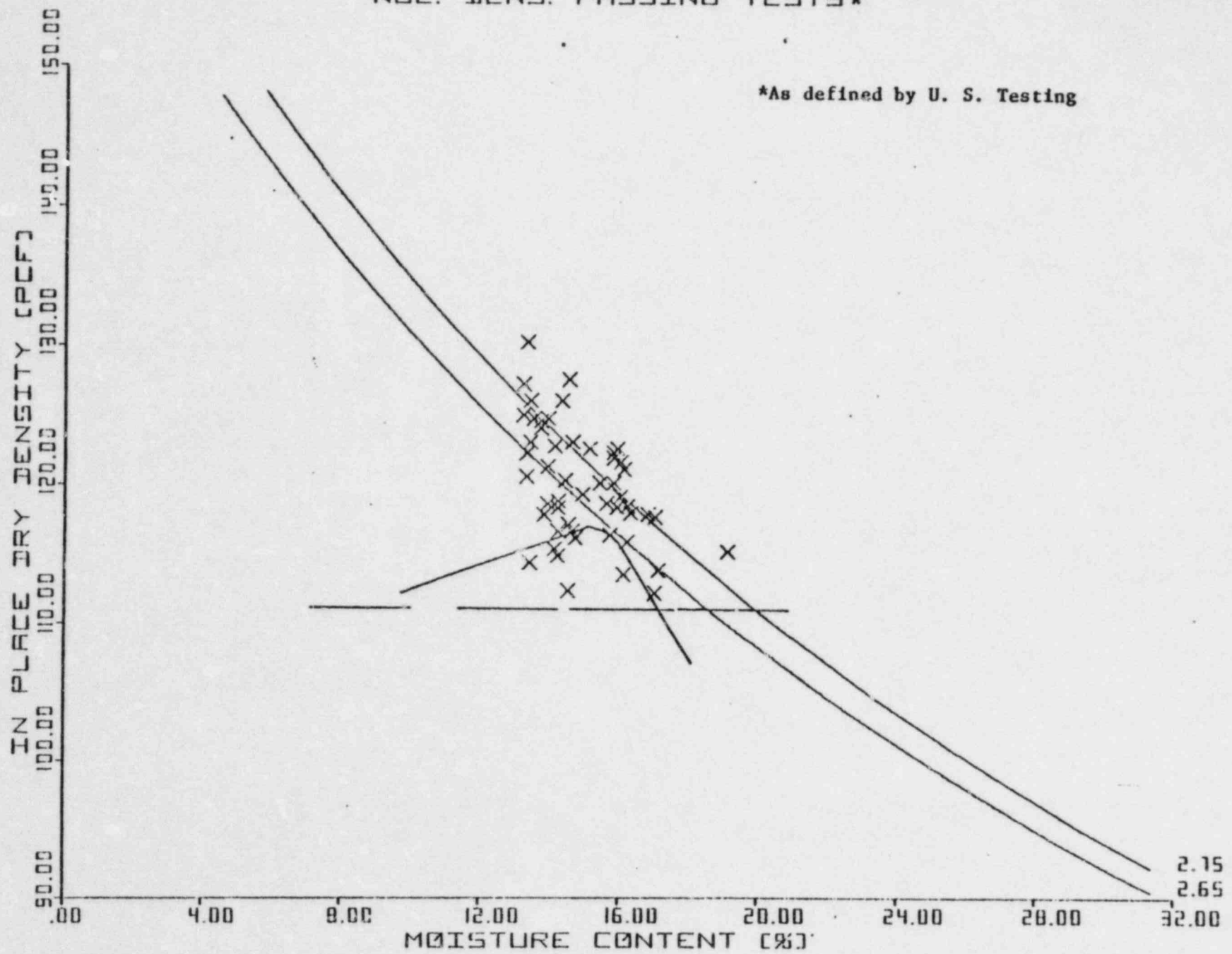
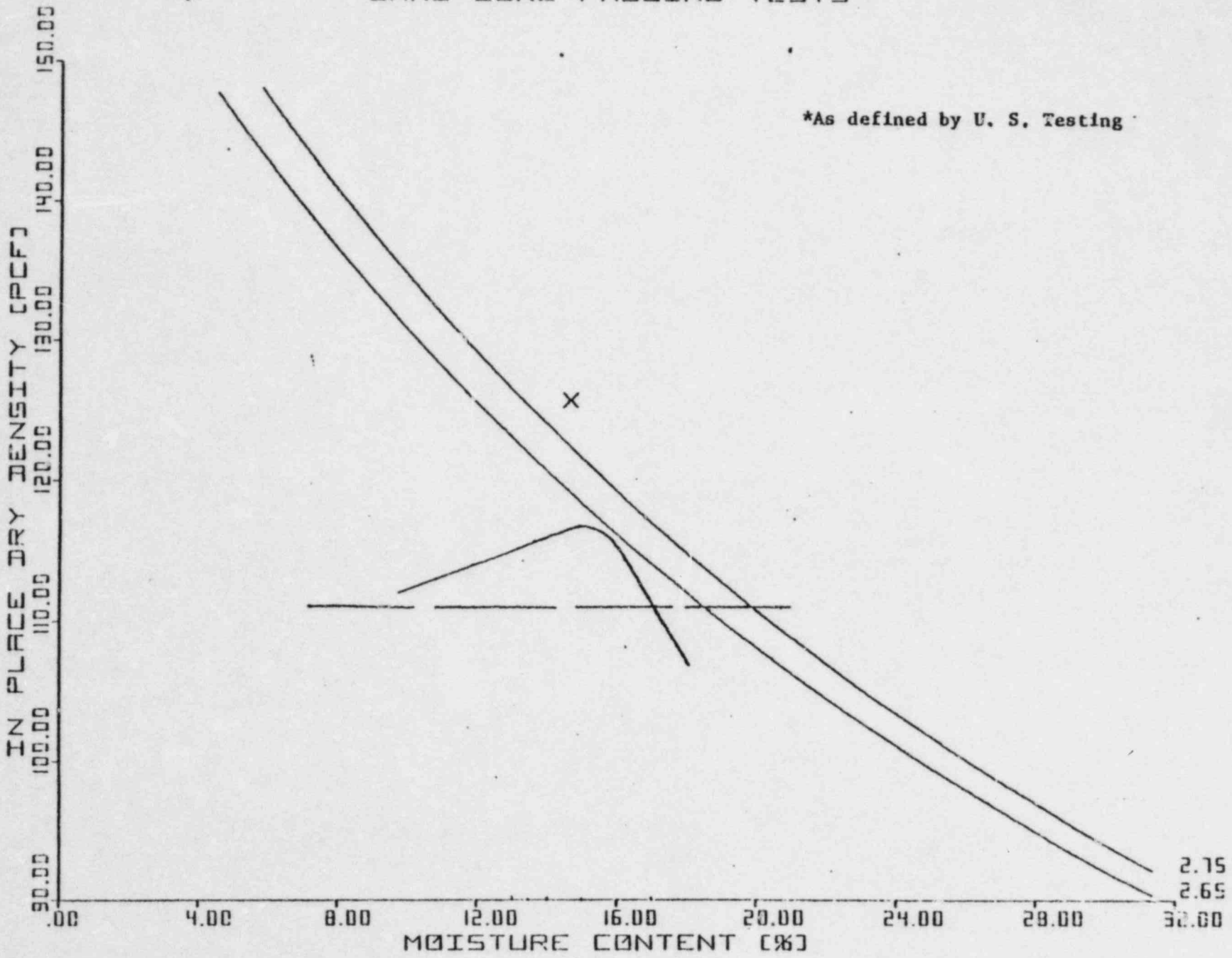


FIGURE 5

MOISTURE-DENSITY FOR BMP 27&

SPECIFIC GRAVITY = 2.65
SAND-CONE PASSING TESTS *



*As defined by U. S. Testing

FIGURE 6

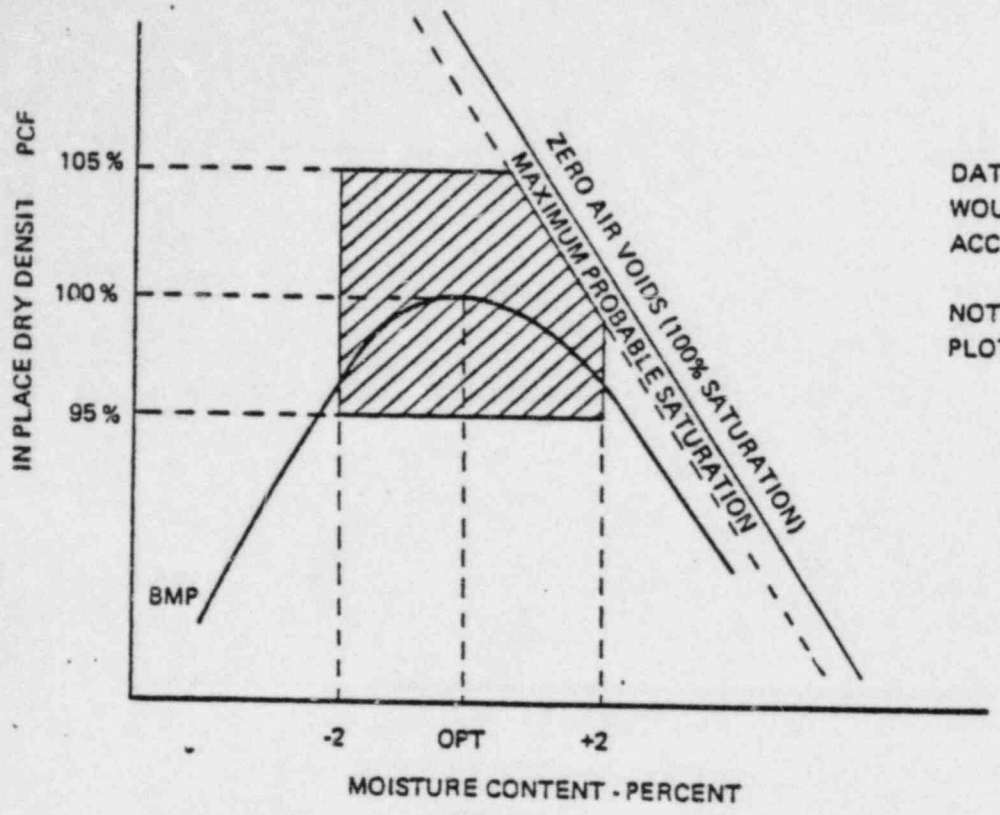


FIGURE 7-A-

DATA POINTS THAT PLOT IN SHADED AREA WOULD BE GENERALLY ACCEPTABLE ACCORDING TO SPECIFICATIONS

NOTE: ABOUT 25% OF ALL FIELD DATA PLOTS IN THE SHADED AREA

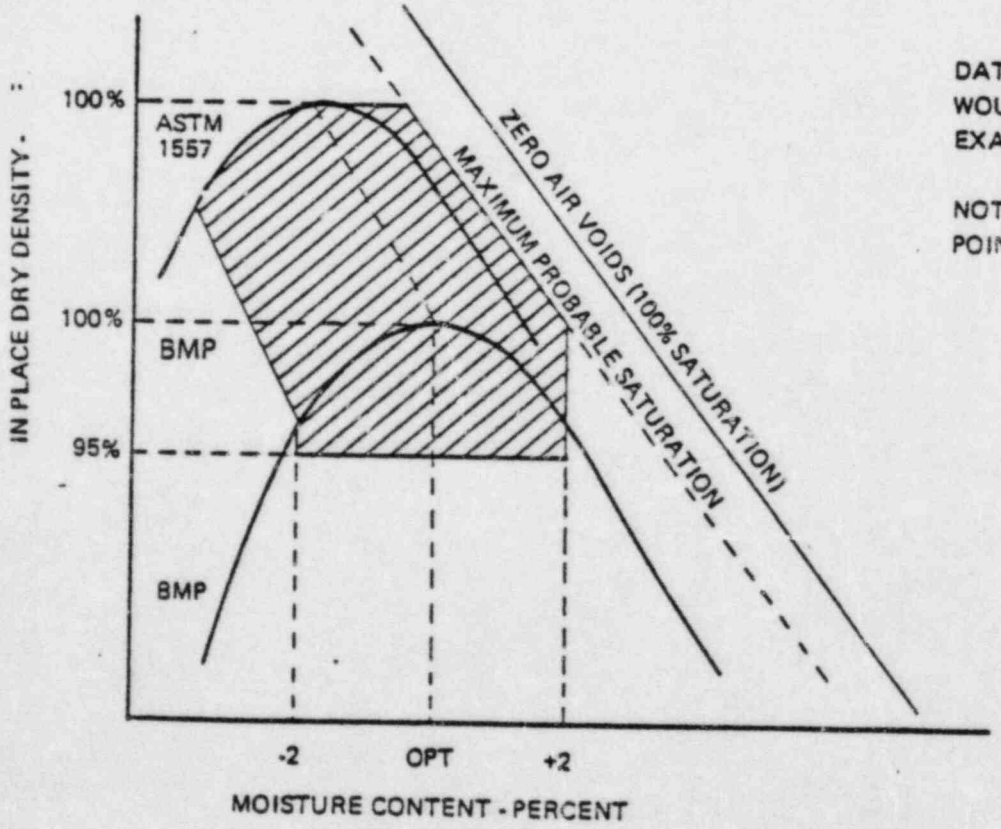


FIGURE 7-B-

DATA POINTS THAT PLOT IN SHADED AREA WOULD BE ACCEPTABLE REGARDLESS OF EXACT SPECIFICATION WORDING

NOTE: ABOUT 40% OF ALL FIELD DATA POINTS PLOT IN THE SHADED AREA

FIGURE 7: WINDOWS OF ACCEPTABILITY (A) BASED ON BMP SPECIFICATION (B) REGARDLESS OF EXACT WORDING OF SPECIFICATION

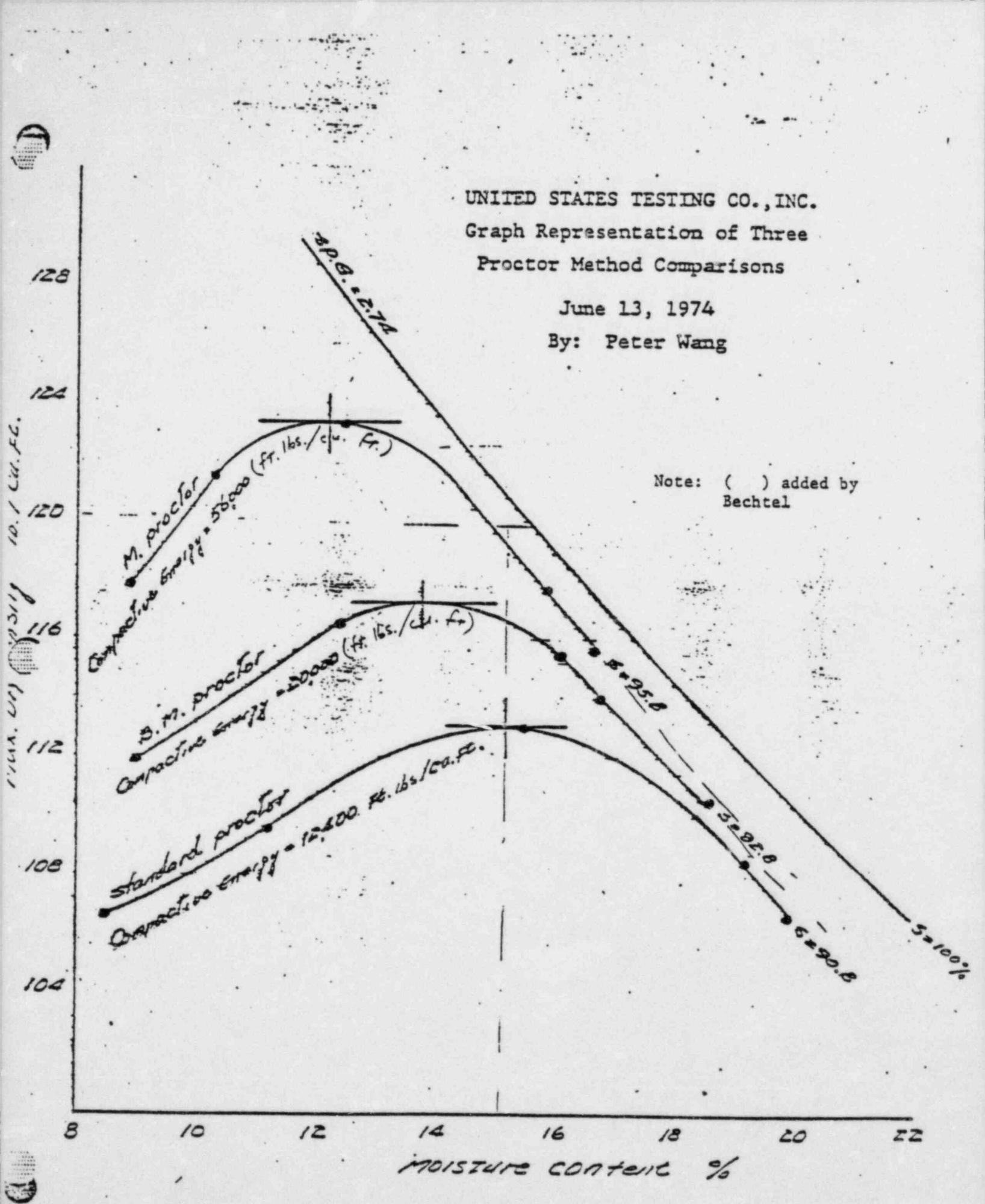

UNITED STATES TESTING CO., INC.
Graph Representation of Three
Proctor Method Comparisons
June 13, 1974
By: Peter Wang
Note: ( ) added by
Bechtel
S.P.G. = 2.74
M. proctor
Compactive energy = 56,000 (ft. lbs./cu. ft.)
S. M. proctor
Compactive energy = 30,000 (ft. lbs./cu. ft.)
standard proctor
Compactive energy = 12,400 ft. lbs/cu. ft.
S = 95.0
S = 92.0
S = 90.0
S = 100%
128
124
120
116
112
108
104
8
10
12
14
16
18
20
22
MOISTURE CONTENT %

FIGURE 8

MOISTURE-DENSITY FOR BMP 27&

SPECIFIC GRAVITY = 2.65
ALL TESTS

3.5% Subtracted from Moisture Content, Dry Density Recalculated

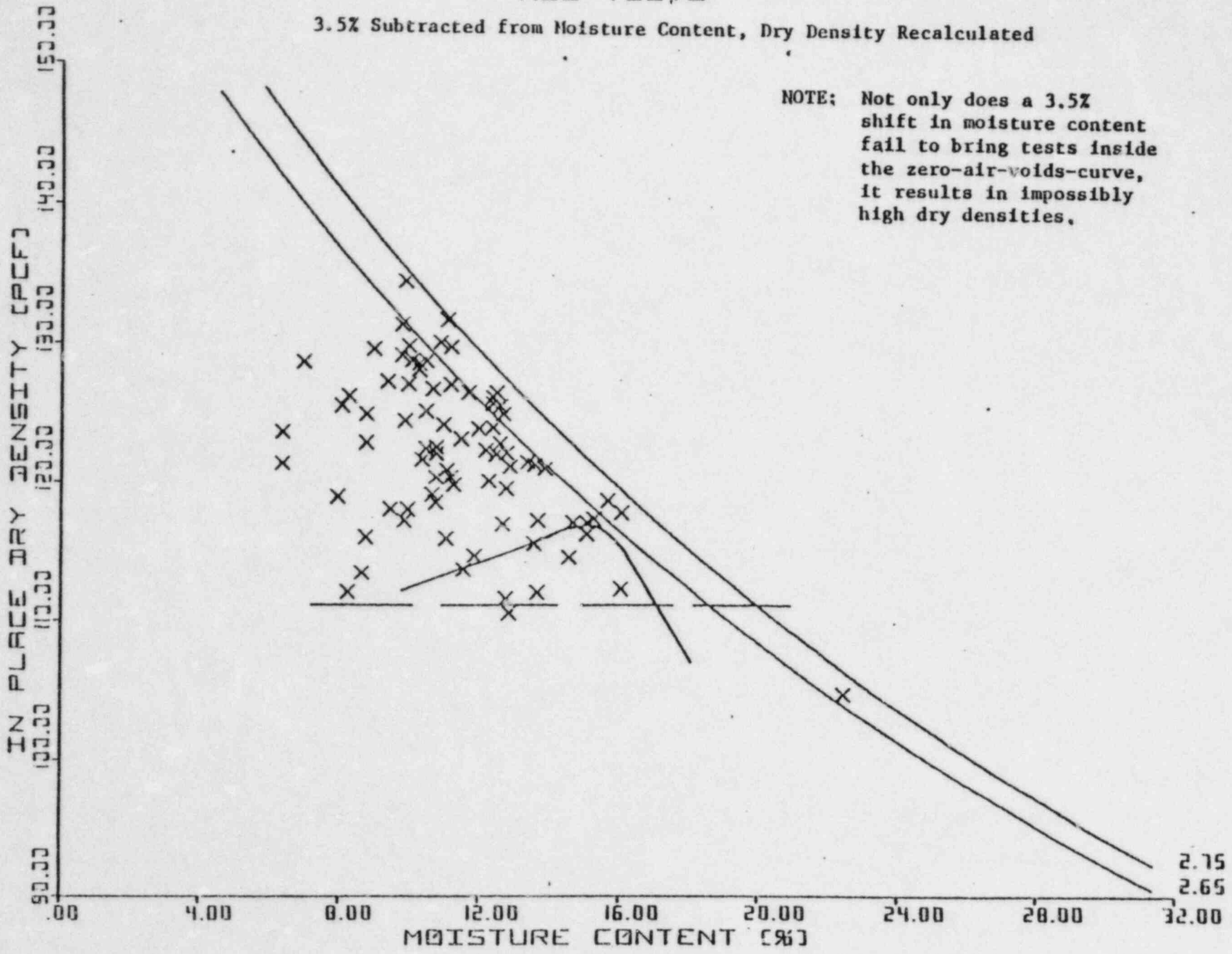
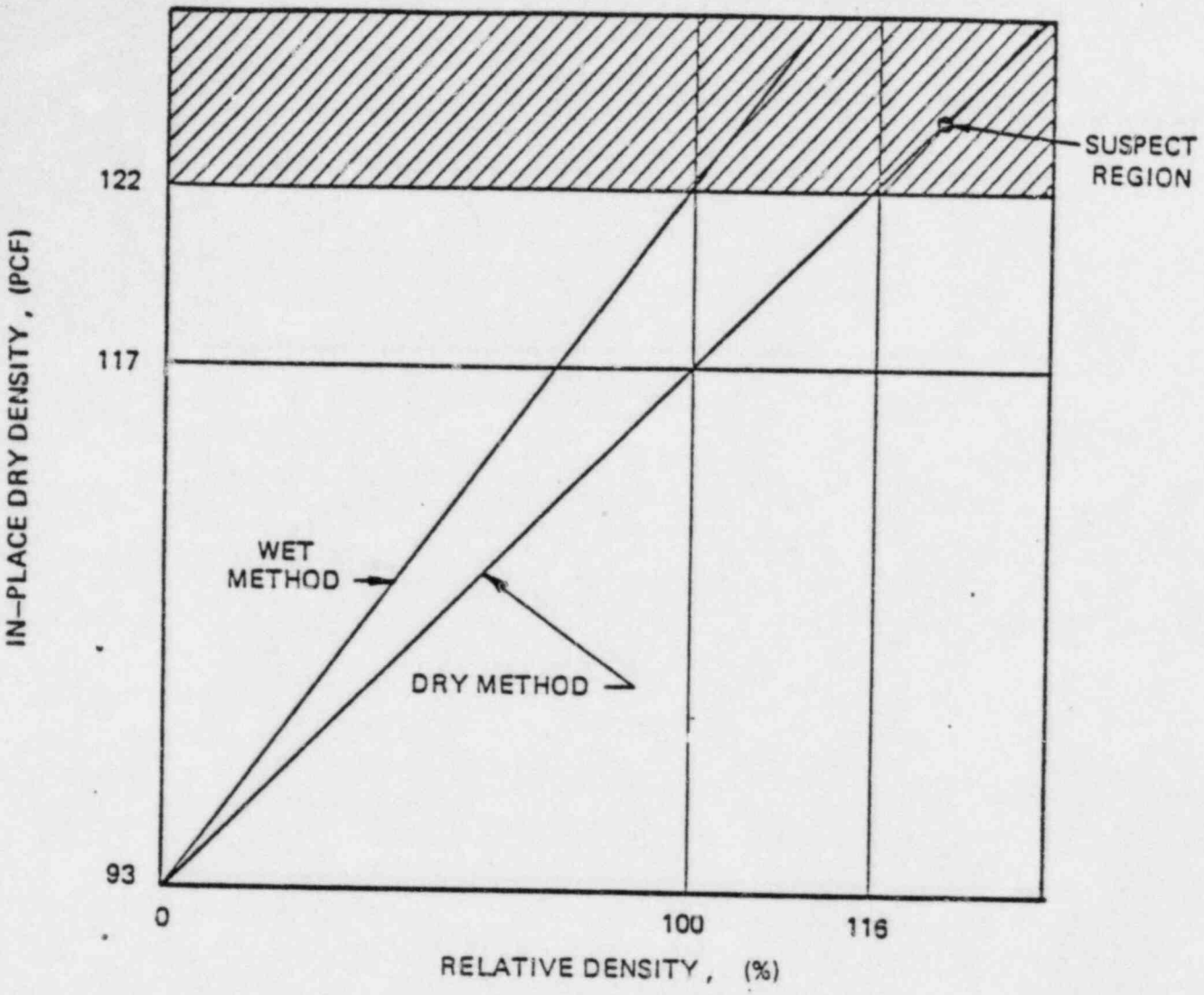


FIGURE 9



NOTE: VALUES FOR DRY DENSITY ARE TYPICAL OF A RANDOM FILL SAND. ANY TESTS SHOWING MORE THAN 117% RELATIVE DENSITY WOULD BE SUSPECT IN THIS EXAMPLE. STRUCTURAL SANDS TEND TO SHOW ONLY 2 OR 3 PCF INCREASE IN MAXIMUM DENSITY AND THUS RESULTS AT MUCH LOWER RELATIVE DENSITY WOULD BE SUSPECT, SAY 105 – 110 PERCENT

FIGURE 10
CHANGE IN RELATIVE DENSITY SCALE FROM DRY TO WET METHODS OF OBTAINING MAXIMUM DENSITY, BASED ON RECENT LAB RESULTS

To File

From TCCooke

Date June 13, 1979

Subject MIDLAND PROJECT GWO 7020 -
NRC SITE TOUR AND OBSERVATION OF TEST PITS
File: 0460.2 Serial: CSC-4138

Put in Diesel Folder

Consumers Power Company

Internal Correspondence

CC *Attendees GSKeeley, P14-408B
DBMiller JJZabritski, P14-416

*Bechtel and Consumers attendees only.

I. Individuals Present:

Sherif S. Afifi	Bechtel Assistant Chief Soils Engineer
R. E. Lipinski	DSS/NRC
J. P. Knight	DSS/NRC
Daniel M. Gillen	DSS/NRC
C. A. Hunt	Consumers Power Executive Civil Engineer
P. A. Martinez	Bechtel Project Manager
*A. J. Boos	Bechtel Project Field Engineer
*R. J. Cook	Resident Inspector/NRC
*T. E. Vandel (Entrance only)	US NRC Region III
Lyman Heller	US NRC NRR
T. E. Johnson	Bechtel Chief Civil/Structural Engineer
K. Dhar	Bechtel Supervisory Engineer
T. C. Cooke	Consumers Power Project Superintendent
D. E. Sibbald	Consumers Power Senior Construction Advisor
K. Wiedner	Bechtel Engineering Manager
*D. Horn	Consumers Power Quality Assurance Group Supervisor/Civil
R. M. Wheeler	Consumers Power Civil Section Head

*Part time

II. Discussion Tour Comments

A. The individuals from the NRC were extremely interested in cracks in the Auxiliary Building, Service Water Building, and Diesel Generator Building. Many questions were asked regarding differential settlement. They seem to be under the impression that there was a great deal of building settlement other than the Diesel Generator Building and that large cracks exist somewhere on the site. We continually had to reiterate the fact that remedial actions were based on soil borings which showed questionable material and not settlement problems. Mr. Lipinski, in particular, was very interested in why we had cracks and analysis regarding same.

B. During the tour it was apparent that the NRC's questions were oriented towards seismology aspects. They were also interested in whether or not we had re-reviewed the different seismic conditions in the light of our

concrete backfill revisions for the Auxiliary Building, wing walls, etc., since the addition of concrete could cause new reactions and forces requiring reanalysis. It was noted that the concrete backfill would be separated from the structures by styrofoam and not tied to the structures. The NRR alluded to possibly more stringent earthquake requirements.

C. When observing the test pits, Mr. Heller expected more sand in the "random fill". It was noted that sand was used primarily around utilities and next to buildings.

D. Mr. Heller appears to be of the view that the simpler engineering fix on the service water overhang, such as concrete backfill as opposed to more complex remedial action, would stand a much better chance of passing review, due at least partially to the fact that much of the available manpower in Washington was involved with Three Mile Island and also because simple straightforward engineering practices will be much easier to discuss in any hearing process. The NRR was informed that piling at the Service Water structure was only for vertical load and that no moments were involved. It appears that possibly Mr. Knight's staff has been reduced from about fifty to near eight, with the forty people being tied up on Three Mile Island activities. There will be a corresponding cutback in the normal amount of licensing activities that will be undertaken by his staff over the next several months.

E. NRR noted that they should receive copies of any Diesel Generator (total site related) material that is being transmitted to Region III directly from the licensee. It also appears that Mr. Knight is more interested in resolving the Midland fill problems in the near future on a "real time basis" as opposed to later review and approval functions such as might be found in going the FSAR route. (Note: Consumer Power Company has been attempting for weeks to arrange a meeting with NRR but it was not until the week of June 4, 1979 that we were able to set a meeting date with them of July 10, 1979.) He recognized that presently the licensee was involved in answering the same or possibly similar questions on three fronts, namely the I&E questions, 50.54f responses and future FSAR revisions, and agreed that it would be beneficial to all parties to consolidate these areas. During the tour it also appeared that in the future NRR may become much more deeply involved in the details in all licensing aspects than they have in the past.

F. It would appear that we should provide more rationale and better arguments for support of duct bank and pipes and man holes, valve pits, etc. during the seismic event. We have to verify or prove that duct banks, for example, will not shear during the earthquake. Mr. Heller was of the opinion that our responses on the safety aspects concerning the borated water storage tank lines will have to be extremely conservative, and that at this point in time for our responses to be accepted, he would be inclined to say that questionable material should be removed and fixed rather than going through some complex explanation as to why it was "acceptable as is" since this was a Category One item which would be required during the postulated accident conditions.

Generally, the NRR personnel appeared to find the information gathered during the tour and observation of the test pits to be of value and the type of information which would expedite their decision making process.

plw

Jim Henderson's Report

work report No. 5 was that the "status of Inryco furnished Field Installation Manual which forms the basis for Bechtel Field Procedure of Installation and Quality Control (PQCI) is questionable." In order for work to resume, it was stipulated that it would be necessary to resolve questions regarding Project Engineering (Bechtel) level of approval for Inryco furnished Field Installation Manual and establish approved instructions for installation and inspection including revising Bechtel Field Procedure and Quality control instruction.

Due to the above work stoppage, observation of the prestressing work activities could not be performed. This matter will continue to be inspected to verify an adequate procedure and inspection program is in effect for the containment prestressing system work activities.

5. Status of Safety Related Soils Work Activities

Safety related soils work is not preceeding until certain corrective actions are taken in order to resolve a number of previously identified deficiencies. Some of the licensee's corrective actions include:

a. Identifying all conflicts within the PSAR or between PSAR and FSAR.

b. Identify all conflicts between PSAR/FSAR and site procedures.

c. Re-evaluate the use of Zone 2 random fill material as a backfill material.

d. Assure that interpretations to the specifications are resolved.

e. Establish a single soils engineer responsible for the soils work activities.

f. Re-evaluate the capability of the equipment being used to meet compaction requirements.

g. Assure proper tests are performed to document acceptability of in-place soils.

h. Assure each nonconformance report is properly dispositioned.

During this inspection, the NRC inspector observed air bubbles percolating from the ground in the safety related tank farm area. A closer inspection indicated that air and water was

being moved through the previously compacted soil materials in this area. It was observed that soil materials were being moved by this condition and leaving voids beneath concrete foundations for the tank structures.

This condition was brought to the attention of CPCo project manager on May 16, 1979. On May 17, 1979, the project manager and superintendent responded by visually observing this condition. They concurred with the NRC inspector that the condition was serious and that damage to the compacted soils may have occurred. The extent of the movement of materials was not known.

The NRC inspector indicated to the licensee that in order to substantiate that the materials and compaction of the soils had not been disturbed, additional soil borings and test pits would need to be performed. The NRC took photos to document the soil condition and movement of soil materials.

It was also brought to the NRC's attention that CPCo QA department had brought this condition to Bechtel QC months earlier, however, no corrective action had been taken to correct these adverse conditions. I had not heard of this

During the exit meeting the CPCo site superintendent gave a copy of a letter to the NRC requiring the contractor to relocate the air line embedded in the fill and turn off the air to the existing line. This letter also indicated to map the location of all air seepage areas so that additional soil borings could be taken in these areas.

6. Review of Procedure and Observation of Testing Concrete Expansion Anchors

The inspector reviewed specification C-305, Rev. 8, "Installation and Testing of Expansion Type Concrete Anchors" and Quality Control Instruction (QCI) -1.50, Rev. 4. In addition, Field Change Notices C-1835 and C-1846 to specification C-305 were also reviewed. The following specific observations were made:

a. As of this inspection, the specification did not require a means of inspecting or identifying the embeddment length of the bolt. CPCo had identified this item in QA request for evaluation on July 28, 1978. Bechtel then issued SCN C-305-9002 to require a permanent length identifier to be stamped on the bolt. CPCo required Bechtel to develop a procedure for ultrasonic testing to reinspect the length of the bolts installed prior to this time.

Rec PBM/TCC

5/7/79 If you take any issue with anything said in here Please advise us I think it's pertinent to Article 4 where we get into early agreement GL

B. Marguglio
cc/bcc

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

4/4/79

April 25, 1979

U. S. Testing Company
1415 Park Avenue
Hoboken, New Jersey 07030

Attention: Dave Ed ey

Job 7220 Midland Project
Subcontract 7220-C-208
Meeting Notes
C-208-B-364

Dear Mr. Edley:

Attached for your information and files please find one copy of meeting notes for the jobsite meeting held on Monday, April 9, 1979, at Hoboken, New Jersey.

Very truly yours,

J. F. Newgen
Project Superintendent

JFN/LFS/DLP/km

Attachments

UNITED STATES TESTING COMPANY'S

Response to the Bechtel Report

"Review of U. S. Testing Field
and Laboratory Construction
Test Data on Soils Uses as Fill"

Midland Units 1 & 2
Job No. 7220

Note: This U. S. Testing report must be read in connection with the Bechtel report in so far that it will provide clarification and rebut statements contained therein.

1. Use of Laboratory Test Compaction Curves

This section of the Bechtel report is concerned with the implied ratio of Field Density Tests to Laboratory Compaction Tests (Ratio 20:1) given in Table 9-1 of Specification 7220-C-208 and the period of time lapse between Laboratory Tests vs. Field Tests.

It is the position of U. S. Testing that Bechtel was then and is now responsible for the monitoring, determining and communicating with U. S. Testing on the fill yardage for use in performing Lab Density Tests. In fact, there were more Lab Density Tests performed by U. S. Testing Technicians (who were double checking results) than directed by Bechtel. It should also be noted that, in most cases, our only Bechtel interface in the field was a labor foreman.

The testing of soil will yield the same densities no matter what time lapse has expired between original testing and subsequent re-tests as long as the material re-tested is representative of the original tests and the test method has not changed. The actual volume of soil that may be represented by any one compaction curve has not been nor can it now be determined. In addition, Bechtel did not control excavated material as required by their specifications and drawings (documented in report on Admin. Bldg.) and it would be likely that any given cubic yard of soil was not only placed several times but tested several times, i.e., the same proctor values would be employed each time a yard of that particular soil was placed.

Visual proctor selection was many times backed-up by pounding a new proctor, in fact, most proctors on the job were generated in this manner as opposed to Bechtel maintaining a frequency list.

During the original submittal of U. S. Testing QA Manual, Bechtel (Project Engineering & Subcontracts) removed the provisions for performing one-point proctor tests for each Field Density Test.

2. Questionable Retests

The statement "A Field Density Test that fails to meet requirements of the specification should have been reported to Bechtel..." is incorrect. All failing test results were reported to either Q.C. or our field interface. However, it has become apparent that our field interface may not have been responsible for making these decisions. Any test U. S. Testing dispositioned as "clearing" was done so at the direction of Bechtel. The clearing of failing tests still is a Bechtel responsibility and on the occasions where U. S. Testing noted clearing tests, the report was a mode of conveying information from our interface. The Bechtel Report mentions three (3) cases where failing tests were cleared, one was "apparently resolved by merely using another Laboratory Compaction Curve...", another "tests labeled 'failed' were incorrectly cleared though the same laboratory standard was referenced.", and the third "two retests were dated prior to the time the original test failure." In fact,

these 'clearings' were the action of Bechtel employees who were also in the habit of marking up U. S. Testing reports. It appears that the standard Bechtel procedure for the dispositioning of failures was to scan reports looking for passing results in the same general area. The direction of U. S. Testing to a test area and provisions for test locations is the responsibility of Bechtel, on those occasions where the Bechtel interface could not relate specific locations the suggestion may have been made by U. S. Testing personnel.

We agree with the Bechtel assumption that it was possible to encounter different soils in the same location, however, it is more likely that the different soils were encountered as a result of the non-control of excavated materials as opposed to the removal and replacement subsequent to a test failure.

U. S. Testing responsibility on this project is to perform testing not control its placement, and in fact, U. S. Testing was excluded from being involved in placement control.

3. Theoretically Impossible Test Results

Any given soil has individual components that cover a broad spectrum of specific gravity values. The major factor contributing to specific gravity values determined by the test method Bechtel requested (ASTM-D854) results from a 25 gram sample and thus the specific gravity values resulting there from should be interpreted with that in mind. The application of the likely

band of specific gravity values represented in the Bechtel report figure 1 results in a 49 percent reduction of theoretically impossible results. The remainder of these test points falling above zero-voids line will be discussed in Section 6. However, specific gravity values from 2.57 to 2.82 for soil fractions are documented for material on this project.

The comment regarding the doubtfullness of the variation of soil properties is likely to be discounted by an examination of the data of the current soils evaluation program.

4. Repeated use of Questionable Laboratory Test Data

Although"...the fact that soil was not being placed or compacted according to specifications" was a major cause for concern. It is evident that another area of concern existed. Errors in calculations went unnoticed thru a good checking system. It is unfortunate that Bechtel's checking system simultaneously experienced difficulty.

5. Limits of Accuracy and Acceptability for Test Data

Although Bechtel statements conclude that only 25 to 40 percent of all clay tests represent compliance to specification, it should not be construed to represent the percentage of valid test data. The envelop of reasonably encountered test values would encompass the vast majority of test data. It has been demonstrated that the nominal scattering of data that may not have been anticipated was well within the statical variance that would be applied to this data.

6. Accuracy of Test Equipment

The average deviation of the nuclear device from oven-dry moistures was +.12 % for a set of 30 tests. The range of differences was approximately from -3 % to + 4 %. It was the assumption of U. S. Testing that Bechtel Engineering was appropriately applying this data to placement tests.

Contrary to the assumption regarding figure 9 with its "impossibly high dry densities" current test data closely resembles this graphical representation.

The use of the nuclear device was employed at the consent of Bechtel to facilitate production.

7. Relative Density Tests

Some of the specification 7220-C-210 zone numbers are an area of concern because of the overlapping soil classifications, i.e., clay could be either zone 1 or 2. The inherent nomenclatural difficulties that plagued the Bechtel Organization in providing data was not addressed in the limited potential problem areas. A re-evaluation of test data, with this third concern in mind, would probably change Bechtel conclusions.

Regarding calculation errors of relative densities and assuming the validity of these errors, it is again unfortunate that our checking systems broke-down.

The re-evaluation of maximum density by the wet method was in response to a relatively recent innovation of Bechtel assigning a geotechnical engineer to oversee the soils operation, here-to-fore there have been no "radical changes" or Bechtel material controls that would serve to flag the need for maximum density method re-determinations. Subsequent to this, the comparison of maximum density methods have been done routinely by U. S. Testing in response to material changes that were identifiable by newly instituted material controls and routine communication with assigned geotechnical representatives. These current comparisons have yielded maximum density variations that result in relative density changes from minimal to 20 %. The acceptability of high relative density results should have been evaluated as part of Bechtel process control that did not exist.

Summary

The Bechtel request that U. S. Testing respond to items 1 thru 5 has been detailed in this report.

The closing remarks of the Bechtel report makes the statement that"...on many occasions the inplace density was divided by the maximum density from the relative density test to get percent compaction..." is true. However, the report fails to mention that this method of calculation was a specific Bechtel directive.

In conclusion, the problems and concerns attributed to U. S. Testing results from a lack of proper soil identification and material quantities normally covered in inspection and placement responsibilities, none of which are contractually the responsibility of the U. S. Testings scope of operations. We are the testing arm of Bechtel. Our function is the reporting of data not its evaluation.

To File

From JJZabritski, P-14-416

Date November 14, 1979

Subject MIDLAND PROJECT
NRC MANAGEMENT MEETING
FILE: 0485.11 UFI: 71*01*11 SERIAL: 7921

9/27/79

CONSUMERS POWER COMPANY

INTERNAL CORRESPONDENCE

CC SHHowell, P-26-336B
GSKeeley, P-14-408B
RCBauman, P-14-412
KRKline, P-14-414
RFGreen, P-14-303
TJSullivan, P-24-624
DBMiller, Midland
LHCurtis, Bechtel
CEMahaney, B&W

On September 27, 1979, CPCo Management met with NRC Management in Bethesda, Maryland to discuss specific design decisions that had been incorporated in the Midland Plant design as a result of TMI-2 and certain NRC open items (NRC letter, S A Varga to S H Howell dated March 30, 1979). In addition, other items impacting Midland were discussed.

A copy of the agenda and personnel in attendance at the meeting is attached.

After an introduction by Mr S H Howell, T J Sullivan described the Midland Nuclear Safety Task Force, its tasks and its present recommendations. His presentation closely followed the attached handout. During this presentation, the following highlights were discussed.

T J Sullivan explained that our approach to the AFW reliability analysis was more rigorous in many cases than what was done by the operating plants. The NRC was concerned that this might entail additional review by the Bulletins and Orders Task Force, and they preferred to see this work done on a generic basis and asked why we were doing more than the operating plants. S H Howell indicated that we were departing or expanding on the B&W Owner's Group programs because past experience has shown that what satisfies the concern for an operating plant will not satisfy the concern for a plant under construction. D Vassallo and additional NRC personnel concurred in that statement.

As a side issue, D Hood stated that there is activity within the NRC that a single electrical AFW feedwater system pump may not meet the single failure criteria.

Sandy Israel asked if we were looking at the overcooling concern that the NRC has on B&W steam generators. T J Sullivan indicated that we were.

J J Zabritski listed additional modifications that resulted from the NRC's open item letter of March 31, 1979 that weren't included on the attached handout as follows:

1. Automatic opening of core flood line valves (ICSB-7)
2. Containment sump design (RSB-14)
3. Safety grade dump-to-sump flow indication (RSB-17)
4. Fuel transfer tube shielding (RAB-2)

On the subject of CPCo's need to have staff technical interaction prior to formal documentation of these changes, D Vassallo indicated that the NRC is still not able to obtain staff recources for technical reviews and they need to pull back and establish schedules. However, D Vassallo stated that the staff would be willing to meet with CPCo on certain issues which were critical to Midland's schedule. CPCo indicated that we would generate such a list of items and request technical meetings with the NRC staff through D Hood.

In regard to documentation, D Vassallo stated that we should indicate our proposed modification in the FSAR for discussion and desired not to receive submittals of proposed modifications and system descriptions via separate transmittal letters.

J J Zabritski also provided a handout (attached) on the status of NRC open items that resulted from the NRC letter of March 31, 1979. The NRC indicated that a matrix of all open items and their status would be a helpful management tool in conducting the licensing review and indicated that they maintain such a matrix for their near-term OL plants. CPCo committed to generate such a matrix and also make it available for NRC use.

On the subject of Short Term and Long Term Lessons Learned, G S Keeley indicated that we have kept abreast of the Short Term Lessons Learned and are incorporating them into our design. However, as discussed above, technical interface with the NRC staff is essential to minimize the impact on the Midland schedule. G S Keeley also indicated that there may be some areas of modifications where long lead time of equipment procurement may preclude making a specific modification prior to fuel load and discussion with the NRC staff would be essential to resolve the issue. D Vassallo indicated that the specific aspects of the Short Term Lessons Learned Report is being sent out to plants under construction (including Midland) today. Long Term Lessons Learned is still on schedule and will be issued in October.

On the NRC's safety review of Midland, J J Zabritski pointed out the following critical path areas and areas in need of early resolution:

1. No discussion has been held with Reactor Systems Branch (RSB) on open items.
2. Instrument and Control Systems Branch (ICSB) has not completed all of their Q-1 review.
3. Fire protection questions in final form need to be issued.
4. Testing program Q-2's need to be issued.
5. SQRT visit needs to be scheduled.
6. Environmental qualification issues need to be resolved.
7. Certain Topical Reports referenced by Midland need to be approved by the NRC.
8. I&C drawing review needs to be scheduled.

NRC concurs that there are problems in resources in accomplishing the above but felt that the matrix of open items and CPCo indicating to D Hood its most pressing concerns will help. CPCo indicated that we would do so.

S Varga indicated that the NRC is in the process of hiring various subcontractors to conduct the Midland Plant review. D Hood stated that the overall review for Reactor Systems Branch (RSB) and Instrument and Control Systems Branch (ICSB)

would not be subcontracted; however, parts of these reviews could be. The RSB reviewer will be new to Midland and, as such, there will be some redundancy and reeducation in the review process. At the present time, the following areas are being considered for outside review.

Mechanical Engineering Review - ETEC
SQRT Review - Naval Research Laboratory
ISI Program for Pumps & Valves - INEL

S Varga indicated that we would still work through D Hood in setting up meetings in these subjects. In addition, initial meetings between these organizations, NRC and CPCo may be necessary to expedite these reviews.

When a specific subcontractor is assigned, D Hood will request CPCo to provide them an FSAR.

On the staff's requirement to document deviations from the SRP Acceptance Criteria, S H Howell asked the following questions:

1. Are the SRP's being reviewed and updated?
2. Is the documentation of deviations being applied to all applicants?
3. Is the documentation of deviations being applied specifically to Midland?

D Vassallo answered "yes" to all three questions. T J Sullivan asked what was the cutoff date used for the SRP's in review of the Midland Plant. Staff responded that the later SRP's have implementation sections.

NRC also indicated that the documentation of deviations is an evolutionary process, ie, later SER's have better documentation efforts than previously written SER's. D Vassallo stated that the Midland Plant SER will not look any different than previously written SER's because of the SRP documentation deviation effort.

On the seismic issue, J J Zabritski indicated that CPCo will have responded to all outstanding seismic questions in a few weeks and now the NRC staff needs to provide a staff position on the Midland seismic issue. NRC had no comment.

In the soils settlement issue, G S Keeley indicated that our current 50.55e Report is on schedule and that we will keep NRC Region III informed of schedule changes on subcontract work. S H Howell asked the status of the technical review in this area. L Rubenstein indicated that he had been urging the NRC technical staff to take a position but has so far been unsuccessful, however, he will keep trying.

On the recently issued question of QA on this subject, S H Howell stated that we were currently in the process of responding to this question and CPCo would provide the response as soon as we could.

Discussion of the Caseload's Forecast Panel Meeting which was held at the Midland Plant on September 18 and 19, 1979 revealed that the NRC had postulated a final construction completion date of June 1982 for Unit 2 with no TMI-2 backfit issues factored into this estimate.

D Scalleti indicated that the Draft Environmental Statement (DES) was still scheduled to be issued in February 1980. However, he stated that as a result of just being made aware of the NRC's new postulated date for completion of Unit 2 in June 1982, his management may not want to issue a DES 2 1/2 years prior to fuel load. D Vassallo stated that if we can get the DES out early there is no reason why we shouldn't hold a separate hearing on environmental matters.

ATTENDEES

NRC MANAGEMENT MEETING
September 27, 1979

CPCo

S H Howell, Senior Vice President
G S Keeley, Midland Project Manager
T J Sullivan, NSRB Chairman
J J Zabritski, Project Licensing Engineer

NRC

D Vassallo, Division of Project Management
S Varga, Division of Project Management
L S Rubenstein, Division of Project Management
D S Hood, Division of Project Management
S Israel, Bulletins & Orders Task Force
F Orr, Division of Systems Safety
T Speis, Division of Systems Safety
D Scaletti, Division of Site Safety & Environmental Analysis
W Lovelace, Management & Program Analysis

AGENDA

1. Applicant's Specific Design Decisions for Midland

   a. Incorporating TMI-2 Effects

   b. Resulting from NRC's Open Items[1/] from Midland Review

   c. Applicant's Need for Staff Feedback Prior to Documentation of Design Changes

2. Impact of Short and Long-Term "Lessons Learned" for Midland

3. Other Matters Impacting Midland

   a. Status of Staff's Safety Review for Midland

      (1) Critical Path Areas (RSB & ICSB)

      (2) Areas in Need of Early Resolution

      (3) Assignment of Staff Reviewers and Use of Contractors

      (4) Applicant's View Regarding Documentation of Deviations from SRP Acceptance Criteria

   b. Seismic Issue and Soils Settlement Issue

   c. Caseload Forecast Panel Meeting Results

   d. Status of Draft Environmental Statement

[1/] Listed in Staff's letter of March 31, 1979

Bechtel Power Corporation
777 East Eisenhower Parkway
Ann Arbor, Michigan
Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

August 10, 1979

BLC-7993

Consumers Power Company
Mr. G. S. Keeley
Project Manager
1945 West Parnall Road
Jackson, Michigan 49201

Midland Units 1 and 2
Consumers Power Company
Bechtel Job 7220
REVIEW of U. S. TESTING FIELD AND LABORATORY TESTS ON SOILS
Files 0614/2801

Dear Mr. Keeley:

Attached for your records is the completed report dated July 1979, entitled "Review of U. S. Testing Field and Laboratory Construction Test Data on Soils Used As Fill."

This report includes resolutions to the questions raised by Consumers Power personnel on the earlier draft report.

The report will now be sent to the subcontractor, United States Testing Company, Inc., for their response to the findings.

Very truly yours,

P. A. Martinez
Project Manager

PAM/pp

MEETING NOTES

U. S. TESTING, CONSUMERS POWER COMPANY AND

BECHTEL POWER CORPORATION

DATE: April 9, 1979

PLACE: U. S. Testing Headquarters, Hoboken, NJ

SUBJECT: See Below*

ATTENDEES:		
	E. Basile	U. S. Testing Company
	E. Zadena	U. S. Testing Company
	E. Edley	U. S. Testing Company
	M. Anzelmo	U. S. Testing Company
	J. Speltz	U. S. Testing Company
	B. Marguglio	Consumers Power Company
	D. Worn	Consumers Power Company
	R. Wheeler	Consumers Power Company
	D. Palmer	Bechtel Power Corporation
	G. Richardson	Bechtel Power Corporation

I)* Ben Marguglio opened the meeting by establishing the following agenda:

1) Describe the problems relating to the Midland soils problem.

2) What U. S. Testing thinks may be the problem: where did U. S. Testing contribute to the problem?

3) What did U. S. Testing say to the NRC during the NRC investigation.

II) Ben Marguglio presented the following to describe the types of problems:

1) Inconsistencies in the SAR

2) SAR Requirements not translated accurately/clearly into the specifications.

3) Requirements for testing were not totally stated. Callout for proctor not total story.

4) Interpretations were varied and not released through normal specification channels.

5) Client suspects there was not a total understanding of the process by any one individual. Lack of expertise.

6) There may have been incorrect proctor selection.

7) There may not have been timely corrective action in identifying the extent of the problem and identification of the problem as opposed to fix.

8) Accountability for inspection may have been lacking.

Who inspected
What inspected
How inspected, etc.

9) U. S. Testing may have utilized ~~to~~ a sampling process without sufficient historical background on the process.

10) U. S. Testing may have failed to qualify the test or the inspection process.

Ben added that all of the above contributed or could have contributed to the problem.

III) The main discussions during the meeting centered around the above. The following is a brief description of the important points of this discussion.

1) Ben discussed the conflicting test methods in specification C- 210 and asked what U. S. Testing did to assure themselves that they had a clear Specification to work to.

U. S. Testing responded that their direction to use Bechtel modified proctor came from Bechtel as did direction of when to take moistures. There was nothing in writing - direction was verbal.

U. S. Testing added that it was not their responsibility to determine when or where to take a test.

U. S. Testing clearly stated that U. S. Testing responsibility was for performing the testing and not to inspect as to where and when testing is to be performed - this is a Bechtel responsibility.

Question by Don Horn concerning moisture, compaction, and fitting of sample to the proper proctor was directed to U. S. Testing. Inherent error and judgement could be highly contributary factors in giving the wrong result.

U. S. Testing stated that variables exist within a soils testing program that can cause erroneous data. U. S. Testing suggested that the testing agency be given more autonomy in making decisions. It was suggested that possibly the testing agency would serve best if it were responsibile directly to the Client.

Ben stated that on Consumers Power Company jobs (future) he expects U. S. Testing to assure that specification interpretations/changes are obtained officially - and added that U. S. Testing Q A should not allow this to happen.

U. S. Testing responded that their Contract does not provide for this type of QA involvement.

2) Ben asked what type of mechanism U. S. Testing used to determine when a new proctor was required.

U. S. Testing responded that this was (is) normally triggered by the lab technician during selection of the proctor in response to a field test.

U. S. Testing added that there are no procedures to cover this operation; that it is a judgement operation that would be difficult to procedurize.

Ben summarized the problem of direction during testing as being unsatisfactory and a more stringent direction process between Contractor and Subcontractor would be required, particularly that any change in test or specification changes must be received in writing prior to implementation.

3) Ben asked who notified U. S. Testing when a new proctor was needed.

U. S. Testing responded this was an ongoing item and proctors were taken as a regular thing and were taken at material changes and new borrows - again there were no procedures.

U. S. Testing stated that they could not remember ever being requested by Bechtel to take a sample specifically to develop a proctor.

U. S. Testing added it was not their responsibility to maintain the test frequency and that they were not privileged to quantity information.

Question of frequency revealed that:

1) 10,000 yard frequency test was not accurately followed as related to exact yardage being moved but was an ongoing check basis based on frequency roughly correleted with yardage - this was done because exact yardage movement was not immediately available to prompt the precise frequency implied by the specification.

U. S. Testing added they felt that they did more than their Contract required in:

Determining new sources and material changes where new proctors are required.

Selection of the appropriate proctor to compare to the field density.

Over involvement with Canonie.

4) Ben asked how U. S. Testing identified the proper curve to use when the curve may be six months old.

U. S. Testing responded, they kept approximately 15 samples to be used.

Ben inquired what the field procedure was in determining when a new proctor is needed. U. S. Testing responded that:

1) Judgement factor by experienced field personnel determines a large portion of the decision.

2) If characteristics changed, or a new borrow was started then an additional proctor would be made .

Ben added following statement:

For Consumers Power Company projects U. S. Testing should take the attitude that, in the absence of a controlled single source or specific designation for a change in soils, the most conservative approach should be taken.

5) General discussion on testing calculations:

A) Some conflicts noted in D. Horn's audits - U. S. Testing should consider.

B) All test reports submitted to Bechtel Q. C. for review - does not include actual calculations.

C) There normally was not a plot of field test results on the proctor curves - no comparisons to zero air-voids curve.

D) If test plots on wrong side of zero air-voids curve there is an error (per D. Edley).

E) Errors are inherent in test methods being applied:

Troxler has $\pm$ 3% error.

Results are conservative.

6) Ben asked what U. S. Testing thought might be the problem - U. S. Testing had no input.

7) Ben asked if U. S. Testing had recommendations for future work - U. S. responded:

A) Take a look at the role you want the test lab to perform.

B) U. S. Testing added that it was Bechtel's responsibility to determine when a new proctor is needed.

C) Review area of what is acceptable material.

Ben requested that U. S. Testing provide Consumers Power with testimonial information that was provided to the NRC during the interviews covering the soils investigation at Midland.

U. S. Testing inquired whether Bechtel would object to this release. Bechtel Subcontracts representative stated that there would be no objection.

The dialogue of these interviews is attached.

Prepared by:

For
David L. Palmer 4-26-79

David L. Palmer Date

NRC DIESEL GENERATOR BUILDING SOILS INVESTIGATION
at the Midland, Michigan, Project Site

Interviewers: Gene Gallagher, NRC Soils Specialist
G. A. Phillip, NRC Investigation Specialist

Interviewee: John Speltz, U.S. Testing Site Project Supervisor

The following notes were generated from notes taken by John Speltz during an interview in the Consumers Power Company conference room on 12/14/78.

Q.) Did you see a conflict in C-210 (earthwork specification) between BMP (Bechtel Modified Proctors) and ASTM D-1557?
A.) Yes, there was an area of concern in section 13.

Q.) What criteria were you working to?
A.) The BMP, as indicated on our reports.

Q.) What is your period of activity on site?
A.) Since December, 1976.

A letter to Church (Subcontracts) from Valenzano (Engineering) of 6/10/74 was shown. Section 13.7 of C-210 was pointed to in the letter.

Q.) What does modified Proctor mean to you?
A.) ASTM D-1557 modifying ASTM D-698.

Q.) Do modified Proctor, BMP, and D-1557 mean the same?
A.) No.

Q.) Does BMP and modified Proctor mean the same?
A.) No.

Showed telecon Hook (Bechtel Q.A. onsite) to Rao (Ann Arbor, Project Engineering), October, 1977, and telecon Teague (Lead Civil Field Engineer) to Rao, October 10, 1977 (copy attached), noting that either D-1557 or BMP can be used.

Q.) What was your source of direction on this?
A.) Verbally, as mentioned in a note on top of the original of the telecon.

Q.) Do you feel Hook or Teague were responding to you (John Speltz)?
A.) No, not to me directly.

Q.) Who would respond to you with this information?
A.) Bechtel Q.C.

Q.) Why is the response so late? → ref: Oct 10, 77 Date
A.) I have no information on that.

Q.) Were there other areas where soil work was going on?
A.) What work are you referring to?

Q.) Were there Q.A. problems in soils at this time?
A.) I believe that Bechtel Q.A. and Consumers Power Company Q.A. were active in soils during this time period (fall of 1978), but I have no specific recollection.

Q.) Is the BMP and type of materials specified for the Diesel Generator fill normal for construction?
A.) I had no interface with Project Engineering and Design.

Showed QCIR SC-1.05 (a Bechtel Q.C. report form).

Q.) Are you aware of Q.C. field activities and responsibilities in soils?
A.) I am aware that they have a program and functions to fulfill, but not of their specific requirements.

Q.) Do you think that Canonie was aware of the specification for compaction and what it was being tested for?
A.) I have no specific knowledge, but assume that they were aware of their job requirements.

Q.) Was Bechtel working soils in addition to Canonie during this time period (1977)?
A.) Yes.

Q.) When did Canonie quit working?
A.) In 1977, there was a big push to be off site for deer hunting season which began November 15th.

Q.) Why are you working to D-1557 now?
A.) Q.C. direction with a memo from Cheek to Siple of 9/29/78 (copy attached).

Q.) What is random fill?
A.) It could be any of several types of material.

Q.) Why would they call random fill just clay?

Cheek to Siple memo was shown. The statement "Random Fill (Clay)" was pointed out.

Q.) If it could be other materials, why would he (Cheek) define it as clay?
Q.) Did he know the difference?
A.) My interpretation of this memo was that it was addressing testing and that he was distinguishing test procedures for granular vs. cohesive soils.

Q.) Do you have anything you wish to add to this discussion?
A.) No.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2/7/79 Jim Keppler - Organ. changes. Fiorelli to change with Heischman. [illegible] will be Project Section Chief. Lee - Elec & Civil Eng. Support.

Wants to indicate how NRC sees Inspection Program at Midland. They noticed meeting & will issue insp. report. Diesel Gen. Bldg. is most serious thing going now. They feel there are several items of non compliance and also errors made in FSAR. Said we intend to update FSAR by 2/20/79 in all areas including [illegible] areas of diesel gen. bldg. Will be inspection on Core internals installation & piping (including hangers, [illegible]) & restraints). Generically have had problems on setting hangers & [illegible] Still evaluating monitoring & [illegible] voltage answer. Electrical & other equip. - shop inspection adequacy (air locks, pump internal, elec. penetration [illegible] & review of environ & seismic qualification (they understand we have people to review this). Cable trays whether Class IE - will be issue at hearing, conduit support, seismic, terminations - crimping & schedule problems, cable routing & separation. On environ there will be a bulletin coming out. We have [illegible] NRC report on this on status & plan. Have had problems with [illegible]. We've checked ours & our welding process is different. Our [illegible]

(Husky) NRC will send copy of Zimmer inspection report. Will be looking at [illegible] of safety related components. B&W separation & noise feedback - we [illegible] to or with isolation cabinets. Will be performing inspection in March or April in AA & CPCo. on eng. to see if we have been meeting [illegible] requirements. Will be overview of QA activities & interfaces (systems audit). Could also be on site.

Discussed 50.55e reports to date & that most are still open on NRC's part even though CPCo. has closed them out. Is NRC reasonably satisfied with close out. [illegible] Insp. will review. For some of them Region needs assistance from staff. They have to close them out in insp. report. Said we have been very good on reporting things per 50.55e & should be commended.

On CPCo. overview program - what are current activities & [illegible] plans thru conclusion of project. We have had overview for 1½ yrs. & [illegible] to do overinspection till end of project. [illegible] NRC feels overview program is important - it's working out for everyone [illegible] part of Midland QA Program. Bechtel has QE QC & [illegible]. [illegible] NRC says that when CPCo. put overview program on it [illegible] on overview as important part of program & NRC hasn't found substantive deficiencies over & above what CPCo. has found. Bechtel program has also improved. Total program is good (CPCo. & Bechtel). If experience shows NRC is picking up things then our program has to be improved.

Summation by Keppler - has put more [illegible] on Midland than other projects on national [illegible]. No. of items of non-compliance are [illegible] no [illegible] NRC. 2 major areas are Diesel Gen. Bldg. & [illegible] equipment (finding items wrong after shop inspection). Upcoming [illegible] - will be important. [illegible] 50.55e. Overall QA program has been good. CPCo - we appreciate purpose of meeting & [illegible].

Region III has briefing document they've prepared for NRR & will be issued to all parties. Has history of QA problems & actions taken. On diesel gen. bldg. - Applicant & Bechtel should have been [illegible] due to NCR's & grade beam problem. Underlying causes - CPCo has relied too much on Bechtel, failure of CPCo. to look at single events as generic. Don't have a broad breakdown in QA program but deficiencies should have been recognized sooner & NRC hasn't found significant deficiencies overlooked by licencee.

Cherry has asked to take depositions before hearing. NRC Lawyers are tending to agree with this.

Consumers Power Company

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

November 16, 1978

Mr. P. A. Martinez
Bechtel Power Corporation
P.O. Box 1000
Ann Arbor, MI 48106

Ref: BLC-6747 dated
November 1, 1978

MIDLAND PROJECT GWO 7020 - CONTINUATION OF THE
DIESEL GENERATOR BUILDING WORK
File: C-210 Serial: CSM-0050

In answer to your request in the above referenced letter, we agree that in the best interest of the schedule, the construction of the Diesel Generator Building should be resumed, as long as monitoring instrumentation is not affected and provisions are made for a topping slab for elevation adjustments after pre-load. Also, the filling of the cooling pond will continue as soon as possible.

These two questions were also answered verbally in the meeting with the Soil Consultants on November 7, 1978 in Champaign, Illinois.

We have notified our Insurance Representative of the large settlements in the Diesel Generator Building and have asked them to investigate our coverage.

D. B. Miller
Site Manager

DBM/DES/pp

To Midland File: B3.0.3

From GSKeeley/TCCooke, P-14-408B

Date December 4, 1978

Subject MIDLAND PROJECT -
DIESEL GENERATOR BUILDING
SETTLEMENT MEETING -
FILE: B3.0.3 SERIAL: 6175

CC DBMiller/TCCooke, Midland
CAHunt, P-14-209B
DEHorn, Midland

11/2/78

Consumers Power Company

INTERNAL CORRESPONDENCE

On Thursday, November 2, 1978, a meeting was held in Ann Arbor between Bechtel and Consumers Power Company technical people to review the situation on the settlement of the diesel generator foundation. An agenda and names of personnel in attendance are attached (Attachments A and B).

During this meeting the following discussion took place:

I. A. See Attachment C for Listing of Inconsistencies

1. Tuveson of Bechtel stated the following:

C-501 is an AA design guide. Bechtel feels that Geo Tech, although not there full time, performed technical supervision. They did not have a man full time for either dike work or power block backfill.

Geo Tech only reviewed data if field requested them to review and only if field had problems. Bechtel feels that field engineers' personnel involved in compaction were qualified soils engineers and could interpret tests and correlation of tests. CP Co does not feel that they were qualified soils engineers on site (most were right out of school). Bechtel (PAMartinez) had said in July 1974 they would have a man full time on the job, but not the site.

2. Bechtel feels that relaxation of Dames & Moore recommendations is supported by field testing on compaction and the D&M Report does not specify the type of equipment to be used. 1973 testing showed that it varied depending on equipment and material. Would have used different compaction if lifts were 6" - 8". CP Co talked to Rexford about difficulty of monitoring spreading and compaction especially in small areas. Bechtel says they feel as comfortable with 12" lifts as 6" - 8". See J L Corley letter to Connolly, 7/23/74. Don Horn says there were areas around containment where they went above mark. During July 1974 PAM committed to CAH that JWanzek would be on job full time - affected by slowdown.

3. Bechtel does not feel there is any conflict. If backfill froze and then thawed, it should be removed. It was all scraped off (usually 2") and then tested with a pickax.

4. C-501 - On-site sand.

   C-211 - Structural backfill so does not have to be too high a percentage (bought off-site sand). CP Co feels that the Bechtel C-210 specification did not require sand soil to be compacted to 85%. Bechtel feels that whether it is 80% or 85% it has no structural effect assuming the sand meets the gradation for structural sand (imported off-site).

5. Bechtel says that they requested that more borings be done before diesel generator problem and they have now demonstrated that we do have adequate compaction of material in sand lens area questioned.

6. Bechtel says that, in some cases, the wrong standards could be followed and that this was the problem with grade beam. There have been times when inexperienced man could have selected the wrong coorelation. Since the diesel building problem, Bechtel has gone to running proctors as soil is being placed although they had taken some borings after grade beam, but did not see any problems. How many proctors were run as material was removed from borrow pit - none. This would have shown whether technicians were utilizing the correct proctors. Present practices require higher density which is more difficult to obtain watching wheel action in small areas was assumed to be impractical.

7. Should Bechtel modify proctor vs ASTM (see NRC Exit #6 below)?

B. <u>NRC Exit (See Attachment D for Listing of Findings)</u>

1. During construction, we are doing every week on diesel and every 60 days on others. We see no need to change from FSAR commitment.

2. Use of random fill was identified as okay in Dames & Moore and PSAR and as long as adequately compacted is okay. Will change FSAR to indicate random fill will be used. In addressing judgment on area and non-uniformity of soil, we should also cover conservatism of structure design to settlements. The building is a stiff structure and can span settlements.

3. Due to various types of equipment, acceptance was performance rather than procedure. Copied from dike work, but not applicable to backfill. The table should be modified.

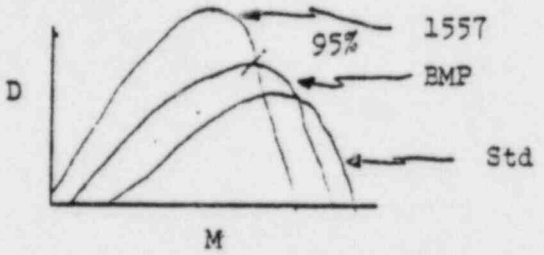
4. Cover this in compaction explanation. Review and change the FSAR. The PSAR said 1/2" is a ballpark figure.

5. Typo; grade instead of actual.

6. C-10 specification in 1969 used four-pass performance specification and test to 20,000 foot pounds Bechtel Modified Proctor (BMP). On restart in 1973, C-10 became C-210 for dike (methods) and performance for rest of fill (testing to BMP with modified - 95% of 1557D). Was added to Section 13 - testing is still based on BMP per Section 12.

   In 1977, Revision 5 was rewritten to 1557 for placement (was rewritten for type of materials - sand). On clays said 95% of 1557. Q-List dike was tested to 95%, but rest was accepted on 4-pass. Test in these areas shown less than 95%. There were 3,000 tests taken.

1557	BMP
95%	100%



(Varies from 8 to 16%.)

BMP was originally implied to be used for dikes. 20,000 ft lb vs 56,000 ft lb of effort on BMP vs 1557. On other jobs Bechtel uses 95% of 1557. Dames & Moore recommended 95% of 1557 or 100% of BMP. Bechtel does not know why 95% BMP was used - possibly 56,000 ft lb was accidently copied out of the D&M Report. As it ended up, Bechtel used 95% of BMP for everything.

	Referenced 1557 (1968)	BMP (1969)
Under & Support Of	95	100
Adjacent to Structure	90	95
Nonsupportive & Adjacent	90	90

7. Working on. Continue monitoring. The elastic foundation question has not yet been analyzed for the worst case.

8. Will discuss utilities and random fill calculations which are major concerns.

9. Feels no problem and could close up later. It is under observation. 0.02" maximum allowable under ACI architectural.

10. Okay.

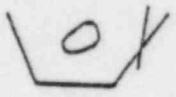
11. Will be monitoring. Initial calculations did consider variations on water level.

12. Okay. Check consultant on preload.

13. Okay.

14. Mat foundations not used normally over random fill or in diesel building; Bechtel disagrees.

    Bechtel disagrees on blow count question and noted that tests may have been taken at planes.



15. Does not believe material was placed as indicated (low blow counts).

II. A. Planned Future Actions

1. Start monitoring underground utilities prior to other activities.

   a. Condensate lines - measure gaps and survey (elevation).

   b. Other pipes - measure sleeve gaps - do additional excavation as required.

   c. Get initial readings on adjacent underground pipes.

2. Release the duct banks.

3. Grout gaps between building footings and soil for more uniformity in soil pressure and avoidance of building stress.

4. Check the relative displacement between duct bank and footings - include the off-set duct bank.

5. Run a profile along the bore of pipe beneath the building before and after preloading. Include horizontal and vertical measurements on center line.

6. Monitor condensate pipes and duct banks and check continuity on one duct per bank.

7. Install soils instrumentation.

   a. Building settlement markers.

   b. Piezometer for pore water pressure (in and out).

c. Settlement monitoring of existing fill at varying elevations.

d. Inclinometers.

8. Preparation for surcharge.

a. Three feet of sand will be placed approximately 20' around the outside of the Diesel Generator Building and inside the Diesel Generator Building for frost protection.

b. Manholes may be utilized in the approximately 2,000 cubic feet of sand.

c. Excavate both sides of duct banks.

d. Protect the turbine generator basement wall, if a surcharge is required in that area.

9. Resolve what will be done in the transformer areas.

B. Scheduling

The duct bank should be cut loose on November 6, 1978. This operation will take approximately 2½ weeks. On November 24, 1978 start grouting operation (1½ weeks maximum time estimate). The pond should be filled by January 1, 1979 if at all possible. Instrument preparation should start immediately to complete in 2-2½ weeks. The meeting with consultants will be held on November 7, 1978 in Champaign, Ill. Decisions on surcharge will be made November 14, 1978.

It is anticipated that cribbing for the surcharge will be complete by mid-December. NRC confirmation of the planned course of action may be required. Once fill has been started, it will take approximately 2 weeks to complete. The surcharge will then remain until approximately June 1, 1979 (assumption). Removal would take about 2 weeks. It is assumed that work would continue where possible in mechanical and electrical areas. Civil work on Diesel Generator Building would probably continue from March 1, 1979 through May 1979 and complete June 1, 1979. One machine must be turned over on March 1, 1980 for hot functional.

Monitoring operations should start as soon as possible prior to cutting the building loose (initial work has been completed).

The NRC, Darl Hood, will be contacted on November 7, 1978 and a meeting will be set up with Messrs Hood and Lyman Heller.

GSK/cg

Attachment A

Bechtel Power Corporation

MEETING AGENDA

Midland Units 1 and 2
Consumers Power Company
Bechtel Job 7220

DATE: Thursday, November 2, 1978, 10 a.m.

PLACE: Ann Arbor Office, 4 D 5

SUBJECT: DIESEL GENERATOR REVIEW MEETING

ATTENDEES: Consumers Power Company / Bechtel

DISCUSSION ITEMS:

(I) CPCo/NRC Questions & Concerns

- (A) "Inconsistencies Discovered to Date"
- (B) NRC Exit Meeting October 27, 1978

(II) Future Activities

- (A) Releasing Duct Banks
- (B) Grouting Gaps Under Footing
- (C) Utilities Monitoring During Release of Duct Banks
- (D) Soil Settlement Instrumentation and Monitoring of Utilities During Surcharging
- (E) Preparation for Surcharge
  - (1) Protective Measures
  - (2) Frost Protection
- (F) Schedule

pp

Attachment B 11/2/

Diesel Generator Recovery Meeting

Attendees:

P. Martinez	BECHTEL
N. Swanberg	"
KARL NIEDNER	"
M O ROTHWELL	—
B.C. McGann	—
AP Betts	"
M. R Williams	" QA
J. O WANZECK	BECHTEL
TAN BLUE	Bechtel
RM Wheeler	CPCO
DE Sobold	CPCO
D E. HORN	CPCO
G. S. Hawley	CPCo.
T. C. Cooke	CPCo.
C. A. Hood	CPCo
G A TOMLSON	Bechtel

ATTACHMENT C

INCONSISTENCIES DISCOVERED TO DATE

1) References:

a. Dames & Moore Report (Page 15)

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

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

Bechtel Field did not have a Soils Engineer on site.

2) References:

a. Dames & Moore Report (Page 14)

b. Bechtel Specifications C-210 and C-211

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

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

Obviously, these two requirements conflict.

3) References:

a. Dames & Moore Report (Page 15)

b. Bechtel Specification C-211

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

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

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

4) References:

a. Bechtel Design Standard C-501

b. Bechtel Specification C-211

Bechtel Design Standard - Table of Minimum Compaction Criteria

Purpose of Fill	-	On Site
Support of Structure		Sand Soil
		Percent Relative Density
		85% (D2049-69)

Spec C-211, Section 5.5.1 - "Cohesionless (sand) material shall be compacted to not less than 80% relative density...by ASTM D. 2049."

Specification and Design Standard conflict.

5) References:

a. Dames & Moore Report (Page 14)

b. FSAR Pages 2-7

c. Drawing C-44

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

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

Bechtel Drawing C-44, Note #4 - "Within the excavation area shown, all loose surficial sands with relative density less than 75% shall be removed."

Added to this drawing 8/23/75.

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

Discussion

The question of whether the loose sands as described in the PSAR were ever removed is a good example of why there should be mechanisms to insure that commitments are properly conveyed to the Construction Group and that the outlined work is successfully concluded. When the note to Drawing C-44 was added, it was too late to economically excavate the loose sand since they had for the most part been covered by backfill.

The attached boring logs and locations confirm existance of the sands, although the blow counts look very good.

6) We question the method used to select the proctors. Errors in reported compaction probably resulted in selection of lower maximum density proctors. See Bechtel letter to US Testing dated February 1, 1978.

Attachment D

TO — JWMarguglio, JSC-220A

FROM DEHorn, Midland

DATE October 31, 1978

Consumers Power Company

INTERNAL CORRESPONDENCE

SUBJECT MIDLAND PROJECT - NRC EXIT INTERVIEW OF OCTOBER 27, 1978
File: 0.4.2 Serial: 230FQA78

CC SAfifi, Bechtel - Ann Arbor
WRBird, JSC-216B
RLCastleberry, Bechtel - Ann Arbor
TCCooke, Midland
JLCorley, Midland
GSKeeley, P14-408B
DBMiller, Midland
JFNewgen, Bechtel

The following people were in attendance at the subject exit interview which was conducted at the end of G. J. Gallagher's inspection of October 24-27, 1978:

CPCo	Bechtel	NRC
RCBauman	WLBarclay	RJCook
TCCooke	ABoos	GJGallagher
JLCorley	RLCastleberry	
DEHorn	LADreisbach	
GSKeeley	PAMartinez	
DBMiller		
BHPeck		
RMWheeler		

Mr. Gallagher stated that the visit was a follow-up on 50.55(e) report of the diesel generator settlement and that it was also a fact finding visit. The inspection consisted of a review of past data, activities in progress and planned activities for future work. Inspection was performed by review of the FSAR commitments; Specification C-210; Specification C-211; PQCI/IR C-1.02; Dames and Moore Report of Foundation Investigation and Preliminary Explorations for Borrowed Materials dated June 28, 1968 and supplement to this report dated March 15, 1969; preliminary data on diesel generator settlement problem including boring plan, cross sections of fill, blow count versus the elevation graphs, lab data, settlement data, boring logs, dutch cone logs, weather data and penetrameter readings in test pits; design drawings C-45, C-109, C-117 and C-1001; soil tests taken in the diesel generator building area during construction compiled by B. T. Cheek, Bechtel QC; observation of soil testing at the test lab and in the field; and discussions with Bechtel Geo-Tech, Project Engineering, Field Engineering, Quality Control Engineering, U.S. Testing, Consumers Power Company, PMO and QA personnel. Mr. Gallagher stated that he would not handle the findings as noncompliances, however, they could become items of noncompliance when they are reviewed by his management.

His findings/observations were as follows:

1. The FSAR states that during operation, settlement readings will be taken every 90 days. Because of the diesel generator settlement problem, this frequency should be re-evaluated for adequacy.

2. FSAR Table 2.5-14 "Summary of Foundation Supporting Seismic Category I Structures" identifies the supporting soil materials under the diesel generator building as being controlled, compacted cohesive soils. However, construction drawing C-109, Rev. 9 and C-117, Rev. 6 identifies the material in this area as Zone 2 material. Zone 2 material is identified as random fill described as any material free of organic or other deleterious materials. In the field a variety of materials have been used for the diesel generator foundation material, in particular, sands, clay, and lean concrete, silty sands and clayey sands. The apparent conflict is that Table 2.5-14 identifies cohesive soils where, in actuality, cohesionless sands have been utilized. A review of the records indicate that sands have been used between elevation 594'-608', areas of elevation 611'-613' and areas between 616'-623'. This indicates the extent of the variability of the material placed under the diesel generator building foundation. Mr. Gallagher did not feel it was good judgement to use random material under the support of a structure.

3. FSAR Table 2.5-21 "Summary of Compaction Requirements" identify random fill to require a compaction effort of a minimum of 4 passes with the specified equipment in this table. This requirement has not been an imposed requirement of Bechtel Specification C-210 nor an inspection requirement of Bechtel Quality Control Instruction C-1.02 for backfill.

4. FSAR section 3.8.5.5 states that settlements of shallow spread footings founded on compacted fill are estimated to be on the order of ½" or less. Site Survey Program has identified settlements in the diesel generator building foundation on spread footings to range from 0.55 inches to 2.30 inches and in excess of 3.0 inches for the diesel generator pedestal.

5. FSAR figure 2.5-47 indicates the foundation of the diesel generator building to be at elevation 634', according to design drawings C-1001, Rev. 5 it is indicated for the diesel generator spread footings and pedestal foundation to be at 628'.

6. A. Specification C-210, section 13.7.1 requires all cohesive backfill in the plant area to be compacted to not less than 95% maximum density as determined by ASTM D1557 method D which requires an effective compactive effort of 56,000 foot-pounds of energy per cubic foot of soil. However, section 13.4 Testing requires testing of the materials placed in the plant area to be performed in accordance with tests listed in section 12.4. This section, in particular section 12.4.5.1, "Cohesive Soils," requires maximum lab densities to be determined using ASTM D1557 Method D provided a compactive energy equal to 20,000 foot-pounds per cubmic foot is applied (Bechtel Modified Proctor Density). To date, the Bechtel Modified Proctor Density for determining maximum proctor density versus optimum moisture content has been utilized. This conflict results in an unconservative method of determining the maximum proctor density and method of assuring that the required percent compaction is achieved. In particular, the actual in-place compaction would be less using the Bechtel Modified Proctor Density as a reference than using the standard ASTM D1557 method D. This is due to the fact that the compactive energy exerted using the Bechtel Modified Method is less than the effort exerted by the standard method D - example: 20,000 foot-pounds versus 56,000 foot-pounds.

6. B. Bechtel Quality Control Instruction C-1.02 section 2.4 testing identifies the applicable inspection criteria and includes Specification C-210, section 13.7 and 12.4 which includes the apparent conflict as described in detail in Part A above.

C. A further review of the original subsurface investigation performed by Dames and Moore and documented in report supplement dated March 15, 1969 page 16 indicates that the recommended minimum compaction criteria for support of structures be 100% of maximum density using a compactive effort of 20,000 foot-pounds (resulting from Bechtel Modified Proctor determination). However, this 100% of Bechtel Modified Proctor corresponds to 95% compaction according to the standard ASTM D1557 method D and not 95% compaction according to Bechtel Modified Proctor method which has been utilized for the entire plant fill area to date. Furthermore, Dames and Moore Report, page 15 states that all fill and backfill material should be placed at or near the optimum moisture content in near horizontal lifts approximately 6-8" in loose thickness. Bechtel specification permits a maximum of 12 inches which affects the compactability of the material.

7. Piping, condensate lines, duct banks, and other utilities under the diesel generator building may also be affected and must be evaluated.

8. Mr. Gallagher stated he was leaving not having seen settlement ~~design~~ calculations and will be discussing design calculations, assumptions made, and conflicts with the FSAR with Licensing.

9. The inspector observed the structural concrete crack that has developed in the east exterior wall. The crack was observed with members from Bechtel Geo-Tech and Consumers Power Company. The crack extended full height of the wall and continued down through the spread footing as seen from the inside of the building. The crack is expected to have been induced flexurally caused by differential settlement. Discussion with Bechtel design staff has indicated that this crack is under study and is currently being evaluated. ACI-318-71 in the commentary section 10.6.4 limits flexural crack exposed to the outside to 0.013". Corrective action may be required if this limit is exceeded.

10. The following tests were observed to be performed in accordance with the applicable tests standards by U.S. Testing:

A. Lab Test ASTM D1557-70

B. Field Test ASTM D/1556-64

11. Calculations should be evaluated on the increase and the rate of increase of the pond fill and the effects of the water in other areas.

12. Mr. Gallagher stated that the NRC does not view preloading of the structure to be a fix or resolution of the problem at this time.

13. Seismic loading calculations should be determined for the type of material existing in its present condition.

Discussed with Bechtel on 11/2/78

To [illegible] from [illegible]

INCONSISTANCIES DISCOVERED TO DATE

Question #1

Discussion

Work performed during Diesel Generator area fill era was not done under the direct supervision of a qualified soils engineer. In fact, Geotech (soils consultants to Bechtel) did not have anyone on site between late 1974 and June/July of 1976 (the grade beam failure). Attachment 1 is an I.O.M. describes the responsibilities of Geotech during the early phases of the job. The item of the letter indicates that the need for Geotech personnel is based solely on the availability of Field Engineers and Q.C. personnel. The letter concludes by stating that the acceptance authority for earthwork was delegated to Q.C. and Field Engineers.

It would have seemed prudent at the remobilization after the 1975 slowdown to reaffirm under the supervision of Geotech that work was being performed properly. Failure to do this has resulted in specification and work operation misunderstandings.

RMW/11-1-78

JLC	
REW	
DRK	
DFH	
FILE	
RETURN	

Q#1

Bechtel Power Corporation

Interoffice Memorandum

Geotech was there after 1973

To J. P. Connolly

Date October 1, 1974

Subject Job 7220 Midland Project
Geotechs Responsibility on
Earthwork Subcontract
O-817

From T. C. Valenzano

Of Construction

Copies to

At Midland, Michigan

This is in response to your request for clarification of Geotech's responsibilities during summer 1973. Geotech's responsibilities were that of providing design assistance to project engineering and assistance to field engineering and QC. Furthermore, Geotech has the responsibility for being cognizant of all phases of the soils work in both engineering and construction. It is their responsibility to be assured that the design is properly interpreted, construction properly performed, and the specified testing requirements properly implemented, and if they are not satisfied, to advise appropriate management personnel. It was within this context that Geotech was allowed to perform acceptance validation for both field engineering and quality control.

This was done because sufficient numbers of experienced Bechtel field engineering and quality control personnel were not available on the site. Geotech's assistance was requested for this reason.

Sufficient numbers were later made available and Geotechs services as an acceptance authority was delegated to QC and field engineers for Q and non-Q work respectively.

T. C. Valenzano

TCV/sw

INCONSISTANCIES DISCOVERED TO DATE

Question #2

Discussion

Although lift thickness may not be solely responsible for the poorly compacted soil, we believe that it is a factor particularily if the following is considered:

1. Dames and Moore recommended 6" - 8" lifts and the report as written today and supposedly used as a design document, still states that the recommended lift thickness be 6-8 inches. (See attachment #1)

2. It has been documented by letter and log entries that on several occasions the 12" left thickness which is unconservative to begin with were exceeded. (See attachment #2)

In conclusion, it is evident that the unconservative approach to lift thickness has aggrevated and contributed to the poor soil conditions.

RMW/11-1-78

Power Company

P.O. Box 1963
Midland, Michigan 48640
July 23, 1974

Midland Project GWO 7020
Canonie QA/QC Daily Report
File: 16.0 Serial: 81FQAE74

Mr. J. P. Connolly
Bechtel Power Corporation
P.O. Box 2167
Midland, Michigan 48640

Dear Mr. Connolly:

There is a discrepancy in the Canonie Fill Placement QA/QC Daily Report and Lift Thickness Check for June 4, 1974, in the QC File. This report gives length 1075' ±, width 150' ±, load count 428, and average lift thickness of 1' uncompacted. Using 18 uncompacted cubic yards per load and the data above, we obtain an average lift thickness of 15.5" uncompacted. According to Specification C-210 Rev 2, Section 12.5.2, "the uncompacted lift thickness shall be not more than 12"."

North Plant
D-12
A-2

We request an explanation for this discrepancy by July 31, 1974.

Yours very truly,

J. L. Corley
Field Quality Assurance Engineer

JLC/DEH/dm

CC: HWSlager
RCBauman
TCCooke

CONSUMERS POWER COMPANY

RECEIVED

JUL 30 1974

MIDLAND PLANT PROJECT
MIDLAND, MICHIGAN

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

July 29, 1974

✓	JLC	
	REW	
	ORK	
	DEH	
	FILE	
	RETURN	

Consumer Power Company
P. O. Box 1963
Midland, Michigan 48640

Attention: J. L. Corley

Reference: 81 FQAE 74
Date: July 23, 1974
FQCL-019

Dear Mr. Corley:

Verification of lift thickness is performed, in the field, by Quality Control personnel of both the subcontractor and Bechtel. Lift thickness verification is documented on the subcontractor's lift thickness report and the Bechtel Quality Control inspection plan for that area. The approximate location of the placement and amount of fill placed (truck count) are also recorded on the subcontractor's report. Further investigation of reports for the day in question, (June 4, 1974) indicate that some of the fill reported to have been placed in a "Q" area was actually placed in a non "Q" area. This situation has now been corrected by having the truck count made at the point of placement rather than at the borrow area, as was previously done.

It should again be stressed that the inspection of the earthwork lift thickness is performed at the point of placement by Quality Control personnel. The load count discrepancy for the day in question, or any other day, has no effect on the quality of the completed work.

Sincerely,

J. P. Connolly

JPC/jmw

Bechtel Corporation

Interoffice Memorandum

To J. P. Connolly

Date August 5, 1974

Subject Discrepancies in Report

From L. V. Hendry

Of Quality Control

Copies to

At Midland, Michigan
Job No. 7220

This letter will confirm fact that there are a few minor differences between my daily field inction report, subcontracts daily report and Canonies QA-QC daily repofor the day of June 4, 1974. All reports agree that it was Zone 1 mrial that was placed upstream from the sand drain, but the actual arecovered is a little cloudy, as is the actual load count for this area. orrective action has since been taken to more closely keep track of placnt bays and all loads are counted on the fill by the dump man.

L. V. Hendry

L. V. Hendry

LVH/jmw

0800 (4-73)

All of the materials mentioned above should be considered suitable for use in the construction of the plant fills. However, it is recommended that preference be given to placement of granular materials in the plant area, if possible, due to the relative ease of compacting these materials. Granular materials can generally be placed and compacted properly under a range of moisture conditions using a variety of compaction equipment. Cohesive clay soils can generally not be placed during periods of wet or freezing weather. In addition, clay soils would be difficult to place in restricted backfill areas because heavy compaction equipment would be required to break-up and compact hard chunk-size pieces that would be removed from on-site excavations.

Filling and Backfilling - It is recommended that fill and backfill materials be placed at or near the optimum moisture content in lifts approximately six to eight inches in loose thickness and that each lift be compacted in accordance with the following criteria:

	RECOMMENDED MINIMUM COMPACTION CRITERIA PERCENT OF MAXIMUM DENSITY*	
PURPOSE OF FILL	ON-SITE COHESIVE SOILS	ON-SITE GRANULAR SOILS
Support of Critical Structures	95	100
Support of Non-Critical Structures	90	95
Adjacent to Structures	90	95

* Maximum density and optimum moisture content should be determined by the ASTM Test Designation D 1557-66T.

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

INCONSISTENCIES DISCOVERED TO DATE

Item #4 - References: a) Bechtel Design Standard, C-501
b) Bechtel Spec., C-210, C-211

Conflict: C-210, C-211 both specify 80% relative density.

C-501 specifies 85% relative density for structure support.

Question: Has Bechtel's specifications, C-210 and C-211, always used 80% relative density as a compaction standard?

Answer: 1) Specification C-211 for structural backfill has always specified 80% relative density.

2) Specification C-210 did not originally address the requirements for compaction of cohesionless materials to be utilized as plant area fill. Revision 5 of the specification is where the requirements for Sands first appeared. When the specification was revised to add a paragraph about sands, it was added at 80% relative density.

In conclusion, the specifications have always been inconsistant with the Project Design Standard.

RMW/10-24-78

INCONSISTANCIES DISCOVERED TO DATE

7. The Bechtel specs do not reflect the compaction requirements as found in the Engineering Design Documents and the Dames and Moore Soils Investigation Report.

References: Confirming ASTM-D1557-Method D.

1. Page A-76 of "Soils and Foundation Investigation Report", December 1975.

   Support of Structures - 100% B.M.P.

2. Page A-18 as in #1 -

   Support of Critical Structures - 95% D1557

3. Table 10 of as in 1 -

   Support of Structures - 95% D1557

4. Standard #C-501 - Under Design Documents - 2.4.4 - "Soil and Foundation Investigation Report."

5. Specification C-210 - Section 13.7 -

   95% ASTM D1557

References to BMP (95%)

1. Spec. C-208 - Section 9.1 - 957.B.M.P.

2. Spec 210 - 12.4 Refers to - 95% B.M.P.

3. Spec C-211 - 95% B.M.P.

From the point in which Bechtel anticipated (field) doing the plant fill work the question of which proctor was correct was an area of confusion. In fact, the field wrote Engineering a letter asking for a clarification which was not addressed by letter (the question of proctors). FCR C-302 was finally the vehicle for answering the question, in that Engineering approved the use of the B.M.P.

Apparently, the specification (C-210) was still not clear since a telecon was recorded (attached) in which Engineering stated that their method for the plant fill area is acceptable. However, in 1974 Geotech stated in a memo (attached) that the plant fill compaction requirements are as that stated in section 13.7 (ASTM D1557). Obviously, the intent of which proctor to use has always been unclear. It is my opinion that 95% of D1557 is what was intended to be used under the plant structures.

This conclusion is based on the following:

1. All design related supportive documents indicate 95% of

D1557. A telecon with Geotech also confirmed that the intent was to use the more conservative method.

2. Justification for clarifications were within the specs themselves, which were not clear to begin with.

BECHTEL

MEMORANDUM

TO J. C. CALLAGH LOCATION: MIDLAND NUCLEAR PL

FROM J.C. WANZECK GEOTECH DATE SEPT 18 19 74

SUBJECT COMPACTION REQUIREMENTS JOB NO. 7220

PLANT ZONE II FILL FILE

SPECIFICATION 7220-C-210 REV 2

SECTION 13.0 PLANT AREA BACKFILL & BEDM BACKFILL

HEREIN WE ADDRESS 13.7 COMPACTION REQUIREMENTS ONLY

IT IS OUR OPINION THAT ALL THE COMPACTION REQUIREMENTS THAT ARE LISTED FOR ZONE II MATERIAL IN THE PLANT FILL IS AS STATED IN 13.7 WITH THE EXCEPTION THAT ZONE 4, 4A, 5, 5A AND 6 MATERIALS NEED NO SPECIAL COMPACTIVE EFFORT OTHER THAN DISCRIBED IN SECTION 13.8.1

J.C. Wanzeck

CC: CALLAGH

SS AFLFI

FILE AND ACHER

All of the materials mentioned above should be considered suitable for use in the construction of the plant fills. However, it is recommended that preference be given to placement of granular materials in the plant area, if possible, due to the relative ease of compacting these materials. Granular materials can generally be placed and compacted properly under a range of moisture conditions using a variety of compaction equipment. Cohesive clay soils can generally not be placed during periods of wet or freezing weather. In addition, clay soils would be difficult to place in restricted backfill areas because heavy compaction equipment would be required to break-up and compact hard chunk-size pieces that would be removed from on-site excavations.

Filling and Backfilling - It is recommended that fill and backfill materials be placed at or near the optimum moisture content in lifts approximately six to eight inches in loose thickness and that each lift be compacted in accordance with the following criteria:

PURPOSE OF FILL	RECOMMENDED MINIMUM COMPACTION CRITERIA PERCENT OF MAXIMUM DENSITY*	
	ON-SITE COHESIVE SOILS	ON-SITE GRANULAR SOILS
Support of Critical Structures	95	100
Support of Non-Critical Structures	90	95
Adjacent to Structures	90	95

* Maximum density and optimum moisture content should be determined by the ASTM Test Designation D 1557-66T.

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

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

	RECOMMENDED MINIMUM COMPACTION CRITERIA	
	ON-SITE SAND SOILS	ON-SITE CLAY SOILS
PURPOSE OF FILL	PERCENT RELATIVE DENSITY*	PERCENT OF MAXIMUM DENSITY**
Support of Structures	85	100
Adjacent to Structures	75	95
Areal Fill (Not supporting or adjacent to structures)	70	90

* Maximum and Minimum density of sand soils should be determined in accordance with A.S.T.M. Test Designation D-2049-64T.

** Maximum dry density and optimum moisture content should be determined in accordance with A.S.T.M. Test Designation D-698, modified to require 20,000 foot-pounds of compactive energy per cubic foot of soil.

FOUNDATION DESIGN DATA

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

12.0 COMPACTION CRITERIA

Fills up to 35 feet thick will be required to obtain the final plant grade elevation of 634. Fill will also be required to achieve the foundation elevation portions of the auxiliary building and the turbine building. Backfills will also be required around all structures.

On-site excavated soils, both sands and clays, are considered suitable for general fill material. Soils containing organic matter are not suitable for use as fill material.

All fill and backfill material should be placed at or near the optimum moisture content in six to eight inch lifts. Each lift should be compacted in accordance with the recommendations shown in Table 10.

No compacted soil should be allowed to freeze. It is recommended that all frozen soils be removed and the affected zone be recompacted prior to resumption of operations each season. Fill compaction and decisions regarding remedial measures for frozen soils at the surface should be performed with the supervision of a soils engineer. In-place density tests in compacted fill will be

TABLE 10

MINIMUM COMPACTION CRITERIA
PLANT AREA FILL AND BERM

Function of Fill	Minimum Compaction Criteria In Situ Sand[1]	In Situ Clay[2]
Support of Structures[3]	85%	95%
Adjacent to Structures[4]	80%	-
Category I Slopes	-	95%
Berm	-	95%
Area Fill (not supporting or adjacent to structures)	-	95%

Notes

[1] All sand compaction is in terms of relative density as determined from ASTM D 2049 test.

[2] All clay compaction is in terms of maximum density as determined by ASTM D 1557, Method D except for area fill not supporting or adjacent to structures. In these areas, ASTM D 1557 may be altered such that only 20,000 ft-lb/ft^3 of energy would be required.

[3] Strength and compressibility testing may be required.

[4] Gradation Specification

The materials used for structural backfill within three feet of the exterior wall of any plant area structure shall be cohesionless and free-draining. The grain-size gradation, as determined by ASTM C-136 (and C-117 when required by the Field Engineer), shall be within the range shown below:

Sieve Size	Percent retained Fine	Coarse
1 inch	-	0
#4	-	25
#10	0	50
#40	40	95
#200	95	-

BECHTEL CORPORATION
POWER DIVISION

TUCSON - AZ

Telephone call

J. HOOK
Route G. RICHARDS
B. CHECK
B. WARD
J. DEAN

By F. G. TEAGUE Of SITE
To S. RAO Of AZ
Date 10/7 19 77 Time 8:00 AM
Subject: SPEC C-210 BACKFILL TESTING Job No. 7770

TEAGUE Q.A. HAS ASKED FOR CLARIFICATION OF SUBJECT SPECIFICATION, SECTION 13, FOR PLANT AREA + BERM BACKFILL. SECTION 13.4 FOR TESTING OF MATERIALS REFERS TO SECTION 12.4 AND THEREFORE REQUIRES THE BECHTEL MODIFIED PROCTOR DENSITY TEST FOR COMPACTION OF COHESIVE BACKFILL, SECTION 13.7 FOR COMPACTION OF THE SAME MATERIALS REFERS TO TESTING IN ACCORDANCE WITH THE ASTM D-1557, METHOD D PROCTER, WITHOUT SPECIFIC REFERENCE TO THE BECHTEL MODIFICATION,

RAO THIS APPARENT CONFLICT IS CLARIFIED BY SPEC. C-208 SECTION 9.1.9, DIRECTIONS TO THE TESTING SUBCONTRACTOR, WHICH CALLS FOR THE ASTM-D1557 TEST FOR THESE MATERIALS AND ALSO ALLOWS BECHTEL FIELD (THE CONTRACTOR) TO CALL FOR THE BECHTEL MODIFICATION OF THAT TEST, EITHE METHOD IS THEREFORE ACCEPTABLE TO PROJECT ENGINEERING.

Fred G Teague

INCONSISTANCIES DISCOVERED TO DATE

Question #5

Discussion

The question of whether the loose sands as described in the PSAR were ever removed is a good example of why there should be mechanisms to insure that committments are properly conveyed to the Construction Group and that the outlined work is successfully concluded. When the note to drawing C-44 was added, it was too late to economically excavate the loose sands since they had for the most part been covered by backfill.

The attached boring logs and locations confirm existance of the sands, although, the blow counts look very good.

RMW/11-1-78

MIDLAND PROJECT
DATE 11 0 2 1978
FILE 7220

GSX
RCS
KRK
BLM
JAR
DCR
RLT
PCW
JJZ
DBM
TCC
JTP
CMG
Manual
File: 15.3.03

Bechtel Power Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

mail address: P.O. Box 1000, Ann Arbor, Michigan 48106

DBM replied

November 1, 1978

Attn: Serviz

4291 2289

MLC-6747

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

Midland Units 1 and 2
Consumers Power Company
Bechtel Job 7220
CONTINUATION OF DIESEL GENERATOR BUILDING WORK
Files 0614/2801

Dear Mr. Keeley:

This letter is to formalize the items discussed during our meeting of October 25, 1978, at the Midland jobsite. We advised that the consultants' recommendation on the course of action for the diesel generator foundation question is expected by November 7, 1978. Preliminary discussions with the consultants, however, have indicated two possible courses of action appear likely — either accepting the building anticipated settlements throughout its life and modifying the design, or preloading the soil to incur most of the settlement prior to plant operation. In either case it would be desirable that the subsurface soils be monitored for movement. Recognizing that there will be some interval between obtaining the consultants' recommendation and embarking on whatever plan is ultimately approved, at this meeting we outlined our plan of activities for continuation of diesel generator building construction and preparation for the possible surcharging of the building area.

Specifically, we propose to:

(1) Proceed with modification work on the building. This includes releasing any settlement restraints imposed by the electrical duct banks and then grouting any gaps which exist beneath the building foundations to insure adequate contact with the underlying soil.

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MIDLAND PROJECT
MANAGEMENT

Bechtel Power Corporation

(2) Concurrent with this activity we plan to proceed with installation of soil settlement monitors in and around the building.

(3) In preparation for the possibility that surcharging may be undertaken, we will proceed with the design and installation of measures to protect the turbine building and adjacent transformer areas from any effects of the surcharge.

(4) We will also proceed with the installation of any frost protection measures which may be needed. We currently envision using a layer of sand for this protection.

(5) Prior to and after releasing the electrical duct banks, we will perform survey measurements on the ends of the casing for the condensate pipes. We will also perform visual inspection and gap measurement for the following pipes: condensate at casing entry and exit, service water at building entry, and diesel oil at building entry. Visual inspection shall be for physical damage or the potential of damage due to settlement. Gaps will be measured at the top, bottom, and sides of pipes.

Since our meeting we have developed order-of-magnitude cost estimates which show that the release of the duct banks and grouting will cost approximately $125,000, and soil monitors will cost $115,000, and the preparations for surcharging will cost $240,000.

The advance measures for protection of the turbine building and transformer area and frost protection, which are required only if preloading is used, would provide a schedule advantage if started at this time should preloading be decided upon.

So that the underlying soil may be subject to conditions anticipated for plant operation, we request that you proceed to fill the cooling pond to its design level of elevation 627.

As we currently envision having the diesel generators for Unit 2 available for hot functional testing on the first of March, 1980, it is imperative that the construction schedule be maintained. Our current schedule requires that construction be resumed by March 1, 1979, at the very latest. It is highly desirable to have the weight of the building in place as soon as possible in the event preloading is undertaken. We therefore request your concurrence to resume building construction.

Bechtel Power Corporation

As the builders risk insurance for the Midland Project is furnished by Consumers Power Company, we ask that you notify your insurers of the large settlements being encountered and take whatever steps are necessary to preserve rights under the insurance applicable to these circumstances.

As there is considerable urgency to these items, it is our hope to be able to start work immediately. We will discuss any questions or comments you may have at the meeting tomorrow, November 2, 1978.

Very truly yours,

P. A. Martinez
Project Manager

PAM/pp

cc: T. C. Cooke
D. B. Miller

Consumers Power Company

ORAL COMMUNICATIONS RECORD

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT

QA5-O

CHRON. FILE NO 0.4.1, 0.4.2 & 0.4.9.20

DATE OF COMMUNICATION 10/2/80 QA-PE&C PERSONNEL PARTICIPATING DEHorn

TIME OF COMMUNICATION 3:10 - 3:25 OTHER PARTY(S) Gene Gallagher, NRC - Region III

PREPARED BY Donald E. Horn

PROJECTS AND/OR SUBJECTS DISCUSSED NRC's soil investigation at the Midland Site and Ann Arbor and 50.54(f) - Question 23 verification of action item packages.

SUMMARY OF CONVERSATION

Gallagher: Stated he needed follow-up information of the soils investigation.

Gallagher: Wanted the identity of all the persons who prepared, checked and approved Specification C-210 and what group they were with (ie. Civil, Mechanical, GeoTech

Horn: I asked which revision.

Gallagher: All that are on the facing sheet.

Gallagher: Who from Mechanical group participated in Specification C-210?

Horn: I was not aware of anyone, because it is a Civil Specification.

RECEIVED OCT 10 1980

Gallagher: Who was Rixford?

orn: Bob Rixford was with Bechtel Project Engineering and then with Bechtel QA.

Gallagher: Who were the surveyors they (USNRC) talked with while at the site during the soils investigation?

(Contd page 2)

Horn: Chuck Wilson was the only one I recalled.

Gallagher: There was another one.

Horn: I could contact Chuck Wilson.

Gallagher: No, that's alright.

Gallagher: Was a list prepared of all the persons we contacted during the soils investigation?

Horn: Not that I'm aware of. I kept notes of the people you (the USNRC) contacted if I was involved in the lawyer's debriefings of those people and if I was aware of any other contacts of people even though I did not attend a debriefing.

Gallagher: Who was the individual who prepared sections in the FSAR and was in charge of coordinating the writing of the FSAR?

Horn: I thought it was Jerry Clements.

Gallagher: Who was it that put 1/2" settlement in the FSAR, who said that's what the PSAR said and had no reason to change it in the FSAR?

Horn: PKChen made that statement.

Gallagher: Who in QA did we contact? Jon Hook was in QA wasn't he?

Horn: Jon Hook was in Bechtel QA at the site, but was with Bechtel Project Engineering at Ann Arbor when you talked with him.

Gallagher: Could the packages being kept on the action items to Question 23 of 50.54(f) be sent to the site, because he wanted to verify completion of the action items prior to the soil hearing.

Horn: Can't you go to Ann Arbor to review the records? That's what you said you were going to do.

Gallagher: Ann Arbor is going into a vendor and there is too much paperwork involved in doing that.

Horn: I will see what I can do.

In summary, Gallagher had requested:

1. The identity of all the persons who prepared, checked and approved Specification C-210 and revisions per the facing sheet. This also included what discipline/ organization the persons were in (ie, Civil, Mechanical, GeoTech).

2. The verification packages being kept on the action items to Question 23 of 50.54(f) be sent to the Midland Site for his review.

This telecon record is not intended as direction to take action on the NRC requests. Any such direction will be issued by the Project Management Office.

CC WRBird
JEBrunner
JWCook
LHCurtis
LADreisbach
[redacted]
HPLeonard
BWMarguglio
JARutgers
RGZamarin

To File

From JEBrunner, P-24-513 JEBrunner/rjg

Date October 3, 1980

CONSUMERS POWER COMPANY

Subject MIDLAND PROJECT
MINUTES OF 8/29/80 MEETING TO APPEAL NEED FOR ADDITIONAL BORINGS
FILE: 0485.16 UFI: 00234S, 71*01 SERIAL: 9610

Internal Correspondence

CC JWCook, P-14-113A
TCCooke, Midland
GSKeeley, P-14-113B
DBMiller, Midland
MIMiller, IL&B
JARutgers, Bechtel
TRThiruvengadam, P-14-400
CWiedner, Bechtel

The meeting was convened at 1:00 pm at the Midland Service Center. The attendance list is enclosed as Attachment 1. The agenda for the meeting is enclosed as Attachment 2. Following introductions, G S Keeley summarized historical events relating to the supply of soils-related information to the NRC. Keeley indicated that CP Co had submitted information via 50.54(f) responses, 50.55e reports, meetings and site visits, and responses to requests for document production covering a period of almost two years (See Attachment-3).

J D Wanzeck of Bechtel Geotech then described the soil investigation done t date, all of which excepting information on 59 borings have been supplied to the NRC in connection with CP Co's proposed soils fix. Wanzeck reviewed past borings taken to date, test pits, cross-hole shots, and settlement information as well as other aspects of CP Co's past efforts to develop soils data necessary to demonstrate the adequacy of the proposed fix. He stated that CP Co had taken over 900 borings at the Midland site and expressed the opinion that no additional borings are necessary.

Dr Ralph Peck, Bechtel's consultant, who is an internationally recognized expert on foundation soils, then discussed the technical basis for Consumer's conclusion that the pre-load program would provide an acceptable solution ot the diesel generator building settlement problem. Peck, with admirable clarity and organization, described the pre-load program, the settlements observed upon surcharging, pore pressure variations as observed through piezometer readings and the future settlements which may be predicted based on an extrapolation of observed settlements. Peck expressed the opinion that the pre-load approach is universally accepted in the soils field and that the information directly supplied via pre-loading would accurately predict future settlement behavior.

A method utilizing results from borings lacks this accuracy, according to Peck, because of inherent inaccuracies in an indirect approach, and because the "fix" would not eliminate all variations in soils parameters below the diesel generator building. Peck felt that the borings approach would erroneously predict greater settlements than would be observed.

Peck's presentation was illustrated with charts and graphs showing settlement measurements and predictions with and without the surcharge, variations in porewater pressure during and after the pre-load, and the loading level on

soils below the diesel generator building as a function of elevation during the preload. The latter clearly showed that the effective stresses in the fill up to elevation 603 under full surcharge load exceeded the post-surcharge effective stresses upon the fill with the full dead and live loads, including effects of permanent dewatering. This was documented in Amendment 81.

Peck was followed by A J Hendron, Jr, another noted expert in the field. Hendron began his presentation with an analysis of inherent errors that can be expected in settlement computations derived from consolidation tests performed on best-possible, undisturbed samples obtained from borings. His conclusion was that the measurement errors inherent in such an approach would totally eliminate any value otherwise obtainable.

Hendron then addressed the subject of bearing capacity. He stated that new calculations which he had recently performed provide a more accurate prediction of the behavior of the soils from a bearing capacity standpoint than had past analyses, which had excluded certain terms from the bearing capacity equation. His latest calculations, which included such terms, demonstrated a factor of safety from a bearing capacity failure on the order of 6 or 7. The design goal for bearing capacity safety factor is 3. Hendron concluded that additional borings were totally unnecessary to demonstrate adequate bearing capacity. This was documented in Amendment 81.

M T Davisson then concluded the technical part of CP Co's presentation with a discussion of underpinnings - piles and caissons. Davisson stated that the use of underpinnings was designed to eliminate the need to consider soils characteristics in plant fill. Additional borings were technically inferior to the in-place tests under load which would be carried out when underpinnings are installed. Davisson felt that additional borings would be useless and misleading. This was documented in Amendment 81.

After a short recess, the staff presented its arguments in favor of more borings. Lyman Heller, US NRC, in a short introductory statement, argued that the additional borings were not intended to "negate" field data, but only to supplement it. Heller also argued that the Corps had requested only 18 additional borings, compared with over 900 already taken. Heller further stated that the staff had been "burned" twice at North Anna by the use of field data alone.

Joseph D Kane, US NRC/NRR/HGEB, then presented the major substance of the NRR arguments. Referring first to the cooling pond dike, Kane stated that a series of borings and lab tests should be taken to provide the dikes stable under all conditions and to determine the properties of fill after compaction.

In the area where underpinnings would be installed, Kane stated that it was proper engineering procedure to estimate foundation behavior prior to any field tests. Kane also stated that borings were necessary because of possible space limitations if the number of caissons necessary to do the job was under estimated. He also expressed concern about negative skin friction being factored into underpinning design.

With respect to the diesel generator building, Kane admitted that field testing was advantageous, but that borings would confirm predicted values, that he was not sure if primary consolidation had been completed, that the building had settled 4" before pre-load and 3-1/2" during pre-loading, and that certain observations of piezometer levels taken during the surcharge may have resulted from errors introduced by varying the level of the cooling pond. Kane also mentioned that CP Co had presented only positive effects of surcharge, and had failed to address 4"-settlement which took place and its effects on structures. Kane failed to state what connection the latter point has with the additional borings issue.

After Kane's presentation, the NRR caucaused.

Messrs Vollmer and Knight then questioned the various individuals present. Vollmer indicated that, in view of the present political climate, he was somewhat surprised at CP Co's attitude toward not supplying additional technical information. He inquired of Mr Cook whether or not CP Co's objections went to the mere necessity of the borings or went to the possibility that the borings results would be actually misleading and counterproductive. Mr Cook answered that both points were primary objections.

Mr Knight wanted to know whether or not CP Co had been advised of the additional borings request when the latest 66 samples were taken. CP Co answered in the negative.

Following a discussion on the negative porewater pressure question (during which there was an exchange between Kane, Peck, Hendron, and Davisson, in which Peck stated that the results were exactly as he would expect), Vollmer indicated, though somewhat ambiguously, that the data supplied seemingly satisfied his concern on the settlement issue. He further stated that new information had been presented during the meeting and that this should formally be supplied. He stated that if he had to make a decision immediately he would have to agree with the staff's recommendation.

It was decided that CP Co would supply a sumary of all soils information including the additional information supplied at the meeting, by 9/15/80. The meeting was then adjourned.

On the same day as and prior to the above meeting, Mr G Lear (NRC) was shown pictures of the piping associated with the return of emergency service water. The part of the piping which is buried along the sides of the emergency cooling pond was exhibited to Lear using the following photos:

Cartridge 4253	Frame 1965
	1966
	2057
	2056
	2033
	2039

Pictures 905
906
907
908
1080
1081

The review of the above photos showed that the pipe was located in an excavated trench in the berm and not the dike slope. Therefore, a postulated baffle dike failure precipitated by the trench is not considered to be a plausable scenario and would not interfere with functioning of the Emergency Cooling Pond.

000343

Bechtel Power Corporation
777 East Eisenhower Parkway
Ann Arbor, Michigan
Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

May 21, 1980

BLC-9289

Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

Attention: Mr. J.W. Cook
Vice President
Midland Project

Subject: Midland Plant Units 1 and 2
Consumers Power Company
Bechtel Job 7220
Soils Settlement Schedules

In early April 1980, we provided informally to some of the Consumers Power Company project team members a copy of four analysis schedules associated with to-go activities on MCAR 24, Soils Settlement. To insure that new members to your project organization are cognizant of this analysis we are forewarding a copy of these analysis schedules for your information. These schedules were developed for the purpose of identifying the critical path for soils settlement activities with respect to the November 1983 "working line" Unit 2 fuel load date. The critical path analysis establishes the critical path through accomplishment of the auxiliary building underpinning. This analysis indicated a NRC "drop dead" release date to proceed of September 15, 1981. This date was used to establish schedule float associated with the activities for permanent plant [illegible]ering, preload of borated water storage tanks, and service [illegible] structure bearing piling.

Please advise me if you have any questions pursuant to these analysis schedules.

Very truly yours,

John A. Rutgers
Project Manager

JAR/WGJ/sll

Attachments:
1. EPS-0109, Rev. A, Auxiliary Bldg. Underpinning
2. EPS-0110, Rev. A, Service Water Pump Structure Bearing Piles
3. EPS-0111, Rev. A, Borated Water Storage Tanks
4. EPS-0112, Rev. A, Permanent Dewatering

cc: R.C. Bauman w/a
W.R. Bird w/a
G.S. Keeley w/o
K.R. Kline w/a
D.B. Miller w/a
A.R. Mollenkopf w/a
T.J. Sullivan w/a

Response Requested: No

Consumers Power Company

ORAL COMMUNICATIONS RECORD

PROJECTS, ENGINEERING AND CONSTRUCTION - QUALITY ASSURANCE DEPARTMENT

QA5-O

CYBON FILE NO WRB 51-80

DATE OF COMMUNICATION 5/12/80 & 5/13/80 CA-PSAC PERSONNEL PARTICIPATING WRBird (DHorn 5/13/80 only)

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

PREPARED BY WRBird

PROJECTS AND/OR SUBJECTS DISCUSSED

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

SUMMARY OF CONVERSATION

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

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

5/13/80 - We called Mr Gallagher back to give him a status of what my investigation revealed and what specific actions we had directed:

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

(OVER)

MIDLAND PROJECT
DATE 4/21/80
INITIAL
JWC
GSK
RCB
WRB
KRK
ARM
TJS
DBM
File:
Manual:

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan
Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

April 17, 1980

BLC- 9140

Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

Attention: Mr. R.C. Bauman
Design Production Manager

Subject: Midland Plant Units 1 and 2
Consumers Power Company
Bechtel Job 7220
Vibratory Settlement of the
Diesel Generator Pedestals
File: 0270, C-2645

This letter addresses the status of the action items identified in the meeting held on November 16, 1979 concerning vibratory settlement of the diesel generator pedestals and the requirement of a settlement monitoring program for these pedestals. The items are presented in a manner corresponding to the action items listed in Meeting Notes No. 1085.

ACTION ITEM STATUS

1) Geotechnical services has obtained and coordinated the consulting services of R. Woods. This action has been completed and the item closed.

2) Project engineering provided the consultant with information pertaining to the diesel generators and the pedestals on November 26, 1979. This item is closed.

3) The consultant has provided project engineering with a recommended pedestal instrumentation and settlement monitoring program (letter from R.D. Woods, consultant, to S.S. Afifi, Bechtel, dated April 4, 1980, attached). This item is closed.

4) Project engineering was to prepare a settlement monitoring procedure for the review of the Consumers Power Company diesel generator startup testing group. This item is dependent on using the diesel generators to provide the excitation of the pedestal. The CPCo construction group has indicated that it would rather use an alternative means of vibrating the pedestals before the diesel generators are installed. Project engineering is currently investigating the feasibility of vibrating the pedestals by alternative means. This investigation is scheduled to be completed by June 2, 1980. A settlement monitoring program based on the conclusions derived from the investigation will be prepared if required.

MAY 14 1980

5) The consultant has evaluated the necessity for grouting of the sands beneath the pedestals in bays 1 and 2 and has concluded that grouting under the pedestals is not necessary. This item is closed.

6) The consultant has provided sand shakedown settlement criteria for a testing program (letter from R.D. Woods, consultant, to S.S. Afifi, Bechtel, dated April 4, 1980, attached). This item is closed.

7) The consultant has provided a procedure for the implementation of a monitoring program. The monitoring program will be added to the design drawings as a design requirement by June 16, 1980. This item is closed.

8) The consultant has provided a prediction of long-term pedestal vibration and settlement behavior. The calculated settlement is 0.0004 inch based on 1 year of continuous diesel operation at 450 rpm. From this calculation, the consultant has conservatively predicted a maximum long-term settlement of 0.25 inch (letter from R.D. Woods, consultant, to S.S. Afifi, Bechtel, dated January 9, 1980, attached). This item is closed.

Very truly yours,

for: L.H. Curtis
Project Engineer

LHC/HGC/sg
4/7/7

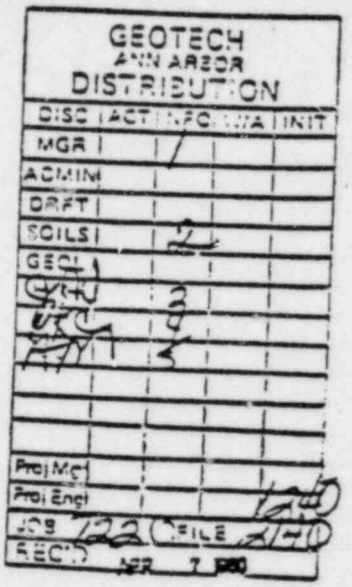
Attachments:
1. Letter from R.D. Woods, consultant, to S.S. Afifi, Bechtel, dated January 9, 1980
2. Letter from R.D. Woods, consultant, to S.S. Afifi, Bechtel, dated April 4, 1980

cc: T. Cooke w/a
D. Miller w/a
T. Sullivan w/a
J. Williams w/a

Response Requested: No

RICHARD D. WOODS
Professional Engineer
700 MT. PLEASANT
ANN ARBOR, MICHIGAN
48103
313-769-4352

April 4, 1980



Dr. S.S. Afifi
Bechtel Incorporated
P.O. Box 1000
Ann Arbor, MI 48106

RE: Midland: Diesel-Generator Pedestal
Vibration Settlement

Dear Sherif,

At your request I have studied the potential for settlement of the diesel-generator pedestals due to vibrations caused by machine operations during initial start-up and have formulated the opinions and recommendations that follow.

Studying the soil profiles under the Diesel-Generator Building and Pedestals as presented in Figs. 2.5-22J through 22N (10CFR.50.55(e) interim report), I have concluded that grouting under the pedestals is not advisable. There are no identifiable sands which could be successfully grouted to prevent machine induced vibratory settlements and the clays and clay-like soils are not susceptible to vibratory settlement or amenable to grouting.

In addition I recommend that both static and dynamic motion measurements should be made during initial start-up of the diesel-generator sets. Static measurements should consist of differential leveling to a precision of 0.001 foot at the four foundation settlement markers shown on Drawing C-994 for each pedestal. These levels should be obtained after approximately ½ hour, 1 hour, 4 hours, and 8 hours of cumulative running time and at 8 hour intervals to a minimum of 36 cumulative hours. The minimum shakedown running time should be thirty six hours.

Dynamic measurements should consist of three component particle velocity measurements on three corners of each pedestal. These vibrations should be monitored continuously during the first hour of operation and intermittently through the first 8 hours of operation. Perman-

ent records should be made as directed by the dynamic measurements consultant (R.D. Woods). Vibrations should be monitored again during the seventh hour of each additional 8 hours of cumulative running time.

The diesel-generator set should be stopped at any time at which either a settlement greater than 1/8 inch is observed in the leveling measurements at any settlement marker or when a particle velocity exceeding 0.005 in/sec (peak) is observed in the dynamic observations.

If there are any questions regarding these recommendations, please contact me.

Sincerely,

Richard D. Woods

Richard D. Woods, Ph.D., P.E.

RICHARD D. WOODS
Professional Engineer
702 MT. PLEASANT
ANN ARBOR MICHIGAN
48103
313-769-4332

January 9, 1980

GEOTECH AND NRC DISTRIBUTION

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	XC		

JOB 7220 FILE 3410
RECD JAN 11 1980

Dr. S.S. Afifi
Bechtel Corporation
Box 1000
Ann Arbor, MI 48105

RE: Midland-Diesel Generator
Pedestal Settlement

Dear Sherif,

On December 19, 1979 you asked me to evaluate the potential for settlement of the diesel generator pedestals due to operation of the diesel generators themselves. I have made an estimate of that settlement based on the assumption that the pedestals are supported on 30 feet of dry sand at a relative density of 45% and that the diesel generators were operating continuously for 1 year. My estimate is that under those conditions the settlement of the pedestals will be 1/4 inch or less.

If you have further questions about this matter, please contact me.

Sincerely,

Richard D. Woods

CC SHHowell
GSKeeley
DBMiller
TCCooke
JJZabritski
JARutgers, Bech-AA
KWiedner, Bech-AA
MIMiller, IL&B

MIDLAND PROJECT
DATE 1/18/80

		INITIAL
	GSK	
X	RCB	
X	KRK	
	RLM	
	JAP	
	DGR	
	MHR	
	RLT	
	PCW	
	JJZ	
	DBM	
	TCC	
	JTP	
	CMG	

Manual:
File: 0485.16

TELECON RECORD

Date January 17, 1980
8:15 AM

Participants	Company
G S Keeley	CP Co
J J Zabritski	CP Co
D Hood	NRC

Subject Soils Issue - Dewatering System

Discussion G S Keeley indicated to D Hood that he was frustrated at the way the NRC Staff did business, especially Lyman Heller's comment at the end of yesterday's meeting that dewatering was not the preferred technical solution. G S Keeley wanted to know what the Staff has in mind since CP Co has spent considerable time and money pursuing the dewatering option and considers it the most conservative way to go. If dewatering is not acceptable, what is?

D Hood replied that it was rather unfortunate the way this issue was raised and it needs to be put in its proper perspective. In the discussion between Walt Ferris of Bechtel and Lyman Heller, Heller was talking as an individual and his opinion did not necessarily represent Staff consensus. Hood indicated that this type of discussion should be valuable to us since it indicated that there are fragmented views on this subject within the Staff. He also indicated that we probably had a right to be concerned as Lyman Heller is the principal Staff reviewer in this area.

G S Keeley replied that this sounds fine but that the Staff has been silent on this issue since the last meeting in July 1979 when we presented the concept to the Staff and Heller with the consultants also in attendance at the meeting.

Contd on Page 2

January 17, 1980
8:15 AM

Keeley indicated that we were upset over Heller's insinuations that the dewatering option was not the consensus opinion of our consultants. CP Co is ready to issue the dewatering subcontract and Heller is now casting doubt over the whole issue with his subtle remarks. Keeley also indicated that the statement that the Corp of Engineers may not buy the dewatering system is frustrating. If they will not buy that system, what will they buy? In reply, D Hood indicated that he has a similar type concern in that the soils review has been difficult from a continuity and schedule aspect and that the Staff has not provided timely feedback to CP Co and that CP Co has taken action at its own risk in pursuing the fixes to the soils issue. Hood indicated that the Staff was very much aware of these factors when the Order was issued.

G S Keeley indicated that we have taken a very conservative position on dewatering and what did Heller have in mind? Was it that we can use analysis to show that liquefaction is not of concern or does he believe that underpinning and caissons are required on the diesel generator building? This would have a very significant cost and schedule effect.

D Hood indicated that he understood that Lyman Heller feels that caissons are a more positive approach but Hood indicated that was his opinion and could not himself see that this option was necessarily any better. G S Keeley stated that our consultants had previously indicated that they believed that the NRC would not accept the use of caissons. The consultants also indicated that dewatering was a more positive and conservative approach.

G S Keeley indicated to D Hood that we will answer the NRC's questions based on our present concept of the dewatering system for Staff review and then if necessary have a meeting with Heller to further discuss his concerns. G S Keeley also indicated that he had discussed this subject with S H Howell who was concerned with the whole way this issue is being handled and he was prepared to come to Washington to resolve this issue with Denton.

Contd on Page 3

TELECON RECORD

January 17, 1980
8:15 AM

D Hood indicated that he concurred with the CP Co approach on submittal of the responses and advised us not to overreact on this issue at this time. He indicated that he would discuss this subject with his management and call us back.

J J Zabritski/cg
1/28/80

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan
Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106

CONSUMERS POWER CO.
RECEIVED
APR 07 1980
Site Mgr.
Midland Project

BLC- 9069

April 1, 1980

1/16/80

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

Attention: Mr. R.C. Bauman

Subject: Consumers Power Company
Midland Plant - Job 7220
Meeting Notes No. 1131
File: 0270, C-2645

Attached for your information are the minutes of the meeting with the NRC which took place in Bethesda, Maryland on January 16, 1980, concerning the NRC's 10 CFR 50.54(f) requests on plant fill.

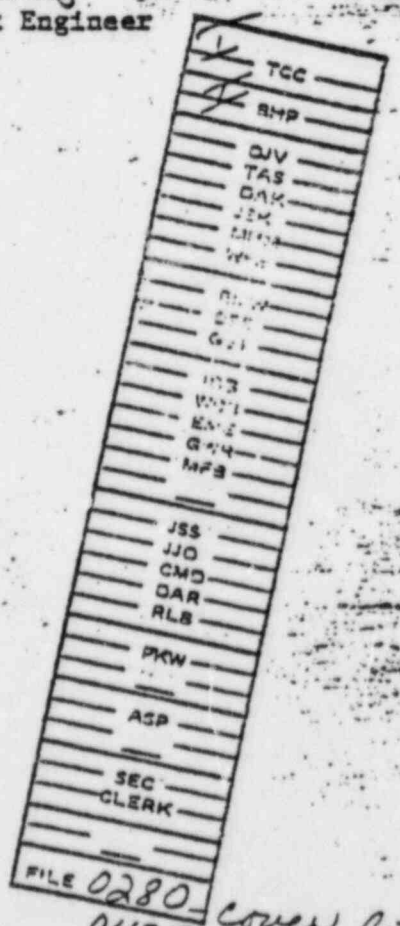
Very truly yours,

L.H. Curtis
Project Engineer

LHC/SL/bjm
3/7/4

Enclosure: Meeting Notes No. 1131

cc: S.S. Afifi
K.D. Bailey
T.C. Cooke
L.H. Curtis
B. Dhar
D.E. Horn
T.E. Johnson
G.S. Keeley
D.B. Miller
T.J. Sullivan
Com Log



cover letter
0485.16

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

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

MEETING NOTES NO. 1131

MIDLAND PLANT UNITS 1 & 2

CONSUMERS POWER COMPANY

BECHTEL JOB 7220

DATE: January 16, 1980

PLACE: NRC, Bethesda, Maryland

SUBJECT: 10 CFR 50.54(f) Questions 4, 14, and 24 through 35 and Responses

FILE: 0279

ATTENDEES:

NRC	Army Corps of Engineers	CPCo	Bechtel
R. Bosnak	J. Kubinski	T. Cooke	S. Afifi
H. Brammer	W. Lawhead	G. Keeley	W. Ferris
A. Cappucci	J. Norton	J. Zabritski	T. Johnson
G. Gallagher	S. Simpson		S. Lo
D. Gillen			W. Paris
R. Gonzales			M. Rothwell
D. Hood			J. Wanzeck
R. Jackson			K. Weidner
J. Knight			
R. Landsman			
R. Lippinski			
F. Schauff			
R. Shewmzker			
J. Spraul			

PURPOSE: The meeting was requested by Consumers Power Company to update the NRC on the work activities related to the settlement of Seismic Category I structures and plant area fill. The information regarding the 10 CFR 50.54(f) responses to Questions 4, 14, and 24 through 35 was presented and clarifications to Questions 24 through 35 were obtained from the NRC staff.

ITEMS DISCUSSED:

I. PRESENTATION

The following subjects were presented.

A. WORK ACTIVITY SINCE JULY 19, 1979:

1. Soil investigation and testing of the following categories:

   a. Additional soil borings

   b. Tank farm investigation

   c. Test pits

   d. Plate load tests

   e. Cross-hole seismic shots

   f. Pumping tests

2. Qualification of equipment

3. Settlement monitoring of structures and equipment

B. QUESTIONS 4.27, 31, 33, AND 35: 50.54(f) REQUESTS ON SOILS

1. Question 4 - Acceptance Criteria of the Preload Program

   The response was revised to include the predicted settlement value of structures and equipment, which in turn becomes the design basis for these structures and equipment.

2. Question 27 - Settlement Analysis for the Diesel Generator Building

   The different components which constituted the total settlement were identified. These are the static settlement for 40 years, earthquake shake-down, dewatering, and diesel pedestal vibration. Methods used in the analyses and degree of conservatism of the approaches were discussed.

3. Question 31 - Load Test of Borated Water Storage Tanks

   Justification of the full-weight test of the borated water storage tank was given. It was based on the soil investigation in the tank farm, the magnitude of the tank loadings, and the construction method used to allow the tanks to withstand settlement.

4. Question 33 - Load Test of Diesel Fuel Oil Tanks

The reason for terminating the load test was given. It was based on the satisfactory condition of the fill, the weight of the diesel fuel oil tanks, the flexibility of the connecting pipes to accomodate settlement, and the small settlement readings throughout the test. It was also pointed out the buoyant force actually reduced the settlement of the tanks.

5. Question 35 - Soil Exploration Subsequent to Preload Program

The full-scale load test and in situ shear wave velocity measurements and laboratory shear strength tests will yield all the design parameters. Therefore, measurement of percent compaction is not necessary because all the engineering properties have already been established directly.

C. Question 24: 50.54(f) Requests on Dewatering

Because the sand backfill under the auxiliary building railroad bay and the diesel generator building was determined to have liquefaction potential during an earthquake, the backfill sand beneath these critical structures is to be dewatered and maintained below the elevation where liquefaction could occur.

A summary of the geotechnical features of the site was presented. The locations of the backfill sands and natural sands were identified and determined to be in hydraulic communication based on the results of pumping tests. The pumping test results also indicated that the major source of groundwater recharge is from the service water pump structure area. The recharge rate at the nearest critical structure (diesel generator building) was established.

A preliminary layout of the dewatering system was presented. The system consists of a line of interceptor wells near the area of the service water pump structure as well as additional areas in which wells are required to remove the groundwater in storage. Part of the temporary construction dewatering wells may be added to the system to maintain the groundwater at the design level, if needed.

Observation wells were installed to monitor the groundwater elevation during the pumping tests. Additional observation wells will be installed near the critical areas to monitor the groundwater level during the life of the plant. The dewatering wells and observation wells will have sufficient backup to ensure redundancy, plus there is sufficient time to activate the backup wells before the water level could reach an unacceptable level. The dewatering system will be non-Q because it does not have to remain functional during and after a safe shutdown earthquake.

D. Questions 14, 25, 26, 28, 29, 30, 34: 50.54(f) Requests on Structures

1. Question 14 - Evaluation of Settlements and Cracks in Seismic Category I Structures

The response was updated to include the results of the diesel generator building analysis with the effect of settlement.

2. Question 25 - Seismic Analysis of Seismic Category I Structures with Changed Foundation Properties

Seismic analysis using the finite element method is beyond the present state of the art. The well documented finite element program in the public domain is SHAKE. However, for the Midland site condition, a soft soil layer over stiffer material at depth, SHAKE will provide unrealistic results. Agreement was reached that the present seismic analysis will be presented to the NRC staff.

3. Question 26 - Loading Combinations to be Used for Seismic Category I Structure with Settlement

The loading combination presented previously in response to Question 15 is adequate. However, an analysis will be made for the diesel generator building using either SRP Sections 3.8.4 and 3.8.5 or ACI 349 as supplemented by Regulation Guide 1.142 for comparison purposes.

4. Questions 28 and 29 - Cracks in Seismic Category I Structures and Crack Mapping

The differential settlement in the diesel generator building occurred during construction. When the structure was preloaded, only rigid body rotation was observed, and, therefore, no significant settlement stresses were induced. The cracks in the diesel generator building were caused by the restraint created by the duct banks and has since been eliminated. The crack survey conducted in January 1980 indicated that the crack widths of all structures have either reduced or stabilized. Cracks in a concrete structure of this type only affect the serviceability, not the strength. Action had been taken to resurvey the cracks in the portions of structures previously identified as inaccessible.

5. Question 30 - Design of Duct Banks

The duct banks were analyzed for free-field seismic wave propagation and solid-structure differential movement. The duct banks were also investigated up to 50% oversized conditions with minimal stress increases.

6. Question 34 - Buried Pipes

This question was not discussed.

II. ACTION ITEMS

10 CFR 50.54(f) Questions 4, 14, and 24 through 35 will be finalized, by incorporating the comments and concerns expressed by the NRC in the meeting. Comments provided as a NRC handout on Questions 16 through 20 will also be resolved and resubmitted.

Prepared by _____

Reviewed by _____

DB/RZ/ht
3/6/11

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		STATUS FINAL CALCULATIONS

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NO.	SUBJECT	FILE
S-75	Guard house & condensate tank pile capacities	8240

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GEOTECH
ANN ARBOR

SKETCH CONTROL

PROJ MIDLAND - SOILS
NUMBER 7220

DWG / DESIGN	TITLE	SCHED	PSAR / FSAR	FR / ER		
SK-G-1A / JHA	Site plan with boring locations	5-31-73 / ARR				
-2 / JOW	Zone A-5 rip-rap	10-30-73 / MMM				
-3 / SSA	Atterburg limits and grain size (D50) for plant area	2-12-74 / ARR	2.5-30			
-4 / SSA	Atterburg limits and grain size (D50) for borrow material	2-12-74 / ARR	2.5-31			
-5 / SSA	Atterburg limits and grain size (D50) for dike perimeter	2-12-74 / ARR	2.5-32			
-6 / SSA	Dry weight, natural water content & shear strength for plant area SUPERS. By III	2-12-74 / ARR				
-7 / SSA	Dry weight, natural water content & shear strength for dike interior "	2-12-74 / ARR				
-8 / SSA	Dry weight, natural water content & shear strength for dike perimeter "	2-12-74 / EKS				
-9 / SSA	Blowcount vs depth for plant area Dike perimeter	2-12-74 / ARR				
-10	-Cancelled-					
-11 / SSA	Liquid limit & plasticity index vs depth for plant area	2-27-74 / ARR				
-12 / SSA	Blowcount vs depth for Railroad Bridge	3-12-74 / EKS				
-13 / SSA	Dry weight, natural water content & shear strength for Railroad Bridge	3-12-74 / EKS				
-14 / SSA	Blowcount vs depth for Spillway	3-12-74 / ARR				
-15 / SSA	Dry weight, natural water content for Spillway	3-12-74 / EKS				
-16 / SSA	Preconsolidation pressure vs elevation for plant area	3-14-74 / EKS				
-17 / SSA	Mean grain size - test results	3-20-74 / ARR				
-18 / MMD	Consolidation test results summary swelling index C_{r1}	4-1-74 / ARR				
-19 / MMD	Consolidation test results summary compression index C_{c2}	4-1-74 / ARR				
-20 / MMD	Consolidation test results summary swelling index C_{r2}	4-1-74 / ARR				
-21 / SSA	Mean grain size band from Dames & Moore reports	4-18-74 / ARR				
-24 / ROA	Grain size distribution bands for near surface site soils	3-11-76 / ARR				
-26 / JOW	Dike investigation boring location plan	6-6-74 / MMM				Spec.Rp. Fig 1
-27 / JBG	Depth vs compaction 2 Sheets	6-6-74 / JBG				" " Fig 2

GEOTECH
ANN ARBOR

SKETCH CONTROL

PROJ MIDLAND - SOILS
NUMBER 7220

DWG / DESIGN	TITLE	SCHED	PSAR / FSAR	FR / ER		
SK-G-28	Borrow area - Mergard property boring	6-7-74				
JOW	locations & cross-section	ARR				
-29	Examples of compaction efforts	6-21-74				
JOW		MMM				A-2
-30	Standard proctor compaction	6-21-74				
JOW		ARR				
-31	Soil sections - emergency cooling	7-12-74				
SSA	pond SUPERSEDED BY SK-G-66	ARR				
-32	Dike cross-sections Sections J & K	7-18-74				
JHA	SUPERSEDED BY SK-G-67	ARR				
-33	Cross-section for telephone cable-T	7-23-74				
JOW		ARR				
-34	Summary of optimum water vs % fines	10-27-75			Canonic claim	
ROA	(1969 data)	ARR			F.2	
-35	Summary of optimum water vs % fines	10-27-75			F.4	
ROA	(Bechtel '73 - '75 data)	ARR				
-36	Comparison of Bechtel 1969 opt.curve	10-27-75			F.9	
ROA	w/natural water content curve	ARR				
-37	Comparison of Bechtel '73 - '75 opt.	10-27-75			F.10	
ROA	curve w/natural water content curve	ARR				
-38	Frequency distribution histogram of	10-30-75			F.11	
ROA	% passing No. 200 seive	ARR				
-39	Comparison of Bechtel total optimum	10-31-75				
ROA	curve w/natural water content curve	ARR			F.11	
-40	Site plan with dike and boring	12-19-75				
ROA	locations (no sections)	ARR	2.5-16			
-42	Location plan-dike sections A - L	7-31-74				
JOW		ARR				
-43	Plant area boring plan	3-4-76				
ROA		ARR	2.5-17			
-48	Dike sections M, N, P, & Q	8-2-74				
SM		ARR				
-49	South half of cooling pond boring	3-4-76				
ROA	plan	ARR	2.5-36			
-50	North half of cooling pond boring	3-4-76				
ROA	plan	ARR	2.5-35			
-51	Modulus of elasticity for cohesive	3-8-76				
ROA	foundation soils	ARR				
-52	Dike sections R, S, U, V, & W	8-5-74				
SM/ROA		ARR				
-53	Lateral earth pressure diagrams	3-15-76				
ROA		ARR	2.5-45			
-55	Estimated ultimate settlements for	8-9-76				
PKC	Units 1 & 2	ARR	2.5-48			
-57	Representative moisture-density	10-1-76				
JOW	relationships	ARR				
-58	Dike sections Y, Z, AA, BB, & CC	8-5-74				
SM/SSA		ARR				

GEOTECH
ANN ARBOR

SKETCH CONTROL

PROJ MIDLAND - SOILS
NUMBER 7220

DWG / DESIGN	TITLE	SCHED	PSAR / FSAR	FR / ER
SK-G-59	Soil pressure diagram, Category I	10-6-76		
PKC	and II structures	ARR	2.5-59	
-63	Stress - strain curves for soils	8-8-74		
DRG	below El. 550	MMM		
-64	Stress - strain curves for soils	8-8-74		
DRG	above El. 550	MMM		
-65	Dike sections A, B, C, D, & E	8-14-74		
SSA		ARR		
-66	Dike sections F, G, & H	8-14-74		
SSA		ARR		
-67	Dike sections J, K, & L	8-15-74		
SSA		ARR		
-68	Subsidance surveillance program -	9-4-74		
SM	Bench mark locations	MMM	2.5-24	
-69	Subsidance surveillance program -	9-4-74		
SM	Bench mark locations	MMM	2.5-25	
-81	CANCELLED			
JOW/SSA				
-82	Summary of natural water content	9-23-74		
JOW/SSA	and percent fines (E.D.C.E.)	MMM		
-83	Summary of optimum water content	10-8-74		
JBG/SSA	and percent fines (E.D.C.E.)	MMM		
-84	CANCELLED			
JBG				
-85	Summary of natural water content	10-14-74		
JBG	and percent fines (Bechtel data)	ARR		
-86	Comparison of natural water content	10-16-74		
JBG	vs percent fine curves	ARR		
-87	CANCELLED			
JBG				
-88	Comparison of optimum water content	10-16-74		
JBG	vs percent fine curves	ARR		
-89	CANCELLED			
JBG/SSA				
-90	CANCELLED (ORIGINALS TO SSA)			
SSA				
-91	CANCELLED (ORIGINALS TO SSA)			
SSA				
-92	CANCELLED (ORIGINALS TO SSA)			
SSA				
-93	Location of flyash basin and swamp	10-25-74		
SSA		MMM		
-94	Mergard borings: Explanation of	10-30-74		
SSA	symbols and log of borings A thru T	MMM		
-95	Sample locations for moisture data	11-7-74		
JBG/ROA		ARR		
-96	Comparison of optimum and average	3-20-75		
SSA	curves (Bechtel data)	ARR		

GEOTECH ANN ARBOR

SKETCH CONTROL

PROJ MIDLAND - SOILS
NUMBER 7220

DWG / DESIGN	TITLE	SCHED	PSAR / FSAR	FR / ER		
SK-G-97	Proctor test and borrow locations	9-9-75				
ROA		ARR	2.5-61			
-98	Optimum moisture vs natural moisture	10-23-75				
ROA		ARR				
-99	Frost penetration vs air freezing index	12-18-75				
ROA		ARR				
-100	Temperature at top of pipe vs air freezing index	12-18-75				
ROA		ARR				
-101	Freezing index vs probability of a colder winter	12-18-75				
ROA		ARR				
-102	Modulus of subgrade reaction vs depth	1-2-76				
ROA		ARR				
-103	Modulus of elasticity for buried piping, sand backfill	1-8-76				
ROA		ARR				
-104	Modulus of horizontal subgrade reaction vs depth	6-1-76				
PKC		JFC				
-105	CANCELLED					
-106	Generalized subsurface dike profile 4 Sheets	7-27-76				
PKC		JFC	2.5-54-57			
-107	Generalized subsurface profile Section A	9-28-76				
PKC		JFC	2.5-20			
-108	Generalized subsurface profile Section B	9-28-76				
PKC		JFC	2.5-21			
-109	Generalized subsurface profile Section C	9-28-76				
PKC		JFC	2.5-22			
-110-1	Liquefaction potential under Category I plant facilities and piping by.....	10-4-76				
PKC		JFC	2.4-42			
-110-2	Liquefaction potential in the plant are by simplified procedure	10-4-76				
PKC		JFC	2.5-41			
-111	Moisture content, dry density, and shear strength vs elevation	10-14-76				
PKC		JFC				
-112	Excavation plan	10-14-76				
PKC		ARR	2.5-37			
-113	Recommended general locations for Settlement instrument and types	11-8-76				
PKC		ARR				
116 117 -119	Subsurface profile of slurry trenchs Sheet 1 of 2	12-3-76				
RDW		ARR	2.5-51			
-121	Plant area dike section K	12-8-76				
PKC		JFC	2.5-49			
-122	Plant area dike section T	12-10-76				
PKC		JFC	2.5-50			
-123	Dike section Z	12-7-76				
RDW		JFC	2.5-60			
-124	Dike sections D and E	12-10-76				
RDW		JFC	2.5-58			
-125	Dike section G	12-10-76				
RDW		JFC	2.5-53			

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DWG / DESIGN	TITLE	SCHED	PSAR / FSAR	FR / ER
SK-G-126 / RDW	Dike section I	12-9-76 / JFC	2.5-59	
-127 / RDW	Piezometer section P 1	12-9-76 / JFC	2.5-63	
-128 / RDW	Piezometer section P 2	12-9-76 / JFC	2.5-64	
-129 / PKC	Percent compaction vs depth	12-13-76 / JFC	2.5-65	
-132 / PKC	Representative moisture - density relationships (II)	12-16-76 / DAH	2.5-39	
-152 / PKC	Liquefaction evaluation under plant structures by standard penetration test data (2 sheets)	1-20-77 / DAH	2.5-43 & 44	
-159 / PKC	Typical piezometer installation Sketch-upstream SUPERSEDED BY SK-G-181 FY	2-14-77		
-160 / PKC	Typical piezomter installation Sketch-upstream SUPERSEDED BY SK-G-181 FY	2-14-77		
-167 / PKC	Plant area boring locations with sand pockets	3-31-77 / JFC	2.5-40	
-168 / PKC	Moisture content, dry density, and shear strength vs elevation	4-1-77 / DAH	2.5-33	
-169 / PKC	t/σ3/Dr vs number of cycles	4-1-77 / DAH		
-170 / PKC	Excavation plant area X-sections	4-2-77 / JFC	2.5-38	
-180 / PKC	Recommended general location for settlement instruments and type	11-14-77 / STW		
-181 / PKC	Piezometer installations	11-15-77 / DAH		6.5
-182 / PKC	Piezometer section P 2 (ER only)	11-15-77 / DAH		6.4
-183 / PKC	Piezometer section P 1 (ER only)	11-14-77 / STW		6.3
-209 / PKC	Settlement benchmark locations at the Power Block	3-10-78 / DAH	2.5-78	
-210 / PKC	Dike Section 2	3-11-78 / STW	2.5-75	
-211-1 / PKC	Dike Section I	3-11-78 / STW	2.5-76	
-211-2 / PKC	Dike Section I	3-11-78 / STW	2.5-76A	
-212-1 / PKC	Dike Section G	3-11-78 / STW	2.5-77	
-212-2 / PKC	Dike Section G	3-13-78 / STW	2.5-77A	
-213 / PKC	Dike piezometer P2-1	3-24-78 / STW		
-214 / PKC	Dike piezometer P2-2	3-24-78 / STW		

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DWG DESIGN	TITLE	SCHED	PSAR FSAR	FR ER		
SK-G-243	Diesel Generator Building boring	10-16-78				
DAH	plan	STW				
-244	Blowcount vs elevation - Diesel	10-16-78				
DAH	Generator Building	STW				
-245	Blowcount vs elevation - Diesel	10-16-78				
DAH	Generator Building - North half	DYW				
-246	Blowcount vs elevation - Diesel	10-16-78				
DAH	Generator Building - South half	DYW				
-247	Blowcount vs elevation - Diesel	10-16-78				
DAH	Generator Building - First Quarter	DJS				
-248	Blowcount vs elevation - Diesel	10-16-78				
DAH	Generator Building - Second Quarter	DJS				
-249	Blowcount vs elevation - Diesel	10-16-78				
DAH	Generator Building - Third Quarter	DYW				
-250	Blowcount vs elevation - Diesel	10-16-78				
DAH	Generator Building - Fourth Quarter	DYW				
-251	Plant area plan	10-17-78				
DAH		STW				
-252	Blowcount vs elevation plant area	10-18-78				
DAH		DYW				
-253	Blowcount vs elevation - Condensate	10-18-78				
DAH	Storage Tanks - South Tanks	DJS				
-254	Blowcount vs elevation - Guard	10-18-78				
DAH	House	DJS				
-255	Blowcount vs elevation - Condensate	10-18-78				
DAH	Storage Tanks - North Tanks	DJS				
-256	Blowcount vs elevation - Condensate	10-18-78				
DAH	Storage Tanks	DJS				
-257	Blowcount vs elevation	10-18-78				
DAH	Tank Farm	DYW				
-258	Blowcount vs elevation	10-18-78				
DAH	East Tank	DYW				
-259	Blowcount vs elevation	10-18-78				
DAH	West Tank	DYW				
-260	Blowcount vs elevation	10-18-78				
DAH	Tank Farm - Center Tank	DYW				
-261	Condensate storage tanks boring	10-18-78				
DAH	plan	DYW				
-262	Tank Farm boring plan	10-18-78				
DAH		DYW				
-263	Dry unit weight vs elevation	10-18-78				
DAH		STW				
-264	Shear strength vs elevation	10-18-78				
DAH		STW				
-265	Water content vs elevation	10-18-78				
DAH		STW				
-266	Total unit weight vs elevation	10-18-78				
DAH		STW				

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DWG / DESIGN	TITLE	SCHED	PSAR / FSAR	FR / ER		
SK-G-267	Plasticity chart	10-19-78				
DAH		STW				
-268	Boring location plan to determine removal of natural sands w/relative density of less than 75%	10-30-78				
PKC		DJS				
-269	Cross-section DG-1 SUPERSEDED	10-31-78				
ASM	Diesel Generator Building BY SK-G-435	DJS	2.5-22J			
-270	Cross-section DG-5	10-31-78				
ASM	Diesel Generator Building	DJS				
-271	Cross-section DG-6	10-31-78				
ASM	Diesel Generator Building	DYW				
-272	Cross-section DG-2 SUPERSEDED	11-1-78				
ASM	Diesel Generator Building BY SK-G-436	DYW	2.5-22K			
-273	Cross-section DG-3 SUPERSEDED	11-1-78				
ASM	Diesel Generator Building BY SK-G-437	STW	2.5-22L			
-274	Cross-section DG-4	11-1-78				
ASM	Diesel Generator Building	STW				
-275	Test Pit #2 East Wall	11-6-78				
ASM	Sheet 1 of 2	DYW				
-276	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-1	DYW				
-277	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-2	DYW				
-278	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-3	DYW				
-279	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-4	DYW				
-280	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-5	DYW				
-281	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-5A	DYW				
-282	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-6	DYW				
-283	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-7	DYW				
-284	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-8	DYW				
-285	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-9	DYW				
-286	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-10	DYW				
-287	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-11	DYW				
-288	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-12	DYW				
-289	Dutch Cone bearing vs elevation	11-6-78				
DAH	P-13	DYW				
-290	Test Pit #2 - East Wall	11-20-78				
DAH	Sheet 2 of 2	DYW				

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DWG / DESIGN	TITLE	SCHED	PSAR / FSAR	FR / ER
SK-G-291	Test Pit #3 - North Wall	11-20-78		
DAH		DYW		
-292	Test Pit #1 - South Wall	11-20-78		
DAH		DYW		
-293	Cross-section A-A' - Tank Farm	11-27-78		
DAH		DYW		
-294	Cross-section B-B' - Tank Farm	11-27-78		
DAH		STW		
-295	Cross-section L-L' Condensate	11-27-78		
DAH	Storage Tanks SUPERSEDED BY SK-G-432	DYW		
-296	Cross-section J-J' - Guard House	11-27-78		
DAH		STW		
-297	Cross-section Q-Q' - Unit 1	11-27-78		
DAH	Transformers	DYW		
-298	Cross-section R-R' - Unit 2	11-27-78		
DAH	Transformers	DYW		
-299	Cross-section G-G' - Radwaste	11-27-78		
DAH	Building	STW		
-300	Instrument location plan	11-30-78		
YKK		STW		
-301	Piezometers and Borros Anchors along Cross section G-G' - Diesel Generator	11-30-78		
DAH	Building SUPERSEDED BY 269,272,273	DYW		
-302	Piezometers and Borros Anchors along Cross section H-H' - Diesel Generator	11-30-78		
DAH	Building SUPERSEDED BY 269,272,273	DYW		
-303	Piezometers and Borros Anchors along Cross section I-I' - Diesel Generator	11-30-78		
DAH	Building SUPERSEDED BY 269,272,273	DYW		
-304	Superimposed load intensity, &	12-13-78		
PKC	settlement vs time - Turbine Building	STW		
-305	Superimposed load intensity, &	12-13-78		
PKC	settlement vs time - Auxiliary Bldg.	STW		
-306	Superimposed load intensity, &	12-13-78		
PKC	settlement vs time - React.Cont.Bldg.	STW		
-307	Subsurface Cross section D-D'	12-26-78		
DAH	Tank Farm & Oily Waste area	STW		
-308	Subsurface Cross section B-B'	12-20-78		
DAH		DYW		
-309	Subsurface Cross section E-E'	12-20-78		
DAH		STW		
-310	Bechtel borings, Dutch cone penetrations, and Test Pit locations in	12-26-78		
ASM	Midland plant area (1978)	DYW		
-311	Piezometer elevation and Pond	1-3-79		
PKC	elevation vs time for Dike area	DYW		
-312	Piezometer elevation and Pond	1-3-79		
PKC	elevation vs time for Dike area	DYW		
-316	Shear strength vs moisture content	1-24-79		
ASM	Diesel Generator Building	STW		
-317	Foundation Settlement Monitoring	1-29-79		
PKC		DYW		

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DWG DESIGN	TITLE	SCHED	PSAR FSAR	FR ER		
SK-G-318	Settlement Record Table	1-29-79				
PKC	Sheet No. 2	DYW				
-319	Diesel Generator Building	2-15-79				
PKC	Foundation Layout and load intensity	DYW				
-320	Underground utilities and	2-20-79				
ASM	Bechtel borings 1977 to Present	STW				
-321	Gradation of Clays - Diesel	2-27-79				
ASM	Generator Building ANALYSES	DYW				
-322	Gradation of Sands - Diesel	2-27-79				
ASM	Generator Building ANALYSES	DYW				
-323	Cc and Cc / 1 + e_o vs elevation	3-1-79				
ASM	Diesel Generator Building	DYW				
-324	Shear strength vs % sand content	3-1-79				
ASM	Diesel Generator Building	DYW				
-325	Activity vs elevation - Diesel	3-1-79				
ASM	Generator Building	DYW				
-326	NATURAL Water content, Atterburg limits vs	3-2-79				
ASM	elevation - Diesel Generator Building	DYW				
-327	Void ratio vs elevation - Diesel	3-2-79				
ASM	Generator Building	DYW				
-328	Percent less than #200 sieve size vs	3-2-79				
ASM	elevation - Diesel Generator Building	DYW				
-329	Percent less than 2 size vs elevation	3-2-79				
ASM	Diesel Generator Building	DYW				
-330	Excavation plan for the Service and	3-8-79				
ASM	Circulating water structures	STW				
-331	Sections A-A' and B-B' - Service	3-10-79				
ASM	and Circulating water structures	STW				
-332	Sections C-C', D-D', & E-E' Service	3-10-79				
ASM	& Circulating water structures	STW				
-333	Summary of compaction test results	3-14-79				
ASM	(20,000 ft. lbs.)	DYW				
-334	Summary of compaction test results	3-14-79				
ASM	(56,000 ft. lbs.)	DYW				
-335	Cross-section F-F' - Auxiliary Bldg.	4-5-79				
ASM	South SUPERSEDED BY SK-G-379	DYW				
-336	Cross-section O-O' Auxiliary Bldg.	4-5-79				
ASM	CANCELLED					
-337	Cross-section H-H' - Auxiliary Bldg.	4-5-79				
ASM	North	DYW				
-338	Cross-section Q-Q' - Radwaste Bldg.	4-5-79				
ASM		STW/Avinash				
-339	Cross-section K-K' - Diesel	4-5-79				
ASM	Generator fuel oil storage tanks	Avinash				
-340	Cross-section S-S' - Service	4-5-79				
ASM	Water Building	STW				
-341	Cross-section T-T' - Service	4-5-79				
ASM	Water Building	STW				

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DWG DESIGN	TITLE	SCHED	PSAR FSAR	FR ER		
SK-G-342	Cross-section U-U' - Service	4-5-79				
ASM	Water Building	PLH				
-343	Cross-section V-V' - Oily Waste	4-5-79				
ASM	Building	PLH				
-344	Cross-section W-W' - Oily Waste	4-5-79				
ASM	Building	PLH				
-345	Cross-section X-X' - Turbine /	4-5-79				
ASM	Auxiliary Building CANCELLED					
-349	Cross-section I-I' - Service	5-19-79				
PKC	Water structure	STW				
-350	Cross-section J-J' - Chlorination	5-23-79				
PKC	Building	STW				
-351	Shear strength vs wet density	6-22-79				
AM		PLH				
-352	Shear strength vs dry density	6-22-79				
AM		PLH				
-353	Shear strength vs water content	6-22-79				
AM		PLH				
-354	Shear strength vs ^ water content COMPACTION	6-22-79				
AM		PLH				
-355	Cc / 1+eo vs dry density	6-22-79				
AM		PLH				
-356	γd & shear strength vs we	6-22-79				
AM		PLH				
-357	Water content vs dry density VS	6-22-79				
AM	COMPACTION WATER CONTENT (BMP)	PLH				
-358	Void ratio vs dry density	6-22-79				
AM		PLH				
-359	Shear strength vs dry density	6-22-79				
AM		PLH				
-360	Peak shear strength vs percent	6-22-79				
AM	strain	PLH				
-361	Water content vs dry density	6-22-79				
AM	vs shear strength	STW				
-362	Water content vs dry density VS	6-24-79				
AM	COMPACTION WATER CONTENT (ASTM)	STW				
-363	Compaction water content vs	6-24-79				
AM	compressive strength	STW				
-364	Shear strength vs wet density	6-24-79				
AM		STW				
-365	Diesel Generator Building location	8-9-79				
AM	of Deep Borros Anchors & Sondex	STW				
-367	Backfill location - Test Pit 1	10-15-79				
JOW		DYW				
-368	Backfill location - Test Pit 2	10-15-79				
JOW		DYW				
-369	Backfill location - Test Pit 3	10-15-79				
JOW		DYW				

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DWG DESIGN	TITLE	SCHED	PSAR FSAR	FR ER		
SK-G-370 JOW	Bakfill location - Test Pit 4	10-15-79 DYW				
-371 JOW	Tank Farm clean up and inspection plan	10-15-79 DYW				
-374 JOW	Tank Farm investigation	10-15-79 DYW				
-377 JOW	Backfill locations - Tests taken outside 4 tanks in Tank Farm	12-17-79 RVO				
-379 ASM	Cross-section F-F' - Auxiliary Building South	12-20-79 STW				
-382 JOW	Backfill locations - inside tanks in Tank Farm	1-17-80 DYW				
-383 JOW	Backfill locations - outside tanks in Tank Farm	1-17-80 DYW				
-395 VA	Settlement vs time Feedwater isolation chambers	3-7-80 STW	2.5-109			
-396 VA	Settlement vs time - Condensate storage tanks North tank (Sht. 1/2)	3-7-80 STW	2.5-95			
-397 VA	Settlement vs time Chlorination Building	3-7-80 STW	2.5-99			
-398 VA	Settlement vs time River intake structure	3-7-80 STW	2.5-106			
-399 VA	Settlement vs time Radwaste Building	3-7-80 STW	2.5-98			
-400 VA	Settlement vs time Service water valve pits	3-7-80 STW	2.5-108			
-401 VA	Settlement vs time Cooling tower	3-7-80 STW	2.5-105			
-402 VA	Settlement vs time Diesel fuel oil storage tanks	3-7-80 STW	2.5-96			
-403 VA	Settlement vs time Make-up water pump structure	3-7-80 STW	2.5-107			
-404 VA	Settlement vs time Deaerator tanks	3-10-80 STW	2.5-104			
-405 VA	Settlement vs time-Oily waste storage tank & oily waste treatment building	3-10-80 STW	2.5-94			
-406 VA	Settlement vs time Transformers (Sht. 1/3) Unit 1	3-10-80 STW	2.5-92			
-407 VA	Settlement vs time Transformers (Sht. 2/3) Units 1&2	3-10-80 STW	2.5-92A			
-408 VA	Settlement vs time Evaporator Building	3-11-80 STW	2.5-103			
-409 VA	Settlement vs time-Circulating water intake structure & retaining wall	3-11-80 STW	2.5-100			
-410 VA	Settlement vs time - Tank farm (Sht. 1/3) Borated water storage tanks	3-11-80 STW	2.5-93			
-411 VA	Settlement vs time - Tank farm (Sht. 2/3) Primary and utility tanks	3-11-80 STW	2.5-93A			

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DWG DESIGN	TITLE	SCHED	PSAR FSAR	FR ER
SK-G-412	Settlement vs time	3-11-80		
VA	Circulating water discharge structures	STW	2.5-102	
-413	Settlement vs time - Service water	3-14-80		
VA	pump structure and retaining wall	STW	2.5-101	
-414	Settlement vs time	3-14-80		
VA	Reactor Buildings	STW	2.5-91	
-415	Settlement vs time	3-14-80		
VA	Turbine Building (Sht. 1/2)	STW	2.5-89	
-416	Settlement vs time	3-14-80		
VA	Turbine Building (Sht. 2/2)	STW	2.5-89A	
-417	Settlement vs time	3-14-80		
VA	Administration and service building	STW	2.5-97	
-418	Settlement vs time	3-15-80		
VA	Auxiliary Building	STW	2.5-90	
-419	Location of settlement markers	4-30-80		
VA		RVO	2.5-48A	
-420	Settlement vs time	5-5-80		
VA	Tank farm (Sht. 3/3) Dike wall	STW	2.5-93B	
-421	Settlement vs time	5-8-80		
VA	Transformers (Sht. 3/3) Unit 2	STW	2.5-92B	
-422	Settlement vs time - Condensate	5-8-80		
VA	storage tanks (Sht. 2/2) South tank	STW	2.5-95A	
-423	Piezometer and pond elevation vs time	5-13-80		
VA	Cooling pond dike	STW	2.5-110	
-424	Piezometer and pond elevation vs time	5-21-80		
VA	Cooling pond dike	STW	2.5-111	
-425	Optimum moisture content vs	6-2-80		
JOW	field moisture content	DYW		
-428	Cross-section G-G'	6-24-80		
VA	Radwaste Building	STW		
-429	Cross-section N-N'	7-7-80		
VA	Tank farm	RVO		
-430	Cross-section P-P'	7-7-80		
VA	Tank farm	RVO		
-431	Cross-section O-O'	7-7-80		
VA	Tank farm	RVO		
-432	Cross-section L-L'	7-14-80		
VA	Condensate storage tanks	DYW		
-433	Cross-section M-M'	7-17-80		
VA	Turbine Building	DYW		
-434	Diesel generator building	7-17-80		
VA	boring plan	DYW		
-435	Cross-section DG-1	7-18-80		
VA	Diesel generator building	RVO		
-436	Cross-section DG-2	7-18-80		
VA	Diesel generator building	DYW		
-437	Cross-section DG-3	7-18-80		
VA	Diesel generator building	RVO		

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DWG / DESIGN	TITLE	SCHED	PSAR / FSAR	FR / ER
-438	CONFINING PRESSURE VS	7-25-80		
AM	SHEAR STRENGTH (CU)	RVO		
-439	MEASURED AND PREDICTED SETTLEMENT	7-25-80		
AM	VS LOG OF TIME (DG-3)	RVO		
-440	CONFINING PRESSURE VS	7-25-80		
AM	SHEAR STRENGTH (CIU)	RVO		
-441	D/G BLDG TYPICAL SETTLEMENT COOLING	7-29-80		
VA	POND LEVEL, PIEZOMETER LEVEL, AND SURFACE LOAD HISTORY	DWN		
-442	[illegible]	8-6-80		
VA	[illegible]	SKH		

PERSONAL RESUME (10-29-80)

J. Kane B

NAME Sherif S. Afifi

DATE 10/27/80

2-1/2" x 2-1/2" GLOSSY

PHOTO DATE

CLASSIFICATION Assist. Chief Soil Engineer GRADE 28

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ORIGINAL BECHTEL EMPLOYMENT DATE 9/17/73

RE-EMPLOYMENT DATE(S) N/A

SPOUSE'S NAME Barbara Jean Afifi

CHILDREN BIRTHDATES 3/1/78

MILITARY SERVICE & RANK None

PROFESSIONAL LICENSES AND SOCIETIES

Professional Engineer, Michigan
Member, American Society of Civil Engineers

EDUCATION AND PERSONAL DEVELOPMENT PROGRAMS

DEGREE, CERTIFICATE, ETC.	SCHOOL	MAJOR (OR SUBJECT)	DATE
B.S.	Ain Shams University Cairo, Egypt	Civil Engineering	1961
M.S.E.	University of Michigan Ann Arbor, Michigan	Civil Engineering	1967
Ph.D.	University of Michigan Ann Arbor, Michigan	Civil Engineering	1970

OTHER SIGNIFICANT INFORMATION (Refer to instructions before completing)

ACHIEVEMENTS:

Afifi, S. S. And Woods, R. D. (1971), "Long-Term Pressure Effects On Shear Modulus of Soils," JSMFD, Proc. ASCE, Vol. 97 SM16, pp 1445-1460, October.

Afifi, S. S. and Richart, F. E., Jr. (1973), "Stress-History Effects On Shear Modulus of Soils," Soils and Foundations, Japanese Society of Soil Mechanics and Foundation Engineering, Vol. 13, No. 1, pp 77-95, March.

Afifi, S. S. and Luscher, U. (1973), "Permafrost Thaw Settlement," A paper presented at the 10th Annual Symposium on Engineering Geology and Soils Engineering, University of Idaho, Mascow, Idaho, pp 1-17, April.

NAME:

OTHER SIGNIFICANT INFORMATION (Continued)

Luscher, U. and Afifi, S. S. (1973), "Thaw Consolidation of Alaskan Silts and Granular Soils," Permafrost: The North American Contribution to the Second International Conference on Permafrost, National Academy of Science, Washington, D.C., pp 325-334, July.

LANGUAGES:

Speak and read Arabic, read French.

GEOGRAPHIC PREFERENCE:

USA

ASPIRATIONS:

Continued technical development in the area of Geotechnical Engineering. Progress within the geotechnical organization to higher management levels.

(USE SUPPLEMENTAL PAGE, IF REQUIRED

WORK HISTORY

DATES MO.-YR. FROM	DATES MO.-YR. TO	COMPANY, DIVISION OR DEPARTMENT; LOCATION AND SUPERIOR	POSITION HELD, SUMMARY OF RESPONSIBILITIES AND SIGNIFICANT ACCOMPLISHMENTS
9/78	Present	H&CF Geotechnical Services, Ann Arbor (S. L. Blue and H. H. Burke)	Assistant Chief Soils Engineer- Responsible for the activities of the Ann Arbor Soils Group which provides Soil Engineering Services to in-house nuclear and fossil power projects. The work includes subsurface investigations, preparation of foundation reports, safety analysis reports and construction specifications, and the support of construction activities. Areas of particular involvement include in-situ measurements of soil properties, laborato testing, foundation evaluations, water front structures, and soil dynamics.
3/74	9/78	H&CF Geotechnical Services, Ann Arbor (S.L. Blue and H. H. Burke)	Soils Engineering Supervisor - Supervisio of soil engineering work associated with nuclear and fossil power projects.
9/73	3/74	H&CF Geotechnical Services, Ann Arbor (J. H. Allen)	Senior Engineer - Worked on various assignments in soil engineering aspects of nuclear and fossil power projects.

(USE SUPPLEMENTAL PAGE, IF REQUIRED

WORK HISTORY (Continued)

DATES MO.-YR. FROM	DATES MO.-YR. TO	COMPANY, DIVISION OR DEPARTMENT; LOCATION AND SUPERIOR	POSITION HELD. SUMMARY OF RESPONSIBILITIES AND SIGNIFICANT ACCOMPLISHMENTS.
6/70	9/73	Woodward-Clyde Consultants, Oakland, California, (U. Luscher)	Staff to Senior Staff Engineer - Worked on the geotechnical engineering design of the Trans-Alaska Pipeline Project. Prepared the soil engineering properties reports required for design of the 800-mile pipeline. Also worked on slope stability evaluations, bearing capacity evaluations, pile design and buried pipe support design.
1/66	5/70	The University of Michigan, Ann Arbor (F. E. Richart, Jr.)	Research Assistant, Teaching Fellow, and Graduate Student - Conducted research in soil dynamics, and assisted in teaching soils courses. Completed Ph.D. degree program.
9/61	12/65	Ain Shams University, Cairo, Egypt (H. Mostafa)	Teaching Assistant - Taught undergraduate students soils and structures in sessions designated for problem solving.
9/61	12/65	Sabry & Yousef Consulting Engineers, 19 Khalek Sarwat Str., Cairo, Egypt (A. Sabry)	Engineer (part-time) - Design of foundations and structures for industrial and residential facilities.

NRC Dep x2
10-30-80 (afifi)

Bechtel Associates Professional Corporation

Inter-office Memorandum

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JOB 7220 FILE 3412
RECD AUG 4 1979

To Distribution

Date August 3, 1979

Subject PROBLEM ALERT -
Incorrectly Placed Backfill

From T. E. Johnson

Of Civil/Structural

Copies to File: 502

At Ann Arbor Office

Attached for your review is a draft copy of the Problem Alert to be issued on the large settlements at Midland due to the incorrectly placed backfill. It is requested that your comments be forwarded to us by August 10, 1979.

T. E. Johnson

xc Copies to:
ORG
JBG
VA
ASM

TEJ/GT/wh

Attachments

Distribution:

E. Rumbaugh
K. Wiedner
J. Milandin
P. Martinez ✓
R. Castleberry
B. Dhar
S. Blue ✓
S. Afifi

8301598

I. DESCRIPTION OF PROBLEM

Insufficiently compacted plant area backfill under the diesel generator building was discovered because of excessive settlement during construction. Both granular and cohesive soils were improperly compacted in other areas of plant fill as well as the diesel generator building. This required extensive reanalysis and/or modifications of the diesel generator building, the service water structure, the feedwater isolation valve pits, and portions of the auxiliary building.

Based on a thorough investigation, the most probable causes for the resulting remedial work include the following.

A. All types of compaction equipment used for plant area backfill were not prequalified for lift thickness and number of passes. This was particularly true for the small hand-operated equipment. Except for the heavy earth-moving equipment used to construct the plant area dikes, reliance was placed on acceptance being established by end result ASTM acceptance tests.

B. An audit has shown that the testing laboratory failed to obtain meaningful and accurate results after performing the ASTM acceptance tests. Some examples are the following.

1. More than one-half of the test results for relative density and percent compaction were outside the theoretical comparison limit.

2. Incorrect soil indentification and calculation errors were also present.

C. The quality assurance (QA) and quality control (QC) departments only provided a surveillance program in lieu of an inprocess, in-depth inspection program. In addition, a continuous, thorough review of the testing methods being performed was not carried out.

II. APPLICABILITY

These conditions are applicable to all projects where structures are supported fully or partially by compacted backfill material.

ORIGIN: AAO	ENGINEER: G.A. Tuveson	CHIEF ENGINEER: T.E. Johnson	PROBLEM ALERT Large settlements due to incorrectly placed backfill	DATE: NO:

III. CORRECTIVE ACTION

A. The structures are being modified to compensate for the in situ soil conditions using the following solutions:

1. Underpinning by the use of caissons and piles for structures partially supported by fill

2. Reduction of residual settlement by surcharge loading structures totally supported by fill

3. Elimination of the possibility of liquefaction of extensive sand backfill areas during a seismic event by installing a permanent dewatering system

B. The earthwork specification has been revised so that all soil compaction requirements are clearly defined in the specification.

C. QA rewrote its inspection plans to implement the requirements in the specifications.

D. A resident geotechnical soils engineer has been assigned to the site to oversee the backfill operation.

E. The soils testing laboratory has been made aware of all testing discrepancies and have taken actions to prevent recurrence.

F. All of the construction equipment to be used for compacting the various types of soils at the site are being qualified to a maximum lift thickness with a specified number of passes.

IV. ACTION RECOMMENDED TO BECHTEL PROJECTS

A. The backfill compaction criteria for project earthwork specifications should have a method basis as well as performance criteria for acceptance; i.e., each type of compaction equipment should be qualified at the jobsite for the respective type of soils to be compacted. This qualification includes lift thickness and number of passes. The final acceptance criteria are still to be based on testing by the appropriate ASTM acceptance standard.

B. A resident geotechnical soils engineer should be assigned to the construction site to provide technical guidance and assistance in directing the earthwork, which includes coordination with the soils testing laboratory.

C. The soils laboratory testing specification should be a separate specification and not part of the physical testing specification which includes other materials such as concrete and reinforcing steel.

D. The subcontract for soils testing performed at the jobsite should be awarded to an engineering firm that is specialized in the soils area.

E. Quality assurance manuals or vendor procedure manuals for the soils laboratory testing should be reviewed by geotech as well as project engineering.

F. A maximum limit of the number of times a proctor curve may be used as representative of the material being placed should be established.

G. To minimize errors in testing, the soils testing laboratory should include the following practices in its testing procedures manual.

1. Cohesive Soils - The moisture content of the field densities cannot fall outside the zero air voids curve for the respective specific gravity.

2. Granular Soils - The stock piled material should be tested for relative density by both the wet and dry methods as defined in the ASTM standards to ensure that the maximum density attainable will be used in placement.

H. Backfill Under Structures

1. Only granular material should be used with a specified gradation band monitored by frequent gradation tests.

2. To ensure that proper compaction is obtained, the frequency ~~of plotting proctor curves or maximum/minimum density tests should be increased.~~ OF TESTING IS INDICATED AND ITS SHOULD BE INCREASED AS JUDGED BY THE RESIDENCE SOILS ENGINEER.

3. Consideration should also be given to performing static plate bearing tests as defined in the ASTM standards. The resident geotechnical soils engineer should have the option of requesting this type test when appropriate.

NRC Dep Ex 2A
10-31-80 (afifi)

Bechtel Power Corporation

Inter-office Memorandum

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JOB 7220 FILE
REC'D NOV 30 1979

To E. A. Rumbaugh

Date November 28, 1979

Subject Problem Alert - Large Settlements Due to Incorrectly Placed Backfill

From J. Milandin

Of Quality Assurance

At Ann Arbor

Copies to

T. E. Johnson
G. A. Tuveson
S. I. Heisler
W. T. Kellermann
S. L. Blue

The subject Problem Alert was originated by Ted Johnson as a result of a meeting which we held on June 13, 1979. The Problem Alert was, in effect, issued to take advantage of the Midland problem by providing for certain revisions in our specifications and controls to preclude such a situation from recurring on another project. As you recall, I suggested the Problem Alert. Ted Johnson has been working very closely with me to insure that QA concerns were included. Ted issued the report to Ken Buchert on October 19 and received a reply, attached, from Ken Buchert, apparently incorrectly dated, on August 27, 1979.

Buchert's reply, in effect, deleted all the recommended corrective actions by the Ann Arbor Office and effectively stated corrective actions which are essentially the same as the present program. Without the AAO recommendations, the Problem Alert is truly incomplete. It will not prevent the problem from occurring again once this Problem Alert has been filed. The idea behind the recommended action of the Ann Arbor Office was to perserve these experiences by revising generic specifications and control procedures which govern the placement of backfill.

It is requested that you look into this matter to determine why the San Francisco Power Division Civil Structural Chief rejected the corrective actions proposed by the Ann Arbor Office. Each of those actions, which were proposed, were tied back to problems which were identified during the course of the investigation and were carefully developed to preclude the recurrence of such a situation in the future. Therefore, as the situation now stands, if the office follows through on the Buchert August 27 letter, new projects may fall into the same situation as Midland did when memories dim.

Please respond by 12/12/79. Please advise whether you consider this a matter to be handled by an MCAR.

J. Milandin

JM/le
JM-79-122
File: AAO-QAR-79-66

NRC Staff Dep
X 3
10-30-80 (affi.)

Bechtel Associates Professional Corporatic

Inter-office Memorandum

To R. L. Castleberry

Date 13 September 1974

Subject Plant Area Fill
Midland Units 1 & 2
Job 7220-001

From [redacted]

Of Geotechnical Services

Copies to J. H. Allen
H. H. Burke/W. R. Ferris
J. C. Hink
R. L. Rixford
J. O. Wanzeck
1320,3410

At Ann Arbor - E

This memo is intended to assist in preparing your formal response to Item 3 of BCBE-370 regarding compaction requirements for the plant area. Herein, we address recommendations given in the soils reports prepared by Dames & Moore for the Midland project and compare them with our earthwork specifications. The material in this memo confirms our previous discussions with your group.

The evaluation here pertains to plant area fill supporting and surrounding structures, any Category I slopes in the plant area, and the berm fill.

In-Situ Clays

Tables 1 & 2 attached (taken from Dames & Moore's soils report of June 28, 1968, Page 15 and its supplement of March 15, 1969, Page 16) present compaction recommendations for fill and backfill. In the June 28, 1968 report, the minimum clay compaction is recommended to be 95% for support of critical structures, 90% for support of non-critical structures, and 90% adjacent to structures, respectively; all percent compaction values are according to ASTM D 1557 Method D (about 56,000 ft-lb compaction energy). In the March 15, 1969 report, the minimum clay compaction is recommended to be 100% for support of structures, 95% adjacent to structures, and 90% for area fill (not supporting or adjacent to structures); all percent compaction values are according to Bechtel Modified Compaction (BMC: 20,000 ft-lb compaction energy).

Specification 7220-C-210 (Section 13.7) requires 95% of ASTM D 1557 Method D for in-situ clay in the plant area and berm.

In comparing the reports with the specification for in-situ clay supporting structures, it is seen that the specification and the 1968 Dames & Moore report are identical. Also, the specification and the 1969 report are consistent since 95% of ASTM D 1557 Method D is approximately equivalent to 100% BMC in some soils. However,

the requirement of 95% of ASTM D 1557 Method D given in the specification is the applicable criteria for compacting clay to support structures. Further assurance by conducting shear strength tests is required (see Section 12.4.8, Specification 7220-C-210). Compressibility tests may also be required.

The berm fill must be compacted to 95% of ASTM D 1557 Method D to insure adequate seepage protection and stability.

Category I fill placed within the failure zone of a slip circle may require a degree of compaction higher than 95% of BMC, because of design for the full SSE. However, it is conceivable that in-place fill compacted to 95% of the BMC will be adequate if strength and permeability properties are shown to be adequate.

Similarly, in-place fill supporting light structures may be adequate at 95% of BMC provided its strength and compressiblity are shown to be adequate.

Fill in the plant area which will not support structures or pipes or be placed within the failure zone of Category I slopes may be compacted to a lesser degree than 95% of ASTM D 1557 Method D (e.g. 95% of BMC). This agrees with Dames & Moore's 1969 report and is consistent with their 1968 report which requires only 90% of ASTM D 1557 Method D.

In-Situ Sands

The Dames & Moore June 1968 report presents recommendations for compacting sand in terms of maximum density while their March 1969 report presents recommendations in terms of relative density. The later report is considered more applicable for sands since relative density is one of the basic parameters required to control liquefaction. Therefore, in-situ sands supporting structures must be compacted to a relative density of 85% (ASTM D-2049). For well-graded sands around structures, the 80% relative density specified in 7220-C-211 is adequate.

Accordingly, any in-situ clay which will be supporting structures or be involved in Category I slopes and the berm must be compacted to 95% of ASTM D 1557 Method D.

If the fill is already in place according to BMC, it may be adequate for some structures, pipes, or slopes, provided it is shown by sufficient testing that its strength, compressibility and seepage

characteristics are adequate. This requires sampling and laboratory shear strength and consolidation testing. Section 12.4.8 of the earthwork specification addresses this issue for any in-place fill. Compaction curves using both ASTM D 1557 Method D and Bechtel Modified Method must also be developed and correlated with shear strength and consolidation test results on the compacted soil to evaluate the compressibility and shear strength achieved from both methods of compaction for the in-place fill.

This information will allow a complete evaluation of any in-place fill for its proposed function, in addition to providing information which will be needed for the FSAR. It should also clear up any questions as to how fill should be placed in the future.

We will be happy to discuss this matter further with you at your convenience.

Sheriff S. Afifi

S. S. Afifi

SSA:lab

Attachments

TABLE 1

Minimum Compaction Criteria from Dames & Moore

June 1968 Report**

Purpose of Fill	Recommended Minimum Compaction Criteria Percent of Maximum Density* On-Site Cohesive Soils	On-Site Granular Soils
Support of Critical Structures	95	100
Support of Non-Critical Structures	90	95
Adjacent to Structures	90	95

* Maximum density and optimum moisture content should be determined by the ASTM Test Designation D 1557 Method D.

** Report, Foundation Investigation and Preliminary Explorations for Borrow Materials Proposed Nuclear Power Plant, Midland, Michigan, June 28, 1968.

TABLE 2

Minimum Compaction Criteria from Dames & Moore

March 15, 1969 Report***

Purpose of Fill	Recommended Minimum Compaction Criteria On-Site Sand Soils Percent Relative Density*	On-Site Clay Soils Percent of Maximum Densi
Support of Structures	85	100
Adjacent to Structures	75	95
Area Fill (not supporting or adjacent to structures)	70	90

* Maximum and minimum density of sand soils should be determined in accordance with ASTM Test Designation D-2049.

** Maximum dry density and optimum moisture content should be determined in accordance with ASTM Test Designation D-698, modified to require 20,000 foot-pounds of compactive energy per cubic foot of soil.

*** Supplement to Report, Foundation Investigation and Preliminary Explorations for Borrow Materials, Proposed Nuclear Plant, Midland, Michigan March 15, 1969.

MINIMUM COMPACTION CRITERIA
PLANT AREA FILL AND BERM

Function of Fill	Minimum Compaction Criteria	
	In Situ Sand[1]	In Situ Clay[2]
Support of Structures[3]	85%	95%
Adjacent to structures (Gradation specified in 7220-C-211)	80%	-
Category I Slopes	-	95%
Berm	-	95%
Area Fill (not supporting or adjacent to structures)	-	95%

(1) All sand compaction is in terms of relative density as determined from ASTM D 2049 test.

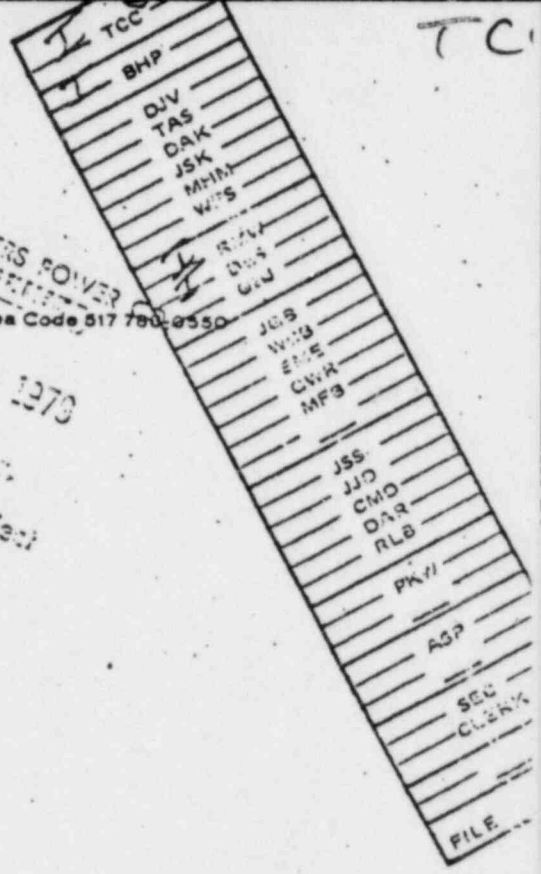
(2) All clay compaction is in terms of maximum density as determined by ASTM D 1557, Method D except for area fill not supporting or adjacent to structures. In these areas, ASTM D 1557 may be altered such that only 20,000 ft-lb/ft^3 of energy would be required.

(3) Strength and compressibility testing may be required to confirm adequacy of fill.

Dep X 4
10-30-80
(affi)

Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550



October 22, 1979

Mr J A Rutgers
Project Manager
Bechtel Power Corporation
PO Box 1000
Ann Arbor, MI 48106

MIDLAND PROJECT -
REMOVAL OF LOOSE SAND -
FILE 0130 UFI 08*06 SERIAL 7802

Reference: 1) Consumers Power Company Letter, Serial 3478, Dated October 6, 19
2) Bechtel Letter, BCCC-3587, Dated October 23, 1978
3) Bechtel Letter, BLC-8167, Dated September 17, 1979

We have reviewed Bechtel letter, BLC-8167, (Reference 3) and disagree with the conclusion that Bechtel is not responsible for the additional costs associated with efforts to resolve NRC Question 362.2. We disagree for the following reasons:

1. The NRC raised the loose sand question in early 1970. On Page 8.00-1 of the PSAR, Bechtel provided the NRC with a discussion of how the sands would be treated. The Bechtel intentions as stated in the PSAR were as follows: "For example, in those areas of the turbine building adjacent to the emergency diesel generator building, existing sand will be removed if <u>further tests</u> show relative density of this sand is less than 75%." It is obvious that in place density testing was intended to be performed in order to verif the natural sand densities.

2. Bechtel Engineering communicated this commitment to construction in 1975 by placing a note on Drawing C-44 indicating that sands with less than 75% relative densities must be removed.

3. The loose sand commitment was also delineated in FSAR Section 2.5.4.5.1. This was a statement that the design drawing (C-44) was issued to require removal of loose sands with relative densities less than 75%.

4. In mid-1978, Bechtel Engineering asked both the Bechtel Construction and Consumers Power Company Field Engineers if they had any knowledge of density tests taken for the purpose of clearing areas where natural sands had existed. Consumers Power Company civil field personnel spent several days looking at records in Jackson to identify any field tests performed to document the densities of the sand. All efforts by Bechtel and Consumers Power Company were unable to identify any documented field density tests which would resolve this question. In mid-1978 when the investigation occurred, all of the areas in question had been covered by approximately 30' of backfill.

It seems obvious to us that although field density tests were to be performed to approve areas where natural sands existed, they were not performed or if performed, they were not documented. Based on the inability to show by documentation that the commitment had been adequately addressed, borings were ordered by Bechtel Engineering to resolve the NRC question. If density test had been performed and documented initially, the recent borings and engineering analysis would not have been required. Failure to properly meet PSAR and FSAR commitments, and the requirements of Drawing C-44, has resulted in significant costs to Consumers Power Company.

Therefore, we do not accept the argument that because the recent borings showed natural sands which had relative densities greater than 75%, Bechtel has no liability for additional costs. It is our contention that no borings or analysis would have been necessary if Bechtel had properly executed drawing, FSAR and PSAR requirements.

G S Keeley
Project Manager

GSK/cg

BCC DBMiller, Midland (3)
JLBacon, M-1085A
DGRandolph, P-14-422
JEFelber, Midland-Accounting

NRC Exhibit # 5 10-30-80 (afifi)

Def-

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

AUG 4 1980

Docket Nos.: 50-329/330

Mr. J. W. Cook
Vice President
Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

Dear Mr. Cook:

SUBJECT: CORP OF ENGINEERS REPORT AND REQUEST FOR ADDITIONAL INFORMATION ON PLANT FILL

My letter of June 30, 1980 requested the results of additional explorations and laboratory testing needed to support certain geotechnical engineering studies on the Midland plant fill and associated remedial actions. That letter noted that details on the extent of these studies would be provided by separate correspondence. Enclosure 1 is a letter report of July 7, 1980 by our consultant, the U.S. Army Corps of Engineers, and is forwarded to this end.

Paragraph 4 of the Corps report identifies additional information needed to resolve specific problems identified in paragraph 3. For purposes of control, we have re-numbered the subparagraphs of paragraph 4 to be sequential with our prior requests on this matter. They have also been marked to reflect the results of NRC review. Your reply should reference the revised numbering system and should address the requests as marked to reflect our changes.

Subparagraph 4j of the Corps report entitled Liquefaction Potential, is not included in our re-numbering since it represents an evaluation rather than a request. We consider this evaluation to be tentative at this time since it is subject to the determination of suitable seismic design input for the site. We will address this matter shortly by separate correspondence.

8008270158

We would appreciate your reply at your earliest opportunity. Should you need clarification of these requests for additional information, please contact us.

Sincerely,

A. Schwencer, Acting Chief
Licensing Branch No. 3
Division of Licensing

Enclosure:
COE Letter Report
dated 7/7/80

cc: See next page

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cc: Mr. William A. Thibodeau
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Mr. Terry R. Miller
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DETROIT DISTRICT, CORPS OF ENGINEERS
BOX 1027
DETROIT, MICHIGAN 48231

ENCLOSURE 1

REPLY TO
ATTENTION OF

7 JUL 1980

NCEED-T

SUBJECT: Interagency Agreement No. NRC-03-79-167, Task No. 1 - Midland Plant Units 1 and 2, Subtask No. 1 - Letter Report

THRU: Division Engineer, North Central
ATTN: NCDED-G (James Simpson)

TO: U.S. Nuclear Regulatory Commission
ATTN: Dr. Robert E. Jackson
Division of Systems Safety
Mail Stop P-314
Washington, D. C. 20555

1. The Detroit District hereby submits this letter report with regard to completion of subtask No. 1 of the subject Interagency Agreement concerning the Midland Nuclear Plant, Units 1 and 2. The purpose of this report is to identify unresolved issues and make recommendations on a course of action and/or cite additional information necessary to settle these matters prior to preparation of the Safety Evaluation Report.

2. The Detroit District's team providing geotechnical engineering support to the NRC to date has made a review of furnished documents concerning foundations for structures, has jointly participated in briefing meetings with the NRC staff, Consumers Power Company (the applicant) and personnel from North Central Division of the Corps of Engineers and has made detailed site inspections. The data reviewed includes all documents received through Amendment 78 to the operating license request, Revision 28 of the FSAR, Revision 7 to the 10 CFR 50.54(f) requests and MCAR No. 24 through Interim Report No. 8. Generally, each structure within the complex was studied as a separate entity.

3. A listing of specific problems in review of Midland Units 1 and 2 follows for Category I structures. The issues are unresolved in many instances, because of inadequate or missing information. The structures to be addressed follow the description of the problem.

a. Inadequate presentation of subsurface information from completed borings on meaningful profiles and sectional views. All structures.

PDR
16 pp

~~8008270160~~

b. Discrepancies between soil descriptions and classifications on boring logs with submitted laboratory test results summaries. Examples of such discrepancies are found in boring T-14 (Borated water tank) which shows stiff to very stiff clay where laboratory tests indicate soft clay with shear strength of only 500 p.s.f. The log of boring T-15 shows stiff, silty clay, while the lab tests show soft, clayey sand with shear strength of 120 p.s.f. All structures.

c. Lack of discussion about the criteria used to select soil samples for lab testing. Also, identification of the basis for selecting specific values for the various parameters used in foundation design from the lab test results. All structures.

d. The inability to completely identify the soil behavior from lab testing (prior to design and construction) of individual samples, because in general, only final test values in summary form have been provided. All structures.

(1) Lack of site specific information in estimating allowable bearing pressures. Only textbook type information has been provided. If necessary, bearing capacity should be revised based on latest soils data. All structures on, or partially on, fill.

(2) Additional information is needed to indicate the design methods used, design assumptions and computations in estimating settlement for safety related structures and systems. All structures except Diesel Generator Building where surcharging was performed.

e. A complete detailed presentation of foundation design regarding remedial measures for structures undergoing distress is required. Areas of remedial measures except Diesel Generator Building.

f. There are inconsistencies in presentation of seismic design information as affected by changes due to poor compaction of plant fill. Response to NRC question 35 (10 CFR 50.54f) indicates that the lower bound of shear wave velocity is 500 feet per second. We understand that the same velocity will be used to analyze the dynamic response of structures built on fill. However, from information provided by the applicant at the site meeting on 27 and 28 February 1980, it was stated that, except for the Diesel Generator Building, higher shear wave velocities are being used to re-evaluate the dynamic response of the structures on fill material. Structures on fill or partially on fill except Diesel Generator Building.

4. A listing of specific issues and information necessary to resolve them.

39. a. Reactor Building Foundation

(1) Settlement/Consolidation. Basis for settlement/consolidation of the reactor foundation as discussed in the FSAR assumes the plant site would

not be dewatered. Discuss and furnish computation for settlement of the Reactor Buildings in respect to the changed water table level as the result of site dewatering. Include the effects of bouyancy, which were used in previous calculations, and fluctuations in water table which could happen if the dewatering system became inoperable.

(2) Bearing Capacity. Bearing capacity computations should be provided and should include method used, foundation design, design assumptions, adopted soil properties, and basis for selecting ultimate bearing capacity and resulting factor of safety.

10.f. Diesel Generator Building.

(1) Settlement/Consolidation. In the response to NRC Question 4 and 27, (10 CFR 50.54f), the applicant has furnished the results of his computed settlements due to various kinds of loading conditions. From his explanation of the results, it appears that compressibility parameters obtained by the preload tests have been used to compute the static settlements. Information pertaining to dynamic response including the amplitude of vibration of generator pedestals have also been furnished. The observed settlement pattern of the Diesel Generator Building indicates a direct correlation with soil types and properties within the backfill material. To verify the preload test settlement predictions, compute settlements based on test results on samples from new borings which we have requested in a separate memo and present the results. Reduced ground water levels resulting from dewatering and diesel plus seismic vibration should be considered in settlement and seismic analysis. Furnish the computation details for evaluating amplitude of vibration for diesel generator pedestals including magnitude of exciting forces, whether they are constant or frequency dependent.

(2) Bearing Capacity. Applicant's response to NRC Question 35 (10 CFR 50.54f) relative to bearing capacity of soil is not satisfactory. Figure 35-3, which has been the basis of selection of shear strength for computing bearing capacity does not reflect the characteristics of the soils under the Diesel Generator Building. A bearing capacity computation should be submitted based on the test results of samples from new borings which we have requested in a separate memo. This information should include method used, foundation design assumptions, adopted soil properties and basis for selection, ultimate bearing capacity and resulting factor of safety.

(3) Preload Effectiveness. The effectiveness of the preload should be studied with regard to the moisture content of the fill at the time of preloading. The height of the water table, its time duration at this level, and whether the plant fill was placed wet or dry of optimum would be all important considerations.

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(a) Granular Soils.

When sufficient load is applied to granular soils it usually causes a reorientation of grains and movement of particles into more stable positions plus (at high stresses) fracturing of particles at their points of contact. Reorientation and breakage creates a chain reaction among these and adjacent particles resulting in settlement. Reorientation is resisted by friction between particles. Capillary tension would tend to increase this friction. A moisture increase causing saturation, such as a rise in the water table as occurred here, would decrease capillary tension resulting in more compaction. Present a discussion on the water table and capillary water effect on the granular portion of the plant fill both above and below the water table during and after the preload.

(b) Impervious and/or Clay Soils.

Clay fill placed dry of optimum would not compact and voids could exist between particles and/or chunks. In this situation SPT blow counts would give misleading information as to strength. Discuss the raising of the water table and determine if the time of saturation was long enough to saturate possible clay lumps so that the consolidation could take place that would preclude further settlement.

Discuss the preload effect on clay soils lying above the water table (7 feet $\pm$) that were possibly compacted dry of optimum. It would appear only limited consolidation from the preload could take place in this situation and the potential for further settlement would exist.

Discuss the effect of the preload on clays placed wet of optimum. It would appear consolidation along with a gain in strength would take place. Determine if the new soil strength is adequate for bearing capacity.

Conclusion: Since the reliability of existing fill and compaction information is uncertain, additional borings and tests to determine void ratio (granular soils) relative density, moisture content, density, consolidation properties and strength (triaxial tests) would appear to be desirable in order to satisfactorily answer the above questions. Borings should be continuous push with undisturbed cohesive soil samples taken.

Delete Covered 6/30/80 Letter

(4) Miscellaneous. A contour map, showing the settlement configuration of the Diesel Generator Building, furnished by the applicant at the meeting of 27 and 28 February 1980 indicates that the base of the building has warped due to differential settlements. Additional stresses will be induced in the various components of the structure. The applicant should evaluate these stresses due to the differential settlement and furnish the computations and results for review.

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SUBJECT: Interagency Agreement No. NRC-03-79-167, Task No. 1 - Midland Plant Units 1 and 2, Subtask No. 1 - Letter Report

41. f. Service Water Building Foundation.

(1) Bearing Capacity. A detailed pile design based upon pertinent soil data should be developed in order to more effectively evaluate the proposed pile support system prior to load testing of test piles. Provide adopted soil properties, reference to test data on which they are based, and method and assumptions used to estimate pile design capacity including computations. Provide estimated maximum static and dynamic loads to be imposed and individual contribution (DL, LL, OBE, SSE) on the maximum loaded pile. Provide factor of safety against soil failure due to maximum pile load.

(2) Settlements.

(a) Discuss and provide analysis evaluating possible differential settlement that could occur between the pile supported end and the portion placed on fill and glacial till.

(b) ~~Present~~ Discuss why the retaining wall adjacent to the intake structure is not required to be a Seismic Category I structure. Evaluate the observed settlement of both the service water pumphouse retaining walls and the intake structure retaining wall and the significance of the settlement including future settlement prediction on the safe operation of the Midland Nuclear Plant.

(3) Seismic Analysis. Provided the proposed 100 ton ultimate pile load capacities are achieved and reasonable margin of safety is available, the vertical pile support proposed for the overhang section of the Service Water Pump Structure will provide the support necessary for the structure under combined static and seismic inertial loadings even if the soil under the overhang portion of the structure should liquefy. There is no reason to think this won't be achieved at this time, and the applicant has committed to a load test to demonstrate the pile capacity. The dynamic response of the structure, including the inertial loads for which the structure itself is designed and the mechanical equipment contained therein, would change as a result of the introduction of the piles. Therefore:

(a) Please summarize or provide copies of reports on the dynamic analysis of the structure in its old and proposed configuration. For the latter, provide detailed information on the stiffness assigned to the piles and the way in which the stiffnesses were obtained and show the largest change in interior floor vertical response spectra resulting from the proposed modification. If the proposed configuration has not yet been analyzed, describe the analyses that are to be performed giving particular attention to the basis for calculation or selection, of and the range of numerical stiffness values assigned to the vertical piles.

(b) Provide after completion of the new pile foundation, in accordance with commitment No. 6, item 125, Consumers Power Company memorandum

dated 13 March 1980, the results of measurements of vertical applied load and absolute pile head vertical deformation which will be made when the structural load is jacked on the piles so that the pile stiffness can be determined and compared to that used in the dynamic analysis.

42. ~~f.~~ Auxiliary Building Electrical Penetration Areas and Feedwater Isolation Valve Pits.

(1) Settlement. Provide the assumptions, method, computation and estimate of expected allowable lateral and vertical deflections under static and seismic loadings.

(2) Provide the construction plans, and specifications for underpinning operations beneath the Electrical Penetration Area and Feedwater Valve Pit. The requested information to be submitted should cover the following in sufficient details for evaluation:

(a) Details of the temporary dewatering system (locations, depth, size and capacity of wells) including the monitoring program to be required, (for example, measuring drawdown, flow, frequency of observations, etc.) to evaluate the performance and adequacy of the installed system.

(b) Location, sectional views and dimensions of access shaft and drift to and below auxiliary building wings.

(c) Details of temporary surface support system for the valve pits.

~~(d)~~ Dewatering before underpinning is recommended in order to preclude differential settlement between pile and soil supported elements and negative drag forces.

(d) Provide adopted soil properties, method and assumptions used to estimate caisson and/or pile design capacities, and computational results. Provide estimated maximum static and dynamic load (compression, uplift and lateral) to be imposed and the individual contribution (DL, LL, OBE, SSE) on maximum loaded caisson and/or pile. Provide factor of safety against soil failure due to maximum pile load.

(e) Discuss and furnish computations for settlement of the portion of the Auxiliary Building (valve pits, and electrical penetration area) in respect to changed water level as a result of the site dewatering. Include the effect of bouyancy, which was used in previous calculations, and fluctuations in water table which could happen, if dewatering system becomes inoperable.

(f) Discuss protection measures to be required against corrosion, if piling is selected.

(g) Identify specific information, data and method of presentation to be submitted for regulatory review at completion of underpinning operation. This report should summarize construction activities, field inspection records, results of field load tests on caissons and piles and an evaluation of the completed fix for assuring the stable foundation.

43. Borated Water Tanks.

(1) Settlement. The settlement estimate for the Borated Water Storage Tanks furnished by the applicant in response to NRC Question 31 (10 CFR 50.54f) is based upon the results of two plate load tests conducted at the foundation elevation (EL 627.00±) of the tanks. Since a plate load test is not effective in providing information regarding the soil beyond a depth more than twice the diameter of the bearing plate used in the test, the estimate of the settlement furnished by the applicant does not include the contribution of the soft clay layers located at depth more than 5' below the bottom of the tanks (see Boring No. T-14 and T-15, and T-22 thru T-26).

(a) Compute settlements which include contribution of all the soil layers influenced by the total load on the tanks. Discuss and provide for review the analysis evaluating differential settlement that could occur between the ring (foundations) and the center of the tanks.

(b) The bottom of the borated tanks being flexible could warp under differential settlement. Evaluate what additional stresses could be induced in the ring beams, tank walls, and tank bottoms, because of the settlement, and compare with allowable stresses. Furnish the computations on stresses including method, assumptions and adopted soil properties in the analysis.

(2) Bearing Capacity. Laboratory test results on samples from boring T-15 show a soft stratum of soil below the tank bottom. Consideration has not been given to using these test results to evaluate bearing capacity information furnished by the applicant in response to NRC Question 35 (10 CFR 50.54f). Provide bearing capacity computations based on the test results of the samples from relevant borings. This information should include method used, foundation design assumptions, adopted soil properties, ultimate bearing capacity and resulting factor of safety for the static and the seismic loads.

44. Underground Diesel Fuel Tank Foundation Design

(1) Bearing capacity. Provide bearing capacity computation based on the test results of samples from relevent borings, including method used, foundation design assumptions, adopted soil properties, ultimate bearing capacity and the resulting factor of safety.

(2) Provide tank settlement analysis due to static and dynamic loads including methods, assumptions made, etc.

(3) What will be effects of uplift pressure on the stability of the tanks and the associated piping system if the dewatering system becomes inoperable?

45. Underground Utilities:

(1) Settlement

(a) Inspect the interior of water circulation piping with video cameras and sensing devices to show pipe cross section, possible areas of crackings and openings, and slopes of piping following consolidation of the plant fill beneath the imposed surcharge loading.

(b) The applicant has stated in his response to NRC Question 7 (10 CFR 50.54f) that if the duct banks remain intact after the preload program has been completed, they will be able to withstand all future operating loads. Provide the results of the observations made, during the preload test, to determine the stability of the duct banks, with your discussion regarding their reliability to perform their design functions.

(c) The response to Question 17 of "Responses to NRC Requests Regarding Plant Fill" states that "there is no reason to believe that the stresses in Seismic Category I piping systems will ever approach the Code allowable." We question the above statement based on the following:

Profile 26" - OHBC-54 on Fig. 19-1 shows a sudden drop of approx. 0.2 feet within a distance of only 20 feet. Using the procedure on p. 17-2,

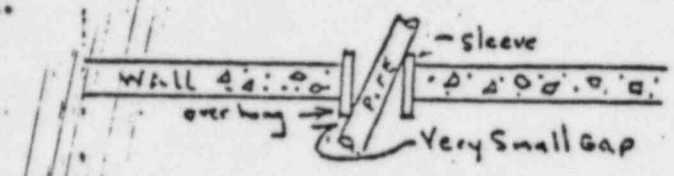
$$\sigma_b = E(e) = E\left(\frac{D}{2R}\right) = E\left(\frac{D}{2}\right)\left(\frac{8\delta}{L^2}\right)$$

$$\sigma_b = 30000\left(\frac{26}{2}\right)\left[\frac{8(0.2)(12)}{(20\times12)^2}\right] = 130.0 \text{ KSI}$$

~~Furthermore, the Eq. 10(a) of Article NC-3652.3, Sec. III, Division 1, of the ASME code requires that some stress intensification factor "i" be assigned to all computed settlement stresses.~~ Yet, Table 17-2 lists only 52.5 KSI stress as allowable for this pipe. This matter requires further review. Please respond to this apparent discrepancy and also specify the location of each computed settlement stress at the pipeline stationing shown on the profiles. More than one critical stress location is possible along the same pipeline.

(d) During the site visit on 19 February 1980, we observed three instances of what appeared to be degradation of rattlespace at penetrations of Category I piping through concrete walls as follows:

West Borated Water Tank - in the valve pit attached to the base of the structure, a large diameter steel pipe extended through a steel sleeve placed in the wall. Because the sleeve was not cut flush with the wall, clearance between the sleeve and the pipe was very small.



Service Water Structure - Two of the service water pipes penetrating the northwest wall of the service water structure had settled differentially with respect to the structure and were resting on slightly squashed short pieces of 2 x 4 placed in the bottom of the penetration. From the inclination of the pipe, there is a suggestion that the portions of the pipe further back in the wall opening (which was not visible) were actually bearing on the invert of the opening. The bottom surface of one of the steel pipes had small surface irregularities around the edges of the area in contact with the 2 x 4. Whether these irregularities are normal manufacturing irregularities or the result of concentration of load on this temporary support caused by the settlement of the fill, was not known.

These instances are sufficient to warrant an examination of those penetrations where Category I pipe derives support from plant fill on one or both sides of a penetration. In view of the above facts, the following information is required.

(1) What is the minimum seismic rattlespace required between a Category I pipe and the sleeve through which it penetrates a wall?

(2) Identify all those locations where a Category I pipe deriving support from plant fill penetrates an exterior concrete wall. Determine and report the vertical and horizontal rattlespace presently available and the minimum required at each location and describe remedial actions planned as a result of conditions uncovered in the inspection. It is anticipated that the answer to Question (1) can be obtained without any significant additional excavation. If this is not the case, the decision regarding the necessity to obtain information at those locations requiring major excavation should be deferred until the data from the other locations have been examined.

(e) Provide details (thickness, type of material etc.) of bedding or cradle placed beneath safety related piping, conduits, and supporting structures. Provide profiles along piping, and conduits alignments showing the properties of all supporting materials to be adopted in the analysis of pipe stresses caused by settlement.

(f) The two reinforced concrete return pipes which exit the Service Water Pump Structure, run along either side of the emergency cooling water reservoir, and ultimately enter into the reservoir, are necessary for safe shutdown. These pipes are buried within or near the crest of Category I slopes that form the sides of the emergency cooling water reservoir. There is no report on, or analysis of, the seismic stability of post earthquake residual displacement for these slopes. While the limited data from this area do not raise the specter of any problem, for an important element of the plant such as this, the earthquake stability should be examined by state-of-the-art methods. Therefore, provide results of the seismic analysis of the slopes leading to an estimate of the permanent deformation of the pipes. Please provide the following: (1) a plan showing the pipe location with respect to other nearby structures, slopes of the reservoir and the coordinate system; (2) cross-sections showing the pipes, normal pool levels, slopes, subsurface conditions as interpreted from borings and/or logs of excavations at (a) a location parallel to and about 50 ft from the southeast outside wall of the service water pipe structure and (b) a location where the cross section will include both discharge structures. Actual boring logs should be shown on the profiles; their offset from the profile noted, and soils should be described using the Unified Soil Classification System; (3) discussion of available shear strength data and choice of strengths used in stability analysis; (4) determination of static factor or safety, critical earthquake acceleration, and location of critical circle; (5) calculation of residual movement by the method presented by Newmark (1965) or Makdisi and Seed (1978); and (6) a determination of whether or not the pipes can function properly after such movements.

46. Cooling Pond.

(1) Emergency Cooling Pond. In recognition that the type of embankment fill and the compaction control used to construct the retention dikes for the cooling pond were the same as for the problem plant fill, we request reasonable assurance that the slopes of the Category I Emergency Cooling Pond (baffle dike and main dike) are stable under both static and dynamic loadings. We request a revised stability analysis for review, which will include identification of locations analyzed, adopted foundation and embankment conditions (stratification, seepage, etc.) and basis for selection, adopted soil properties, method of stability analysis used and resulting factor of safety with identification of sliding surfaces analyzed. Please address any potential impact on Category I pipes near the slopes, based on the results of this stability study. Recommendations for location of new exploration and testing have been provided in a separate letter.

(2) Operating Cooling Pond. A high level of safety should be required for the remaining slopes of the Operating Cooling Pond unless it can be assured that a failure will not: (a) endanger public health and properties, (b) result in an assault on environment, (c) impair needed emergency access. Recommendations for locations of new borings and laboratory tests have been submitted in a separate letter. These recommendations were made on the assumptions that the stability of the operating cooling pond dikes should be demonstrated.

47. Site Dewatering Adequacy.

(1) In order to provide the necessary assurance of safety against liquefaction, it is necessary to demonstrate that the water will not rise above elevation 610 during normal operations or during a shutdown process. The applicant has decided to accomplish this by pumping from wells at the site. In the event of a failure, partial failure, or degradation of the dewatering system (and its backup system) caused by the earthquake or any other event such as equipment breakdown, the water levels will begin to rise. Depending on the answer to Question (a) below concerning the normal operating water levels in the immediate vicinity of Category I structures and pipelines founded on plant fill, different amounts of time are available to accomplish repair or shutdown. In response to Question 24 (10 CFR 50.54f) the applicant states "the operating groundwater level will be approximately el 595 ft" (page 24-1). On page 24-1 the applicant also states "Therefore el 610' is to be used in the designs of the dewatering system as the maximum permissible groundwater level elevation under SSE conditions." On page 24-15 it is stated that "The wells will fully penetrate the backfill sands and underlying natural sands in this area." The bottom of the natural sands is indicated to vary from elevation 605 to 580 within the plant fill area according to Figure 24-12. The applicant should discuss and furnish response to the following questions:

(a) Is the normal operating dewatering plan to (1) pump such that the water level in the wells being pumped is held at or below elevation 595 or (2) to pump as necessary to hold the water levels in all observation wells near Category I Structures and Category I Pipelines supported on plant fill at or below elevation 595, (3) to pump as necessary to hold water levels in the wells mentioned in (2) above at or below elevation 610, or (4) something else? If it is something else, what is it?

(b) In the event the water levels in observation wells near Category I Structures or Pipelines supported on plant fill exceed those for normal operating conditions as defined by your answeer to Question (a) what action will be taken? In the event that the water level in any of these observation wells exceeds elevation 610, what action will be taken?

(c) Where will the observation wells in the plant fill area be located that will be monitored during the plant lifetime? At what depths will the screened intervals be? Will the combination of (1) screened interval in cohesionless soil and (2) demonstration of timely response to changes in cooling pond level prior to drawdown be made a condition for selecting the observation wells? Under what conditions will the alarm mentioned on page 24-20 be triggered? What will be the response to the alarm? A worst case test of the completed permanent dewatering and groundwater level monitoring systems could be conducted to determine whether or not the time required to accomplish shutdown and cooling is available. This could be done by shutting off the entire dewatering system when the cooling pond is at elevation 627 and determining the water level versus time curve for each observation well. The test should be continued until the water level under Category I structure, whose foundations are potentially liquefiable, reaches elevation 610 (the normal water level) or the sum of the time intervals allotted for repair and the time interval needed to accomplish shutdown (should the repair prove unsuccessful) has been exceeded, whichever occurs first. In view of the heterogeneity of the fill, the likely variation of its permeability and the necessity of making several assumptions in the analysis which was presented in the applicant's response to Question 24a, a full-scale test should give more reliable information on the available time. In view of the above the applicant should furnish his response to the following:

If a dewatering system failure or degradation occurs, in order to assure that the plant is shutdown by the time water level reaches elevation 610, it is necessary to initiate shutdown earlier. In the event of a failure of the dewatering system, what is the water level or condition at which shutdown will be initiated? How is that condition determined? An acceptable method would be a full-scale worst-case test performed by shutting off the entire dewatering system with the cooling pond at elevation 627 to determine, at each Category I Structure deriving support from plant fill, the water level at which a sufficient time window still remains to accomplish shutdown before the water rises to elevation 610. In establishing the groundwater level or condition that will trigger shutdown, it is necessary to account for normal surface water inflow as well as groundwater recharge and to assume that any additional action taken to repair the dewatering system, beyond the point in time when the trigger condition is first reached, is unsuccessful.

(2) As per applicant response to NRC Question 24 (10 CFR 50.54f) the design of the permanent dewatering system is based upon two major findings: (1) the granular backfill materials are in hydraulic connection with an underlying discontinuous body of natural sand, and (2) seepage from the cooling pond is restricted to the intake and pump structure area, since the plant fill south of Diesel Generator Building is an effective barrier to the inflow of the cooling pond water. However, soil profiles (Figure 24-2 in the "Response to NRC Requests Regarding Plant Fill"), pumping test time-drawdown graphs (Figure 24-14), and plotted cones of influence (Figure 24-15) indicate that south of Diesel Generator Building, the plant fill material adjacent to

the cooling pond is not an effective barrier to inflow of cooling pond water. The estimated permeability for the fill material as reported by the applicant is 8 feet/day and the transmissivities range from 29 to 102 square feet/day. Evaluate and furnish for review the recharge rate of seepage through the fill materials from the south side of the Diesel Generator Building on the permanent dewatering system. This evaluation should especially consider the recovery data from PD-3 and complete data from PD-5.

(3) The interceptor wells have been positioned along the northern side of the Water Intake Structure and service water pump structures. The calculations estimating the total groundwater inflow indicate the structures serve as a positive cutoff. However, the isopachs of the sand (Figures 24-9 and 24-10) indicate 5 to 10 feet of remaining natural sands below these structures. The soil profile (Figure 24-2) neither agrees nor disagrees with the isopachs. The calculations for total flow, which assumed positive cutoff, reduced the length of the line source of inflow by 2/3. The calculations for the spacing and positioning of wells assumed this reduced total flow is applied along the entire length of the structures. Clarify the existence of seepage below the structures, present supporting data and calculations, and reposition wells accordingly. Include the supporting data such as drawdown at the interceptor wells, at midway location between any two consecutive wells, and the increase in the water elevations downstream of the interceptor wells. The presence of structures near the cooling pond appears to have created a situation of artesian flow through the sand layer. Discuss why artesian flow was not considered in the design of the dewatering system.

(4) Provide construction plans and specification of permanent dewatering system (location, depths, size and capacity of wells, filterpack design) including required monitoring program. The information furnished in response of NRC Question 24 (10 CFR 50.54f) is not adequate to evaluate the adequacy of the system.

(5) Discuss the ramifications of plugging or leaving open the weep holes in the retaining wall at the Service Water Building.

(6) Discuss in detail the maintenance plan for the dewatering system.

(7) What are your plans for monitoring water table in the control tower area of the Auxiliary Building?

(8) What measures will be required to prevent incrustation of the pipings of the dewatering system. Identify the controls to be required during plant operation (measure of dissolved solids, chemical controls). Provide basis for established criteria in view of the results shown on Table 1, page 23 of tab 147.

(9) Upon reaching a steady state in dewatering, a groundwater survey should be made to confirm the position of the water table and to insure that no perched water tables exist.

Dewatering of the site should be scheduled with a sufficient lead time before plant start up so that the additional settlement and its effects (especially on piping) can be studied. Settlement should be closely monitored during this period.

Provide your plans for conducting this groundwater survey.

N/A

j. Liquefaction Potential.

An independent Seed-Idriss Simplified Analysis was performed for the fill area under the assumption that the groundwater table was at or below elevation 610. For 0.19 g peak ground surface acccceleration, it was found that blow counts as follows were required for a factor of safety of 1.5:

Elevation ft	Minimum SPT Blow Count*[1] For F.S. = 1.5
610	14
605	16
600	17
595	19

The analysis was considered conservative for the following reasons (a) no account was taken of the weight of any structure, (b) liquefaction criteria for a magnitude 6 earthquake were used whereas an NRC memorandum of 17 Mar 80 considered nothing larger than 5.5 for an earthquake with the peak acceleration level of 0.19 g's, (c) unit weights were varied over a range broad enough to cover any uncertainty and the tabulation above is based on the most conservative set of assumptions. Out of over 250 standard penetration tests on cohesionless plant fill or natural foundation material below elevation 610, the criteria given above are not satisfied in four tests in natural materials located below the plant fill and in 23 tests located in the plant fill. These tests involve the following borings:

SW3, SW2, DG-18, AX 13, AX 4, AX 15, AX 7, AX 5, AX 11, DG 19, DG 13, DC 7, DG 5, D 21, GT 1, 2.

Some of the tests on natural material were conducted at depths of at less than 10 ft before approximately 35 ft of fill was placed over the location. Prior to comparison with the criteria these tests should be multiplied by a factor of about 2.3 to account for the increase in effective overburden pressure that results from the placement and future dewatering of the fill.

1*For M = 7.5, blow counts would increase by 30%.

Of the 23 tests on plant fill which fail to satisfy the criteria, most are near or under structures where remedial measures alleviating necessity for support from the fill are planned. Only 4 of the tests are under the Diesel Generator Building (which will still derive its support from the fill) and 3 others are near it. Because these locations where low blow counts were recorded are well separated from one another and are not one continuous stratum but are localized pockets of loose material, no failure mechanism is present.

In view of the large number of borings in the plant fill area and the conservatism adopted in analysis, these few isolated pockets are no threat to plant safety. The fill area is safe against liquefaction in a Magnitude 6.0 earthquake or smaller which produces a peak ground surface acceleration of 0.19 g or less provided the groundwater elevation in the fill is kept at or below elevation 610.

48. X. Seismic analysis of structures on plant fill material.

(1) Category I Structures. From Section 3.7.2.4 of the FSAR it can be calculated that an average V_s of about 1350 ft/sec was used in the original dynamic soil structure interaction analysis of the Category I structures. This is confirmed by one of the viewgraphs used in the 28 February Bechtel presentation. Plant fill V_s is clearly much lower than this value. It is understood from the response to Question 13 (10 CFR 50.54f) concerning plant fill that the analysis of several Category I structures are underway using a lower bound average V_s = 500 ft/sec for sections supported on plant fill and that floor response spectra and design forces will be taken as the most severe of those from the new and old analysis. The questions which follow are intended to make certain if this is the case and gain an understanding of the impact of this parametric variation in foundation conditions.

(a) Discuss which Category I structures have been and/or will be reanalyzed for changes in seismic soil structure interaction due to the change in plant fill stiffness from that envisioned in the original design. Have any Category I structures deriving support from plant fill been excluded from reanalysis? On what basis?

(b) Tabulate for each old analysis and each reanalysis, the foundation parameters (v_s, ν and ρ) used and the equivalent spring and damping constants derived therefrom so the reviewer can gain an appreciation of the extent of parametric variation performed.

(c) Is it the intent to analyze the adequacy of the structures and their contents based upon the envelope of the results of the old and new analyses? For each structure analyzed, please show on the same plot the old, new, and revised enveloping floor response spectra so the effect of the

changed backfill on interior response spectra predicted by the various models can be readily seen.

(2) Category I retaining wall near the southeast corner of the Service Water Structure. This wall is experiencing some differential settlement. Boring information in Figure 24-2 (Question 24, Volume 1 Responses to NRC Requests Regarding Plant Fill) suggests the wall is founded on natural soils and backfilled with plant fill on the land side. Please furnish details clarifying the following:

(a) Is there any plant fill underneath the wall? What additional data beyond that shown in Figure 24-2 support your answer?

(b) Have or should the design seismic loads (FSAR Figure 2.5-45) be changed as a result of the changed backfill conditions?

(c) Have or should dynamic water loadings in the reservoir be considered in the seismic design of this wall? Please explain the basis of your answer.

5. In your response for the comments and questions in paragraph 4 above, if you feel that sufficiently detailed information already exists on the Midland docket that may have been overlooked, please make reference to that information. Resolution of issues and concerns will depend on the expeditious receipt of data mentioned above. Contact Mr. Neal Gehring at FTS 226-6793 regarding questions.

FOR THE DISTRICT ENGINEER:

P. McCALLISTER
Chief, Engineering Division

? RO, ANSI

NRC Dep. Ex # 1
(Keeley 10-23-80)

Dec 1973

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

LBP-74-71

ATOMIC SAFETY AND LICENSING BOARD

Michael L. Glaser, Chairman
Lester Kornblith, Jr., Member
Emmeth A. Luebke, Member

In the Matter of

CONSUMERS POWER COMPANY

(Midland Plant,
Units 1 and 2)

Construction Permit
Nos. 81 and 82
(Show Cause)

September 25, 1974

INITIAL DECISION

Appearances

Michael I. Miller, Esq., and R. Rex Renfrow III, Esq., of Isham, Lincoln, and Beale; Judd Bacon, Esq., and Paul Koval, Esq., of Consumers Power Company; and Harold F. Reis, Esq., and J. A. Bouknight, Esq., of Newman, Reis and Axlerad for Consumers Power Company

Laurence M. Scoville, Jr., Esq., P. Robert Brown, Jr., Esq., Bartholomew P. Molloy, Esq., and Richard C. Marsh, Esq., of Clark, Klein, Winter, Parsons & Prewitt for Bechtel Power Corporation and Bechtel Associates Professional Corporation

John Gerold Gleeson, Esq., and Leslie F. Nute, Esq., for The Dow Chemical Company

Myron M. Cherry, Esq., for Saginaw-Sierra Intervenors

James P. Murray, Esq., and Roy E. Kinsey, Jr., Esq., for AEC Regulatory Staff

I. INTRODUCTION AND BACKGROUND

1. On December 3, 1973, Consumers Power Co. (Consumers), by Order to Show Cause, was ordered, by the Atomic Energy Commission's Director of Reg.

Regulation, to show cause why all activities under Construction Permit Nos. 81 and 82 for the Midland facilities, Midland Plant, Units 1 and 2, should not be suspended pending a showing by Consumers that it was in compliance with the AEC's regulations governing quality assurance, and that it would continue to comply with such regulations throughout construction. Consumers was granted construction permits Nos. 81 and 82 for the Midland Units by Initial Decision of an Atomic Safety and Licensing Board issued on December 14, 1972. This Initial Decision was ultimately affirmed by the Atomic Safety and Licensing Appeal Board (Appeal Board) after a series of decisions[1] on exceptions taken by certain of the parties to the construction permit hearing proceedings.[2]

2. During the review process, the Appeal Board, because of the history of the failure of Consumers and its architect-engineer, Bechtel Corp., to observe required quality assurance practices and procedures, imposed certain conditions[3] on Consumers relating to Consumers' quality assurance program. These conditions, which the Appeal Board termed as a "predicate for the permits now to remain in effect," called for Consumers to file periodic reports, either with the Appeal Board or Staff, on Consumers quality assurance activities. The Appeal Board requested that, for its information, copies of all reports required to be filed with the Staff be forwarded to the Appeal Board by the Staff on a timely basis, together with any comments that the Regulatory Staff may have. The Appeal Board also indicated it desired to receive Staff comments on the report required to be filed directly with the Appeal Board, and these comments were requested to include the results of any Staff inspection of Consumers. The Appeal Board also indicated it would closely monitor the activities of Consumers and its architect-engineer, Bechtel Corp., with respect to Consumers' quality assurance program. These specific conditions were set forth in the Appeal Board's decision of March 26, 1973 (ALAB-106, *supra*).

A. The December 3, 1973, Order to Show Cause

3. The Order to Show Cause issued by the Director of Regulation specified several instances of non-compliance with quality assurance requirements. More specifically, the Order to Show Cause stated that Commission inspections had revealed Consumers' nonconformance with quality assurance program requirements involving concrete work, had revealed inadequate record-keeping, and had revealed serious deficiencies associated with Cadwelding operations. Cadwelding

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[1] *In re* Consumers Power Company (Midland Plant, Units 1 and 2): ALAB-100, RAI-73-2, 58 (Feb. 12, 1973); ALAB-101, RAI-73-2, 58 (Feb. 20, 1973); ALAB-106, RAI-73-3, 182 (Mar. 26, 1973); ALAB-115, RAI-73-4, 257 (Apr. 17, 1973); ALAB-123, RAI-73-5, 331 (May 16, 1973); ALAB-132, RAI-73-6, 431 (June 28, 1973); ALAB-147, RAI-73-9, 636 (Sept. 18, 1973); ALAB-152, RAI-73-10, 816 (Oct. 5, 1973); ALAB-160, RAI-73-11, 1002 (Nov. 26, 1973).

[2] ALAB-152, *supra*.

[3] ALAB-106, *supra* at 186.

is a process for fusing together metal bars used in reinforced concrete construction, and represents a critical step in construction of the Midland facility. The Order to Show Cause also referred to a memorandum, dated November 26, 1973, from the Atomic Safety and Licensing Appeal Board to the Director of Regulation, which pointed to certain deficiencies in Consumers' implementation of its quality assurance program, and urged that appropriate enforcement action be taken against Consumers. The Appeal Board also referred to the conditions it had imposed on Consumers in ALAB-106, and the history of the failure of Consumers and its architect-engineer to observe required quality assurance practices and procedures. The Director of Regulation indicated that the Appeal Board memorandum warranted examination of whether Consumers would comply with required quality assurance requirements throughout the construction process. Thus, the December 3 Order suspended all Cadwelding operations at the Midland plant site, pending further order and determination by the Director of Regulation.

4. Thereafter, Consumers answered the Order to Show Cause, claiming compliance with AEC quality assurance regulations, and urging that the Order to Show Cause be dismissed. On December 24, the Saginaw-Sierra Intervenors (Saginaw), intervenors to the Commission's construction permit hearing proceedings involving the Midland facilities, requested a hearing on the Order to Show Cause. On December 17, 1973, as a result of a special inspection, the Director of Regulation issued a Modification of Order to Show Cause, which lifted the suspension of Cadwelding activities at the Midland plant site. The Modification, however, provided that all other provisions of the December 3, 1973, Order to Show Cause would remain in effect. On December 18, 1973, the Saginaw filed a petition to revoke the construction permits.

B. The Commission's January 21, 1974, Order for Hearing

5. On January 21, 1974, the Commission issued a Memorandum and Order denying Saginaw's petition to revoke, denying Consumers' Motion to dismiss, and granting Saginaw's request for hearing. The Commission specified the following issues to be decided by this Atomic Safety and Licensing Board (Board):

(1) Whether the licensee is implementing its quality assurance program in compliance with Commission regulations; and

(2) Whether there is a reasonable assurance that such implementation will continue throughout the construction process.

The Commission directed this Board to determine whether Consumers' construction permits should be modified, suspended or revoked, or whether other action is warranted by the record, in the event either of the two issues was decided adversely to Consumers. Consumers, Saginaw, Dow Chemical Company (Dow), and the Regulatory Staff were made parties to the

proceeding. Bechtel Professional Corporation and Bechtel Power Corporation (Bechtel), Consumers' architect-engineer for the Midland facilities, filed a petition for intervention.

C. The Procedural Background of this Board's Conduct of Hearing

6. An initial prehearing conference was held in Chicago, Illinois.[4] The Board granted Bechtel's petition, and permitted it to participate as a party.[5] The Regulatory Staff announced that it no longer supported entry of an order which would suspend, modify or otherwise alter Consumers' construction permits.[6] The Staff's announced position effectively placed Saginaw as the only party to the proceeding supporting modification of Consumers' permits. At this prehearing conference, however, the Board ruled that Consumers had the ultimate burden of proof, and was required to demonstrate why its construction permits should not be suspended, revoked or otherwise modified.[7]

7. The Board also indicated that the two issues specified in the Commission's January 21, 1973, Memorandum and Order covered construction activities beyond the Cadwelding activities which had precipitated the Order to Show Cause,[8] but that the hearing was limited to construction of nuclear power plants as opposed to operation.[9]

8. At this initial prehearing conference, counsel for Saginaw informed the Board that he would be unable to proceed in the active representation of his clients' interests unless he received financial assistance from the Commission. Accordingly, counsel for Saginaw indicated he would file a petition with the Commission within a few days requesting counsel and witness fees.[10]

9. Counsel for Dow informed the Board that his client would not actively participate in the Show Cause proceeding.[11]

10. The Board informed all parties that it would require written testimony and a trial brief be filed with the Board prior to the hearing in connection with the matters proposed to be addressed by evidence,[12] and adopted a procedural

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[4] The Board held the prehearing conference, as well as a subsequent prehearing conference on May 30, 1974, in Chicago, to accommodate counsel for the Saginaw Group, who had indicated that his appearance at any other location would be inconvenient, and would work a financial hardship on Saginaw, Tr. 25.

[5] Tr. 20.

[6] Tr. 32-33, 48-49.

[7] Tr. 68.

[8] Tr. 43.

[9] Tr. 68.

[10] Counsel first indicated he would file such petition with the Board. The Board, however, advised counsel that it had no jurisdiction to act on such petition, and suggested that the petition be filed with the Commission, Tr. 28, 83.

[11] Tr. 31.

[12] Tr. 56-58, 77-83.

schedule for the proceeding. The date of June 25, 1974, was established for commencement of hearing.

11. On April 22, 1974, counsel for Saginaw, Consumers and Bechtel served sets of interrogatories on the various parties to the proceeding, including the Staff. In addition, both Consumers and Bechtel served a Request to Admit Facts on the Staff, and a Notice of Deposition on Saginaw.

12. On May 10, 1974 the Board determined that answers to certain of the interrogatories served on the Staff by Saginaw were necessary to a proper decision in the proceeding and were not reasonably obtainable from any other source. Thus, pursuant to Section 2.718(i) of the Commission's Rules of Practice,[13] we certified to the Commission the question of whether these interrogatories should be answered by the Staff. In our certification, we expressed the view that the attitude of Consumers, especially that of senior management personnel, toward compliance with Commission regulations and license requirements was relevant and material to the resolution of the issue of future compliance, and recommended that the Staff be required to provide whatever available information it may possess respecting Consumers' licensed activities which might reflect upon Consumers' attitude toward compliance with Commission regulations and license requirements. Without awaiting a Commission ruling, on May 22, 1974, the Staff answered the interrogatories which the Board had certified. The Board's ruling with respect to the scope of permissible discovery was subsequently applied to the objections of Consumers to Saginaw's discovery request.

13. On May 10, 1974, the Board also denied Saginaw's Motion for an Extension of Time to file a request for the production of documents. This order was based upon the representation of Consumers that it had voluntarily made available to Saginaw for inspection and copying all documents referenced in Consumers' answers to interrogatories.

14. It was not until May 11, 1974 that counsel for Saginaw filed a Verified Petition and Motion to the Atomic Energy Commission for Expert Witnesses' Fees and Attorneys' Fees. The petition stated that unless such fees were forthcoming, Saginaw would be unable to participate in a meaningful manner in this proceeding,[14] and alleged that the participation of Saginaw was necessary for an adequate airing of the issues and explanation of the facts.[15]

15. On May 22, 1974, all parties, except Saginaw, filed answers to interrogatories which were directed to them by other parties. On May 21, 1974, the day before answers to interrogatories were due from each party, Saginaw filed several motions which, in substance, requested an extension of the

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[13] 10 CFR § 2.718(i) (1974).

[14] In the Matter of Consumers Power Company (Midland Plant, Units 1 and 2), Verified Petition, at pp. 2, 5(May 11, 1974).

[15] *Id.* at p. 7.

discovery period. These requests were premised on the fact that the Commission had not acted upon Saginaw's petition for fees which had been filed 10 days earlier.

16. On May 30, 1974, the Board held a second prehearing conference in Chicago, Illinois. After hearing oral argument, the Board denied Saginaw's several requests, including a motion for continuance pending a Commission decision on Saginaw's petition for fees. The Board, however, gave Saginaw leave to renew its motion for continuance in the event a favorable ruling on its petition was forthcoming from the Commission.[16] The Board ordered Saginaw to answer interrogatories served upon it by June 5, 1974.[17] The Board also reiterated its earlier ruling on the burden of proof, but accorded Consumers until June 10, 1974, to present the Board with a memorandum of law on the burden of proof in an administrative show cause proceeding.[18]

17. The Board also adopted a revised schedule for the proceeding, as follows:

A. Discovery to close on June 17, 1974;

B. Written testimony from all parties due on June 28, 1974;

C. Trial briefs due on July 8, 1974; and

D. Hearing to commence in Midland, Michigan, on July 16, 1974.[19]

18. On June 5, 1974, Saginaw filed its answers to the interrogatories propounded by Consumers and Bechtel. Shortly thereafter, Consumers filed a Motion to Compel Answers to Interrogatories, on the ground that the answers of Saginaw were unresponsive and incomplete.[20] The Board granted this motion,[21] but Saginaw did not respond.

19. On June 5 and 6, 1974, Bechtel and Consumers filed with the Commission responses to Saginaw's petition for fees, requesting that the petition be denied. The Staff filed its answer to Saginaw's petition for fees on June 10, 1974.

20. On June 10, 1974, Consumers also filed a "Motion to Impose the Burden of Proof on the Proponent of an Order Suspending, Revoking or Otherwise Modifying Construction Permit Nos. 81 and 82", in which Consumers argued that the proponent of an order modifying the construction permits bears the ultimate burden of proof. On June 12, 1974, Bechtel filed a brief in support of Consumers' motion, arguing that the burden of proof in this proceeding should properly be placed on the Staff and/or Saginaw. On June 18, 1974, the Staff also responded by stating that the burden of proof lay with the proponent of the Order to Show Cause. Saginaw filed no response.

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[16] Tr. 116.
[17] Tr. 115.
[18] Tr. 114, 135-136, 139.
[19] Tr. 128, 133.
[20] Tr. 157.
[21] Tr. 158.

21. On June 28, 1974, Consumers, Bechtel and the Staff filed written testimony and exhibits with the Board and other parties. Saginaw filed no written testimony. On this date, the Board also initiated a conference call to all counsel, and advised them that the Board, upon considering Consumers' motion to change the burden of proof, had reversed its earlier ruling with respect to burden of proof, and was placing the burden of proof on the Staff and Saginaw.[22]

22. On July 8, 1974, trial briefs were filed by Consumers, Bechtel and the Staff. No trial brief was filed by Saginaw, despite a specific order to do so from the Board at the May 30, 1974, prehearing conference:

> If you have no witnesses, your trial brief ought to reflect that fact, or if you don't have a direct case, other than the case you make in cross-examination, you should indicate this in your trial brief. We would want something from you along these lines.[23]

23. On July 9, 1974, the Board placed another conference call to counsel for all parties, for the express purpose of determining whether Saginaw intended to go forward with a presentation, or otherwise appear, at the evidentiary hearing. Counsel for Saginaw advised the Board and the other parties that he would not be participating on behalf of Saginaw, unless the Commission were to grant his petition for fees.

24. On July 10 1974, the Commission issued a Memorandum and Order denying the Saginaw petition for fees. The Commission concluded that the petition must be denied for lack of a proper showing of need.[24]

25. On July 10, 1974, the Board placed another conference call to counsel for the parties to determine whether Saginaw's counsel or Saginaw, in view of the Commission's July 10, 1974, Memorandum and Order,[25] intended to go forward. Counsel for Saginaw advised the Board that he would not be present at the evidentiary hearings. However, counsel did indicate he would participate further in the proceedings to the extent of filing proposed findings of fact and conclusions of law, as well as a memorandum requesting the Board to take official notice of certain documents Saginaw intended to rely upon to carry its burden.[26]

26. On July 10, 1974, the Board issued its written Memorandum and Order ruling that the burden of proof in this proceeding was on the Staff and Saginaw to the extent that these parties desired that Construction Permit Nos. 81 and 82 be modified or revoked.

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[22] Tr. 124-125.

[23] Tr. 152.

[24] Memorandum and Order, RAI-74-7, 1(July 10, 1974).

[25] See n. 24, *supra*.

[26] Tr. 153.

27. On July 16, 1974, the Commission issued a Memorandum and Order[27] on the question certified to it on May 14, 1974, concerning whether or not the Staff was required to answer Saginaw's interrogatories. The Commission ruled that the Staff should answer all interrogatories with respect to which the Board had determined that answers were necessary to a proper decision, and were not reasonably obtainable from any other source. As we have noted, these answers had already been provided by the Staff on May 22, 1974.

28. On July 16, 1974, pursuant to a *Notice and Order for Commencement of Evidentiary Hearing*[28] dated June 17, 1974, the evidentiary hearing commenced in Midland, Michigan, and continued through July 18, 1974. All of the parties to the proceeding were present except for Saginaw. Each of the other parties presented testimony and participated in cross-examination. The Board required both Consumers and the Staff to present witnesses[29] in addition to those who had submitted prepared testimony. The Board also questioned various witnesses that had been presented.

29. The Staff presented four witnesses—Mr. Walter E. Vetter, the technical assistant to the Director of Directorate of Regulatory Operations, Region III; Mr. Roger Rohrbacher, Principal Reactor Inspector for Directorate of Regulatory Operations, Region III; Mr. Cordell C. Williams, Reactor Inspector for Directorate of Regulatory Operations, Region III; and Mr. Dolphus E. Whitesell, Reactor Inspection Specialist for Directorate of Regulatory Operations.

30. In addition, Mr. James G. Keppler, the Director of Directorate of Regulatory Operations, Region III, appeared and gave testimony at the specific request of the Board.

31. Consumers presented four witnesses, including Mr. Russell C. Youndahl, Senior Vice President, and Mr. Stephen H. Howell, Vice President. The Board requested that Consumers make available Mr. Ralph Sewell, Nuclear Licensing Administrator for Consumers, to answer the Board's questions concerning statements he had given to the Directorate of Regulatory Operations in connection with an investigation of Consumers' Palisades facility.

32. Bechtel presented ten witnesses, as well as a panel comprised of five persons.

33. Neither Saginaw's counsel nor anyone representing Saginaw appeared at the evidentiary hearing.

34. Following the Staff's direct case, and after no evidence was offered by Saginaw, Consumers moved:

(1) That the Board issue an order holding that Saginaw was in default under 10 CFR §2.707; and

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[27] Memorandum and Order, RAI-74-7, 4 (July 16, 1974).
[28] 39 *Fed. Reg.* 22447.
[29] Tr. 155, 439.

(2) That the proceeding be dismissed, since the burden of proof had not been met.[30]

The Board denied this motion.[31] The Board also indicated it would give Saginaw until July 25, 1974, to file its memorandum requesting official notice to be taken of certain documents.[32] At the close of the evidentiary hearings on July 18, 1974, Consumers renewed its motion to hold Saginaw in default and to dismiss the proceeding on the grounds that the burden of proof had not been met.[33] The Board indicated it would take this renewed motion under advisement.[34] Our ruling on this motion is set forth below.

35. On July 25, 1974, the Board, having received no memorandum from Saginaw, issued an Order closing the record. Proposed findings of fact and conclusions of law were submitted by Consumers and Bechtel jointly, and by the Staff, on the specified date of August 12, 1974. No reply findings were filed. Saginaw did not file proposed findings of fact or conclusions of law. However, Saginaw filed a "Motion" on August 12, 1974, requesting a two-week extension in the deadline to file proposed findings. The Board denied the "Motion" for lack of good cause shown. Saginaw renewed its "Motion" on August 26, 1974, and the Board again denied it for lack of good cause shown.

D. Consumers' Renewed Motion

36. The Board has considered Consumers' renewed motion to hold Saginaw in default, and to dismiss this proceeding on the grounds that the burden of proof has not been met. We deny this motion. While there appears to be ample precedent for this Board to grant Consumers' motion, the Board believes that in the circumstances here present, a determination is warranted on the record respecting Consumers' compliance with Commission quality assurance requirements and the implementation of Consumers' quality assurance program. Indeed, we would not have ordered hearings to proceed were it not for the fact that the Board believed substantial public interest questions existed regarding Consumers' compliance with Commission quality assurance requirements and Consumers' implementation of its quality assurance program.

II. FINDINGS OF FACT

A. Issue No. 1

Whether the licensee is implementing its quality assurance program in compliance with Commission regulations.

[30] Tr. 429-438.
[31] Tr. 432.
[32] Tr. 590-593.
[33] Tr. 705.
[34] Tr. 707.

37. The first issue is whether Consumers is implementing its Quality Assurance Program in compliance with the Commission's regulations. The regulations governing quality assurance are set forth in 10 CFR Part 50, Appendix B. Although the language of Appendix B has not been amended in any significant way since it originally became effective on July 27, 1970,[35] the interpretation of its requirements has been changing in an evolutionary process over the years. Licensee compliance with the Appendix has been evaluated by the Staff consistent with the interpretation which was in effect at the time of evaluation.

38. The function of the Directorate of Regulatory Operations, as it relates to this case, is to conduct field inspections of the activities of Consumers (and its contractors) to obtain, by means of selective sampling inspections, reasonable assurance that licensed activities are in accord with the AEC's requirements[36] and are not, or will not be, inimical to the health and safety of the public. This function, which in this case is carried out by personnel of the Region III Office in Glen Ellyn, Illinois, is executed in accordance with guidelines provided by the Directorate of Regulatory Operations Headquarters Staff by experienced and knowledgeable Regional Office inspectors, assisted by various specialists and consultants. The principal activities by these personnel with respect to the Midland facility have included:

(a) Examination of Consumers' and its contractor's QA and QC programs to compare the requirements and controls actually imposed by Consumers with commitments made to the Commission;

(b) Inspections of quality control records;

(c) Observations of construction work in progress; and

(d) Selective examinations of construction procedures.[37]

39. Limited preconstruction permit activities at the Midland site commenced under an AEC exemption issued in July of 1970 and were suspended by Consumers in November, 1970, when extensive delays in issuance of a Construction Permit became apparent. Construction was resumed in June, 1973, and has continued, with the brief suspension discussed herein, to the present.[38] Quality assurance activities, both by Consumers and by the Regulatory Staff, however, began even before the start of construction in 1970.

40. The Midland Preliminary Safety Analysis Report (PSAR) was issued on January 13, 1969. Appendix 1B of the PSAR (which predated Appendix B of 10 CFR Part 50) was a very brief description of the Quality Assurance Program for

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[35] 35 *Fed. Reg.* 10498.

[36] These requirements are found in the construction permit, the application, the provisions of the Atomic Energy Act, and the rules and regulations of the Commission (Tr. 185).

[37] Tr. 184-188; 341-342; 347-351; 357-366.

[38] Testimony of Howell, following Tr. 485, pp. 6-7, 13.

the proposed facility.[39] Amendment No. 4 to the PSAR was issued on October 2, 1969, subsequent to the publication[40] on April 17, 1969, of the proposed Appendix B. This amendment was a complete revision of the original quality assurance program.[41] Amendment No. 6 to the PSAR was issued on December 29, 1969, to respond to the Commission's request for a description of the manner in which the Midland Quality Assurance Program would be implemented. Amendment No. 8 was issued on February 9, 1970, to provide, pursuant to the Commission's request, documentation of interface responsibilities during design, procurement, construction and pre-operational testing. These amendments provided more details than described in the initial issuance of Appendix 1B and spelled out more specifically the responsibilities of Consumers, Bechtel, and B&W and the interfaces between these organizations.[42] During 1970, the Directorate of Regulatory Operations (RO), then the Division of Compliance, carried out a number of inspections. During the period September 29 to October 1, 1970, shortly before Consumers' suspension of construction, RO conducted a site inspection during which deficiencies relating to the placement of concrete were identified. Consumers and Bechtel evaluated the findings and took the actions they considered appropriate.[43] RO was not able at that time to complete its inspection and evaluation of these corrective actions because of the cessation of construction. Re-inspection of these activities, however, did not occur in September 1973.[44]

41. During the 1970 -1973 suspension of construction, Consumers and Bechtel made numerous changes in the Quality Assurance Programs, some for internal reasons and some in response to the AEC's developing interpretation of Appendix B.[45] After resumption of construction, inspections continued. In some cases deficiencies in the Quality Assurance Program were found and corrective actions taken.[46] On December 3, 1973, the Director of Regulation issued the Order to Show Cause, identifying three specific examples which indicated a possible failure of Consumers to implement its Quality Assurance Program in compliance with Commission regulations. These examples, each of which is discussed below, were:

(a) Inspections occurring on September 29–October 1, 1970, revealed several instances of Consumers' non-conformance with quality assurance program requirements involving concrete work. These matters were discussed by the Appeal Board in its Memorandum and Order of March 26, 1972

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[39] Licensee's Exhibit K-5.
[40] 34 *Fed. Reg.* 6599.
[41] Licensee's Exhibit K-6.
[42] Testimony of Keeley, following Tr. 458, pp. 8-14.
[43] *Id.* at p. 14.
[44] Tr. 266-268.
[45] Keeley, pp. 14-19; Howell, pp. 8-13.
[46] Keeley, pp. 19-35.

(ALAB-106), in which the Appeal Board imposed certain additional conditions on Consumers with respect to its quality assurance program;

(b) Inspections conducted on September 10, 11 and 27, 1973, revealed several additional violations of 10 CFR Part 50, Appendix B, Criteria II and V, involving inadequate record keeping procedures relating to quality assurance and unavailability of certain quality assurance records; and

(c) Inspections conducted on November 6-8, 1973, identified serious deficiencies associated with Cadweld splicing of concrete reinforcing bars. These constitute violations of 10 CFR Part 50, Appendix B, Criteria II, V, XIII, XV and XVII.[47]

Concrete Placement

42. On September 29 and 30, and on October 1, 1970, RO conducted the site inspection, mentioned *supra*, during which they found certain deficiencies in concrete placement activities, including the improper use of vibrators.[48] Immediately following this RO inspection, Consumers and Bechtel evaluated the findings and took the following corrective action:

(a) Bechtel committed itself to review the applicable ASTM specification regarding concrete sampling;[49]

(b) Bechtel established a special crew of craft personnel to do the vibrator work. This crew had been trained in the proper use of vibrators;[50]

(c) Bechtel assigned a Quality Control Engineer to full-time monitoring of all Q list concrete pours;[51]

(d) Consumers field personnel were instructed to provide increased surveillance during concrete pours to insure compliance with established requirements, including taking of samples, and additional documentation was required to transport between the batch plant and the pour location.[52]

43. Although construction at the Midland site was by then suspended, RO conducted an inspection at the job site on January 6-7, 1971. At that time, the inspectors were informed of the corrective action undertaken by Consumers and Bechtel regarding the concrete deficiencies noted in the previous RO inspection. However, due to the fact that construction had been halted, the inspectors were not able to observe implementation of the corrective action and, therefore, informed Consumers that these items would remain in the follow-up status until

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[47] In the matter of *Consumers Power Company* (Midland Plant, Units 1 and 2), Order to Show Cause, December 3, 1973.

[48] *Id.* at p. 14.

[49] Licensee's Exhibit CP-2.

[50] *Id.*

[51] *Id.*

[52] Keeley, p. 14.

construction resumed and RO could verify that the corrective procedures had been implemented.[53]

44. Prior to the actual resumption of concrete activities in 1973, the Bechtel Quality Assurance group conducted a review of inspection reports and other documentation to determine whether or not further corrective action was required in order to satisfy the commitments made in 1970. As a result of this review, an intensive indoctrination and training program was implemented for personnel involved in placing and inspection of concrete work. This program contained, among other things, detailed instructions in the proper use of vibrators. Detailed inspection plans were developed and implemented and quality assurance personnel were instructed to promptly identify and to take necessary actions to correct any discrepancies noted during concrete operations. In addition, Bechtel assigned a Quality Control representative to full-time monitoring of test lab activities. Additional training and indoctrination requirements for Quality Control personnel were established, and the Bechtel specification governing testing of concrete was updated to the latest revisions of industry codes and standards.[54]

45. On September 5-7, 1973, at its first inspection following re-activation of construction at the Midland Plant, RO observed the corrective action relative to the concrete deficiencies. RO determined that the deficiencies had been corrected but that certain of these activities would be further observed in subsequent inspections.[55] This was finally considered by RO to be resolved as a result of an inspection on March 6-7, 1974.[56]

Record Keeping Procedures

46. On September 10, 11 and 27, 1973, RO performed an inspection of Bechtel Engineering to evaluate compliance with the applicable quality assurance criteria for design and procurement activities at Midland. In its report of that inspection, RO cites deficiencies in documentation control procedures.[57] Although each of the discrepancies identified by RO had been previously identified by Bechtel's Quality Assurance Group and corrective action had been initiated,[58] Bechtel completed corrective action in each of the following areas:

(a) Retention of records common to areas affecting quality;

(b) Maintaining current drawings in the Project Engineering stick files;

(c) Procedures to prescribe control of interface activities between design groups;

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[53] Tr. 267-9; Licensee's Exhibit CP-2.

[54] Testimony of Dotson, following Tr. 597, pp. 18-20.

[55] Licensee's Exhibit CP-3.

[56] Licensee's Exhibit CP-19.

[57] Licensee's Exhibit CP-12.

[58] Bechtel's Exhibits Dotson-17, -18, -19, -20A, -20B, and -21.

(d) Procedures to prescribe control, issuance and changes to Bechtel's Internal Procedures Manual; and

(e) Amending the Nuclear Quality Assurance Manual to provide Project Engineering the flexibility to impose evolving quality assurance requirements on vendors.[59]

47. During its inspection of January 10-11, 1974, RO reviewed the actions taken to correct the deficiencies in the above areas and concluded that the corrective action taken was adequate and was being properly implemented.[60]

Cadweld Splicing

48. On November 1, 1973, the Bechtel Field Quality Assurance Engineer found several completed Cadweld splices from which the asbestos packing had not been completely removed.[61] He issued an open Quality Assurance Daily Log to the Bechtel Project Superintendent[62] which required corrective action prior to covering the Cadwelds with concrete.[63]

49. On November 6-8, 1973, RO carried out an inspection at the site that indicated to them that serious deficiencies existed with respect to Cadwelding. These deficiencies related to void measurement techniques and the associated acceptance criteria, the comprehensiveness of records to demonstrate correct performance of Cadwelding, and the adequacy of the existing procedures for proper control and documentation of Cadwelding activities. Mr. Vetter testified that as a result, the Staff, on November 9, requested in a telephone call to Consumers' Project Manager that Cadwelding be suspended pending corrective action and review by the Staff of the corrective action. The Project Manager responded that he, also, had felt that there had been major QA/QC problems associated with the Cadwelding, that a hold had been placed on the activities the previous day, that Consumers personnel had thoroughly reviewed the matter, and that, as a result of their subsequent actions, they felt that the hold should be lifted. He was informed that it was the Staff position that all existing Cadwelds should be re-inspected and requalified by properly qualified personnel and that a determination should be made by the regional office that an acceptable program for Cadwelding had been developed and implemented before work was resumed. Shortly afterwards, the Project Manager confirmed that the Cadwelding had been suspended in accordance with the Staff's request.[64]

50. As a result of that inspection, Consumers took a number of actions. In addition to requalifying the Cadwelds, Consumers undertook the following additional steps:

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[59] Dotson, pp. 23-28.
[60] Licensee's Exhibit CP-16; Tr. 327.
[61] Dotson, p. 5; Bechtel's Exhibit Dotson-2.
[62] Keeley, p. 28.
[63] Tr. 602.
[64] Tr. 188-190; 289-290; 317-321.

(a) An increase in the number of Consumers' Field Quality Assurance personnel from one, prior to the November 6-8 RO inspection, to four during the early part of December;

(b) Consumers' quality assurance personnel were provided with procedures requiring audits to determine that all safety-related activities would be accomplished in accordance with the requirements of 10 CFR 50, Appendix B and ANSI N45.2. In addition to these program type audits, Field Quality Assurance personnel were also provided procedures requiring verification, by actual observation, that Bechtel work and inspection Procedures for quality-related activities were being implemented;

(c) Consumers' field quality assurance personnel were made responsible for reviewing and approving all Bechtel Master Inspection Plans to determine whether these inspection plans adequately assure the quality of work function by providing adequate Quality Control acceptance parameters, adequate detail of the inspection function and adequate evidence that all quality-related activities were being properly observed and documented; and

(d) Procedures for regular meetings between Consumers' General Office personnel and Consumers Field Quality Assurance personnel were written and implemented. These procedures require one-day visits every two weeks by the Midland Quality Assurance Supervisor to the Midland Site, one-day visits every two months by Consumers' Director of Quality Assurance Services, and quarterly meetings between Consumers' Midland Quality Assurance Services personnel with the Vice President of Electric Plant Projects, the Director of Quality Assurance Services and members of the Midland Project Organization.[65]

51. Bechtel management also took steps to verify that the Cadwelds were of proper quality, to determine necessary revisions to the Bechtel Quality Assurance program for Midland and to insure that similar situations would not recur.[66] This action included:

(a) Development of more formalized procedures for specialized work processes;

(b) Requiring Quality Control Engineers to conduct quality acceptance and verification inspections;

(c) Implementation of an action program to provide more timely response to Quality Assurance/Quality Control findings;

(d) Qualification of Quality Control Engineers in accordance with written procedures covering qualifications, indoctrination, training, testing and certification in accordance with requirements of ANSI N45.2.6 and AEC Regulatory Guide 1.58; and

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[65] Keeley, pp. 29-30.

[66] Testimony of Yates, following Tr. 5770, pp. 10-11.

(e) Increased management and supervisory personnel attention including visits to the site at least twice per year by the Bechtel Vice President and Deputy Division Manager, San Francisco Power Division, each quarter by the Vice President and Area Manager of the Ann Arbor area office, and once every other month by the Ann Arbor Office Manager of Construction.[67]

Implementation of these actions was verified by Bechtel management[68] and directives were issued to re-emphasize Bechtel's commitment to Quality Assurance.[69]

52. Special inspections were carried out by the Staff at the site on November 20 and 21 and December 6 and 7, 1973, after Consumers had notified the Staff that necessary corrective actions had been completed. At the first of these inspections, the Staff found that, although substantial corrective action had been taken with respect to the specific Cadwelding problems, further action was necessary by Consumers with regard to its analysis of the implications of the Cadwelding problems to the overall implementation of the Midland quality assurance program. Although it appeared to the Staff that attention had been addressed to this latter matter, the Staff did not find adequate documentation of such action.[70]

53. The fact that the actions taken by Consumers and its contractors between November 9 and the November 20-21 inspection did not entirely fulfill the Staff's requirements appears to have resulted, at least in large part, from a lack of mutual understanding of what was required.[71] On November 21 the Staff further clarified its position to include the requirement that:

> Consumers Power Company ... demonstrate that the Midland quality assurance/quality control programs had been analyzed for shortcomings by Consumers Power Company and ... corrective action, indicated to be necessary as a result of [the] quality assurance/quality control program shortcomings analysis had been adequately prescribed.[72]

54. As a consequence of this clarification, Consumers formally documented its analysis of the programmatic aspects of the Cadweld deficiencies[73] and another RO inspection was scheduled for December 3, 1973. This inspection was subsequently cancelled by RO and Consumers was notified shortly thereafter of the issuance of the Order to Show Cause. The cancelled inspection was rescheduled and held on December 6 and 7, 1973.[74] During this inspection, RO concluded that the programmatic deficiencies, including management involve-

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[67] Bechtel's Exhibit Yates-5.
[68] Yates, pp. 10-11.
[69] *Id.*, Bechtel's Exhibits Yates-6, -7, and -8.
[70] Tr. 191, 290; 321-322.
[71] Tr. 191; 213-216; 222-225; 369-370; 509-511.
[72] Tr. 191.
[73] Howell, p. 19; Licensee's Exhibit K-7 and K-8.
[74] Howell, *id.*; Licensee's Exhibit CP-14.

ment, and special problems relating to Cadwelding at Midland had been satisfactorily resolved.

55. On December 13, a Memorandum was sent by Dr. Knuth (Director of Regulatory Operations) to Mr. Muntzing (Director of Regulation) recommending that the Order to Show Cause, which had been issued on December 3, 1973, be modified to permit Cadwelding activities to resume. The Order to Show Cause was so modified on December 17, 1973.[75]

56. An additional re-inspection was made on January 10 and 11, 1974, to determine the degree of implementation of the commitments made earlier, including those made in Consumers' answer to the Order to Show Cause. The Staff found that Consumers had taken appropriate action.[76]

57. Based upon the testimony of the witnesses presented by the Regulatory Staff and the testimony of Consumers' and Bechtel's witnesses, the Board finds that Consumers is implementing its quality assurance program in compliance with the Commission's regulations.

B. Issue No. 2

Whether there is a reasonable assurance that such implementation will continue throughout the construction process.

58. The second issue that must be decided by this Board is whether there is reasonable assurance that Consumers' implementation of its quality assurance program in compliance with Commission regulations will continue throughout the construction process. The Board has analyzed the evidence of record and has classified such evidence into three general areas, which it believes will be useful in deciding this issue. The first is the actions that Consumers and its contractors have taken in the past to establish an effective program and to search out and put into effect improvements in it. The second is the expressed points of view and intents of the senior personnel involved. The third is the opinions of the Staff's expert witnesses and the bases for these opinions. With respect particularly to the latter two areas, the Board realizes that its judgments will necessarily be somewhat subjective and will be based in part on the demeanor of the witnesses, which the Board has carefully observed and considered.

Actions by the Licensee

59. The actions taken by Consumers and its contractors to improve their quality assurance programs prior to the November 1970 suspension of construction have been discussed *supra*.[77] Subsequent to the suspension, on February 1, 1971, a corporate reorganization was instituted by Consumers, in

[75] Tr. 192-193; 291; 322-324; 342; 402-404.

[76] Tr. 196-201; 291-292; 325-326.

[77] Paragraph 40.

which overall responsibility for specific corporate projects was delegated to specified individuals. The philosophy underlying the new organization structure was that if total responsibility for each project was delegated to specified individuals, projects could be properly supervised without the complexity of coordinating corporate activity through various departmental interfaces.[78] On August 31, 1971, and again on December 8, 1971, Consumers' Quality Assurance Program Audit Manual was voluntarily upgraded to provide more detailed procedures for implementation.[79] Similarly, Consumers' Departmental Communications Guideline Manual was issued in December of 1971 and revised in March of the following year.[80] The Midland Project Procedures Manual, which was required by these guidelines, was issued in October, 1972.[81]

60. In March of 1972 Bechtel submitted to Consumers for review and concurrence a policy statement revising and defining the policy and responsibilities for the Quality Assurance Program of its Power and Industrial Division. Consumers' comments on this statement were resolved and the statement was accepted by Consumers in February of 1973.[82]

61. In an effort to obtain another perspective regarding Commission quality assurance requirements, Consumers employed the NUS Corporation as a consultant to examine the Quality Assurance Program. NUS submitted its report on December 15, 1972, stating that Consumers had a complete and detailed audit plan. NUS recommended that the Quality Assurance organization be given complete independence from those groups having cost and scheduling functions and that Quality Assurance activities be expanded beyond its auditing function. As a result of this report, Quality Assurance activities were expanded and the Quality Assurance organizations were given greater, although not complete, independence. Under the new organization, which became effective February 15, 1973, the title of the Quality Assurance Engineer was changed to Quality Assurance Administrator and he reported directly to Mr. Howell, the Vice President in charge of Electric Plant Projects.[83] Soon after this reorganization the QA Administrator inferred from a statement in an RO inspection report that the Commission did not correctly understand the new organization. Discussions were held with the RO staff to rectify this and as a result, a further reorganization was made on October 1, 1973. The position of Director of Quality Assurance Services was created on the same level as all project managers and directors of service organizations and reporting directly to the Vice President, Electric Plant Projects. This reorganization resulted in a separation of the Quality Assurance organization from the Midland Project organization which

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[78] Keeley, pp. 14-15, Howell, pp. 8-9.
[79] Keeley, p. 15; Howell, p. 9.
[80] Keeley, p. 18.
[81] *Id.*, p. 19.
[82] *Id.*, pp. 15-18; Yates, pp. 2-3; Bechtel's Exhibit Y-1.
[83] Howell, pp. 11-13; Licensee's Exhibits H-3 and H-4.

had cost and scheduling responsibilities. This independent Quality Assurance organization was given responsibility for all aspects of Quality Assurance including policy and implementation. The organization and responsibilities remain essentially the same today.[84] Also, during 1973, additional staffing was provided for the quality assurance organization, the Quality Assurance Manual and the Policies and Procedures Manual were revised, and a new Quality Assurance Services Department Procedures Manual was written to provide procedures for the new organization.[85]

62. Shortly after the reorganization, Consumers asked NUS to make a new review of the QA program[86] and, after the Cadwelding problem arose, expanded the assignment to include a recommendation regarding the desirability of using a third-party inspection organization independent of both Consumers and Bechtel. NUS recommended against such use of a third-party inspection group.[87] They did recommend, however, that Consumers (1) incorporate pertinent requirements of ANSI N45.2 standards into its Quality Assurance Program, (2) consolidate Quality Assurance procedures into a single Quality Assurance Manual, (3) consolidate all Quality Assurance activities (including operational) under a single Quality Assurance Manager, (4) clearly define Quality Assurance responsibilities during pre-operational testing, (5) perform a detailed review of the Bechtel and B&W Quality Assurance Program, (6) conduct a baseline audit of principal vendors using a third party organization, and (7) establish a Quality Assurance/Quality Control Surveillance Inspection Program tied to the Midland construction schedule. With the exception of the consolidation of both construction and operational Quality Assurance functions under one Quality Assurance Manager, and the recommendation regarding third-party baseline audits of principal vendors, an activity already completed by Consumers' Project Quality Assurance Services Department (PQASD) personnel, these NUS recommendations have been fully implemented by incorporation into a revised Consumers' Quality Assurance Manual.[88]

63. In recognition of the usefulness of a periodic third party review, Consumers has retained the General Electric Nuclear Engineering Services Apollo group to review and comment on the revised manual. That review process is underway and upon completion of the review, a revised manual and implementing procedure will be issued. In addition, General Electric has reviewed the audits which Consumers has completed.[89] To date, General Electric Apollo has not indicated that any major changes in the Consumers Quality Assurance

3rd party review useful in review of the manuals, but not in the QA program itself

[84] Howell, pp. 14-15; Licensee's Exhibit H-5.
[85] Howell, p. 15.
[86] *Id.*, p. 16.
[87] *Id.*, p. 20.
[88] *Id.*, pp. 20-22; Licensee's Exhibit H-10.
[89] Howell, p. 22.

Program would be desirable.[90] General Electric Atlanta has also been asked to conduct annual reviews of the Consumers Quality Assurance Program for the purpose of determining whether that program is being properly implemented and to offer recommendations for updating the Program to meet evolving regulatory and industry standards.[91]

64. Consumers also has directed Bechtel to assure that their procedures used on the Midland Project comply with both 10 CFR 50, Appendix B and ANSI N45.2 and to consider ANSI N45.2 as the controlling document in evaluating the Bechtel Quality Assurance Program. When a major audit of Bechtel activities was conducted during March of 1974, ANSI N45.2 was used as one of the bases of the audit. In NCR-61, dated April 1, 1974, Consumers directed Bechtel to revise its Nuclear Quality Assurance Manual to specifically state policy requirements supporting the procedures which Bechtel had established in order to comply with the requirements of ANSI N45.2. Bechtel has complied with the corrective action of this nonconformance report.[92]

65. Similarly, in August of 1973, Consumers directed B&W to apply its newly revised Quality Assurance Program to the Midland Project. Thus, Consumers became the first utility to put into effect the upgraded B&W Quality Assurance Program.[93]

66. As a consequence of the Cadwelding problem, additional steps were taken by both Consumers and Bechtel to upgrade quality assurance. These steps have been described in connection with Issue No. 1.[94]

67. Consumers has also instituted two types of field audits to assure that Bechtel construction and Quality Control personnel have received effective training, that Bechtel inspection procedures are adequate and that proper documentation is provided. The first of these audits, the program audit, consists of using a checklist provided in the Quality Assurance Services Procedures manual to review Bechtel field activities prior to commencement of work at the site. The program audit procedures also require a comparison of the Bechtel Master Inspection Plan with the requirements listed in the Preliminary Safety Analysis Report, Commission regulations, specifications and drawings. PQASD also approves the Master Inspection Plan prior to commencement of work in the field. In addition to these program audits, an implementation audit surveillance is also performed by Consumers' PQASD personnel to assure that Bechtel work and inspection activities are being accomplished in accordance with approved procedures and that approved specifications are being met.[95]

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[90] Tr. 490-491.
[91] Keeley, pp. 32-33.
[92] *Id.*, pp. 33-34.
[93] *Id.*, p. 35.
[94] Paragraphs 50 and 51 *supra*.
[95] Keeley, pp. 5-6.

68. In addition to these field activities, PQASD schedules and conducts (1) audits of Bechtel Engineering, Procurement, Inspection and Quality Assurance; (2) audits of B&W Engineering, Procurement, Quality Assurance and fabrication facilities; and (3) audits of major suppliers.[96] Consumers and Bechtel have both also instituted additional training activities. Consumers instituted a formal training program for all of its Quality Assurance personnel in 1973.[97] It was expanded in 1974 to include the use of outside, as well as Consumers, personnel to conduct the training. The training of new employees and the retraining of present employees will be a continuing process.[98]

69. Similarly, Bechtel's indoctrination and training program continued to evolve through the addition of more detailed and comprehensive requirements. Presently, each Quality Assurance Engineer is required to complete an in-depth, comprehensive training program consisting of classroom preparation, on-the-job experience and participation in different kinds of audits. Quality Control Engineers are certified under a program designed to comply with ANSI N45.2.6 and Regulatory Guide 1.58.[99] The training program for Engineers and Designers has become more formal and more comprehensive.[100] Bechtel's Procurement Inspection training program also has continued to evolve to the point where it presently includes certification, recertification and supplementary sessions tailored to meet specific needs. This program is currently being upgraded to meet the requirements of ANSI N45.2.6 and N45.2.12.[101]

Licensee's Management Position

70. Russell C. Youngdahl, Senior Vice President in charge of all aspects of Consumers' electric generating and transmission planning, construction, operation and maintenance, including nuclear generating stations, presented testimony on this subject. Mr. Youngdahl is one executive level below the chief executive officer. Mr. Youngdahl's perception of the attitude of the President and Chairman of the Board of Directors toward Quality Assurance has been one of insistence on the highest standards of Quality Assurance; this attitude has been expressed in the presence of representatives of the Commission.[102] Mr. Youngdahl testified that the Commission's rules and regulations, as well as license requirements, are regarded by Consumers' management as the equivalent of statutes and, as such, are considered binding on the Company and its employees.[103] Mr. Youngdahl stated that, although the management has always

[96] *Id.*, p. 6.
[97] Howell, p. 22.
[98] *Id.*; Keeley, pp. 4-5.
[99] Testimony of Tucker, following Tr. 663, pp. 7-9.
[100] Testimony of Martinez, following Tr. 626, pp. 11-12.
[101] Testimony of Southard, following Tr. 641, pp. 5-6.
[102] Tr. 528-529.
[103] Testimony of Youngdahl, following Tr. 519, p. 6.

demanded quality in its work at least equal to industry standards, its approach has evolved from one of primary reliance on its engineering constructor to a more formalized reliance upon its own Quality Assurance organization and program.[104] In order to formally document this approach, Mr. Youngdahl, on March 29, 1974, issued a Quality Assurance Policy statement which committed the entire electric organization, including both the operating group and the projects group, to implement a Quality Assurance plan which meets both 10 CFR 50, Appendix B and ANSI N45.2. In order to make certain that this policy is implemented by the operating group, a Director of Quality Assurance Operations was named on June 1, 1974.[105]

71. Mr. Youngdahl's personal involvement in the QA process ranges from daily review of EPP activities to monthly review of PQASD activities. He participated in meetings with Bechtel senior management following the November 6-8, 1973, RO inspection at which it was stressed that Quality Assurance implementation must be improved and that Bechtel management must be more closely involved in quality assurance at Midland. It was his suggestion to procure a third party review of the Midland Quality Assurance Program.[106]

72. The Palisades Nuclear Plant investigation by the Commission and the United States Department of Justice stimulated the publication of a management directive which explicitly set forth responsibilities for reporting violations of Commission rules, regulations and license requirements. This directive requires notification to the Commission by Consumers of all items which are deemed to be violations and also of all items which are subject to interpretation as to whether or not they are in fact violations.[107]

73. The Board requested that Consumers make Ralph B. Sewell, Nuclear Licensing Administrator for operating nuclear power plants, available for questioning on the attitude of senior management personnel toward compliance with Commission rules and regulations.[108] The Board questioned Mr. Sewell regarding statements given the RO staff in connection with the operation of the gaseous radwaste system at the Palisades plant during 1972.[109] The Board's concern was that, in this instance, extraordinary steps may have been required to direct the attention of Consumers management to important safety matters.[110] Mr. Sewell testified that it was Consumers' intent to fully comply with all Commission rules, regulations and licensing requirements.[111] Mr. Sewell's

[104] Youngdahl, pp. 3-4.
[105] Youngdahl, p. 5; Licensee's Exhibit Y-2.
[106] Youngdahl, pp. 4-5.
[107] Youngdahl, p. 6; Licensee's Exhibit Y-3.
[108] Tr. 399-402; and 439.
[109] Tr. 546-547.
[110] Tr. 563.
[111] Tr. 564.

statement described his normal channels of communication within the company.[112] Mr. Sewell emphasized that he did not have to take extraordinary steps to direct management's attention to his request to the Palisades operating staff to perform corrective maintenance on the gaseous radwaste system.[113] Soon after he communicated his concerns, the operating personnel at Palisades performed extensive maintenance on the system,[114] and therefore, he did not seek management affirmation on his position.[115]

74. Stephen H. Howell, Vice President in charge of Electric Plant Projects, having direct responsibility for design, construction and construction quality assurance activities for nuclear power plants, testified at the hearing. He stated that the policy of Consumers is and has always been to comply with all laws, ordinances, regulations and rules and to require its contractors to do the same.[116] Mr. Howell stated that his perception of the attitude of his superiors toward Quality Assurance was that they believed it to be important and that they had manifested this belief to him on numerous occasions.[117]

75. The attitude toward compliance with Commission rules and regulations was set forth by Gilbert S. Keeley, Director of Project Quality Assurance Department Services in response to a Board question as to why the future implementation of the Midland Quality Assurance Program will be better than its past implementation in terms of effectiveness:

> Now there is no doubt in my mind [that] we have been implementing [the upgraded QA program carried out since Oct. 1, 1973], if the AEC feels that they want us to provide more visibility on any of these functions we are doing, we're going to do it as far as I am concerned.
>
> As I say, I have been given that responsibility to implement or to set QA policy and to see that the policy is implemented, not only by Consumers Power Company but by B&W and Bechtel.[118]

76. In order to insure that management personnel remains informed of Quality Assurance activities at the Midland site, Consumers has had periodic in-depth status meetings among its management personnel for a number of years.[119] On February 1, 1974, the requirement for these meetings was formalized so as to require at least quarterly meetings between Vice President, EPP, and representatives of General Office Quality Assurance, Midland Field Quality Assurance and the Midland Project. Reports of these meetings are

[112] Tr. 559-562.
[113] Tr. 564-565.
[114] Tr. 548-550.
[115] Tr. 563-565.
[116] Howell, pp. 4-5.
[117] Tr. 502-503, 507.
[118] Tr. 477.
[119] Howell, p. 24.

submitted to the Senior Vice President.[120] These formal procedures further require one-day visits every two weeks to the Midland site by the Midland Quality Assurance Supervisor and one-day visits every two months by the Director of Quality Assurance Services.[121] In addition, PQASD submits a monthly resume of Quality Assurance activities to the Vice President, EPP and through him, to the Senior Vice President. The Vice President, EPP, further reviews all audit reports, nonconformance reports and RO inspection reports.[122] For example, when a Consumers nonconformance report (NCR) is issued and the responsible Quality Assurance individual has made the initial analysis as to whether the deviation is reportable under 10 CFR 50, 55(e), the Vice President, EPP, is contemporaneously advised.[123]

How many NCRs deemed reportable

Staff's Views on Future Compliance

77. The Staff's views on the question of future compliance are embodied primarily in Mr. Vetter's prepared testimony and in the Boards direct examination of Mr. Vetter and Mr. Keppler. After testifying that: (1) shortcomings in implementation of the Midland quality assurance/quality control programs have been identified and corrected, and (2) Consumers Power Company Management personnel have demonstrated awareness of the need to become involved, and stay involved, with quality assurance/quality control programs designed to assure proper construction of the Midland Plant,[124] Mr. Vetter concluded that "reasonable assurance now exists that compliance will continue throughout the construction period".[125]

78. Mr. Keppler was asked by the Board to characterize quality assurance program at Midland as it compared to that at other facilities under construction in his region. He stated as his opinion that it was "probably comparable",[126] but suggested that his inspectors might be in a better position to make such a judgment. When polled, they concurred with Mr. Keppler's assessment.[127]

ALAB 100 dismisses similar "as good as other usual plant arguments"

79. Mr. Keppler was asked by the Board what evidence he would look for in order to determine whether or not it was likely that a licensee would comply with the rules and requirements in the future.[128] After pointing out that with a new licensee he can only inspect to determine whether the licensee is satisfying

[120] Youngdahl, p. 4; Licensee's Exhibit Y-1.
[121] Keeley, p. 30.
[122] Howell, p. 24.
[123] Tr. 504.
[124] Tr. 201-202. The bases for this statement appear at Tr. 194-201.
[125] Tr. 201.
[126] Tr. 377-378.
[127] Tr. 393-395.
[128] Tr. 379.

Q to Keppler- what future evidence did I look for in ...

commitments made to the Directorate of Licensing,[129] he went on to say that in the case of a licensee who has had previous nuclear experience, he looks at "the past performance of the utility in terms of their ability to comply with their commitments in the past." Among the actions that he considers are:

> the action that management has taken with respect to making sure that the commitments are being met, that appropriate instructions have been provided, that there's a plan of action laid out to see that the commitments are fulfilled and that there is a program of audit developed to follow up and assure that the commitments are fulfilled.[130]

80. After responding affirmatively to the question of whether he had considered the past performance of Consumers Power Company from this standpoint, he was asked for his views on the performance.[131] He prefaced his answer by pointing out that one must consider this question in the light of changes in the regulatory inspection and enforcement programs. He pointed out that the Big Rock Point facility was "over ten years old" and that the Palisades plant "was licensed around 1970".[132] During the intervening time, many changes, in addition to adoption of the quality assurance criteria, have taken place. Originally there were very few plants and the program for dealing with violations and noncompliance matters "was less structured than it is today", being based more on efforts to bring licensees into compliance than on resort to enforcement actions. As there came to be more and more licensees and their performance was not "as good as had been hoped for" stronger enforcement practices were adopted.[133] With this introduction, Mr. Keppler testified that there had been "many situations that we dealt with on Big Rock Point and in the early stages of Palisades which I would characterize as a negative attitude on the part of a licensee" and that he is "on record as having been concerned about the performance of Consumers Power Company". He then testified that, despite the serious reservations about past performance, "it is my view that we have seen a very discernible change over the past several months . . . that has been factored into our thinking on this case: changes in organization structure, changes in facing up to commitments, and dealing with commitments" and that "they had seemed to face up to this problem in a much more professional way than I have seen them face up to any other problem; that they had convinced themselves of

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[129] Tr. 380.

[130] Tr. 380-381.

[131] Tr. 383.

[132] The Board notes that the construction permit for Big Rock Point was issued May 31, 1960, and the operating license August 30, 1967, and that the comparable dates for Palisades were March 14, 1967, and March 24, 1971. These differences from Mr. Keppler's recollections enhance, rather than detract from, his point.

[133] Tr. 383-384.

what it took to do the job and they were taking steps to do it."[134] Mr. Keppler identified the recent events that characterized the "very discernible change" as including the careful consideration on the part of the company reflected in the commitments regarding the Quality Assurance Program contained in the response to the Order to Show Cause, the discussions between the Staff and Consumers' senior management personnel regarding the Palisades matter, the reorganization both at the site and at the home office to focus more management involvement in the problems being experienced and changes in attitude on the part of the people with whom inspectors had been dealing.[135]

81. Because of the fundamental role played by the IRO inspection program in reaching conclusions such as those of Mr. Keppler stated above, the Board asked Mr. Keppler to provide a general description of the inspection program for reactors under construction.[136] His description, FSAR, and the testimony regarding the program by the other Staff witnesses, has led the Board to conclude that the Staff has an active and effective program that is capable of detecting significant deviations from the Commission's requirements. Although the Board does not consider it necessary to recite the details of the program here, we note that the general approach includes enlarging the inspection effort in cases where the findings indicate a need for such intensification.[138] As one Staff witness characterized it, "we give the oil to the squeaky wheel". This philosophy, in the view of the Board, should assist in the detection of incipient adverse quality assurance trends before they become major problems and before they result in difficult-to-correct hardware deficiencies. In this respect we also note the increasingly effective enforcement procedures of the Staff[139] and Mr. Keppler's assertion that "if the company fails to live up to its obligations that we're not afraid to step in and stop construction just like we did this time."[140]

82. Based upon consideration of the entire evidentiary record in this proceeding, the Board concludes that although there have been questions of compliance and of attitude regarding QA in the past, there is reasonable assurance that implementation of the Midland QA program will continue to be conducted in compliance with Commission requirements during the remainder of the construction process. We take particular note of Mr. Keppler's statement that "... if the company fails to live up to its obligations that we're (the Staff) not afraid to step in and stop construction. ..." (Tr. 386).

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[134] Tr. 385-386. The other Staff witnesses were asked for their characterizations of Consumers' attitude. Their answers, which agree with Mr. Keppler's, appear at Tr. 417-421.

[135] Tr. 388-389.

[136] Mr. Vetter's description of the program as it relates to this case (Tr. 184-188) has been discussed with respect to Issue No. 1.

[137] Tr. 357-361. See also Tr. 347-351 and 405-407.

[138] Tr. 347-349; 372-376.

[139] Tr. 384-385; 387; 391-393.

[140] Tr. 386.

III. CONCLUSIONS OF LAW

83. Based upon the foregoing findings of fact, and upon consideration of the entire evidentiary record in this proceeding, the Board concludes as follows:

1. Consumers is implementing its quality assurance program in compliance with Commission regulations;

2. There is reasonable assurance that such implementation will continue throughout the construction process;

3. Construction Permit Nos. 81 and 82 issued to Consumers Power Company for the Midland Plant, Units 1 and 2, should not be suspended, modified or revoked.

IV. ORDER

WHEREFORE, it is ORDERED, in accordance with the Atomic Energy Act of 1954, as amended, and the Commission's Rules and Regulations, that this proceeding is terminated.

It is further ORDERED, in accordance with Sections 2.760, 2.762, 2.764 2.785 and 2.786 of the Commission's Rules of Practice, that this Initial Decision shall be effective immediately, and shall constitute the final action of the Commission forty-five (45) days after the date of issuance hereof, subject to any review pursuant to the Commission's Rules of Practice and the Commission's Memorandum and Order and Notice of Hearing, dated January 21, 1974. Exceptions to this Initial Decision may be filed by any party to this proceeding within seven (7) days after service of this Initial Decision. Within fifteen (15) days thereafter (twenty (20) days in the case of the Regulatory Staff), any party filing such exceptions shall file a brief in support of such exceptions. Within fifteen (15) days after service of the brief of the party or parties filing exceptions (twenty (20) days in the case of the Regulatory Staff), any other party to this proceeding may file a brief in support of, or in opposition to, exceptions which have been filed.

ATOMIC SAFETY AND LICENSING BOARD

Emmeth A. Luebke

Lester Kornblith, Jr.

Michael L. Glaser

Issued at Bethesda, Maryland,
this 25th day of September, 1974.

NRC ~~Hood~~ Dep Ex 2
Keeley (10-23-80)

RESUME OF PROFESSIONAL AND
EDUCATIONAL EXPERIENCE

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I. Professional Experience

a. July, 1975 to Present. Project Manager on Midland Nuclear Power Plant which is a dual-purpose nuclear plant designed to supply 1300 Megawatts electrical to the Consumers Power system and up to 4,000,000 lb/hr of process steam to the Dow Chemical Company. Up until March, 1980, I had overall responsibility for the licensing, design, construction, testing, costs, scheduling and contract administration of contracts between Consumers and its principal suppliers and between Consumers and Dow Chemical for this $3.1 billion Project until fuel loading takes place. Upon appointment of a Vice-President for Midland in March of 1980, my responsibilities as Project Manager were changed to include design, construction, testing and administration of contracts.

b. November, 1973 to July, 1975. Appointed Director of Quality Assurance Services for nuclear and conventional power plants' design and construction. Responsibility for: Building up staff of QA personnel, seeing that they were given training, setting QA policies for the Company, and preparing necessary QA Program Manuals and Procedures. Supervise staff of 11 people (6 in General Office and 5 at Midland Plant Site) who have expertise in areas of Mechanical, Electrical, Civil, Instrumentation and Control, and Non-destructive Examination (NDE). This staff reviews and approves QA Programs of Architect-Engineers, Suppliers, and Construction Contractors and conducts audits and surveillance for implementation of quality-related activities. The staff is spokesman for Consumers Power on NRC Regulatory Operations inspections on site.

1970 to November, 1973. Director of Electric Plant Projects Engineering. Supervised staff of four Nuclear Engineers, three Mechanical Engineers, one Metallurgical Engineer, two Civil Engineers, one Instrumentation and Control Engineer, and one Electrical Engineer. This staff was responsible for: Developing Consumers Power design bases for Nuclear and Conventional power plants; developing inputs for specifications for Consumers Power prime contractors such as

boiler, NSSS, and turbine/generator; reviewing designs and specifications produced by Architect-Engineer; writing pre-operational and hot functional tests and reviewing test results; reviewing recommendations made by Architect-Engineer on procurement of power plant equipment; technical review of potential suppliers for placement on Consumers Power Approved Bidders List; and assisting in licensing activities with the NRC or State.

c. 1968 to 1970. Supervisory Nuclear Engineer. Supervised staff of two Engineers. Responsible for: Writing up specifications for nuclear fuel; performing evaluation of fuel bids and recommending supplier; review of engineered safeguards systems, reactor protective systems, radwaste systems, and nuclear instrumentation systems to assure they met latest industry standards and AEC criteria; assisted in AEC licensing activities; and compiled site meteorological data and made dose calculations.

d. 1963 to 1970. Nuclear Engineer. Reviewed designs of nuclear plant engineered safeguards systems, reactor protective systems, radwaste systems, and nuclear instrumentation systems to assure they met latest industry standards and AEC criteria. Wrote up specifications for nuclear fuel, did fuel cost calculations, recommended fuel supplier, and assisted in writing fuel contract. Initially performed as Project Engineer on Palisades Plant for assembly and review of PSAR and organized Start-up Test Program for Palisades.

e. 1961 to 1963. Start-up Engineer at Big Rock Point Plant. Responsible for Consumers Power review of preoperational test procedures. Responsible for running tests. Evaluated test results with assistance from other Consumers Power personnel, NSSS personnel and AE personnel. Obtained AEC Cold License on the plant and functioned temporarily as Shift-Supervisor until additional Consumers Power personnel were qualified.

f. 1955 to 1961. Engineer in Atomic Power Division of Westinghouse Electric Corporation. From 1955 to 1956, I was Reactor Engineer on the S1W Plant at the Navy Reactor Test Facility (NRTF), Idaho, with responsibilities in the areas of reactor operations and plant instrumentation, including the qualification of Navy reactor plant operators. From 1956 to 1957, I was Senior Engineer in the S1W Engineering Group, concerned with the design and procurement of nuclear instrumentation and reactor protective system equipment. During part of 1957, I was a member of the Westinghouse start-up crew at the Shippingport Atomic Power Plant responsible for various phases of reactor plant check-out and had prime responsibility for qualification of the utility's reactor plant operators and for initial criticality operations. In 1958 and 1959, I was plant Reactor Engineer for the A1W Plant at NRTF, Idaho, responsible for reactor plant instrumentation testing and qualification of Navy reactor plant operators. From 1959 to 1960, I was Supervisor of the A1W Instrument Shop with responsibility for setting up all instrumentation for A1W Plant testing. From 1960 to 1961, I was A1W Chief Operator Trainee, receiving training in all aspects of A1W Plant operation.

g. 1949 to 1955. Electrical maintenance and start-up with Pacific Gas and Electric in conventional steam plants. Four years of this time was as Electrical Maintenance Foreman at PG&E's Antioch Steam Generating Plant supervising five electricians.

h. 1948 to 1949. Test Engineer for General Electric Co in Schenectady, New York. Assigned as Test Engineer in areas of induction motors, electronic control and armament controls.

II. Educational Experience

a. 1940 - Graduate of Topeka, Kansas High School.

b. 1942 - Graduate of Kansas City, Missouri Junior College with Associate Science Degree in Engineering.

c. 1946 to 1948. Attended University of Missouri at Rolla and graduated with B.S. in Electrical Engineering. "B+" average. Member of Tau Beta Pi and Phi Kappa Phi national honorary fraternities.

d. 1953 - Taught relay courses to PG&E Electricians.

e. 1958 to 1961. Post-graduate courses from University of Idaho extension at Idaho Falls. 18 hours' credit towards Masters in Electrical Engineering for such courses as Advanced Engineering Math, Pulse and Digital Circuits and Transistor Circuits.

f. 1965 - 2-semester course at University of Michigan on Computer Solutions to Transmission Line Problems.

g. 1968 - 2-semester Welding Technology night course at Jackson Junior College.

h. 1974 - Assisted in conducting training of Consumers Power QA personnel on nuclear power plant systems; AEC and Industry QA requirements. Attended courses we arranged in QA Program Evaluation, ASME Section 3, and NDE.

i. 1974 - Taking one semester Jackson Junior College night course in NDE (Radiography, Diepenetrant and Magparticle) with lab work.

III. Committee and Society Membership

a. 1964 to 1973. Member of Consumers Power Company Safety, Audit and Review Board for its Nuclear Power Plants.

b. 1964 to 1970. Member of IEEE Nuclear Power Standards Group involved in writing electrical standards for nuclear power plants.

c. 1970 to 1975. Member of ASME N45.2 Standards Committee writing QA Standards to supplement Appendix B to 10 CFR 50.

d. 1972 to 1975. Chairman of ASME N45.2.13 Work Group writing QA Standard "Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants."

e. Member of Tau Beta Pi, National Engineering Honorary Fraternity.

f. Registered Engineer in State of Michigan.

g. Member of Michigan Society of Professional Engineers.

October 22, 1980

NRC X6
10-30-80 (afifi)

Midland Units 1 & 2
Job 7220-001

TRIP REPORT

DATES: January 30 to March 24, 1978

LOCATION: Midland Units 1 & 2
Midland, Michigan

SUBJECT: Piezometer and Settlement Marker Installation

ATTENDEE: W. R. Kinzer - Geotech/Geology

During February and March, concurrent with several other related drilling programs, the design cooling pond dike piezometers and settlement markers were installed under my inspection at the Midland Power Plant. The work was performed in accordance with technical specification C-77 and technical drawing C-69, and issued for construction as an amendment to subcontract 7220-FSC-318. A total of 20 piezometers and 24 settlement markers were completed during this phase of the field work.

Ten piezometers each were installed along two separate dike sections designated P1 and P2 (stations 25 + 48 and 12 + 13) respectively. Three pneumatic type and 7 casagrande type piezometers were installed along section P1 at elevations between 565 and 607.2 feet. Two pneumatic and 8 casagrande piezometers were installed along dike section P2 at elevations between 568.0 and 609.1 feet. All piezometers were installed as close to the specification design as possible. As-built drawings as well as boring logs, daily reports, and other miscellaneous data were transmitted to S. S. Afifi as they became available. Fluid levels in 17 of the installed piezometers were obtained on March 20, 1978, the remaining 3 were read on March 24, 1978. On site personnel were instructed in the operation of the test equipment on March 24, 1978 and all test gear was turned over to Consumers Power Company at that time.

Installation of the settlement markers was begun on March 13, 1978 with all 24 markers completed by March 22, 1978. All were installed 12 to 13 feet from the dike reference line and were all bottomed 15 feet below the existing dike crest. Rust resistant paint was substituted for use on the exposed tips of the installed steel bar stock as "Galvanox" was unavailable locally. On site surveying was informed of the completion of the settlement markers and instructed to begin the first elevation survey as soon as possible. The first elevations are expected to be available by March 31, 1978.

Wayne R. Kinzer

WRK/lag

50-329/330 OM, OL

Exhibits from

10/23/80 Oral Deposition

of

Gilbert S Keeley,

Project Mgr of Midland Plant,
Consumers Power Company

Exhibits 1 & 2