UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

NRC STAFF TESTIMONY OF DARL HOOD, JOSEPH KANE,
FRANK RINALDI AND EUGENE GALLAGHER ON STAMIRIS CONTENTION 2

Q.1. Please state your names and positions with the NRC.

A. My name is Darl Hood. I am a Senior Project Manager in the Division of Licensing, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission.

My name is Joseph Kane. I am a Principal Geotechnical Engineer within the Hydrologic and Geotechnical Engineering Branch, Division of Engineering, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission.

My name is Frank Rinaldi. I am a Senior Structural Engineer in the Structural Engineering Branch, Division of Engineering, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission.

My name is Eugene Gallagher. I am a civil engineer with the U.S. Nuclear Regulatory Commission. Since February 1981, I have been assigned to the Reactor Engineering Branch, Division of Resident and Regional Reactor Inspection, Office of Inspection and Enforcement. Prior to February 1981, I was a reactor inspector assigned to the Region III, Reactor Construction and Engineering Support Branch, Office of Inspection and Enforcement.

Q.2. Have you prepared a statement of professional qualifications?

A. Yes. Copies of these statements are found in Attachment 1.

Q.3. Please state the duration and nature of your responsibilities with respect to the Midland Plant, Units 1 and 2?

A. I, Darl Hood, am the Project Manager for the Midland Plant application for operating licenses. I have served in that position from August 29, 1977, when the application for operating licenses was tendered to the NRC for acceptance review, up to the present time. My responsibilities include management of the Staff's environmental and radiological safety reviews. I am responsible for the responses to Stamiris Contention 2(a), (d), (e) and supplementary Items 1, 6, 10 and 12.

I, Eugene Gallagher, was assigned to the Midland Plant (among others) from October 1978 until January 1981. Since October

of 1978, I have spent approximately 1 year of effort performing inspections, reviewing quality control records and procedures, observing work activities, reviewing Consumers Power Company's (hereafter CPC or Applicant) response to 50.54(f) questions 1 and 23, and attending meetings and presentations by CPC and Bechtel regarding the soil settlement matter of the Midland Plant. I am responsible for the response to Stamiris Contention 2(c).

I, Joseph Kane, have served since November 1979 as the technical monitor for the Midland portion of an interagency contractual agreement between the NRC and the U.S. Army Corps of Engineers, Detroit District (hereafter the Corps). By this contract the Corps has been assisting the NRC Staff in the safety review of the Midland Project in the field of geotechnical engineering. In addition to, and as a consequence of, my serving as contract technical monitor, I have become directly involved in the assessment of the adequacy of the remedial measures which have been proposed by CPC to correct the plant fill settlement problem. I am responsible for the responses to Items 2, 3, 4, 5, 7, 8, 9 and 11 of Stamiris' supplement to Contention 2.

I, Frank Rinaldi, have served since February 1980 as the technical monitor for the Midland portion of an interagency contractual agreement between the NRC and the Naval Service Weapons Center (hereafter NSWC). By this contract the NSWC has been assisting the NRC Staff in the safety review of the Midland Project

in the field of structural engineering. In addition to, and as a consequence of, my serving as contract technical monitor, I have become directly involved in the assessment of the adequacy of the remedial measures which have been proposed by CPC to correct the plant fill settlement problem. I am responsible for the response to Item 4 of Stamiris' supplement to Contention 2.

Q.4. Please state the purpose of this testimony.

A. The purpose of this testimony is to address Stamiris Contention 2 as stated in the Appendix to "Prehearing Conference Order Ruling on Contentions and on Consolidation of Proceedings (October 24, 1980)," and as supplemented by Ms. Stamiris in "Intervenor Answer to Applicant's Interrogatories, 4/20/81." This testimony does not address Stamiris Contention 2(b) since the parties agreed that discussion of Contention 2(b) would be postponed to the August portion of the hearing.

Stamiris Contention 2 reads as follows:

> Consumers Power Company's financial and time schedule pressures have directly and adversely affected resolution of soil settlement issues, which constitutes a compromise of applicable health and safety regulations as demonstrated by:
>
> a) the admission (in response to §50.54(f) question #1 requesting identification of deficiencies which contributed to soil settlement problems) that the FSAR was submitted early due to forecasted OL intervention, before some of the material required to be included was available;

b) the choice of remedial actions being based in part on expediency, as noted in Consumers Power Company consultant R. B. Peck's statement of 8-10-79;

c) the practice of substituting materials for those originally specified for "commercial reasons" (NCR QF203) or expediency, as in the use of concrete in electrical duct banks (p. 23 Keppler Report)*;

d) continued work on the diesel generator building while unresolved safety issues existed, which precluded thorough consideration of Option 2 - Removal and Replacement Plan; and

e) the failure to freely comply with NRC testing requests to further evaluate soil settlements remediation, inasmuch as such programs are not allowed time for in the new completion schedule presented July 29, 1980.

April 20, 1981 Supplement to Contention 2

Further examples of the effect of financial and time pressures on soil settlement issues:

Examples	Effect on soil settlement issues
1. 11/7/78 Bechtel action item:"proceed with preparations for preload as rapidly as possible"	1. Root causes not adeq. investigated. Organizational deficiencies not eliminated prior to proceeding with remediation
2. 11/7/78 decision to fill pond "immediately, because the amount of river water available for filling is restricted"	2. Affected piezometric measurements during preload
3. 11/7/78 "5 month period is available in the schedule for preloading"	3. The surcharge was removed at the end of this 5 months despite lack of NRC satisfaction that secondary consolidation was assured

* March 22, 1979 Keppler Investigation Report conducted by Region III, Dec. 78-Jan. 79.

4. Failure to grout gaps prior to cutting of duct banks, failure to cut condensate lines when first suggested, failure to break up mudmat at DGB	4. Resulted in additional stresses to DGB which could have been avoided
5. Choice to continue construction of DGB	5. Eliminated practical consideration of Removal & Replacement Option
6. Early FSAR submittal and inadequate review of FSAR	6. Precluded early detection of inconsistencies which could have prevented some of the s.s. problems
7. Failure to reconstruct geometry of area prior to fill placement, failure to await NRC approval before proceeding with Preload, selection of "least costly feasible alternative" for DGB.	7. Varying degrees of caution and conservatism were foregone in favor of cost and schedule advantages
8. Failure to excavate loose sands as committed to in PSAR	8. Contributed to inadequacy of subsoils
9. Installation of preload instrumentation was subject to time pressure assoc. with frost protection considerations	9. Expenditures for preload instrumentation (CJD 11/1/78 memo) prior to formal adoption of preload = premature commitment
10. Appeals to NRC to consider financial plight and schedule deadlines as in Seismic Deferral Motion	10. If granted, would affect seismic--soil settlement standards
11. Depth and breadth of surcharge limited by practical consideration of DGB, Turbine B. structures	11. Afforded less than optimum conditions for surcharge
12. Changes to design (DGB foundation), material, or proceedural specifications without proper approval	12. Contributed to settlement or stress problems and allowed conflicts to go unnoticed as preventative indicators

Q.5 What is the NRC Staff response to Stamiris Contention 2(a)?

A. First, the statement which Contention 2(a) calls an "admission" is found in the third paragraph of CPC's response to 50.54(f) Request 1, Part b (page 1-2 of Responses to NRC Requests Regarding Plant Fill). That full paragraph which is a part of the Applicant's explanation regarding contradictions between the PSAR and the FSAR reads as follows:

> The Midland FSAR was submitted to the NRC at an earlier point in the project schedule than would have normally occurred in order to provide additional time for the operating license hearings due to the forecasted intervention. Consequently, some of the material required to be included in the FSAR was not available at the time of its initial submittal, or was supplied based upon preliminary design information. As the design and construction continued, the appropriate sections of the FSAR were revised or updated to include the necessary information.

Second, a portion of the application for operating licenses, namely the FSAR, was tendered by CPC on August 29, 1977. The NRC performed an acceptance review pursuant to Section 2.101 of 10 CFR Part 2, and by letter dated November 11, 1977 advised the Applicant that the tendered FSAR was sufficiently complete based upon all of the information filed, taken as a whole. The Midland FSAR was docketed on November 18, 1977. The remainder of the application, namely the Environmental Report, was tendered March 1, 1978 and docketed April 14, 1978.

Third, the original schedule approved by NRC in December 1977 was based upon a projected fuel load date of October 1, 1980 for Unit 2. The major licensing milestones scheduled for the FSAR review were:

FSAR docketed	11/18/77
Safety Evaluation Report (SER) issued	3/30/79
ACRS Meeting	5/10/79
Supplement to SER issued	7/13/79
Start OL hearing	8/13/79
End OL hearing	7/15/80
Decision	10/1/80

It is not unusual for the Staff to initiate review of an FSAR without inclusion of all the material which will ultimately be required for completion of that review. Moreover, the difficulty associated with certain statements made in the FSAR was not a matter of information excluded from the early versions of the FSAR, but rather a matter of their accuracy.

A decision by the NRC to docket an FSAR and the establishment of review schedules are administrative matters for which the NRC's goal is to provide for completion of the licensing review consistent with the construction schedule. With respect to the Applicant's statement that "some of the material required to be included in the FSAR....was supplied based upon preliminary design information," the obligation of the Applicant to provide accurate information under oath or affirmation pursuant to Section 50.30 to 10 CFR Part 50 is by no means waived by these administrative matters, regardless of when they occur. Similarly, the quality assurance requirements of Appendix B to 10 CFR Part 50 which are applicable to the FSAR apply irrepective of any time table.

For these reasons, the early submittal of the FSAR provides no justification for the deficiencies associated with soil settlement problems, nor does it constitute a compromise of applicable health and safety regulations.

Q.6. What is the NRC Staff response to Stamiris Contention 2(c)?

A. NCR QF 203 (Attachment 2) identifies three instances where user test reports for granular soil material did not meet specification gradation limits.

(1) User Test Report 0630: the acceptance gradation limits for material passing the ½" sieve were 75-90%; the user test report showed 94% passing. This deviation was "accepted as is" based on engineering review of the actual gradation of the material supplied.

(2) User Test Report 1036: the acceptance gradation limits for material passing the ½" sieve were 75-90%; the user test showed 91%. This deviation was rejected based on an engineering review and material was not permitted to be used in "Q" areas, but the material was permitted to be used in non-"Q" areas.

(3) User Test Report 0836: the acceptance gradation limits for material passing the #200 sieve were 12% - 20%; the user test showed 11%. The reason given for the 12% - 20% acceptance

criteria was for "commerical reasons" since the supplier could supply material within these limits. The specification, however, permitted material to be within 7 - 20%. Therefore, the acceptance criteria or the user test report was more restrictive than the specification requirements.

In all three cases the in-process corrective action was acceptable based on a review of the facts. These three nonconforming conditions did not adversely or directly affect resolution of the soil settlement issue.

Regarding the use of concrete for "expediency" in the electrical duct banks area the following should be considered. Based on the IE investigation the lean concrete material in itself was not a matter of concern. The matter of concern was that the design controls did not verify if the substitution of concrete in this area would affect the design basis of the structure (i.e. interface between the electrical duct banks and the Diesel Generator Building settlement). The IE investigation found that the design interface and consideration between electrical and civil was not adequate to assure the necessary tolerance between the duct banks and the structure to provide free movements when settlements occurred. The question of expediency was not the issue in IE investigation report 78-20, but rather the issue was the adequacy of the design coordination.

Q.7 What is the NRC Staff response to Stamiris Contention 2(d)?

A. The Staff does not agree that continued work on the Diesel Generator Building foreclosed consideration of the removal and replacement option as a viable alternative. Indeed, that option remains viable today should that option prove necessary. As noted in the Applicant's response to 50.54(f) Request 21, the continuation of building construction would contribute to the additional costs for implementing the removal and replacement option in the event the elected preload plan should fail to provide acceptable results. Such financial matters undertaken at the Applicant's own risk would not deter the NRC from requiring an acceptable solution in the event of unacceptable results from the option implemented.

Q.8. What is the NRC Staff response to Stamiris' Contention 2(e)?

A. The "new completion schedule" referred to in Contention 2(e) was presented by CPC during the meeting of the NRC's Caseload Forecast Panel in Midland, Michigan on July 29, 1980, to assess the construction completion schedule for Midland Plant, Units 1 and 2. The new estimate for completion of Unit 2 was July 1983, and for Unit 1 was December 1983. The corresponding dates for commercial operation were December 1983 and July 1984 (steam operation), respectively.

The Staff assumes that the "NRC testing requests" stated in Contention 2(e) refer to the June 30, 1980, Staff request (Request 37) for additional borings and laboratory analyses.

The NRC Staff knows of no basis for Stamiris' statement that the new completion schedule does not allow time for testing programs to further evaluate soil settlement remediation. Furthermore, it cannot recall any such statement by the Applicant at the July 29, 1980, meeting nor at any other time. Rather, it is the Staff's understanding that the results of laboratory analyses of the borings as requested by NRC and the Corps, will be provided beginning in mid-June 1981. This timetable is compatible with the completion schedule as presented July 29, 1980.

Q.9. What is the NRC Staff response to Item 1 in Stamiris' supplement to Contention 2?

A. The "11/7/78 Bechtel action item" cited in Item 1 of Stamiris' supplement to Contention 2 refers to "Meeting Notes No. 882" of Mr. B. C. McConnel of Bechtel for a November 7, 1978 meeting between CPC, Bechtel and Bechtel's consultants. The meeting notes are located at Tab-12, Volume 4 of "Responses to NRC Requests Regarding Plant Fill" (Attachment 3). The action item appears to result from the discussion at page 2 of the meeting notes indicating that a 5-month period was available in the schedule, and that Dr. Peck

recommended proceeding with the instrumentation and preload as rapidly as possible.

Ms. Stamiris is correct that matters of relevance to the quality assurance program, which include investigations as to the root causes of the soil settlement and reviews of organizational structures for potential deficiencies, were not completed as of November 7, 1978, nor prior to proceeding with the preload program for the Diesel Generator Building. The Staff had expressed a similar concern during the meeting of December 4, 1978, as noted at the end of the "Summary of December 4, 1978, Meeting on Structural Settlement," January 12, 1979:

> The staff also stated that while attention to remedial action is important, determination of the exact cause is also quite important for verifying the adequacy of the remedial action, assessing the extent of the matter relative to other structures, and in precluding repetition of such matters in the future.

The Staff's 50-54(f) Request 1 which was issued March 21, 1979, also noted the Staff's concern that such quality assurance reviews be performed. This was followed by 50.54(f) Request 23 on September 11, 1979. The Staff's concern for quality assurance was a significant factor in the NRC's decision to issue the December 6, 1979 Order Modifying Construction Permits.

Q.10. What is the NRC Staff response to Item 2 in Stamiris' supplement to Contention 2?

A. The Staff agrees with Stamiris Contention 2, Item 2, to the extent that CPC's decision to fill the cooling pond "immediately, because of the amount of river water available for filling is restricted," did affect the piezometric measurements during pre-loading. This statement was made in the November 7, 1978, Meeting Notes referred to in the preceding response. (Attachment 3). The coincident effects on piezometric monitoring caused by seepage still developing from the raised pond and also due to the development of excess pore water pressures under the surcharge loading were identified by the Staff (Attachment 4) and its consultants, the Corps, as being an important reason for not being able to fully accept CPC's conclusion on the effectiveness of the surcharge program. To overcome this problem, the NRC has attempted to have the effectiveness of the surcharge program verified by requiring the additional borings and laboratory testing for the Diesel Generator Building foundation soils.

The Staff would agree that time schedule pressures did compel CPC to accept less than the best sequence in the pond raising-surcharge placement operations and therefore, these pressures may have adversely affected resolution of the soil settlement issues.

Q.11. What is the NRC Staff response to Item 3 in Stamiris' supplement to Contention 2?

A. The Staff agrees with Stamiris that the minutes of the meeting held November 7, 1978, between CPC, Bechtel and Bechtel's consultants does indicate "a 5-month period is available in the schedule for preloading." The Staff also agrees with the Stamiris contention that the surcharge was removed without NRC being satisfied that secondary consolidation was assured. The Staff acknowledges, however, that CPC did notify the NRC of its intention to remove the surcharge fill prior to actually removing it.

The reasons the Staff was not satisfied with the effectiveness of the surcharge program can be traced to CPC's former practice of not identifying the criteria that would be acceptable to the NRC Staff in advance of completing the remedial action. CPC's practice and the resulting difficulty that it presented to the Staff is illustrated in the following paragraph taken from the "Summary of July 18, 1979, Meeting on Soil Deficiencies at the Midland Plant Site" (Attachment 5):

> The staff noted that the response to its 10 CFR 50.54 requests for acceptance criteria for remedial actions (e.g., questions 4, 6, etc.) had not resulted in identification of criteria in advance of the remedial action. Rather the repl: notes that the criteria will be determined during or after the remedial action. The staff stated that this approach by the applicant does not provide for timely staff feedback at the outset, but rather the staff must await results of the program to determine what acceptance criteria were used and if they are acceptable. Thus, the remedial action is being conducted entirely at the applicant's own risk.

The Staff's conclusions as to whether secondary consolidation had been reached due to the surcharge program and as to the effectiveness of the surcharge program awaits receipt and review of the results of additional borings and laboratory testing as discussed in response to Question 10.

Q.12. What is the NRC Staff response to Item 4 in Stamiris' supplement to Contention 2?

A. The matters of grouting gaps prior to cutting duct banks and breaking up the mudmat were considered at a meeting between CPC, Bechtel and Bechtel's consultants as reflected in "Meeting Notes No. 882." (Attachment 3) These notes at page 3, paragraph 6, state:

> The duct banks which appear to be restraining the building settlement should be isolated from the building as necessary. The building construction should continue, thereby providing more weight on the foundations. Any gaps between the footing and the mudmat would require grouting. The grouting would not be necessary prior to preload. It was pointed out that from a safety and a building distress point of view, it would be advisable to grout existing gaps prior to releasing duct banks. It was also suggested that the mudmat be broken up prior to preload.

Similarly, in the trip report by CPC (Attachment 6) for this same November 7, 1978, meeting, the following account of the above discussion is given at page 3:

> The question of grouting the gaps between the footing and the soil was discussed. Dr. Peck and Dr. Hendron did not feel the grouting of the gap between the footing and soil was necessary prior to preload. However, discussion continued and it was concluded that Bechtel would grout any gaps between the footing and soil after the preload had been removed. It was suggested by the consultants that the mudmat be broken up prior to preload application and that early grouting may also be beneficial in relieving some building stress.

With respect to the condensate lines, the Staff was advised by 50.55(e) Interim Report #4 to Management Corrective Action Report 24 dated February 16, 1979, and forwarded by cover letter dated February 23, 1979, of the preloading progress and that the two condensate lines had been cut. Interim Report #4, at page 5, stated:

> 2. Preload Operation
>
> Preloading of the Diesel Generator Building is continuing. As of February 2, 1979, the granular fill material for the preload has been placed to the elevations shown in Figure 41.
>
> 3. Cutting of the Condensate Pipelines
>
> The two 20-inch condensate lines and two 6-inch condensate lines shown in Figures 9 and 10 have been cut outside the turbine building wall to prevent potential overstressing of the pipes during preload. Continued surveillance will be provided on the cut pipelines and further evaluation will be provided in subsequent reports."

The Staff is unable to conclude that grouting the gaps prior to isolating the duct banks would have been the better approach to preloading. There are advantages and disadvantages associated with either decision--to grout or not to grout. The decision not to grout likely allowed some immediate stress relief in bay areas 3

and 4 when the duct banks were released. On the other hand, it is uncertain as to the extent that beneficial reduction in additional stresses to other portions of the Diesal Generator Building would have resulted had grouting been performed prior to cutting away the duct bank.

With the benefit of hindsight, it would appear that initially not grouting and a more gradual lowering of the structure after release from the duct banks would have been preferable, rather than the actual abrupt release of the structure. Such an approach would have permitted a more gradual redistribution of loading to the Diesal Generator Building's foundation. Grouting then might still have been necessary following the initial relief of stresses in order to result in more uniform future settlement and to avoid the inducement of possible additional stresses in other portions of the Diesal Generator Building.

It is the Staff's understanding that the condensate lines were actually cut. Therefore, these unconnected lines were apparently not a cause of additional stresses to the Diesel Generator Building.

With regard to not breaking up the mudmat beneath the Diesel Generator Building, it is likely this decision lessened the stresses imposed during surcharging since the structure foundation was stiffer and better able to span any soft soil areas that may have existed. There is a trade off, however, in that not breaking up the mudmat

reduced the effectiveness of the surcharge in consolidating the softer foundation soils which were being bridged by the structures foundation and mudmat. If in the future during plant operation, new or extended cracking of the wall footings and mudmat were to occur, redistribution of loading pressures could result and possibly lead to additional settlement.

The Staff therefore concludes that CPC's failure to act listed in Item 4 did not adversely effect resolution of the soil settlement issues.

Q.13. What is the NRC Staff response to Item 5 in Stamiris' supplement to Contention 2?

A. This Contention is essentially the same as Stamiris Contention 2(d) addressed in response to Question 7 of this testimony. In summary, CPC's decision to continue construction of the Diesel Generator Building does make it more difficult and costly to select the removal and replacement option, but it does not eliminate this option. The Staff views this decision by CPC as evidence of its willingness to proceed at its own risk; it does not view CPC's decision as having an adverse effect on resolution of the soil settlement problem.

Q.14. What is the NRC staff response to Item 6 in Stamiris' supplement to Contention 2?

A. Had the FSAR been tendered as late as August 1978 instead of August 1977, little or no detection of inconsistencies would have occurred during this interval with respect to soil settlement problems. The basis for this position is the following statement by the Applicant in response to 50.54(f) Request 1, page 1-3 of "Responses to NRC Requests Regarding Plant Fill," Volume 1:

> Through the above procedures and actions, the FSAR and project design documents are constantly being reviewed and compared against each other. When inconsistencies are identified, they are corrected. However, there are some sections of the FSAR that are essentially inactive (e.g., the FSAR section relates to items for which the design, procurement, and construction phases have been completed and there have been no recent document changes or NRC questions to prompt a review of the section).
>
> Prior to the identification and investigation of the Diesel Generator Building settlement starting in August 1978, FSAR Section 2.5 and Subsection 3.8.5 (which were the areas of contradictions in the PSAR and FSAR as described by I&E during the meetings of February 23 and March 5, 1979) were considered inactive. All of the major plant backfill operations were completed, no significant revisions to the related civil specifications or calculations were made, and only two NRC questions were received at that time. These two NRC questions were related to Section 2.5 and dealt with the seismicity of the Michigan region.

Q.15. What is the NRC Staff response to Items 7, 9 and 11 of Stamiris' supplement to Contention 2?

A. The Staff is uncertain as to the meaning of "reconstruct geometry of area" in the beginning of Item 7 and therefore the Staff cannot respond to this aspect of the Contention. The Staff views

the intent of supplemental Items 7, 9, and 11 of Stamiris Contention 2 as questions on the adequacy and conservativeness of the selected preloading solution to remedy the plant fill settlement problem of the Diesel Generator Building. The Staff recognizes that decisions and actions by CPC are naturally affected by cost and schedule considerations. The Staff does not feel that these competing concerns are irreconcilable, but rather the Staff attempts to recognize the needs of applicants while exercising its regulatory responsibility through firmly insisting upon acceptable margins of safety and assurances that provide for protection of the health and safety of the public. The Staff therefore concludes that the examples listed in Items 7, 9 and 11 have not adversely affected resolution of the soil settlement issue.

Further, with respect to supplemental Item 11 which claims that the depth and breadth of surcharge was limited by practical consideration of the Diesel Generator Building and Turbine Building and that this afforded less than optimum conditions for surcharge, the Staff believes the significant issue here should be, not whether optimum conditions existed, but whether accepted results were achieved by the surcharge program as executed. In this regard, the results of additional borings and laboratory testing requested by the Staff and the Corps are to be provided for review in the near future. The assessment of these results by the Staff and the Corps will be the subject of later testimony in this hearing.

Q. 16. What is the NRC Staff response to Item 8 in Stamiris' supplement to Contention 2?

A. In February 1978 the NRC in its review of the Midland FSAR forwarded Request 362.2 which sought documentation of the method CPC used to remove the loose natural sands (sands with less than 75% relative density) from the foundations of safety related structures as CPC committed to do in the PSAR. In subsequent submittals in response to NRC Request 362.2, CPC provided the results of boring explorations which had been drilled in August and September of 1978 and additional explorations in 1979. The date when these borings were drilled occur after the site area fill had been placed. These late results and evaluation of the boring information which CPC has documented did not indicate the presence of loose natural sands beneath safety related structures. Based on these facts, the Staff is unable to conclude that CPC failed to excavate loose natural sands as committed to in the PSAR or that this failure contributed to the inadequacy of the subsoils.

Q.17. What is the NRC Staff response to Item 10 in Stamiris' supplement to Contention 2?

A. The resolution of the "Seismic Deferral Motion" was achieved consistent with the NRC Staff's needs as expressed at the prehearing conference of April 27, 1981. No compromise of applicable health and safety regulations is associated with this resolution.

Q.18. What is the NRC Staff response to Item 12 in Stamiris' supplement to Contention 2?

A. Ms. Stamiris is correct that these manifestations of the breakdown in quality assurance existed prior to December 6, 1979. Such matters were the subject of the NRC Staff Motion for Summary Disposition on the Issue of Quality Assurance Implementation Prior to December 6, 1979. However, as other Staff testimony demonstrates, the quality assurance program now satisfies all required NRC criteria; further, as a result of revisions in the quality assurance program, the improved implementation of the program, and other factors discussed in testimony submitted by James G. Keppler, the NRC now has reasonable assurance that quality assurance and quality control programs will be appropriately implemented with respect to future soils construction activities including remedial actions taken as a result of inadequate soil placement.

DARL S. HOOD

OFFICE OF NUCLEAR REACTOR REGULATION
U.S. NUCLEAR REGULATORY COMMISSION

PROFESSIONAL QUALIFICATIONS

I am a Senior Project Manager in the Division of Licensing, Office of Nuclear Reactor Regulation. I am responsible for managing licensing activities by the Commission with respect to Midland Plant, Units 1 and 2.

I have served in the position of Project Manager with the Commission since August 1976. This position provides for the managing of radiological safety reviews of applications for licenses and authorization to construct or operate light water nuclear power plants. As of April 1980, the position also provides for the managing of the environmental reviews of such applications. I assumed responsibility for Midland Plant, Units 1 and 2, when the application for operating licenses was tendered in August 1977. Other nuclear plants for which I have previously served in this capacity are the standardization design of Westinghouse which is designated RESAR-414 (Docket STN50-572), Catawaba Nuclear Station, Units 1 and 2 (Dockets 50-413 and 50-414), and River Bend Station, Units 1 and 2 (Dockets 50-458 and 50-459).

Between June 1969 and August 1976 I held two sequential positions within the Nuclear Power Systems Division of Combustion Engineering, Inc. (C-E) at Windsor, Connecticut. After March, 1973, I was Assistant Project Manager for the Duke Power Project. This position provided assistance in directing all efforts by C-E to design, fabricate, purchase and license the nuclear steam supply systems, reactor core, and associated auxiliary systems for Cherokee Units 1, 2 & 3 and Thomas L. Perkins Units 1, 2 & 3. The position assured that all aspects of the contracts were met and that safe and reliable systems were provided to the required schedule and at a reasonable profit to C-E. I assisted Duke Power in preparing the Preliminary Safety Analysis Report (PSAR) and provided for all C-E licensing support for these units. I also provided coordination of all other nuclear plants referencing the C-E Standard Safety Analysis Report to assure compatibility with C-E standard reference design. Until March, 1973, I was a Project Engineer in C-E's Safety and Licensing Department and was responsible for licensing of nuclear power plants. I coordinated the preparation of the Millstone Unit 2 PSAR and FSAR and the Calvert Cliffs Units 1 & 2 FSAR and interfaced with NRC, the utility, architect engineer and all C-E functional departments on licensing support matters. I ensured that NRC criteria, standards, and guides were incorporated into the nuclear steam supply system design.

Between August 1966 and June 1969, I was a Nuclear Safety and Radiation Analysis Engineer in the Nuclear Safety Unit, Nuclear Division of the Martin Marietta Corporation at Baltimore, Maryland. The purpose of this position was to perform hazard evaluations for nuclear power sources applied in space missions. My primary duty was to determine public exposure to radiation for malfunctions occurring during the intended mission. I also determined means by which the hazard potential for nuclear space systems could be mitigated to the extent that nuclear safety criteria were met. I conducted research with regards to the development of suitable criteria for permissable exposure levels and their probabilities, taking into account the dependence of acceptable risk on the benefit to be derived. My primary assignment was with the SNAP 29 (Systems for Nuclear Auxiliary Power) project. My evaluations of this nuclear power source included the formulation and application of computerized models for the transport of fuel released at high altitudes, in deep ocean and in shallow waters. I derived models for these release areas to incorporate the activity into human food chains and determined the expected ingestion dose, the number of people involved and the exposure probabilities. Inhalation dose was determined for radioactive fallout from the high-altitude release.

Between February 1965 and August 1966 I was a Nuclear Quality Control Engineer within the Electric Boat Division of General Dynamics at Groton, Connecticut. The purpose of this position was to provide control of quality for naval reactor systems, components, and shielding during the construction or overhaul of submarines by this shipyard. My primary area of responsibility was shielding. Duties included establishing procedures for the inspection of fabrication and installation of lead and polyethylene shielding, and resolving problems in complying with these or other shielding procedures. The position required a knowledge of nuclear theory, SSW systems design, Bureau of Ships contract and design requirements, non-destructive testing techniques, and quality control requirements.

Between November 1963 and February 1965, I was an Aeronautical Engineer for Nuclear Propulsion and Power at the George C. Marshall Space Flight Center, National Aeronautics and Space Administration in Huntsville, Alabama. I performed investigations of the nature and magnitude of the nuclear radiation environment, shielding systems and safety systems associated with proposed nuclear space vehicles for candidate space missions.

Between November 1963 and college graduation in 1962, I held various positions including chief of a missile electronics training unit at Redstone Arsenal, Alabama; student at the U.S. Army Signal Officer's Orientation Course at Fort Gordon, Georgia; and Marine Engineer for ordinance and special weapons within the Design Division of the Norfolk Naval Shipyard, Portsmouth, Virginia.

I received a Bachelor of Science Degree in Nuclear Engineering from North Carolina State University in 1962. I am a member of the Health Physics Society.

PROFESSIONAL QUALIFICATIONS AND EXPERIENCE

NAME: Joseph D. Kane

ADDRESS: 7421 Miller Fall Road
Derwood, MD 20855

EDUCATION:

B.S. Civil Engineering Villanova University	1961
M.S. Civil Engineering Villanova University	1973
Post-degree studies, Soils and Foundation Engineering	
University of California	1972
University of Maryland	1978

PROFESSIONAL REGISTRATION:

Registered Professional Engineer (1966) - Pennsylvania 12032E

PROFESSIONAL SOCIETY:

American Society of Civil Engineers

EMPLOYMENT POSITIONS:

February 1980 - Present	Principal Geotechnical Engineer U.S. Nuclear Regulatory Commission
May 1977 - February 1980	Geotechnical Engineer U.S. Nuclear Regulatory Commission
October 1975 - May 1977	Soils Engineer U.S. Nuclear Regulatory Commission
August 1973 - October 1975	Supervisory Civil Engineer Chief, Soils Design Section U.S. Army Corps of Engineers Philadelphia District
January 1963 - August 1973	Civil Engineer Soils Design Section U.S. Army Corps of Engineers Philadelphia District
January 1962 - January 1963	Design Engineer McCormick - Taylor Associates Philadelphia, Pa.

PROFESSIONAL EXPERIENCE SUMMARY:

1975 to Present

In NRC Division of Engineering, Geotechnical Engineering Section, Mr. Kane has specialized in soil mechanics and foundation engineering. Experiences in this position have included the following:

a. Evaluation of the foundation adequacy of proposed sites for nuclear facilities with respect to design and operational safety. This work has included evaluation of geotechnical, soils and rock mechanics, foundation and earthquake engineering related aspects. The results of this review effort are summarized in a safety evaluation report for each of the proposed facilities which have included nuclear power plants, nuclear fuel reprocessing plants and uranium mill tailings waste systems.

b. Serving as a technical adviser for soil and foundation engineering related aspects in the development of regulatory guides, acceptance and performance criteria that are intended to assure construction and operational safety of nuclear facilities.

c. Serving as a technical representative for the Office of Nuclear Reactor Regulation on the NRC Advisory Group concerned with federal dam safety.

d. Serving as an instructor for the Office of State Programs in the training of state personnel who are responsible for construction and operational inspections of uranium mill tailings embankment retention systems.

1963 to 1975

During this period Mr. Kane was employed with the U.S. Army Corps of Engineers, Philadelphia District and attained the position, Chief, Soils Design Section, Foundations and Materials Branch, in 1973. Professional experiences with the Corps of Engineers have included the following:

a. The embankment and foundation design of four large multi-purpose earth and rockfill dams with appurtenant structures (spillways, inlet and outlet structures, control towers, flood protection facilities, etc.). Responsibilities ranged from the initial planning of

subsurface investigations to select the most feasible sites through all design stages which were culminated in the final preparation of construction plans and specifications. This work included planning and evaluation of laboratory testing programs, studies on slope stability, seepage control and dewatering systems, settlement, bearing capacity, liquefaction, embankment safety instrumentation and slope protection.

b. Served as a technical consultant to field offices charged with construction inspections for assuring completion of structures in compliance with design analysis and contract specifications. Participated in the development of needed modifications during construction whenever significant changed site conditions were uncovered.

c. Directed the efforts of engineers in the Soils Design Section in other fields of civil work projects that included the embankment and foundation design of levees, waterfront pile supported structures and disposal basins for the retention of hydraulic dredge waste.

1962 to 1963 — Served as design and project engineer for private consulting firm. This work included the design of large federally funded highways, a race track and various structures constructed to provide a Pennsylvania State park marina.

Frank Rinaldi, P.E.
Structural Engineering Branch
Division of Engineering
Office of Nuclear Reactor Regulation

U.S. Nuclear Regulation Commission

My name is Frank Rinaldi. I presently reside at 5506 Beech Ridge Drive, Fairfax, Virginia, 22030 and I am employed as a Senior Structural Engineer in the Structural Engineering Branch, Division of Engineering, Office of Nuclear Reactor Regulation, Washington, D.C., 20555.

Professional Qualifications

I received a B.S. degree in Civil Engineering from the City College of New York (1966) and a M.S. degree in Civil Engineering from Maryland University (1974).

I am a registered Professional Engineer in the Commonwealth of Virginia (1972).

I am a member of the Main Committee of the ACI-ASME Committee on Concrete Pressure Components for Nuclear Service (Concrete Reactor Vessels and Containments).

I have been employed by the NRC, Structural Engineering Branch since 1974 as a Senior Structural Engineer. My duties include development of design criteria for nuclear structures and participation in the formulation of safety criteria. Duties also involve safety-related review of structural and seismic design criteria (Safety Analysis Report & Topical Reports) for power systems and the evaluation of nuclear containment structures, reactor vessels and other structures and components.

The following is a summary of my previous professional experience:

1971-1974 U.S. Atomic Energy Commission

Fuel Fabrication and Transportation Branch
(Structural Engineer)

1970-1971 Naval Facilities Engineering Command-Division of Research Development and Testing and Evaluation (General Engineer).

1968-1971 Naval Facilities Engineering Command-Electronics Facilities Support Branch (Structural Engineer).

1966-1968 Naval Facilities Engineering Command-Chesapeake Division (Civil Engineer).

EUGENE J. GALLAGHER

OFFICE OF INSPECTION AND ENFORCEMENT
U.S. NUCLEAR REGULATORY COMMISSION

PROFESSIONAL QUALIFICATIONS

I am a Civil Engineer in the Division of Resident and Regional Reactor Inspection, Reactor Engineering Branch, Office of Inspection and Enforcement.

I received a Bachelor of Engineering Degree in Civil Engineering from Villanova University in 1973 and a Master of Science Degree in Civil/Structural Engineering from Polytechnical Institute of New York in 1974. I am a registered Professional Engineer in the States of Illinois (#37828), Florida (#29114) and Louisiana (#16376). I am a member of the American Society of Civil Engineers, American Concrete Institute and Tau Beta Pi National Engineering Honor Society.

In my present work at the NRC, I provide technical assistance in the area of civil engineering to Regional offices and resident inspectors with particular emphasis on the design and construction of reinforced and prestressed concrete structures, foundations, structural steel buildings and in structural testing and surveillance. In addition, I provide technical input for the development and interpretation of industry codes, standards and regulatory requirements relating to inspection activities.

From 1978 to 1981 I was a member of the NRC Region 3 inspection staff responsible for the inspections of civil engineering aspects of plants under construction and in operation. This included the inspection of laboratory and field testing of concrete, steel and soils materials, earth embankments and dams, material sources, piping systems and reinforced and prestressed concrete structures. In addition, a review of management controls and quality assurance programs were performed at plants under construction. I participated in approximately 90 inspections of reactor facilities.

Prior to joining the NRC Staff I was employed by EBASCO Services, Inc. in New York City from 1973 to 1978. I performed designs of reinforced concrete and steel structures, design of hydraulic and water supply systems and preparation of specifications for construction. From 1976 to 1978, I was the civil resident engineer at the Waterford 3 Nuclear Plant site responsible for providing technical assistance to construction.

During 1972 and 1973 I was employed by Valley Forge Laboratory in Devon, PA performing inspection and testing on concrete, steel and soil materials.

ADDITIONAL NRC TRAINING

Fundamentals of Inspection, NRC, February 1973 (40 hours)
BWR Fundamentals Course, NRC, March 1973 (40 hours)
Concrete Technology and Codes, Portland Cement Assoc., May 1978 (80 hours)
Quality Assurance Course, NRC, August 1973 (40 hours)
Nondestructive Examination and Codes, Rockwell Int'l., August 1978 (120 hours)
PWR Fundamentals Course, NRC, November 1973 (40 hours)
Welding Metallurgy, Ohio State University, September 1980 (80 hours)

Attachment 2

Route To	This Copy For
	WLBarclay JWBird ARBrooke RHermeston DJHowell DRJohnson GSKeeley BWLackring BAMarguglio LMMartinez JHLandin JFNewgen DMTaggart

Consumers Power

Nonconformance Report No OF-203

File 16.3.4 & 16.3.6
Issue Date November 22, 1977
Project Midland 1 & 2

File Title NCR's on Bechtel Construction and Quality Control

This Nonconformance Report is Issued To:

G. L. Richardson
Bechtel Lead QAE

who is responsible for corrective action.

Prepared By Donald E. Horn Date 11-22-77
Approved By [signature] Date 11/22/77
Written Reply Requested By Date 12/16/
Corrective Action Requested By Date 12/30/

Nonconformance Description and Supporting Details:

See attachment.

AEC Reportable Yes ☐ No ☒ See Procedure 9 (For Nuclear Projects Only)

Stop Work Necessary Yes ☐ No ☑ See Procedure 16 - Stop Work No _____
No Hold Tags Applied

Recommended Corrective Action:

See attachment.

[1]Corrective Action Taken:

See attachment.

[1]Verification of Corrective Action Required Yes ☒ No ☐

[1]Method of Verification:
Reviewed letters GLR-12-77-517, GLR-1-78-001 and GLR-01-78-040 from G. L. Richardson to J. L. Corley; letters 216FQA77 and 6FQA78 from J. L. Corley to G. L. Richardson; letters 0-1621 and 0-1651 from J. Newgen to G. Richardson; Bechtel QC Training Session QCFM-4250; and NCR's 1055 and 1094.

[1]Nonconformance Closure Confirmed By Donald E. Horn
Date 2-2-78

[1]To be completed at time of closure by Consumers Power QA Services.

Attachment to NCR No QF-203

Nonconformance Description and Supporting Details:

Project Quality Control Instruction R-1.00, "Material Receiving Instruction" Section 5.2 of Revision 3 and Section 5.1 of Revision 5 states in part, "Requirements for the sampling and testing and the acceptance criteria reference documents shall be noted on the applicable IR" and Section 5.4 of Revision 3 and 5.3 of Revision 5 states, "Review any required user's test data reports to verify that they have been satisfactorily completed".

Part A

QCIR No. R-1.00-1560 for Zone 4A Fine Backfill references User's Test Report No. 0630 and the acceptance criteria as:

Sieve Size	% Passing
1"	100
3/4"	90-100
1/2"	75-90
3/8"	60-85
#200	7-15

Contrary to the above, User's Test Report No. 0630 references 75-100% passing as the acceptance criteria for the 1/2" sieve, consequently 94% passed the 1/2" sieve and it was accepted when actually it failed.

Part B

QCIR No. R-1.00-2105 for Zone 4A Fine Backfill references User's Test Report No. 1036 and the acceptance criteria as:

Sieve Size	% Passing
1"	100
3/4"	90-100
1/2"	75-90
3/8"	60-85
#200	7-15

Contrary to the above, User's Test Report No. 1036 indicated 81% passing the 1/2" sieve and accepted, this should have indicated 91% passing the 1/2" sieve and failed.

Attachment to NCR No QF-203

Nonconformance Description and Supporting Details: (Contd)

Part C

QCIR No. R-1.00-1836 for Zone 4A Fine Backfill references User's Test Report No. 0836 and the acceptance criteria as:

Sieve Size	% Passing
1"	100
3/4"	90-100
1/2"	75-90
3/8"	60-85
#200	12-20

Contrary to the above, User's Test Report No. 0836 had 11% passing the #200 sieve and it was accepted.

Recommended Corrective Action:

Part A & B

1. Present these findings to Bechtel Project Engineering so Project Engineering can determine what additional tests, reviews, etc. are needed to justify the material these tests represent. Have Project Engineering determine the acceptability of the material these failing tests represent.

2. Determine the underlying cause(s) for these discrepancies and take corrective action to preclude repetition in other areas.

Part C

1. An evaluation of this material is not needed because the acceptance criteria as given on QCIR No. R-1.00-1836 was 12-20% passing the No. 200 sieve. It should have been 7-20%, therefore, the test result of 11% is passing.

2. Determine the underlying cause(s) for QC not rejecting the Zone 4A Fine Backfill per the QCIR No. R-1.00-1836 acceptance criteria of 12-20% passing the No. 200 sieve. Review the interface between the material receiving QCE's and the test lab QCE's to determine if there is a breakdown in communicating the inspection criteria for materials being received. Take corrective action to preclude repetition.

Attachment to NCR No QF-203

[1]Corrective Action Taken:

Part A & B

1. NCR-1094 was written to identify the nonconforming material in Part A. Project Engineering dispositioned this material "Use-As-Is". NCR-1055 was written to identify the nonconforming material in Part B. Field Engineering has dispositioned this material "Reject For Q-Use". This material was only used in Non-Q Areas.

2. The underlying cause of these conditions was improper review of the test reports by Quality Control. To prevent this condition from recurring, a training session was held with cognizant individuals in attendance.

Part C

1. Based on response given in Part A of letter 0-1621 from J. Newgen to G. Richardson, it was necessary for Field Engineering to justify the more stringent requirements and the use of this material when it did not meet these requirements. The justification was given by Field Engineering.

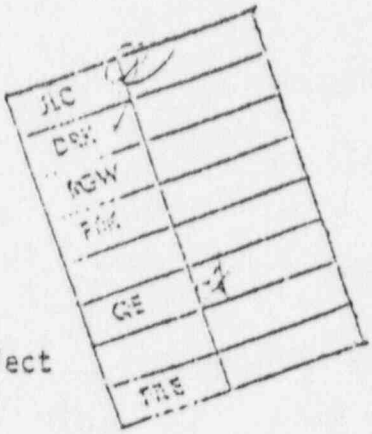
2. The underlying cause of this condition was that the Civil QC Engineer identified the different gradation requirements on the QCIR and failed to bring it to the attention of the QC Receiving Engineer. To preclude repetition, the cognizant QC engineers in both disciplines were reminded that close interfacing is a necessity.

CONSUMERS POWER COMPANY
RECEIVED
FEB 1 1978
FIELD QUALITY ASSURANCE
MIDLAND, MICHIGAN

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

January 31, '978



Consumers Power Company
P. O. Box 1963
Midland, MI 48640

Attention: J. L. Corley

Job 7220 Midland Project
CPCo NCR QF-203 Final
GLR-01-78-040

Dear Mr. Corley:

Ref: 1) Letter J. Corley to G. Richardson, 216FQA77, dated 12/23/77

The following is in response to the above subject nonconformance report which identified problems on user tests for backfill material.

For the material identified in Part A of the subject finding, NCR-1094 was written. This NCR has been dispositioned by Project Engineering as Use-As-Is, and is now closed.

For the material identified in Part B of the subject finding, NCR-1055 was written. This NCR is closed as previously addressed in letter GLR-01-78-001.

For the material identified in Part C of the subject finding the field has provided justification as to why FMRs had stricter requirements than those given by Project Engineering. In letter ~~C-1621~~ C-1651, dated 1/17/78, Field Engineering stated in part:

> The reason for specifying a 12-20% range of aggregate passing through a #200 sieve, when Specification C-210, Rev. 5 and Dwg. C-130, Rev. 6 allowed a range of 7-20%, was strictly for commercial reasons. The vendor said he had a supply of "12-20% material". When this material actually turned out to be 11%, it was still acceptable for use in accordance with our specification and drawing.

This concludes our action on the subject nonconformance report. Should you desire additional information, do not hesitate to bring it to my attention.

Very truly yours,

G. L. Richardson

G. L. Richardson
LEAD QUALITY ASSURANCE ENGINEER

GLR/JGH/sw

Bechtel Power Corporation

Interoffice Memorandum

To: G. L. Richardson

Subject: Job 7220 Midland Project
FMR Preparation
0-1651

Date: January 17, 1973

From: J. F. Newgen

Construction

Midland, MI

References: 1) Ltr. Richardson to Newgen, GLR-12-77-532, dated 12-23-77 (I 8840)
2) Ltr. Corley to Richardson, 216FQA77, dated 12-23-77

This memo is in response to reference 1 and is numbered similarly.

1. Our reason for specifying a 12-20% range of aggregate passing through a number 200 sieve, when Specification C-210, Rev. 5 allowed a range of 7-20%, was strictly for commercial reasons. The vendor said he had a supply of "12-20% material". When this material actually turned out to be 11%, it was still acceptable for use in accordance with our Specification. The only "error" was in dispositioning NCR QF-203 by revising the FMR, rather than noting to "use as is".

2. The intent of our previous response to blank signature blocks on FMR's CY-3171, Rev's 1 & 2, was to point out the following:

   a. Revisions to FMR's for commercial purposes do not fall under the QA program.

   b. Paragraph 3.10.2 of the IJI-1, Rev. 1 limits the necessity of the approval process of FMR revisions to those which address specification changes.

   c. Commercial changes to FMR's are not governed by FPG-8.000.

3. We disagree that a generic problem currently exists in the approval completeness of FNR's. The PFE and APFE's have indicated the frequency of signature omission is negligible on "Q" FNR's. Those which have lacked signatures were returned when discovered.

4. The PFE and APFE's have intensified their surveillance of "Q" FNR's to assure the requirements of FPG-8.000 are implemented.

J. F. Hengen

JFH/LFS/re

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

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

Attachment 3

MEETING NOTES NO. 882

MIDLAND PLANT UNITS 1 & 2

CONSUMERS POWER COMPANY

BECHTEL JOB 7220

DATE: Tuesday, November 7, 1978

PLACE: Champaign, Illinois

SUBJECT: Settlement of the Midland Diesel Generator Building

FILE: 0279, C-280, C-2640, C-2645

ATTENDEES:	CONSULTANTS	CPCo	BECHTEL
	J. Dunnicliff	T.C. Cooke	S. Afifi
	Dr. A. Hendron, Jr.	C.A. Hunt	J. Betts
	Dr. R. Peck	D.E. Horn	S. Blue
		R.M. Wheeler	W.R. Ferris
		D.E. Sibbald	Y.K. Lim
			A. Marshall
			P.A. Martinez
			B.C. McConnel
			M.O. Rothwell
			N.W. Swanberg

PURPOSE: To obtain formal recommendations from the consultants.

ITEMS DISCUSSED:

1. Background Information

Bechtel presented settlement data for the diesel generator building. The data indicated no significant change in the previous trends except for the eastern most diesel generator pedestal which experienced significant additional settlements during the past month of (approximately 1 inch at the N-W corner, 3/4 inch at the N-E corner and 0.4 inches at the other two corners). It was noted that the soil test pit was dug in this bay and some of the differential settlement could be attributed to the pit. The remaining boring data was consistent with previous boring information. The possible corrective actions previously discussed were reiterated:

a. No corrective action taken except grouting under footings.
b. Modify the present strip foundations for the walls to a continuous mat foundation for the entire building.

c. Preload and consolidate the soil under the building.
d. A combination of Items b and c above.
e. Underpin the building to transmit loads directly to the undisturbed soil layer.
f. Remove and replace fill.

2. Recommentations

Soil boring data substantiated the jobsite observations by Dr. Peck that the fill is settling under its own weight. There are only two suitable options to correct the situation:

a. Remove fill and replace with denser material.
b. Densify existing material in place.

Therefore, the preload option is suggested to consolidate the material in place. The soil data indicate a nonhomogenous fill. Therefore exact amount of preload and the consolidation duration cannot be estimated from the laboratory tests. To predict the amount and duration of the preload, instrumentation of the soil movement is needed.

It was indicated that a 5-month period is available in the schedule for preloading. Dr. Peck stated that it is likely that the settlement will occur rapidly once the preload is placed, but that the additional settlement could not be predicted with any accuracy at this time. A range of 6 to 18 inches was considered to be quite pessimistic. Dr. Peck recommended proceeding with the insturmentation and preload as rapidly as possible.

3. Other Options

The other options were briefly discussed. Options a and b would not stop the differential settlement and there would still be settlement of the underground utilities. The effects of the settlement may show up after several years, causing problems during plant operation. Underpinning (Option e) would only be necessary in case of structural distress after the preload had been completed. Underpinning prior to preload would not help the settlement of the soil under its own weight. It was not felt to be an adequate solution.

4. Pond Fill

The consultants suggested that the best sequence would be to place the preload and then raise quickly the cooling pond water level to its operating level. This sequence would allow the consolidation to occur as rapidly as possible. Otherwise, the additional water entering the soil voids will have to be forced back out, extending the consolidation duration. However, after further discussion it was agreed to by the consultants to proceed with filling of the pond immediately, because the amount of river water available for filling is restricted.

5. Bearing Capacity

The consensus was that there is no bearing capacity problem, static or dynamic. However, if justification, in addition to the monitoring data during preload, is required by the NRC, test pits may be dug to determine actual bearing capacity. Additional samples from borings after the preload are not recommended.

6. Suggested Activities

The highest priority is to install the soil monitoring devices. The soil anchors at several depths should go in first starting with the SE corner of the building and then the piezometers could be placed. The duct banks which appear to be restraining the building settlement should be isolated from the building as necessary. The building construction should continue, thereby providing more weight on the foundations. Any gaps between the footing and the mud mat would require grouting. The grouting would not be necessary prior to preload. It was pointed out that from a safety and a building distress point of view, it would be advisable to grout existing gaps prior to releasing duct banks. It was also suggested that the mud mat be broken up prior to preload.

7. Preload Details

The preload height should be about 20'-0", approximately equal to the depth of the material to be consolidated. Physical limits restrict the preload depth to approximately 23 feet. The preload rate is not critical and even distribution would be adequate. The preload should be stopped at 10 feet for about a week to watch the monitoring, and then increased to 15 and 20 feet as necessary. It was suggested that a 20-foot berm with a 30 degree slope be used aroung the bulding where possible. Frost protection for the area to be preloaded was considered appropriate if required by weather conditions.

8. Possible Cause

Consumer's asked the consultants for the cause of the excessive settlement. Dr. Hendron stated that there were in addition to nonuniform fill, erratic properties which may have been caused by too much variation in lift thicknesses. Dr. Peck said that the exact answer may be extremely difficult to determine. He added that material placed dry of optimum would later, with the presence of moisture, tend to soften the materials. He also added that refilling of excavations from existing fills tends to be less adequate than the original fill. He said large areas to be compacted are better than small areas and gave the example of the dike versus the Diesel Generator foundation area.

9. Cooling Pond Dike

The opinion of the consultants was that it is not necessary to perform borings in the cooling pond dike. There is a possibility of hydraulic fracture. The monitoring information from the dike has shown no reason for concern. There has been no significant settlement since the 1-1/2-inch settlement in the southeast corner observed in early 1978. This is the best evidence that the dike is performing satisfactorily. There also has been a detailed visual inspection made on the dikes which indicates no evidence of problems.

10. Liquefaction

There are some sand materials under the north side of the diesel generator building. The boring blow counts in some isolated zones indicate that the potential for liquefaction would have to be evaluated. Vibrofloatation is a possible solution for liquefaction problems if they exist.

11. Proposed Instrumentation

The proposed instrumentation to be used to monitor the structure, soil, and utilities was discussed. The structure, including the generator pedestals, would be monitored by survey. Areas covered by preload would have rods encased by sleeves extending to a visible point. Four of the existing cracks in the concrete structure will be monitored by electronic strain gages. The existing fill will be monitored by 50 borros anchors. The anchors will be placed at three levels within the fill. There will also be some anchors placed outside of the preloaded area as settlement control. The borros anchors should be initially monitored on a daily basis. Settlement platforms will be used through the preload to monitor the top of ground. The pore water pressure will be monitored by 20 piezometer at approximately the same three levels, except that the sand length is to be shortened to approximately 2 feet.

The utilities under the structure (condensate and service water pipes) would be monitored by drag through settlement devices. The accuracy of data is anticipated to be $\pm$ 1/4 inch and a series of readings would have to be made to develop a base line. Inclinometers were proposed to monitor the lateral movement of soil and utilities but the soil consultants felt that they were not needed.

12. Slab at Elevation 634'-0"

The consultant suggested that grating be used inside the building instead of the compacted fill and slab to eliminate material placed above the foundation. The feasibility was to be investigated by Bechtel.

13. Other Structures

The other structures founded on plant fill will be discussed following the December 4, 1978, meeting with the NRC.

14. Contact with NRC

A call was placed to Mr. Hood and Mr. Heller of the NRC by Mr. Cooke of CPCo; Dr. Peck and Dr. Hendron, soils consultants; and Mr. Ferris of Bechtel informing them of our progress and to set up a jobsite visit on December 3, 1978, with a discussion the following day.

ACTION ITEMS:

Bechtel	1.	Proceed with preparations for preload as rapidly as possible.
Bechtel	2.	Evaluate the feasibility of using a grating floor at elevation 634'-0".
Bechtel	3.	Evaluate the potential for liquefaction. This item was resolved with the consultants at the November 18, 1978, meeting held in Urbana, Illinois.

B.C. McConnel

B Chas McConnel

BCM/js
12/1/1

Attachment 4

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

JUN 3 0 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: REQUEST FOR ADDITIONAL INFORMATION REGARDING PLANT FILL

We have reviewed your responses to our requests of November 19, 1979 regarding the quality of plant fill, effects and remedial actions resulting therefrom. Our review is being performed with the assistance of the U. S. Army Corps of Engineers. We and they find that the results of additional explorations and laboratory testing identified in Enclosure 1 (Request 37) are needed to support required geotechnical engineering studies. Details on the extent of these studies will be provided shortly by separate correspondence. Enclosure 1 is provided in order that you may initiate planning of the required explorations in a timely manner. However we suggest you await receipt of these further details prior to physically beginning the explorations. Enclosure 1 (Footnote 4 of Table 37-1) also includes requests for advanced notification of the availability of certain samples.

As noted in our Request 37 of Enclosure 1, your position in previous responses to Requests 5 and 35 not to complete additional explorations, sampling and laboratory testing after preloading continues to be unacceptable to us. So that you might better understand our position, we offer the following observations:

(1) The preload program as completed on the heterogeneous materials which were placed for the purpose of structural fill is not necessarily an improvement, nor does it necessarily produce foundation soils of more uniform engineering properties, compared to the soil performance which would have resulted if the material had been properly compacted to the original requirements established in the Midland PSAR.

(2) To develop reasonable assurance of plant safety, the required studies are needed to serve as an independent verification of the predictions of future settlements and the conclusions of the preload program.

(3) The required studies will permit an estimate of total and differential settlement for involved structures and systems following drawdown with the proposed permanent dewatering system.

(4) Certain aspects of the preload program, such as the complication introduced by the simultaneous raising of the cooling pond reservoir, present difficulties in our full acceptance of your conclusion of the preload program.

Enclosure 1 also includes other requests for information which we and the U. S. Army Corps of Engineers need to continue our review.

We would appreciate your response to Enclosure 1 at your earliest opportunity. A partial reply based upon data already available should be submitted rather than to await the results of new borings and tests contained in parts of Enclosure 1. Should you require clarifications of these requests and positions, please contact us.

Sincerely,

A. Schwencer, Acting Chief
Licensing Branch No. 3
Division of Licensing

Enclosure:
As stated

cc: See next page

cc: Michael I. Miller, Esq.
Isham, Lincoln & Beale
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1 First National Plaza
Chicago, Illinois 60603

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Managing Attorney
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Jackson, Michigan 49201

Mr. Paul A. Perry, Secretary
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Mr. Wendell Marshall
Route 10
Midland, Michigan 48640

Grant J. Merritt, Esq.
Thompson, Nielsen, Klaverkamp & James
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Minneapolis, Minnesota 55402

cc: Commander, Naval Surface Weapons Center
ATTN: P. C. Huang
G-402
White Oak
Silver Spring, Maryland 20910

Mr. L. J. Auge, Manager
Facility Design Engineering
Energy Technology Engineering Center
P. O. Box 1449
Canoga, Park, California 91304

Mr. William Lawhead
U. S. Corps of Engineers
NCEED - T
7th Floor
477 Michigan Avenue
Detroit, Michigan 48226

ADDITIONAL REQUESTS REGARDING PLANT FILL

36. We have reviewed your response to Request 24 and find that information from additional boring logs is needed.

Provide the boring logs for the following explorations:

a. Pull down holes PD-1 thru PD-27 (35 holes that include 8A, 20A, 20B, 20C, 15A, 15B, 15C and 27A)
b. LOW-1 thru LOW-14 (14 holes)
c. TW-1 thru TW-5 and PZ-1 thru PZ-48 (55 holes)
d. OW-1 thru OW-5 (5 holes)
e. TEW-1 thru TEW-8 (8 holes)

The logs should include date and method of drilling, the type and location of samples attempted. Also provide the locations, boring logs and available test data of any exploration completed in 1979 and 1980 which has not yet been submitted.

37. (RSP) Your position in previous responses to Requests 5 and 35 not to complete additional explorations, sampling and laboratory testing following the preload program continues to be unacceptable. We require that you complete as a minimum, the exploration and testing program indicated by Table 37-1.

38. Discuss the foundation design for any seismic safety-related piping and conduit connected to or located under the Radwaste Building and Turbine Building where piping and conduit have been placed on plant fill.

Table 37-1

Request for Additional Explorations, Sampling and Testing

Location 1/	Depth 2/	Sampling 3/	Lab Testing 4/	Anticipated Geotechnical 6/ Engineering Studies to be Required
Diesel Generator Building (6 holes along perimeter)	Thru fill and a minimum of 5' into natural glacial till soils	Classify samples according to Unified Soils Classification System	For cohesive soils C-D (Consolidated-Drained) C-U (Consolidated-Undrained) Consolidation 5/ For sands Drained Direct Shear on both loose & dense specimens Relative Density	Bearing Capacity Settlement Piping Distortion
Auxiliary Building (2 holes)	Same as above	Same as above	Same as above except add U-U (Unconsolidated-Undrained for cohesive soils	Caisson Foundation Design (Vertical and Lateral Load Support)
Service Water Pump (1 hole) Structure and Retaining Walls (2 holes)	Same as above	Same as above	Same as above except consolidation testing would be limited to samples in retaining wall foundations.	Pile Foundation Design (Vertical and Lateral Load Support) Retaining Wall Stability & Settlement.
Cooling Pond Embankments (7 holes along perimeter)	Extend thru fill and a minimum of 5' into natural residual soils except hole no. 5 which should extend to bottom elevation of cooling pond.	Same as above	For cohesive soils C-D (Consolidated-Drained) C-U (Consolidated-Undrained) U-U (Unconsolidated-Undrained)	Slope Stability Fill compaction adequacy

NOTES: See page 2

Table 37-1 (continued)

NOTES:

1/ See attached Figs. 37-1 and 37-2 for approximate boring location. Holes to be accurately located in the field to avoid obstructions, underground piping and conduits and slurry trench area.

2/ No boring is to be terminated in loose or soft soils.

3/ Continuous split spoon sampling using SPT is required. Holes are to be held open using either casing or hollow stem auger. Additional borings to obtain representative undisturbed samples for detailed laboratory testing should be located at the completion and elevation of the split spoon sampling program. The groundwater level should be recorded at the completion of drilling in all borings once the level has stabilized.

4/ Normal classification (e.g., gradation, Atterberg Limits) unit weight and moisture content testing to be performed on representative samples from each significant foundation layer. This column pertains to lab testing in addition to the above mentioned tests. It is requested that at least one week notice be provided to the NRC before opening undisturbed samples to permit on site visual observation by Corps of Engineer representative.

5/ The maximum load should be great enough to establish the straight-line portion of the void ratio-pressure curve.

6/ Details on the extent of geotechnical engineering studies to be completed using the results of field and lab testing work will be provided in a separate letter.

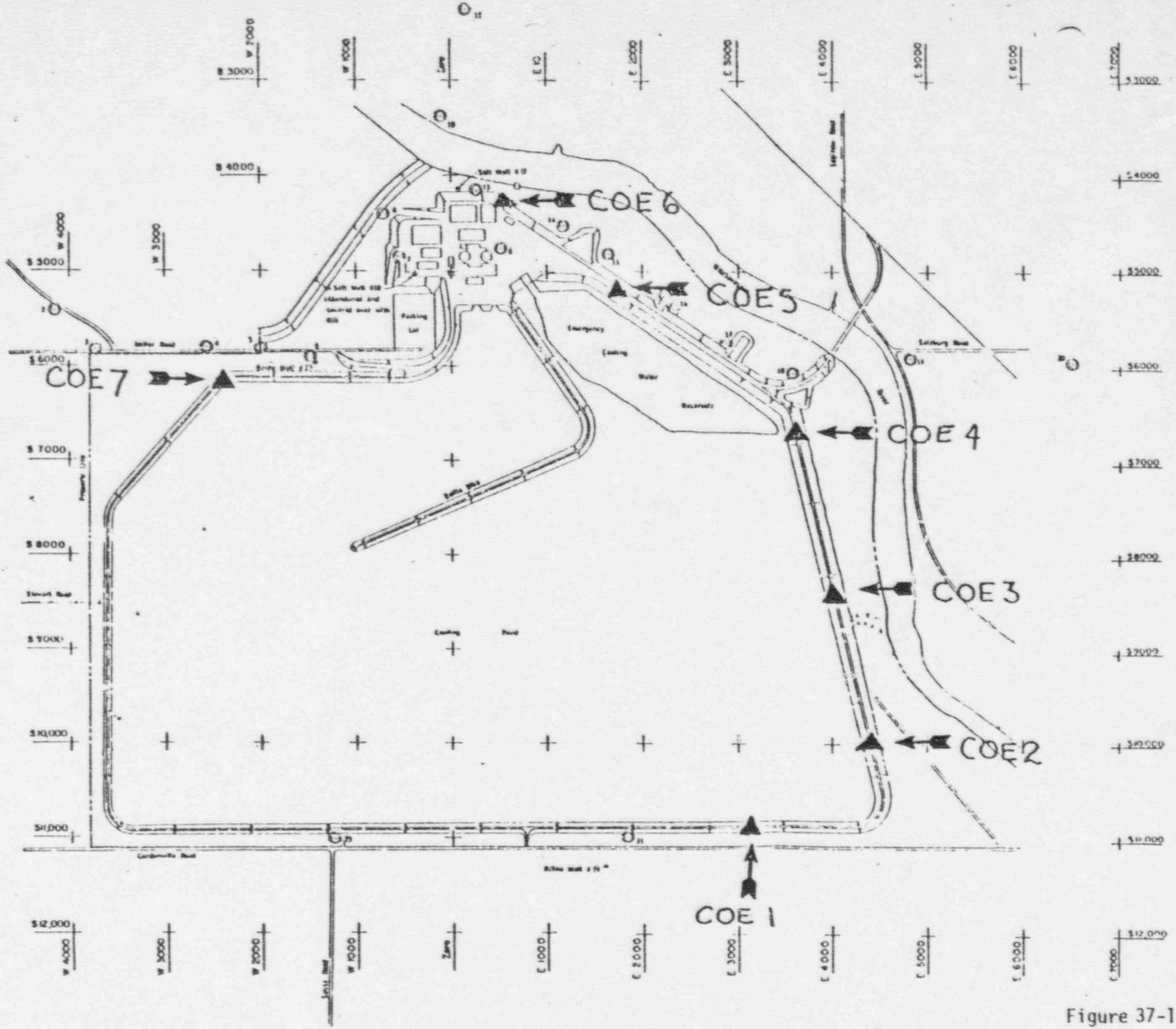

Figure 37-1

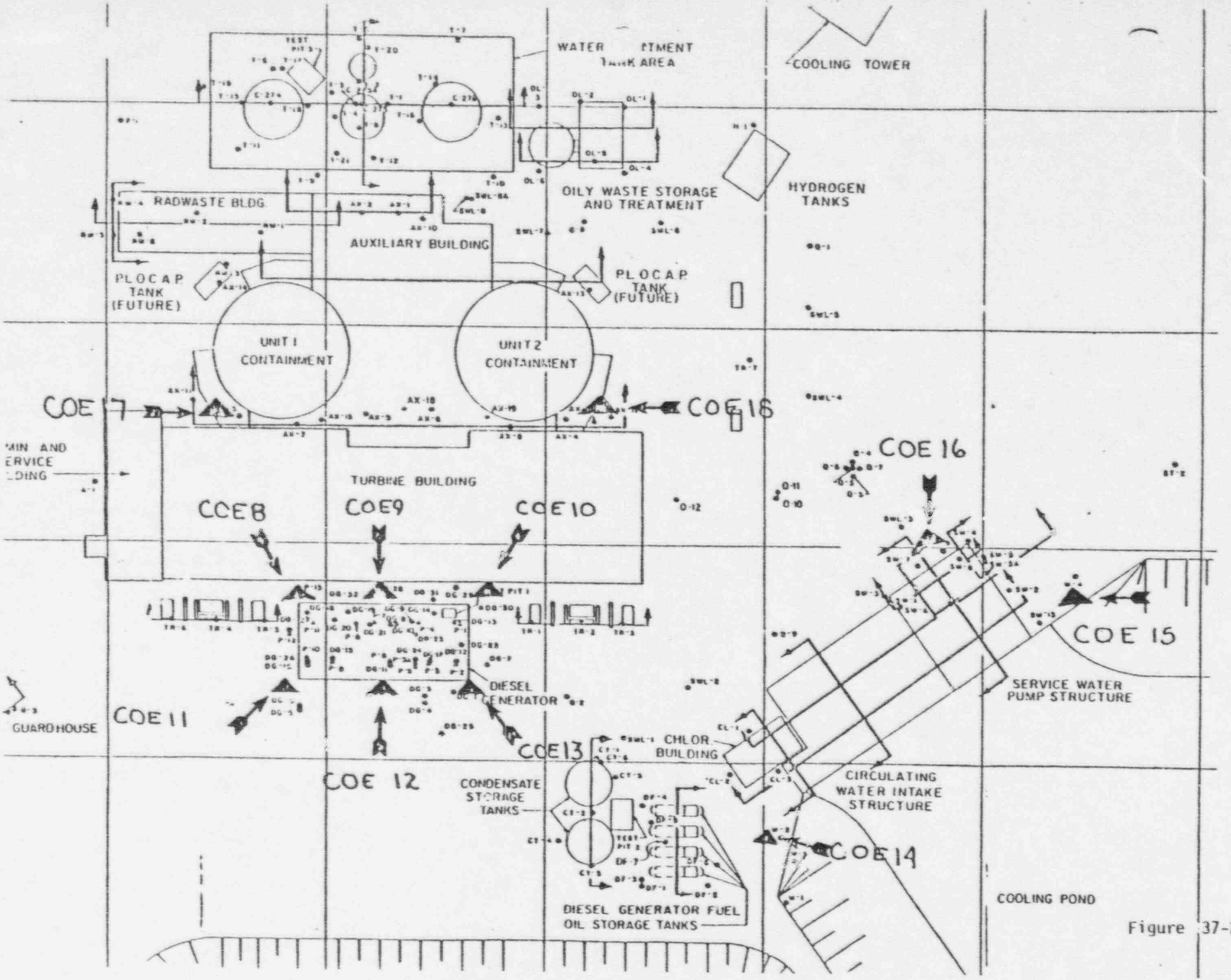
WATER TREATMENT TANK AREA
COOLING TOWER
OILY WASTE STORAGE AND TREATMENT
HYDROGEN TANKS
RADWASTE BLDG
AUXILIARY BUILDING
PLOCAP TANK (FUTURE)
PLOCAP TANK (FUTURE)
UNIT 1 CONTAINMENT
UNIT 2 CONTAINMENT
COE 17
COE 18
COE 16
TURBINE BUILDING
COE 8
COE 9
COE 10
COE 15
SERVICE WATER PUMP STRUCTURE
DIESEL GENERATOR
COE 11
COE 13
CHLOR BUILDING
COE 12
CONDENSATE STORAGE TANKS
CIRCULATING WATER INTAKE STRUCTURE
COE 14
DIESEL GENERATOR FUEL OIL STORAGE TANKS
COOLING POND
GUARDHOUSE

Figure 37-2

Attachment 5

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

OCT 16 1979

Docket Nos. 50-329
and 50-330

APPLICANT: Consumers Power Company

FACILITY: Midland Plant, Units 1 & 2

SUBJECT: SUMMARY OF JULY 18, 1979 MEETING ON SOIL DEFICIENCIES AT THE MIDLAND PLANT SITE

On July 18, 1979, the NRC staff met in Bethesda, Maryland with Consumers Power Company and the Bechtel Corporation to discuss deficiencies in the fill used at the site for Midland Plant, Units 1 & 2. Also present were representatives of the ACRS staff. Meeting attendees are listed in Enclosure 1.

In response to NRC requests, the applicant has documented in detail the presentations given during this meeting. The presentations are contained in S. H. Howell's letter to J. G. Keppler dated August 10, 1979. In view of the August 10, 1979 letter, no summary of the presentations is contained herein. Rather, additional discussion consisting of comments and questions given during and following the presentations are summarized.

During the presentation regarding remedial work in progress or planned (item 3 of the presentations), the staff noted that underground piping from the borated water storage tanks and service water lines pass under railroad tracks, and that these and other piping are subject to loads due to construction cranes and other traffic. The staff requested the applicant to describe the design features and other measures which assure that such piping is not subjected to excessive loads. The applicant will respond at a later date.

The applicant noted that it is performing laboratory investigations of the stainless steel piping removed from the condensate storage tank. This underground piping was found to be heavily corroded. It was noted that the injection piping from BWST is of the same composition and is also unprotected from electro-chemical attack. The test-pits in the tank farm area which are being dug to investigate the effect of the air discharged from underground pneumatic lines was also described. Results will be reported shortly.

DUPE OF
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The staff noted that the response to its 10 CFR 50.54 requests for acceptance criteria for remedial actions (e.g., questions 4, 6, etc.) had not resulted in identification of criteria in advance of the remedial action. Rather the reply notes that the criteria will be determined during or after the remedial action. The staff stated that this approach by the applicant does not provide for timely staff feedback at the outset, but rather the staff must await results of the program to determine what acceptance criteria were used and if they are acceptable. Thus, the remedial action is being conducted entirely at the applicant's own risk.

The applicant's presentation of the permanent site dewatering system (presentation item 3.8) noted that the system is not designed to seismic Category I requirements, but that the monitoring aspects of the system are safety grade. The NRC staff noted that acceptance criteria for the dewatering system are given in the Standard Review Plan (Section 2.4.13, Revision 1) and requested that the applicant address Branch Technical Position HMB/GSB 1, "Safety Related Permanent Dewatering Systems", Revision 1, attached thereto. The applicant will respond in the near future. The quality assurance plan for implementing the dewatering system will also be provided in future reports.

Bechtel described the structural and seismic analytical investigations being performed or planned for the affected structures (item 4 of the presentations). The staff noted that further review of the acceleration (g) value used for site design has been impacted by staff manpower restructuring for the TMI-2 investigations and that use of outside contractors for the Midland seismic review is presently being considered. The staff also noted that its present review indicates some areas of disagreement with the applicant's proposed loads combinations and design criteria for SSE and differential settlement, and with the treatment of cracks in structural walls. The staff will further document these and other positions at a later date.

Bechtel reported (item 7 of the presentations) the results of its investigations into the cause of insufficient compaction of the plant area fill, and identified five causes considered to be the most probable. The applicant noted its agreement with the Bechtel findings. Bechtel noted that personnel were not included as a most probable cause because its review of qualifications and experience of both Bechtel and US Testing personnel had shown presence of sufficient education, experience, and training to carry out the tasks assigned. The NRC staff noted that it disagrees with Bechtel's finding that personnel qualification was not a probable cause, and stated that further review of the basis for this Bechtel finding will be needed.

Staff comments regarding the QA/QC aspects (presentation item 8) were based upon the applicant's 10 CFR 50.54(f) responses to question 1 by letter of April 24, 1979:

(1) The applicant's response in item B.1 of Appendix I (page I-3) states its conclusion that "Specifications C-210 and C-211 provide sufficient criteria by which to ensure that the fill is adequately placed to prevent excessive settlement." The staff noted its disagreement with this statement. The staff noted, for example, that its I&E investigations show that the specifications did not require qualification of equipment used to compact material, the lift thicknesses permitted were excessive for adequate compaction, the moisture control was unclear and the compactive effort to develop 95% of compaction was internally in conflict within Specification C-210.

(2) The applicant's response in item B.2 of Appendix I (page I-3) noted that letters, TWX's, telecons, and memoranda are often used to clarify the intent of the specifications, and that "it is possible" that in some situations the clarification provided through such methods may have modified the specification without formally changing the wording of the specifications. The staff commented that a more positive statement appears to be warranted based upon the findings of I&E. Numerous examples where telecons and memoranda were used to change the requirements of the specifications without revising the controlled document itself was cited in I&E Inspection Report No. 50-329/78-20 and 50-330/78-20. I&E found that not only did these memoranda change the requirements of the specifications, but in some instances, conflicted with previous engineering directives.

(3) The staff noted that its review of QA aspects was continuing and that further requests for information would be issued.

At the conclusion of the presentations, the NRC staff noted that the information presented was significant to the present review, and requested that the applicant document and submit its presentations, including copies of the viewgraph slides used.

Darl Hood, Project Manager
Light Water Reactors Branch No. 4
Division of Project Management

Enclosure:
As stated

cc: See next page

ENCLOSURE 1

ATTENDEES

July 18, 1979

Consumers Power Company

G. S. Keeley
D. E. Horn
T. Thiruveneadam
T. C. Cooke

NRC:NRR

D. S. Hood
D. M. Gillen
R. E. Lipinski
J. Gilray
F. Schauer
L. Heller
L. S. Rubenstein

NRC:OELD

R. Hoefling

NRC:IE

D. W. Hayes
G. Gallagher
J. B. Henderson

ACRS

D. Zukor
P. Tam

Bechtel*

T. E. Johnson (BPC)
P. A. Martinez (BPC)
K. Wiedner (BPC)
D. Riat (AA)
W. R. Ferris (SF)
H. Wahl (AA)
A. B. Arnold (SF)
B. Dhar (AA)
F. J. Hsiu (AA)
S. S. Afifi (AA)
G. Richardson (BPC)
A. J. Boos (BPC)
J. R. Davie (G)

Bechtel Consultants

R. B. Peck
R. Loughney
C. H. Gould

* BPC = Bechtel Power Corporation
AA = Ann Arbor, Michigan
SF = San Francisco, Calif.
G = Gaithersburg, Md.

TO File

Attachment 6

FROM TCCooke/RMW

DATE December 12, 1978

Consumers Power Company

INTERNAL CORRESPONDENCE

SUBJECT MIDLAND PROJECT GWO 7020 - TRIP REPORT, CHAMPAIGN ILLINOIS - DIESEL GENERATOR SETTLEMENT
File: B3.0.3 Serial: CSC-3674

CC PAMartinez, CAHunt, GSKeeley, DEHorn, DBMiller

The following represents a corrected set of CPCo notes from the November 7, 1978 meeting in Urbana, Illinois. The notes as written reflect comments from Bechtel, and Serial 3593 is superceded by these notes. Please note same on Ser. 3593.

Neil Swanberg opened the meeting by stating that a call would have to be made to the NRC at 10:30. A discussion would proceed up to 10:30 and after the call to the NRC. Darl Hood would be contacted within the NRC. Darl would later contact Mr. Heller to try to get a meeting set up before Thanksgiving. Dr. Skip Hendron asked what the NRC has been told to date. A discussion of Mr. Gene Gallagher's visit was given.

Chuck McConnell stated as of last Friday there have been no surprises and the trend is the same on the settlements. The far east bay of the Diesel Generator Building where the test pit had been dug has indicated settlements of 1" for the northwest corner, 3/4" for the northeast corner, 4/10" for the southwest and southeast corner of the pedestal during the last month. This area had received additional loading. Neil Swanberg noted settlement appears to be decreasing, but a rate of settlement curve has not been drawn.

Austin Marshall presented boring data to Dr. Peck.

Chuck McConnell stated the correction action options considered.

1. Use-as-is, with some grouting.
2. Continuous mat foundation.
3. Preloading.
4. A combination of continuous mat and preloading.
5. Underpinning.
6. Remove and replace fill.

Sherif Afifi stated that data had been made available to the consultants as it became available, summarized the conversations with the consultants since their field visits and stated that the consultants feel preloading is the most attractive option.

Discussion of preferred options followed. Dr. Peck opened by saying it is evident that the fill is loose. Settlement is due to its own weight. In Dr. Peck's opinion, there are only two options - preloading or remove and replace fill. Dr. Peck felt we should get on with instrumentation and preloading. He stated we do not have adequate data with the boring program to determine the amount of preload and

the length of preload. We should get data from the preload, which will provide a reliable estimate of the time required for preloading.

Dr. Hendron stated that there was neither a homogeneous engineered fill nor a uniformly compacted fill. Chuck McConnell asked why preload was more attractive than the others. Dr. Peck stated that the continuous mat foundation option would not stop the differential settlement and we would still have settlement of duct banks. Dr. Hendron stated that five or ten years down the road construction would be off the site and the owner would have settlement problems. The consultants stated that preload should (because of the type of material involved) provide us with rapid and decisive answers as to the effectiveness of this action. Stress may possibly be induced in the pipes below the building as a result of additional building settlement.

Phil Martinez stated that we have five months in the schedule for preloading and asked if this would be adequate time. Dr. Peck said that he did not know at this time, however, once preload did start we would know how long preload would be required.

Also, he stated that settlement will occur fast after preloading has begun. The consultants were also asked about bringing the pond up to elevation 627'. They stated that the preload should be applied prior to filling the pond to 627'. Due to the river water level restrictions, it was determined that there will be limitations to pumping so that pond fill should begin as soon as possible. By not saturating the soil, the consolidation process would be accelerated due to the absence of additional water in the voids.

Neil Swanberg asked if construction could continue in the Diesel Generator Building. Dr. Hendron said he did not see any problem with continuing construction and Dr. Peck agreed.

Dr. Hendron stated that he was disappointed that Mr. Heller from the NRC and staff had not seen the test pits. Don Horn stated that G. Gallagher from Region III, of the NRC, had taken pictures of the test pit located in the Diesel Generator Building and separation of soil from the footing.

Dr. Peck stated that underpinning may be required after, and only after, preloading. Underpinning prior to preloading was discussed. Dr. Peck stated that preloading was necessary. Underpinning efforts should not commence until after preload because drag down loads would be applied to the piles during preload. Also, damage to the structure could occur during underpinning prior to preloading. Dr. Peck felt that preloading should do the job.

Dr. Hendron added that there was no bearing problem static or dynamic loaded. Bob Wheeler asked if bearing capacity justification would have to be given the NRC after preloading had occurred. The consultants felt justification would not be necessary, however, if tests were required, test pits could be dug to determine the in situ bearing capacity of the soil.

Dr. Peck stated that if piling was to be used, in lieu of preload, there would be less than 50% chance that this could be justified to the NRC and that he did not consider piling adequate in his own mind.

Dr. Hendron agreed that cutting the duct banks loose has to be done. Dr. Peck and Dr. Hendron stated that settlement at various depths must be monitored beneath and away from the structures. The high priority as they see it is instrumentation and preload. Placement of piezometers can go in later.

Next the height of the preload was discussed. Chuck McConnell stated that we have 23 feet to work with because of the second floor of the Diesel Generator Building construction. The question of the rate of loading was asked. Dr. Peck stated that any rate would be adequate but even distribution was necessary. Dr. Hendron stated that preloading should be stopped at ten feet for about a week to monitor the effect of this preload. Discussions ensued and it was decided that fill would initially be placed 10' layer and a maximum of 20' with observations made during the placement. The consultants emphasized that it is very important to load the area between the north side of the Diesel Generator Building and the Turbine Buildi in order to effectively preload the area. Bechtel noted that further analysis and possible bracing of the Turbine Building wall will be required to support the additional surcharge between the buildings.

Tom Cooke asked what additional settlement we could expect based on this preload. Dr. Peck stated 6-18" additional settlement with the 18" being very pessimistic. Dr. Peck also stated that the height of the preload should be equal to the depth of the material to be consolidated and this would be approximately 20 feet. If excessive settlement is observed, the bulk of the problem should be resolved.

The question of grouting the gaps between the footing and the soil was discussed. Dr. Peck and Dr. Hendron did not feel the grouting of the gap between the footing and soil was necessary prior to preload. However, discussion continued and it was concluded that Bechtel would grout any gaps between the footing and soil after the preload had been removed. It was suggested by the consultants that the mud mat be broken up prior to preload application and that early grouting may also be beneficial in relieving some building stress.

Tom Cooke asked the consultants for the cause of the excessive settlement. Dr. Peck stated that there were in addition to non-uniform fill, erratic properties which may have been caused by too much variation in lift thicknesses. Dr. Peck added that material placed dry of optimum would later, with the presence of moisture tend to soften the materials. He also added that refilling of excavations from existing fills tends to be less adequate than the original fill. Large areas to be compacted are better than small areas. An example of the dike versus the Diesel Generator foundation area was given. The exact answer may be extremely difficult to determine. He stated that the exact cause may never be fully determined.

Next a discussion of the cooling pond dikes took place. The question of drilling holes in the dike was discussed. Dr. Peck and Dr. Hendron stated that they did not feel that this was necessary. The dike has not indicated any problems. Jim Betts mentioned that a settlement of 1 and 1/4" had been taken on a portion of the dike, however, this has not changed since that time and there is a possibility of this being an error in survey. No other areas have indicated settlement in the cooling pond dikes. Also, Sherif Afifi has stated that visual inspections have been made of the dike system and no problems seem to exist. The meeting adjourned

at 10:30 so that Tom Cooke, Dr. Peck, Dr. Hendron, and Walter Ferris could contact the NRC. Darl Hood and Mr. Heller were both contacted in the same call. A meeting at the site is tentatively scheduled for December 3 and 4 with the NRC and consultants. A visit to the site would be made by the NRC on December 3 and discussions would follow on December 4 with the consultants. The NRC did not seem to want to make two trips to the site; they felt one should be adequate.

The meeting continued with Chris Lin stating he had plots of blow counts on sand materials under the Diesel Generator Building north. The plots indicated that some of the material may be questionable due to potential liquefaction of the material. Dr. Peck looked at the plots and stated that this problem would have to be evaluated. He stated that if there was a problem that vibroflotation could possibly be used.

John Dunnicliff, the Instrumentation Consultant, described the instrumentation that was proposed for use in the settlement evaluation. Five rods would be placed on the Diesel Generator pedestals, one in each corner and one in the middle. Also, riser pipes would be placed on the outside of these rods to keep soil from affecting the rods. Fifty borros anchors would be placed at three different elevations to monitor soil movement. Settlement platforms would also be placed in the fill at three different elevations. Drag through settlement cages with accuracy approximately $\pm$ 1/4" would be used to monitor pipe settlement. An average of the readings would be made to establish a baseline. Inclinometers were going to be installed. Four electrical devices would be placed on the cracks to monitor movement. Tape would be placed over the cracks in the walls to keep material from moving into these areas. Dr. Peck and Dr. Hendron suggested that a 20' berm and 30° slope of preload be placed around the structure except for the north end where this would have to be modified due to the Turbine Building walls. Pore pressure monitoring would be done with 20 standpipe piezometers at three different elevations corresponding with the borros point anchors. It was mentioned that sand would be used as frost protection and Dr. Hendron stated that this was a good idea. Jim Betts asked if a structural backfill was compacted inside the structure, could it remain after preload. The consultants suggested that material not be placed above the foundation and that grating be used in the place of soil and slab. Bechtel Engineering said that they would look into this. The question of how often readings be taken on the anchors was asked. Dr. Peck suggested that the readings be taken daily (initially).

Other areas of possible settlement would be discussed following the December 4 meeting with the NRC at the site. It was suggested that another meeting not be held until the December 4 meeting with the NRC and that a tentative date, January 16, 1978, meeting with the consultants would be adequate.