UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAY 10 1982

MEMORANDUM FOR: Robert L. Tedesco, Assistant Director
for Licensing
Division of Licensing

FROM: James P. Knight, Assistant Director
for Components & Structures Engineering
Division of Engineering

SUBJECT: MIDLAND PLANT UNIT NOS. 1 AND 2

The applicants submittals regarding Phase 2 of the underpinning repair work at the Midland Plant have been reviewed from the standpoint of Structural and Geotechnical engineering. We conclude that the Phase 2 program is acceptable provided that certain modifications and requirements are incorporated. The enclosure to this memo entitled "Midland Plant, Provisions for Acceptance of Phase 2" lists the modifications and requirements we believe necessary. Based on discussions with your staff we understand that the transmittal of these provisions to the applicant will include specific instructions to document the accomplishment of these actions and inform Region III as that documentation is available for the inspectors examination. We believe that this approach is appropriate.

James P. Knight, Assistant Director
for Components & Structures Engineering
Division of Engineering

cc: R. Vollmer
D. Eisenhut
R. Purple
E. Adensam
D. Hood
R. Hernan
F. Schauer
G. Lear

Midland Plant

Provisions for Acceptance of Phase 2

1. Deep-seated bench marks DSB-AS1 and DSB-AS2. DSB-AS1 and DSB-AS2 shall be installed at a distance not to exceed 5-feet from the wall of the Main Auxiliary Building which is founded at Elevation 562. Actual locations of these installed bench marks and any modifications in tolerance criteria required on Drawing C-1493(Q) due to changes from the original DSB-AS locations shall be documented.

2. Monitoring devices required to be installed. The following devices shall be properly installed and operating prior to drifting under the turbine building or FWIV pit.

DSB-1W	DSB-AS1	DMD-1W
DSB-1E	DSB-AS2	DMD-1E
DSB-2W	DSB-AN	DMD-11
DSB-2E		DMD-12
DSB-3W		DMD-13
DSB-3E		

3. Strain gage installation. The following revisions shall be made to the proposed instrumentation shown on drawing C-1495, "Instrumentation - El. 695 - 0 5/16" for Bldg. Settlement Monitoring".

   a. With reference to drawing C-1495 Sectional View - Wall at Col. Lines 5.3 and 5.6. Reorientate the proposed vertical strain gage installation between Elevations 646 to 659 to a slope similar to lower gages between Elevations 584 to 614.

b. With reference to drawing C-1495, Sectional View-Wall at Col. Lines 7.4 and 7.8. Change orientation of proposed lower strain gages between Elevations 584 to 614 to be perpendicular to orientation shown on Drawing C-1495 in the March 31, 1982 submittal (Figure 3). On this same sectional view add an additional strain gage between Elevations 646 to 659 at an inclination similar to the above recommended orientation. (The labeling of column lines H and G is reversed on the copy of this sectional view submitted to the staff.)

4. Pier load t st procedures. The following modifications and additions shall be made to the pier load test procedures provided by the April 22, 1982 submittal from J. Cook to H. Denton entitled "Response to the NRC Staff Request for Additional Information Required for Completion of Staff Review of the Borated Water Storage Tank and Underpinning of the Service Water Pump Structure." (It is the NRC Staff's understanding that, although the procedures were submitted for underpinning work for the Service Water Pump Structure, the procedures are applicable to the pier load test to be conducted during Phase 2 underpinning work for the Auxiliary Building.)

a. Page 12. The maximum required test load should be equal to 1.3 times the maximum anticipated design load. As an alternative, should there be structural difficulties in developing the required reaction load for the pier test, the NRC Staff would accept a procedure where the maximum test load for the pier load test was equal to 100 percent the max. anticipated design load and a plate load test (ASTM D1196) was performed to a maximum test load equal to 130 percent of the maximum anticipated design load.

b. Page 12. Significant modifications to the specified ASTM D1143-81 test procedures, as the Applicant may deem appropriate, require early notification and the approval of the NRC Region III Office.

c. Page 12. The rate of settlement shall not exceed 0.003 inch per hour when controlling the length of time that the 100% test load increment is to be maintained.

d. Page 12. In order to provide a more positive reduction of skin friction, plywood sheeting coated with 1/8-inch thick bitument or equivalent shall be installed on all test pier sides prior to performing the pier load test as a replacement for the plastic sheeting proposed by Consumers Power.

e. To permit correlation with the previously approved measures proposed by the Applicant to demonstrate the adequate foundation capacity of the other installed piers, a minimum of two in situ density tests and five cone penetrometer tests shall be performed on the soil at the bottom of the pier selected for test loading.

5. Construction Dewatering. During underpinning of the Auxiliary Building area, the upper phreatic surface shall be maintained a minimum of 2 feet in depth below the bottom of any underpinning excavation at any given time. The final plan for the dewatering system shall be established and implemented in advance of drifting under the turbine building or FWIV pit. The dewatering plan should include the locations and depths of the dewatering wells and piezometers (observation wells). Installation details and criteria for monitoring loss of soil particles due to pumping shall be the same as those previously approved by the staff for the dewatering of the Service Water Pump Structure.

6. Monitoring movement of Feedwater Isolation Valve Pit (FIVP). Jacking of the FIVP back to its original position shall be required if the relative settlement between the Reactor Containment and the FIVP or between the Turbine Building and the FIVP reaches a total settlement of 3/8-inches since the time piping connections were made.

DRAFT
5/7/82

MIDLAND - AUXIL. BLDG - PHASE 2 5/85

ROUTING AND TRANSMITTAL SLIP Date 5/7/82

TO: (Name, office symbol, room number, building, Agency/Post)	Initials	Date
1. J. Knight		
2.		
3.		
4.		
5.		

Action	File	Note and Return
Approval	For Clearance	Per Conversation
As Requested	For Correction	Prepare Reply
Circulate	For Your Information	See Me
Comment	Investigate	Signature
Coordination	Justify	

REMARKS

This is a draft of the provisions which we discussed last night.

I have not coordinated this with SEB, particularly item 3, which you may elect to omit because of input from SEB. I have provided an extra copy if you wish to have SEB review our input.

We plan to formally send this to LPM thru your office when agreement is reached.

Item 4 a and 4 c may give CPC some difficulties and they have indicated they would like to consider these recommendations.

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/Post)	Room No.—Bldg.
J. Kane	Phone No. 2-8153

5041-102
☆ GPO : 1980 O - 311-156 (5)

OPTIONAL FORM 41 (Rev. 7-76)
Prescribed by GSA
FPMR (41 CFR) 101-11.206

5/10/82

The attached draft was edited by Jim Knight & sent to Elinor Adensam on 5/7/82. Gilray was to receive copy of transmittal letter from Knight to Adensam. Knight's action no longer required CEs to formally send these [illegible]

Docket Numbers: 50-329/330

MIDLAND PLANT, Units 1 and 2

SUBJECT: AUXILIARY BUILDING UNDERPINNING - PHASE 2

Prepared by: Joseph D. Kane, DE, HGEB, GES

1. Deep-seated bench marks DSB-AS1 and DSB-AS2. The NRC staff requires that DSB-AS1 and DSB-AS2 be installed at a distance not to exceed 5-feet from the wall of the Main Auxiliary Building which is founded at Elevation 562. Actual locations of these installed bench marks and any modifications in tolerance criteria required on Drawing C-1493(Q) due to changes from the original DSB-AS locations are required to be provided to NRC Region III office at least two weeks in advance of the start of Phase 2 underpinning work.

2. Monitoring devices required to be installed. The Applicant is required to notify the NRC Midland Resident Inspector and document in writing that the following devices are properly installed and operating prior to the start of Phase 2 underpinning work.

DSB-1W	DSB-AS1	DMD-1W
DSB-1E	DSB-AS2	DMD-1E
DSB-2W	DSB-AN	DMD-11
DSB-2E		DMD-12
DSB-3W		DMD-13
DSB-3E		

3. Strain gage installation. The NRC staff requires the following revisions to drawing C-1495, "Instrumentation - El. 695 - O 5/16" for Bldg. Settlement Monitoring", prior to installing the strain gages on the Auxiliary Building.

   a. Sectional View - Wall at Col. Lines 5.3 and 5.6. Reorientate the proposed vertical strain gage installation between Elevations 646 to 659 to a slope similar to lower gages between Elevations 584 to 614.

   b. Sectional View - Wall at Col. Lines 7.4 and 7.8. Change orientation of proposed lower strain gages between Elevations 584 to 614 to be perpendicular to orientation shown on Drawing C-1495 in the March 31, 1982 submittal (Figure 3). On this same sectional view add an additional strain gage between Elevations 646 to 659 at an inclination similar to the above recommended orientation. The labeling of column lines H and G is incorrect and should be reversed on this sectional view.

4. Pier load test procedures. The NRC staff requires the following modifications and additions to the pier load test procedures provided by the Applicant in the April 22, 1982 submittal from J. Cook to H. Denton entitled "Response to the NRC Staff Request for Additional Information Required for Completion of Staff Review of the Borated Water Storage Tank and Underpinning

of the Service Water Pump Structure." It is the NRC Staff's understanding that, although the procedures were submitted for underpinning work for the Service Water Pump Structure, the procedures are applicable to the pier load test to be conducted during Phase 2 underpinning work for the Auxiliary Building.

a. Page 12. The maximum required test load should be equal to 1.3 times the maximum anticipated design load. The Applicant is required to provide the actual value of the maximum test load and its basis to the NRR Staff at least two weeks in advance of beginning Phase 2 work.

b. Page 12. Significant modifications to the specified ASTM D1143-81 test procedures, as the Applicant may deem appropriate, require early notification and the approval of the NRC Region III Office.

c. Page 12. In recognition of the sensitivity of the rigid plant structures to differential movement, the NRC Staff requires that the rate of settlement not exceed 0.003 inch per hour when controlling the length of time that 100% ~~and 130%~~ test load increments ~~are~~ to be maintained.

d. Page 12. In order to provide a more positive reduction of skin friction, the NRC staff ~~requires~~ that plywood sheeting coated with 1/8-inch thick bitumen be installed on all test pier sides prior to performing the pier load test. The bituminous coating is the Staff's recommended replacement for the plastic sheeting proposed by the Applicant.

e. To permit correlation with the previously approved measures proposed by the Applicant to demonstrate the adequate foundation capacity of the other installed piers, the NRC staff requires a minimum of two in situ density tests and ~~two~~ five cone penetrometer tests be performed on the soil at the bottom of the pier selected for test loading.

5. Construction Dewatering. During underpinning of the Auxiliary Building area, the Applicant is required to maintain the upper phreatic surface a minimum of 2 feet in depth below the bottom of any underpinning excavation at any given time. The Applicant's plan for dewatering is required to be provided to the NRR Staff at least two weeks in advance of beginning Phase 2 work. The dewatering plan should include the locations, depths and typical installation details of the dewatering wells and piezometers (observation wells). Monitoring for loss of soil particles due to dewatering pumping shall be performed using filter criteria similar to the provisions identified in the April 2, 1982 ~~and criteria to be required for monitoring loss of soil particles due to pumping, similar to the criteria in the~~ letter from R. Tedesco to J. Cook, Apr. 2, 1982, "Staff Concurrence ~~Service Water Pump Structure~~ re: Installation and Operation of Construction Dewatering and Observation Wells for the Service Water Pump Structure."

6. Monitoring movement of Feedwater Isolation Valve Pit (FIVP). Based on the Applicant's consultant statement at the February 1-5, 1982 design audit, it is the NRC Staff's understanding that jacking of the FIVP will be required if the relative settlement between the Reactor Containment and the FIVP, or between the Turbine Building and the FIVP, reaches 3/8-inch. This procedure is acceptable to the NRC Staff. Any modifications to this procedure and limits by the Applicant will require the approval of the NRR Staff.

5/B5

RECORD OF TELEPHONE CONVERSATION

DATE: May 11, 1982, 1:00 pm PROJECT: Midland

RECORDED BY: Joseph D. Kane CLIENT:

TALKED WITH:	CPC	Bechtel	NRC
	J. Schaub	N. Swanberg	F. Rinaldi
	J. Mooney	J. Anderson	D. Hood
		C. Russell	J. Kane
		B. Dhar	
		W. Paris	J. Kane

ROUTE TO: J. Knight
G. Lear
L. Heller
D. Hood
F. Rinaldi
H. Singh
S. Poulos
R. Landsman, Region III
J. Kane

MAIN SUBJECT OF CALL: To discuss Phase 2 Issues - Auxiliary Building Underpinning

ITEMS DISCUSSED:

Consumers arranged this conference call to discuss review items related to Auxiliary Building underpinning. These items had been identified in a brief call on May 7, 1982 by J. Kane to J. Schaub where the NRC Staff had expressed their recommendations on the following items:

1. Location of deep seated benchmarks DSB-AS1 and DSB-AS2. The current hold on construction and field installation of monuments prevents the actual locations from being established. Consumers will provide actual locations when these benchmarks are installed and recognize these monuments are to be installed at a distance not to exceed 5 feet from the wall of the Main Auxiliary Building which is founded at Elevation 562.

2. Strain gage installation. The NRC Staff's comments for correction of drawing C-1495 were accepted and the drawing will be revised. (Lower strain gages at Elev. 584 to 614 on Sectional View-Wall at Col. Lines 7.4 and 7.8 are to be reorientated 90 degrees and column lines H and G will be corrected). Bechtel will check why strain gage at Elev. 646 to 659 range was not proposed for Wall at Col. lines 7.4 and 7.8 and will get back to Staff. The vertical alignment of strain gage on Col. Lines 5.3 and 5.6 at Elevation range 646 to 659 is being controlled by the need to avoid equipment obstructions on the wall. Consumers will make an analytical correction for the vertical alignment when evaluating strain gage readings.

3. Pier test procedures. Consumers indicated the dead load available in the existing structure for the reaction load in the pier load test is approximately 90 percent of the maximum design load. Consumers wished to further consider the Staff's recommendation to perform a plate load test where the maximum test load would be equal to 130 percent of the maximum design load and a pier load test at 90 percent of the maximum design load.

   Consumers accepted the Staff's recommendation for performing two in situ density tests and a minimum of five cone penetrometer tests on the soil at the bottom of the pier selected for load testing. Consumers also agreed to use bituminous coated plywood sheeting for reducing the effects of skin friction during the pier load test.

   Consumers wished to further consider the Staff's recommendation for requiring a rate of settlement that would not exceed 0.005 inch per hour when controlling the length of time that the 90 percent test load increment would be maintained.

   To better explain what the Applicant intended when it indicated that it would make modifications to ASTM D1143 as deemed appropriate, Consumers will provide the Staff with the pier load test procedures that identify the proposed modifications.

4. Construction dewatering. The Applicant indicated its plan for construction dewatering during underpinning is nearly complete and will be provided to the Staff within a week. Most of the dewatering wells are already installed but additional wells are planned. The additional wells are to be installed with Q/A procedures that are similar to the permanent dewatering wells which were previously approved by the NRC Staff. Monitoring for loss of soil particles due to pumping will be conducted according to the agreements reached for construction dewatering of the SWPS. (April 2, 1982 letter with enclosures, R. Tedesco to J. Cook).

   Consultants to Consumers indicated the already installed construction dewatering wells extend to the natural clay layer at approximately El 585. The Staff indicated that the anticipated plan for construction dewatering to be provided by Consumers should address the problem of handling seepage on the sides and bottom of pier excavations which extend below the bottom of the already installed wells.

5. Movement of Feedwater Isolation Valve Pit (FIVP). Consumers indicated its intent to assure transfer of the FIVP loading to the Turbine Building and Buttress Access Shafts by jacking the installed support system. It is not the intent of this jacking to restore the FIVP to its original position but

rather assure transfer of the load. The procedure for future jacking which Consumers indicated they would follow at the February 1-5, 1982 design audit and which was found acceptable by the NRC Staff requires jacking of the FIVP back to its original position if the relative settlement between the Reactor Containment and the FIVP reaches a total settlement of 3/8-inches since the date that the piping connections were made.

DRAFT

5/17/82
5/85

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Docket Nos.: 50-329
and 50-330 OM, OL

Mr. J. W. Cook
Vice President
Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

Dear Mr. Cook:

Subject: Approval Status for Construction Wells and Monitoring Instruments, and Staff Concurrence on Deep-Seated Benchmarks

Your letter of May 10, 1982 states that when the Memorandum and Order of the Licensing Board was issued April 30, 1982, Consumers Power Company was proceeding with certain soils remedial work with full awareness and concurrence of the Staff; however, explicit written approval for that work had not been obtained. You also noted that this work has been stopped in accordance with the Order, and requested that the Staff verify its concurrence so that the work can be reactivated. The three work items you identified in this category are:

(1) installation of deep-seated benchmarks,
(2) installation and operation of construction wells that were not previously operating, and
(3) installation of monitoring system instruments and mounting.

Items (1) and (2) are addressed by Enclosures (1) and (2) respectively. With respect to item (3), your letter notes that work on the monitoring system instruments and mounting for the auxiliary building is presently stopped because Region III concurrence has not been obtained. We are advised that Region III will provide explicit written confirmation of NRC approval following resolution of existing QA deficiencies. The Office of NRR has no additional requirements for approval of item (3), beyond those needed for Region III approval.

Sincerely,

Robert L. Tedesco, Assistant Director
for Licensing
Division of Licensing

Enclosures: As stated

cc: See next page

MIDLAND

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ENCLOSURE 1

STAFF CONCURRENCE ON INSTALLATION OF DEEP SEATED BENCHMARKS

Consumers has provided the NRC Staff with information on the installation of deep-seated benchmarks and relative-absolute instrumentation beginning with the design audit of January 18-19, 1982 and continuing through the submittal of March 31, 1982 (Letter from J. Cook to H. Denton, Response to the NRC Staff Request for Additional Information Required for Completion of Staff Review of Phases 2 and 3 of the Underpinning of the Auxiliary Building and Feedwater Isolation Valve Pits). The information for the Auxiliary Building underpinning work which has been provided includes locations, depths, elevations, instrumentation accuracy and typical installation details of the proposed instruments. This information is contained in the following documentation:

a. Technical Specification for Monitoring Instrumentation for Underpinning Construction, Specification 7220-C-198(Q), Jan. 18, 1982 Rev. 0 (Provided at the Feb. 3, 1982 Design Audit)

b. Drawings C-1490(Q) and C-1491(Q), Auxiliary Building, Instrumentation Location for Underpinning, January 20, 1982; Revision 1 (Provided at the Feb. 3, 1982 Design Audit)

c. Drawing C-1493(Q), Auxiliary Building and F.I.V.P., Instrumentation System and Monitoring Matrix, May 29, 1982, Rev. A (Provided by applicant's letter of March 31, 1982)

d. Sketches of Carlson Stress Meter and Telltale Installations, Midland Plant Instruments for Pier Measurements, Jan. 15, 1982

On the basis of review of the above information by the Staff and its Consultant's, the NRC Staff concurs with Consumers proceeding with the installation of the deep-seated benchmarks and relative-absolute instrumentation for monitoring the Auxiliary Building underpinning work.

Your letter of May 10, 1982 states that installation of deep-seated benchmarks is being carried out by Woodward Clyde Consultants, which is subject to its own quality assurance program and procedures approved by Consumers and previously subject to NRC Staff inspections. We are advised that these NRC inspections have resulted in a finding that these activities are being conducted to an acceptable quality assurance program.

On the basis of the technical review by the staff and its consultants of the information in the above documents, and on the basis of Region III's favorable finding with respect to the quality assurance program, the NRC Staff concurs with Consumer's proceeding with the installation of the deep-seated benchmarks and relative-absolute instrumentation for monitoring the Auxiliary Building underpinning work. This acceptance should not, however, be construed by you to restrict regional inspection or enforcement in any area where the Region identifies safety related activities they consider to fall under their purview.

ENCLOSURE 2

CONSTRUCTION DEWATERING WELLS

In the past Consumers position with respect to temporary or construction dewatering has been that this work was not permanent, it was being conducted to enable performace of construction activities and, therefore, the work did not require NRC Staff approval. Consumers did not provide the details of the construction dewatering design and installation and did not seek NRC Staff approval for these activities.

More recently the Staff has concluded that certain aspects of construction dewatering activities related to underpinning the Service Water Pump Structure (SWPS) and Auxiliary Building could potentially affect the foundation stability of these nearly completed structures. The Staff has actively reviewed the Applicant's temporary construction dewatering plan for the SWPS and has reached agreement with Consumers on an acceptable plan (April 2, 1982 letter with enclosures from R. Tedesco to J. Cook, Staff Concurrence for Installation and Operation of Construction Dewatering and Observation Wells for the Service Water Pump Structure). The Staff is presently attempting to obtain and evaluate the Applicant's plan for construction dewatering during Auxiliary Building underpinning and intends to issue a letter of concurrence when all review issues related to the plan are resolved.

It is the Staff's position, with respect to the remaining construction dewatering wells that are already installed and operating, that these wells be monitored for the loss of soil particles due to pumping similar to the requirements agreed upon and recorded in Enclousre 3 to the April 2, 1982 letter.

The specifications for a construction dewatering well are dependent upon the specific application. Consequently, approval for typical field practices, on other than a case-by-case basis is not meaningful. Therefore, for the future, the design and installation details of construction dewatering wells that have not yet been operated or installed should be addressed on a case-by-case basis following appropriate notification of the staff by the applicant. This procedure will permit an assessment of the safety significance of the proposed well. However, any construction well for which the procedures for installing and monitoring the loss of soil particles are equivalent to those previously approved for permanent dewatering wells may be considered acceptable, provided also that the upper phreatic surface is maintained two feet below the bottom of any excavation or as otherwise approved in advance by Region III.

DRAFT - Review of Apr 22, 1982 Submittal on BWST & Swis

5/85

Midland Plant, Units 1 and 2
Docket Numbers: 50-329/330
Subject: Geotechnical Engineering Evaluation of Consumers' April 22, 1982 Submittal (Response to the NRC Staff Request for Additional Information Required for Completion of Staff Review of the Borated Water Storage Tank and Underpinning of the Service Water Pump Structure)
Prepared by: Joseph D. Kane, HGEB, DE, NRR

The following comments and questions are based on the reviews of the subject submittal by the Geotechnical Engineering Section Staff and its consultants, Dr. S. Poulos, Geotechnical Engineers, Inc. and H. Singh, U.S. Army Corps of Engineers. The Applicant's response to Confirmatory Issues 4, 5, 7, 8, 9, 10, 11, 12, 22, and 23 for the Service Water Pump Structures are structural engineering issues and are not discussed in this evaluation.

Q.1. (Issue 1, Page 2, Par. 3) Provide the range in layer thicknesses that the oil-impregnated sand will be placed beneath BWST IT-60 tank and the construction controls to be required for its placement and compaction.

Q.2. (Issue 2, Page 3, Par. 2) Averaging the strain over a 20-foot gage length is not acceptable to the Staff because this averaging could lead to underestimating stresses and unacceptable cracking. Installing shorter length gages (maximum length of 5 feet) over the 20-foot length is recommended. The Staff's concern with the single 20-foot gage length is further discussed in Q.5.

Q.3. (Issue 2, Page 3, Par. 3) As a minimum, the BWST ring beams should be monitored for increasing strains at a frequency of at least once a year, following the initial 5 year period of plant operation.

Q.4. (Issues 1 and 2, Pages 5 and 6). The Applicant's responses to issues 1 and 2 are inadequate with respect to the basis for adopting the soil spring stiffness of 4,000 KCF and with respect to determining the effects of differential settlement on the existing SWPS. The importance in resolving these inadequacies with the Applicant is dependent on Structural Engineering Branch's evaluation of Consumers May 7, 1982 submittal on the limit analysis of the SWPS. If Consumers statement in the May 7, 1982 submittal is found acceptable by SEB, that the SWPS is not overstressed even if the north overhang portion were completely unsupported by the plant fill, then there is no longer a need to resolve the range in soil stiffness differences between the glacial till and plant fill. If, however, the results of the limit analysis are ultimately found not acceptable by SEB, then the Applicant should either justify the adoption of the soil spring stiffness value of 4000 KCF or alternately use a stiffness of K = 400 KCF for the glacial till which is considered reasonable and acceptable to the Staff and its consultants.

Q.5. (Issue 3, Page 6). The proposed 5/16-inch displacement criterion over a 20-foot gage length is not acceptable to the Staff or its consultants. A 5/16-inch extension, if it were to occur over a short length within the 20-foot gage length, would imply very high stresses in the steel

and would result in cracking during underpinning. More gages of shorter lengths (e.g., maximum length of 5 feet) would be preferable to permit identification of the more highly stressed sections. The Staff and its consultants recognize the advantages of the proposed strain monitoring program but consider measurement of the vertical differential settlement, similar to what is being carried out for the Auxiliary Building underpinning work, to be the more positive and sensitive construction control that would permit corrective action to be taken before overstressing the SWPS would occur. For these reasons the Staff requires that underpinning of the SWPS be controlled by monitoring of vertical differential settlement ~~where~~ to tolerable limits ~~has been~~ established ~~in~~ by appropriate analysis before starting this work.

Q.6. (Issue 6 Page 7). The Applicant's response to issue 6 does not provide the calculations for sliding resistance of the SWPS under seismic loading which were requested at the March 16 through 19, 1982 design audit. For this reason Item 2.2 of Enclosure 8 to the May 25, 1982 letter from D. G. Eisenhut to J. W. Cook again requests this information.

Q.7. (Issue 13, Pages 10-12) The following changes and additions should be made to the Applicant's response to issue 13.

a. On 5th line, Page 10, the word "solely" should be deleted.

b. On 2nd line, Par. 3, Page 11, the word "generally" should be deleted. At the end of this paragraph add the following: The correlation between the pier or plate load test results and the penetration tests performed on the foundation soils will be used to correct the correlation graphs and to judge the suitability of the bearing stratum.

c. Last paragraph, Page 11 should be revised to incorporate the following changes. The zone of influence should be defined by extending lines downward at a slope of 1 horizontal (H) to 1 vertical(V) from the edge of the footing into the foundation soils. If the foundation soil is cohesionless, a braced excavation is required if the excavation must proceed more than 6-inches below the adjacent pier or, if not an immediately adjacent pier, then 6-inches below the intersection of the pier footing with the 1H to 1V zone of influence slope. Movements of adjacent piers shall be monitored as the excavation proceeds to 18-inches or less. Excavations shall be stopped and construction procedures modified if measured movements are larger than anticipated.

Q.8. (Issue 14, Page 12). The modifications and additions which were required for the pier load test procedures for the Auxiliary Building (Enclosure 2 to the May 25, 1982 letter from D. G. Eisenhut to J. W. Cook, Par. 4) are also required in the procedures for the Service Water Pump Structure. In addition, if the very dense sandy alluvium is ultimately accepted as

the foundation for a portion of the SWPS underpinning piers, then either a pier or a plate load test should also be conducted on this foundation material.

Q.9. (Issue 18, Pages 13-15). The following comments and questions are numbered in identical order to the numering of the contingency plan items given in response to issue 18:

1.c. What procedure is to be followed that will permit a single well failure to be identified from the total system?

2.b. It is unclear what level will be equalized and the time it will take to complete this action. What occurrence (e.g., settlement measurement, etc.) triggers this reaction to uncontrolled groundwater flow?

3.a. and 3.b. Is the equipment for carrying out techniques such as forepoling or spieling or grouting to stop ground loss in readiness at the plant site?

4.a. Include limits on maximum depth of excavation and zone of influence and requirements for bracing.

4.b. A required increase in bearing area of underpinning piers is a significant change that requires notification of Region III.

5. Recording of excessive pier settlement requires an evaluation of its cause and notification of Region III before proceeding with other piers.

6. The use of wedges and plates would be the routine method to stop movement in the event of a jack failure.

7. A loss in functioning of the important northerly benchmarks would require underpinning work to be stopped until the benchmarks were restored.

8. Prior to implementing the listed items of 8a, 8b and 8c the underpinning work should be stopped and the existing excavation faces carefully supported.

The contingency plan should be revised to incorporate the above Staff's comments and Applicant's responses.

Q.10. (Issue 19, Pages 15-16). The following comments should be incorporated into the notes controlling the checking or adjusting of jacking loads.

Jacking will be controlled to limit settlements to acceptance criteria values identified on SWPS-14 (To be established by the Applicant and evaluated by the Staff). Wedges and plates will be used to prevent unacceptable movement in the event of a jack failure, both during pier construction and during application of final jacking loads.

During construction of Piers 1, 2 and 3 the jacks will be monitored at least at the start of every shift and daily during holidays and weekends. More frequent checking and jacking is required until the rate of load decrease is small enough and sufficiently stabilized to permit checking once during each shift.

Q.11 (Issue 20, Page 16). The above comments on jacking control and monitoring frequency are applicable to the transfer of the jacking load into the permanent underpinning wall. Provide the actual value of the "predetermined rate".

Q.12 (Issue 24, Page 19). It is unclear from the Applicant's response whether Consumers intends to comply with the Staff's recommendation (April 2, 1982 letter from R. Tedesco to J. Cook, Staff Concurrence for Installation and Operation of Construction Dewatering and Observation Wells for the Service Water Pump Structure, Enclosure 3, Page 4) and require extension of the six previously proposed piezometers to at least elevation 570. The Staff does not have a problem if the Applicant chooses to add piezometers to the original six and terminate these piezometers at "an elevation no lower than approximately 1 foot above the undisturbed natural soil. However, the Staff still requires that the bottom elevation of the original six piezometers be drilled to at least elevation 570.

The Staff does not accept the Applicant's statements on controlling the groundwater level in the SWPS area during underpinning construction for the following reasons:

a. Drawing the water level down to approximately the interface of the fill and natural soil is not a realistic control. Completed borings show this surface and soil conditions to be highly variable in the immediate area of the underpinning work with the interface level ranging from Elevation 605 to Elevation 583.

b. Identification of the soil type at the bottom of the dewatering well does not provide assurances that blow outs will not occur at the base of pier excavations because this information does not address the problem of pervious layer stratification and impervious layers of insufficient thickness.

For the above reasons the Staff reiterates its position that there should be a control on the upper phreatic surface which requires a minimum 2-foot depth between the upper phraetic surface being controlled by dewatering and the bottom of any underpinning excavation at any given time. As a minimum, the six originally proposed piezometer locations are to be used to verify that the groundwater is acceptably being maintained during underpinning. It is recognized that localized temporary dewatering techniques such as sumping may be necessary to produce hydrostatically relieved conditions in areas of entrapped water.

Q.13 (Fig. SWPS-14). A correction to Note 9 is needed to indicate that all instrumentation and material identified in the Monitoring Matrix is to be Q-listed unless otherwise shown not to be required. A separate request of the Applicant to provide the following drawings identified on Fig. SWPS-14 has been made.

Drawing Nos.	Subject
C-2040 thru C-2043-11	Crack Monitoring Requirements
C-2003 and C-2004	Building Settlement Monitoring Requirements
C-2035 and C-2036	Details of Wall and Pier Settlement Monitoring

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Discuss w/ Midland Consultants - April 22, Submittal by CPC
For SWPS

CONFIRMATORY ISSUE NO. 1

pg. 5) GEI - basis for stresses is SEB work

COE - Existing stresses must be known - Use existing settlement or Re to determine stresses due to settlement

CPC - Existing loading of overhang portion that is founded on fill is INDETERMINATE therefore, can not calculate stresses. Visually no structural stress observed.

- Jacking will relieve structural loads caused by settlement (transfer both to new underpinning wall and lower mat presently on fill) and permit analysis of stresses in structure to be made

RESOLUTION - SEB should evaluate limit analysis which shows no soil support is needed. If limit analysis (recently submitted for SWPS (Issue 1) is acceptable to SEB, this question is no longer required (Alternately - allow for fill) support to be removed there and then & all load to be transferred to line load - calculate stresses due to this change in loading)

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CONFIRMATORY ISSUE NO. 2

pg 5&6) GEI - Using k = 4000 KCF for till material during jacking is NOT APPROPRIATE for computing stresses

COE - Did not comment

CPC - It is necessary to use the stiff spring of 4000 KCF as a boundary element when evaluating preload to make the effects of differential settlement (during preload) to be negligible in the computer analysis

RESOLUTION - If limit analysis is not accepted by SEB

The appropriateness of using a K = 4000 KCF for the glacial till foundation soils has not been demonstrated and remains questionable. Either CPC should justify adoption of the K = 4000 KCF to the Staff's satisfaction or alternately use a K = 400 KCF for the till which is acceptable to the Staff

This question is also eliminated if limit analysis is accepted by SEB. Limit analysis is indicating that full support can be withdrawn entirely and steel will still not go into plastic range (indicating F.S. = 2, flexure & ~~mat~~ overturning)

? shear friction theory to calculate resistance of joint

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CONFIRMATORY ISSUE NO 3

pg 6) GEI – Has problem w/ CPC 5/16" criterion on strain monitoring because it implies a high stress in the steel & would permit cracking during underpinning. Recommends control be on VERTICAL DIFFERENTIAL SETTLEMENT similar to Control Tower to AVOID inducing severe stresses during underpinning

COE – Points out problem with averaging strains over 20' length & indicates this criterion is UNACCEPTABLE. Recommends shorter gage lengths (5' increments) to identify location of max. strain.
Recommends criteria also be established on basis of settlement monitoring.

$$\text{Strain} = \frac{\Delta l}{l} = \frac{5/16''}{20\text{ft} \times 12\frac{\text{in}}{\text{ft}}} = 0.013\ \text{in/in}$$

If 5/16" change in length occurred in 2ft length of structure, then strain is actually 0.013 in/in or stress of 390 K/in².

$$E = \frac{\text{Stress}}{\text{Strain}} \qquad \text{Stress} = E \cdot \text{strain} = 30{,}000\frac{\text{kip}}{\text{in}^2} \times 0.013\frac{\text{in}}{\text{in}} = 39\ \text{K/in}^2$$

$$\left(\tfrac{2}{3} \times 60\ \text{K/in}^2 = 40\ \text{K/in}^2\right)$$

CPC – Indicates 5/16 inch displacement in 20' gage length as criterion to stop construction. 5/16" is based on reinforcing steel approaching 2/3 the yield strain.

RESOLUTION – Need for settlement criteria
Comments on proposed 20' gage length
What stress in steel would be acceptable then back calculate strain for a gage length of 5'?
Settlement monitoring (more sensitive) will pick up movement whereas strain gage may not pick up movement.
Position – Use settlement & establish criteria
Will verify limit analysis (nothing

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CONFIRMATORY ISSUES NO. 6

pg 9) GEI & COE – Provided response on sliding resistance is inadequate

RESOLUTION – CPC is again requested to provide sliding calculations with assumptions and basis for assumed soil input properties and interface friction values
Refer to Encl. 8, Item 2.2 of May 25, 1992 submittal

CONFIRMATORY ISSUE No. 13

pg. 10, 11 & 12) GEI – Delete words "solely" (5th line, last par., pg. 10) and "generally" (2nd line, middle par., pg. 11)

Resolution – Use GEI recommendation

6/BB

RECORD OF TELEPHONE CONVERSATION

DATE: May 11, 1982, 1:00 pm PROJECT: Midland

RECORDED BY: Joseph D. Kane CLIENT:

TALKED WITH:	CPC	Bechtel	NRC
	J. Schaub	N. Swanberg	F. Rinaldi
	J. Mooney	J. Anderson	D. Hood
		C. Russell	J. Kane
		B. Dhar	
		W. Paris	J. Kane

ROUTE TO: J. Knight
G. Lear
L. Heller
D. Hood
F. Rinaldi
H. Singh
S. Poulos
R. Landsman, Region III
J. Kane

MAIN SUBJECT OF CALL: To discuss Phase 2 Issues - Auxiliary Building Underpinning

ITEMS DISCUSSED:

Consumers arranged this conference call to discuss review items related to Auxiliary Building underpinning. These items had been identified in a brief call on May 7, 1982 by J. Kane to J. Schaub where the NRC Staff had expressed their recommendations on the following items:

1. Location of deep seated benchmarks DSB-AS1 and DSB-AS2. The current hold on construction and field installation of monuments prevents the actual locations from being established. Consumers will provide actual locations when these benchmarks are installed and recognize these monuments are to be installed at a distance not to exceed 5 feet from the wall of the Main Auxiliary Building which is founded at Elevation 562.

2. Strain gage installation. The NRC Staff's comments for correction of drawing C-1495 were accepted and the drawing will be revised. (Lower strain gages at Elev. 584 to 614 on Sectional View Wall at Col. Lines 7.4 and 7.8 are to be reorientated 90 degrees and column lines H and G will be corrected). Bechtel will check why strain gage at Elev. 646 to 659 range was not proposed for Wall at Col. lines 7.4 and 7.8 and will get back to Staff. The vertical alignment of strain gage on Col. Lines 5.3 and 5.6 at Elevation range 646 to 659 is being controlled by the need to avoid equipment obstructions on the wall. Consumers will make an analytical correction for the vertical alignment when evaluating strain gage readings.

dupe in package

3. Pier test procedures. Consumers indicated the dead load available in the existing structure for the reaction load in the pier load test is approximately 90 percent of the maximum design load. Consumers wished to further consider the Staff's recommendation to perform a plate load test where the maximum test load would be equal to 130 percent of the maximum design load and a pier load test at 90 percent of the maximum design load.

   Consumers accepted the Staff's recommendation for performing two in situ density tests and a minimum of five cone penetrometer tests on the soil at the bottom of the pier selected for load testing. Consumers also agreed to use bituminous coated plywood sheeting for reducing the effects of skin friction during the pier load test.

   Consumers wished to further consider the Staff's recommendation for requiring a rate of settlement that would not exceed 0.005 inch per hour when controlling the length of time that the 90 percent test load increment would be maintained.

   To better explain what the Applicant intended when it indicated that it would make modifications to ASTM D1143 as deemed appropriate, Consumers will provide the Staff with the pier load test procedures that identify the proposed modifications.

4. Construction dewatering. The Applicant indicated its plan for construction dewatering during underpinning is nearly complete and will be provided to the Staff within a week. Most of the dewatering wells are already installed but additional wells are planned. The additional wells are to be installed with Q/A procedures that are similar to the permanent dewatering wells which were previously approved by the NRC Staff. Monitoring for loss of soil particles due to pumping will be conducted according to the agreements reached for construction dewatering of the SWPS. (April 2, 1982 letter with enclosures, R. Tedesco to J. Cook).

   Consultants to Consumers indicated the already installed construction dewatering wells extend to the natural clay layer at approximately El 585. The Staff indicated that the anticipated plan for construction dewatering to be provided by Consumers should address the problem of handling seepage on the sides and bottom of pier excavations which extend below the bottom of the already installed wells.

5. Movement of Feedwater Isolation Valve Pit (FIVP). Consumers indicated its intent to assure transfer of the FIVP loading to the Turbine Building and Buttress Access Shafts by jacking the installed support system. It is not the intent of this jacking to restore the FIVP to its original position but

rather assure transfer of the load. The procedure for future jacking which Consumers indicated they would follow at the February 1-5, 1982 design audit and which was found acceptable by the NRC Staff requires jacking of the FIVP back to its original position if the relative settlement between the Reactor Containment and the FIVP reaches a total settlement of 3/8-inches since the date that the piping connections were made.