

50-329/330 OM, OL

Exhibits from  
10/21, 22/80 Oral Deposition  
of  
Donald Horn  
Quality Assurance ~~Eng.~~ Engr.,  
Consumers Power Co.

Exhibits 1-3

8101050 514 XA

NRC Dep Ex T for I.D.

12/21/80 (H:11)

Handwritten initials and the letter 'E' in the top right corner.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

REGION III  
799 ROOSEVELT ROAD

GLEN ELLEN, ILLINOIS 60137  
M19 22, 1979

Docket No. 50-329  
Docket No. 50-330

Consumers Power Company  
ATTN: Mr. Stephen H. Howell  
Vice President  
1945 West Parnall Road  
Jackson, MI 49201

Investigation  
78-20  
Report

Stamp: RECEIVED 2 ELECTRONIC

Gentlemen:

This refers to the investigation conducted by Messrs. G. A. Phillip, E. G. Gallagher and G. F. Maxwell of this office on December 11-13, 16-20, 1978, and January 4-5, 9-11 and 22-25, 1979, of activities at the Midland Nuclear Plant, Units 1 and 2, authorized by NRC Construction Permits No. CPPR-81 and No. CPPR-82. The investigation related to the settlement of the diesel generator building at Midland and the adequacy of the plant area fill. The preliminary results of this investigation were discussed with Consumers Power Company and Bechtel Corporation representatives in our office on February 23 and March 5, 1979. The report on the matters discussed during those meetings were included with my letter to you dated March 15, 1979. That letter also set forth the principal matters of our concern as a result of this investigation.

Enclosed is a copy of the report of this investigation. In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and the enclosed investigation report will be placed in the NRC's Public Document Room, except as follows. If this report contains information that you or your contractors believe to be proprietary, you must apply in writing to this office within twenty days of your receipt of this notice, to withhold such information from public disclosure. The application must include a full statement of the reasons for which the information is considered proprietary, and should be prepared so that proprietary information identified in the application is contained in an enclosure to the application.

EXM  
@ACK

Consumers Power Company - 2 -

APR 22 1976

The results of this investigation continue to be under review by the NRC staff. Upon completion of this review you will be advised of any enforcement action to be taken by the Commission.

Should you have any questions concerning this investigation, we would be pleased to discuss them with you.

Sincerely,

James G. Keppler  
Director

Enclosure: IE Investigation  
Reports No. 50-329/78-20  
and No. 50-330/78-20

cc w/encl:  
Central Files  
Reproduction Unit NRC 20b  
PDR  
Local PDR  
NSIC  
TIC  
Ronald Callen, Michigan Public  
Service Commission  
Dr. Wayne E. Faith  
Myron M. Cherry, Chicago

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

REGION III

Report No. 050-329/78-20; 050-330/78-20

Subject: Consumers Power Company  
Midland Nuclear Power Plant, Units 1 and 2  
Midland, Michigan

Settlement of the Diesel Generator Building

Period of Investigation: December 11-13, 18-20, 1978 and January 4-5,  
9-11, 22-25, February 23, March 5, 1979

Investigators: *G. A. Phillip*  
G. A. Phillip

3-19-79

*E. J. Gallagher*  
E. J. Gallagher

3-19-79

*G. F. Maxwell*  
G. F. Maxwell

3-19-79

Reviewed By: *D. W. Hayes*  
D. W. Hayes, Chief  
Engineering Support Section 1

3/19/79

*G. F. Fittelli*  
G. F. Fittelli, Chief  
Reactor Construction and  
Engineering Support Branch

3/19/79

*C. E. Norelius*  
C. E. Norelius  
Assistant to the Director

3/19/79

## REASON FOR INVESTIGATION

On September 7, 1978, the licensee notified Region III, by telephone, that the settlement of the Diesel Generator Building and foundations experienced constituted a matter reportable under the requirements of 10 CFR 50.55(e). Written interim reports were subsequently submitted by the licensee by letters dated September 29 and November 7, 1978. An investigation was initiated to obtain information concerning the circumstances of this occurrence to determine whether: a breakdown in the Quality Assurance program had occurred; the occurrence had been properly reported; and, whether the FSAR statements were consistent with the design and construction of the plant.

## SCOPE

This investigation was performed to obtain information relating to design and construction activities affecting the Diesel Generator Building foundations and the activities involved in the identification and reporting of unusual settlement of the building. The investigation consisted of an examination of pertinent records and procedures and interviews with personnel at the Midland site, the Consumers Power Company offices in Jackson, Michigan, and the Bechtel Power Corporation offices in Ann Arbor, Michigan.

## SUMMARY OF FACTS

By letter dated September 29, 1978, the licensee submitted a report as required by 10 CFR 50.55(e) concerning an unusual degree of settlement of the Diesel Generator Building (DGB). This report confirmed information provided during earlier telephone conversations on or about August 22, 1978, with the NRC Resident Inspector and on September 7, 1978, with the Region III office. This report was an interim report and was followed by periodic interim reports providing additional information concerning actions being taken to resolve the problem. Further testing and monitoring programs and an evaluation of the resulting data have been undertaken by the licensee to determine the cause of the settlement and the adequacy of the corrective action being taken. The results of these efforts will be submitted in a final report to the NRC.

Information obtained during this investigation indicates: (1) A lack of control and supervision of plant fill activities contributed to the inadequate compaction of foundation material; (2) corrective action regarding nonconformances related to plant fill was insufficient or

inadequate as evidenced by the repeated deviations from specification requirements; (3) certain design bases and construction specifications related to foundation type, material properties and compaction requirements were not followed; (4) there was a lack of clear direction and support between the contractors engineering office and construction site as well as within the contractors engineering office; and, (5) the PSAP contains inconsistent, incorrect and unsupported statements with respect to foundation type, soil properties and settlement values.

## DETAILS

### Persons Contacted

During this investigation approximately 50 individuals were contacted. Twelve CPCo personnel which included corporate engineering and quality assurance personnel as well as site management, quality assurance and quality control personnel. Thirty-two Bechtel personnel were contacted. These largely consisted of site engineering, quality assurance, quality control, survey and labor supervisors and personnel in project engineering, quality assurance and Geotech at the Ann Arbor, Michigan office. Three individuals employed by U.S. Testing Company were also interviewed.

### Introduction

On August 22, 1978, the licensee informed the NRC Resident Inspector at the Midland site that unusual settlement of the Diesel Generator Building (DGB) had been detected through the established Foundation Data Survey Program. While the licensee regarded the matter as serious it was not considered to be reportable under the provisions of 10 CFR 50.55(e) until further data was obtained.

Following the acquisition of additional data from further surveys and a core boring program which was initiated on August 25, 1978, the licensee concluded the matter was reportable and so telephonically notified Region III on September 7, 1978. The notification was followed up by a series of interim reports the first of which was submitted to Region III by letter dated September 29, 1978. Subsequent interim reports were transmitted by letters dated November 7, 1978 and January 5, 1979.

An inspection was conducted by Region III during the period October 24-27, 1978, to review the data then available; to observe the current condition of the structure; and, to review current activities. Information regarding the inspection is contained in NRC Inspection Report No. 50-329/78-12; 50-330/78-12.

On December 3-4, 1978, a meeting with NRR and Region III representatives was held at the Midland site to review the status of the problem, to discuss open items identified in the aforementioned inspection report and possible corrective actions.

### Identification and Reporting of Diesel Generator Building Settlement

Surveys to establish a baseline elevation for the DGB were completed by Bechtel on May 9, 1978. As a result of these surveys, the Chief of Survey Parties noted what he considered to be unusual settlement. He

indicated that from his experience he would have expected about 1/8" settlement. The July 22 data showed a differential settlement between various locations ranging from 1/4" to a maximum of 1 5/8". He promptly instructed his survey personnel to resurvey to determine whether the data was accurate. The resurvey confirmed the accuracy of the survey data. The Chief of Survey Parties reported the survey results to the Bechtel lead civil field engineer.

★  
The lead civil field engineer said that in July 1978 the settlement of a pedestal in the DGB was noted from surveys and about a week later a 1" discrepancy was noted when scribes on the DGB were being moved up. He said that at that time he was uncertain as to whether actual settlement had occurred, the survey was in error or the apparent discrepancy was a construction error. He instructed the Chief of Survey Parties to check his survey results and to perform surveys more frequently than the 60-day intervals required by the survey program as a means of determining whether actual settlement had occurred and whether settlement continued.

The Field Project Engineer was also informed of the apparent settlement and concurred with the lead civil field engineer's actions. He said he had toured the building at that time and he saw no visible indications of stress which could be expected when unusual settlement occurs.

The lead civil field engineer said the DGB was monitored for about a month. He compared the amount of settlement being experienced with the settlement values reflected in Figure 2.5-48 of the FSAR and did not consider it reportable until those values were exceeded. When the settlement did exceed those values as indicated by survey data obtained on about August 18, 1978, he prepared a nonconformance report with the assistance of OC personnel.

The July 22 survey data was transmitted by the site to the Bechtel Project Engineering office in Ann Arbor by a routine transmittal memo dated July 26, 1978. The data was received at Ann Arbor, processed through document control on August 9, 1978, and was routinely routed to the Civil Engineering Group Supervisor. He stated he did not review the data but placed a route slip on it indicating those members of his group who should review it.

The engineer in the Civil Group, who had established the survey program and who was responsible for assuring it was being carried out, stated he reviewed the data and did not regard it as unusual. For that reason he did not bring the matter to anyone's attention but merely routed it to other personnel in the civil group. The engineer responsible for the DGB said he did not see the data before the settlement problem was identified by the field in a nonconformance report.



With the issuance of the nonconformance report, No. 1482, on August 18, 1978, CPCo was also informed of this condition. On or about August 21, 1978, the NRC Resident Inspector was orally informed of the matter by CPCo. It was indicated at that time that although CPCo regarded the matter as serious, they did not consider it to be reportable under 10 CFR 50.55(e).

Construction on the DGB was placed on hold on August 23, 1978 and a test boring program was initiated on August 25, 1978. After preliminary evaluation of soil boring data, a Management Corrective Action Report (MCAR), No. 24, was issued by Bechtel on September 7, 1978. The MCAR stated that based on a preliminary evaluation of the data, the matter was reportable under 10 CFR 50.55(e), 1, iii and Region III was so notified by telephone on that date.

The telephone notification was subsequently followed up by a letter dated September 29, 1978, from CPCo enclosing a copy of MCAR 24 and Interim Report 1 prepared by Bechtel.

On the basis of the above, it is concluded that in this instance the licensee complied with the reporting requirements of 10 CFR 50.55(e).

#### Review of PSAR/FSAR Commitments on Compacted Fill Material

In a previous NRC Inspection Report, No. 329/78-12; 330 78-12, an apparent inconsistency was identified between FSAR Table 2.5-14 (Summary of Foundations Supporting Seismic Category I and II Structures), Table 2.5-9 (Minimum Compaction Criteria) and the site construction drawing C-45 (Class I Fill Material Areas) regarding the type of foundation material to be used for plant area fill. Table 2.5-14 identifies the supporting soil materials for the Auxiliary Building D, E, F, and G, Radwaste Building, Diesel Generator Building and Borated Water Storage Tanks to be "controlled compacted cohesive fill." Table 2.5-9 also indicates the soil type for "support of structures" to be clay. Contrary to these FSAR commitments, drawing C-45 indicates Zone 2 (random fill) material, defined in Table 2.5-10 as "any material free of humus, organic or other deleterious material," is to be used with "no restrictions on gradation." Boring samples substantiated that Zone 2 (random fill) material was in fact used.

During this investigation a review of documentation showed that the commitment to use cohesive soils was also made in response to PSAR question 5.1.11 and submitted in PSAR Amendment 6, dated December 12, 1969, which states, "Soils above Elevation 605 will be cohesive soils in an engineered backfill." This response also indicated that certain class I components such as, emergency diesel generators, borated water storage tanks and associated piping and electrical conduit would be founded on this material.

CPCo quality assurance issued a nonconformance report QF-66, dated October 10, 1975, which stated that contrary to the PSAR statement (quoted above) Specification C-211 being implemented at the site required cohesionless (sand) material to be used within 3 feet of the walls of the plant area structures. The corrective action taken was for Bechtel to issue SAR Change Notice No. 0097 which stated, "The FSAR will clarify the use of cohesive and cohesionless soils for support of Class 1 structures." As noted above, the FSAR tables 2.5-14 and 2.5-9 once again stated that cohesive (clay) material was used for support of structures while the construction drawing continued to permit the use of random fill material.

This investigation included efforts to ascertain whether procedures were established and implemented for the preparation, control and review of the technical criteria set forth in the safety analysis report (SAR). This included the role of both Bechtel and CPCo in the review of the SAR. Bechtel had established control of the SAR in procedure MED 4.22 (Preparation and Control of Safety Analysis Report Revision 1, dated June 20, 197-). The SAR preparation and review flow chart requires the Engineering Group Supervisor (EGS) to review the originator's draft for technical accuracy and compliance with the standard format guide. Records indicated that Section 2.5.4 was originated by the Bechtel Geotech group on January 3, 1977. It was reviewed and approved for technical accuracy by an engineer in the civil project group on April 29, 1977. No technical inaccuracies were noted in the documentation. The Civil EGS advised that he did not personally review Section 2.5.4.

The designated engineer stated that in his review of the section he was primarily concerned with the Auxiliary Building not the Diesel Generator Building. He said the review of FSAR material was performed by members of a group set up for this purpose. Not all of the content was checked since they relied to some extent on the originator. The author of Section 2.5.4 said he was not aware that changes regarding fill material had occurred since the preparation of the PSAR. It was ascertained that Field Engineering did not review the FSAR prior to its submittal.

A partial review of the FSAR revealed that although Figure 2.5-48 indicates anticipated settlement of the Diesel Generator Building during the life of the plant to be on the order of 3 inches. Section 3.8.5.5 (Structural Acceptance Criteria) contains the following statement: "Settlements on shallow spread footings founded on compacted fills are estimated to be on the order of 1/2" or less."

Section 3.8 was prepared by Project Engineering. Geotech, who prepared Section 2.5, said they were unaware of the presence of the statement regarding 1/2" settlement in Section 3.8. The originator of Section 3.8

said that the above statement was taken from the Dames and Moore report submitted as part of the PSAR. Since the PSAR did not show any change in this regard, he assumed the statement was valid for inclusion in the FSAR. He said there was no other basis to support this statement.

CPCo also has an established procedure for the review and final approval of the SAR by procedure MPPM-13 dated June 23, 1976. Section 5.6 states that "CPCo shall approve all final draft sections of the FSAR prior to final printing." Discussion with the responsible licensee representatives for review of Section 2.5.4 indicated that a limited amount of cross-reference verification of technical content of the FSAR is performed by CPCo.

The CPCo Project Engineer in Jackson stated that the review of drawings and specifications was an owner's preference kind of thing. No attempt was made to review all drawings and specifications since they did not have the manpower or expertise for that type of review. The staff engineers of the various disciplines were asked to indicate the drawings and specifications they wanted to review.

Regarding the review of the FSAR, he said that he had prepared a memorandum to the staff engineers stating the procedure that would be followed in performing the review. An examination of this memo, dated July 28, 1976, showed that prime reviewers would perform a technical review, resolve comments made by other reviewers and perform the CPCo licensing review to assure compliance with required FSAR format and content.

As portions of the FSAR were received from Bechtel, CPCo sent comments to Bechtel. Following this review, meetings between Bechtel and CPCo were held to clear up any unresolved matters before each section was released for printing. A review of the files at CPCo relating to Section 2.5 and 3.8 showed that no comments were made concerning the above inconsistent and incorrect content. The apparent inconsistent and incorrect statements were not identified during the review of the FSAR prior to submittal and the review procedures did not provide any mechanism to identify apparent inconsistencies between sections of the FSAR.

Based on the above, measures did not assure that design basis included in design drawings and specifications were translated into the license application which resulted as an inconsistency between the design drawings and the FSAR. This is considered an item of noncompliance with 10 CFR 50, Appendix B, Criterion III as identified in Appendix A. (329/78-20-01; 330/78-20-01)

### Effect of Ground Water in Plant Area Fill

Final plant grade will be established at elevation 634. The normal ground water was assumed to be at ground surface prior to construction, approximately elevation 603. The surface of the water in the cooling water pond will be at a maximum of approximately elevation 627.

The Dames and Moore report on Foundation Investigation submitted with PSAR Amendment No. 1, dated February 3, 1969, stated that, "The effect of raising the water level to elevation 625 in the reservoirs will cause the normal ground water level in the general plant area to eventually rise to approximately elevation 625. However, a drainage system will be provided to maintain the ground water level in the plant fill at elevation 603."

A supplement to Dames and Moore report was submitted in PSAR Amendment No. 3, dated August 13, 1969, which changed the above planning of a drainage system to control the ground water. The supplement states, "The underdrainage system considered in the initial report has been eliminated; consequently it is assumed that the ground water level in the plant area will rise concurrently to approximately elevation 625."

A Bechtel soils consultant theorized in a December 4, 1978, site meeting that if soils beneath the diesel generator building had been compacted too dry of optimum, changes in moisture after placement could cause the soils to settle significantly. Therefore, the total effect of the ground water being permitted to saturate the plant fill material is undetermined at this time. An evaluation of this condition is under review by the licensee. This item is considered unresolved. (329/78-20-02; 330/78-20-02)

### Review of Compaction Requirements for Plant Area Fill

During the investigation a review of the history of the compaction requirements was performed in order to determine whether the compaction of the plant fill was implemented in compliance with the commitments in the PSAR and in site construction specifications.

PSAR, Amendment 1, dated February 3, 1969, presented the Dames and Moore report "Foundation Investigation and Preliminary Exploration for Borrow Materials." The recommended minimum compaction criteria for support of critical structures is stated on page 15. It indicates 95% of maximum density for "cohesive soils" as determined by ASTM D-1557-66T and 100% for "granular soils."

PSAR, Amendment 3, dated August 13, 1969, included a supplement to the Dames and Moore report entitled, "Foundation Investigation and Preliminary

Exploration for Borrow Materials." Page 16 of this report lists the recommended minimum compaction criteria for sand soils and cohesive soils. For the fill material for supporting structures the minimum compaction is 85% relative density for sand and 100% of maximum density for clay as determined by ASTM D-698 modified to require 20,000 ft-lbs. of compactive energy (equivalent to 95% of ASTM D-1557, Method D which provides 56,000 ft-lbs of compactive energy). Subsequent to the filing of Amendment 3, no amendments were made to the PSAR to indicate that the recommendations contained in the Dames and Moore report would not be followed or would be further modified.

Bechtel Specification C-210, Section 13.0 (Plant Area Backfill and Berm Backfill) indicates the compaction requirements for cohesive soil (13.7.1) to be "not less than 95% of maximum density as determined by ASTM D-1557, Method D" and for cohesionless soils (sand) (13.7.2) to be compacted "to not less than 80% relative density as determined by ASTM D-2049."

A comparison of the PSAR commitments to the specification requirements shows that the compaction commitments for cohesive soil (clay) were translated into the construction specification i.e. 95% of maximum density using ASTM D-1557, Method D (compactive energy of 56,000 ft-lbs. However, the compaction commitment in the PSAR for cohesionless soil (sand) was not the same as in the construction specification, i.e. 85% relative density versus the 80% relative density, translated in the construction specification.

The compaction requirements actually implemented were as follows:

- a. Cohesive soil (clay): 95% of maximum density as determined by the "Bechtel Modified Test," a compactive energy of 20,000 ft-lbs was used instead of 56,000 ft-lbs of compactive energy as committed to in the PSAR and required by the construction specification C-210, Section 13.7.1.
- b. Cohesionless soil (sand): 80% relative density as determined by ASTM D-2049 was used instead of 85% as committed to in the PSAR. However, this is consistent with construction specification C-210, Section 13.7.2.

The compaction requirements implemented during construction of the plant area fill between elevations 603 and 634 were, therefore, less than the commitments made in the PSAR for cohesive and cohesionless fill material. In addition, the cohesive (clay) material was also compacted to less than that required by the Bechtel specification. (Specification C-210, Section 13.7).

A review of Specification C-210 (specification controlling earthwork contract) beginning with Revision 2, dated July 27, 1973, which was issued for subcontract showed that it contained conflicting sections relating to the plant area backfill compaction requirements.

Section 13.7, Compaction Requirements, from revision 2 to the latest revision of specification C-210 consistently specified that the backfill in the plant area shall be compacted to 95% of maximum density as determined by ASTM 1557, Method D.

Section 13.4, Testing Plant Area Backfill, of specification C-210 contained the statement that tests would be performed as set forth in Section 12.4.5, Laboratory Maximum Density and Optimum Moisture Content, which in turn specified a lesser standard, 20,000 foot-pounds per cubic foot, which is commonly referred to as the Bechtel Modified Proctor Density Test (BMP). This is contrary to the requirements of Section 13.7. Section 12 of the specification applies to Dike and Railroad Embankment Construction.

It was also noted that this control inconsistency was reflected in the applicable Midland QA Inspection Criteria, SC-1.10, Item 2.3(d) Compaction which states "Backfill material for the specified zones has been compacted to the required density as determined by Bechtel Modified Proctor Method" and has references C-210, Section 13.7 as the inspection criteria.

The inconsistency in control is further indicated in Specification C-208 which defined the testing contract requirements of subgrade materials. Section 9.1 (Testing) required compaction tests to be in accordance with ASTM D-1557 and only when directed was the BMP compaction criteria to be used. It was determined contrary to this U.S. Testing was only orally advised that the BMP was the standard to be applied to the tests they performed of plant area fill.

Through interviews and an examination of internal documents it was ascertained that because of these inconsistencies, the question of the applicable compaction standard for cohesive materials in the plant area was a recurring one.

The following is a summary of the documentation regarding the confusion of the compaction requirements for plant area fill:

1. Letter 7220-C-210-77 dated June 10, 1974, (subcontracts to Field Engineering) states "there has been some confusion as to the interpretation of the following item: 13.7 Compaction Requirement: all backfill in the plant area and berm shall be compacted to not less than 95% of maximum density as determined by modified Proctor method

(ASTM 1557, Method D), with the exception that Zones 4, 4A, 5, 5A, and 6 Materials need no special compactive effort other than as described in Section 12.8.1 (emphasis included in specification). Quality Control questioned whether the exception stated above applies only to Zones 4, 4A, 5, 5A, and 6 or did construction have to abide by Section 12.8.1 for Zones 1 and 2. Section 12.8.1 clearly requires Zone 2 material to be placed with a 50 ton rubber tired roller with a minimum of four roller passes per lift. QC's interpretation was that the field needed "to obtain 95% of maximum density by the modified Proctor method (ASTM 1557, Method D), with no restrictions as to the method used to obtain these results."

2. Letter 7220-C-210-23, dated June 24, 1974, (field Engineering to construction) responded to Item 1 above. It states, "We have reviewed your June 10, 1974, IOM concerning compactive effort required on Zones 1 and 2 in the plant and berm backfill areas. We agree with your interpretation; i.e. a 95% of maximum density is the acceptance criteria, and the number of roller passes listed in Paragraph 12.8.1 does not apply to plant and berm backfill. We feel the specification is now clear and no FCR is required."
3. Letter BCBE-370, dated July 25, 1974, (field construction to project engineering) lists outstanding items requiring Project Engineering's action. This includes the question, "Is the 95% compaction required in the plant area to be 95% of Bechtel Modified or 95% of ASTM-1557, Method D."
4. Letter BEBC-456, dated August 1, 1974, (Project Engineering to Field Construction) states that Geotech is addressing the question posed in BCBE-370 (Item 3 above).
5. Memorandum from Geotech to Bechtel Field, dated September 18, 1974, responds to the question raised in BCBE-370 (Item 3 above). It states, "It is our opinion that all the compaction requirements that are needed for Zone II material in the plant fill is as stated in 13.7 with the exception that Zones 4, 4A, 5, 5A, and 6 materials need no special compactive effort other than described in Section 12.8.1." Geotech reiterates the specification requirement of 95% of ASTM 1557, Method D. This was confirmed with the Geotech personnel.
6. Telecon dated September 9, 1974, from R. Grote (Field Engineering) to Rixford (Project Engineering) states, "I made an analogy (an exaggeration admittedly but applicable) that if the compaction could be achieved with a herd of mules walking over the fill it would be acceptable as long as it got the required 95% compaction. Rixford agreed."

7. Telecon Consumers to Bechtel Engineering dated September 19, 1974, expressed Consumers Power Company concern about what they felt was a lack of control of compaction in the plant area fill. CPCo addressed the added responsibility this lack of control places on the inspector. Bechtel told CPCo that it "was the inspector's job to make sure we got proper placement, compaction, etc."
8. Telecon dated September 18, 1974, by Bechtel Field Engineering to Bechtel Project Engineering discussed compaction requirements for specification C-210. It stated, "Compaction acceptance is based on meeting an 'end product' requirement, i.e. 95% of maximum density only. No method of achieving this 'end product' is specified or is required. Rixford fully agrees with the above."
9. Telecon dated October 7, 1977, from Bechtel Field Engineering to Bechtel Project Engineering states, "QA has asked for clarification of subject specification (C-210), Section 13 for plant area and berm backfill. Section 13.4 for testing of materials refers to Section 13.4 and therefore, requires the Bechtel Modified Proctor Density Test for Compaction of cohesive backfill. Section 13.7 for compaction of the same materials refers to testing in accordance with ASTM D-1557, Method D Proctor, without specific reference to Bechtel Modification." Bechtel Engineering responded to this question as follows: "This apparent conflict is clarified by Specification C-208, Section 9.1.a, direction to the testing subcontractor, which calls for ASTM D 1557 test for these materials and also allows Bechtel Field (the contractor) to call for the Bechtel Modification of that test. Either method is therefore acceptable to project engineering."
10. Telecon dated October 7, 1977, from Bechtel QA to Bechtel Project Engineering questions, "Is the intent of Paragraph 13.7 of Specification C-210 that the test be run to the 'Bechtel' modified proctor test as is indicated in the FSAR Paragraph 2.5.4.5.3 and in response to NCR 88." Engineering's response was "yes."

Various interviews were held with Bechtel construction field engineers, U. S. Testing personnel and Bechtel Ann Arbor Geotech and Project Engineering personnel to ascertain their understanding of the compaction requirements. Four predominant versions of the understood compaction requirements were stated by various individuals within the Bechtel organization. They are as follows:

- a. Specification C-210 required the contractor to perform compaction to the ASTM 1557, Method D, however, the testing requirements would be performed to the less stringent "Bechtel Modified Test Method."



- b. The required compaction and testing was always understood to be based on the "Bechtel Modified Test Method."
- c. The required compaction and testing was always understood to be based on the standard ASTM 1557, Method D requirements.
- d. A tacit understanding had been established to use the Bechtel Modified Method, but to exceed this requirement by enough to also satisfy the requirement of ASTM 1557, Method D.

It is apparent from the above four distinctly different understandings of the compaction requirements, that the apparent confusion was not resolved. A member of the Bechtel QA staff in Ann Arbor who had previously been a QA Engineer at the Midland site said that QA audits of QC inspection criteria did not identify the above inconsistencies.

This failure to accomplish activities affecting the quality of the plant area fill in accordance with procedures is considered an item of noncompliance with 10 CFR 50, Appendix B, Criterion V as identified in Appendix A. (329/78-20-03; 330/78-20-03)

#### Review of Moisture Control Requirements for Plant Area Fill

Specification C-210, Section 13.6 (Moisture Control) requires moisture control of the plant area fill material to conform to Section 12.6. The moisture control requirement in Section 12.6.1 states, in part, "Zone 1, 1A and 2 material which require moisture control, shall be moisture conditioned in the borrow areas," and that "water content during compaction shall not be more than two percentage points below optimum moisture content and shall not be more than two percentage points above optimum moisture content."

Contrary to the above, Bechtel QA identified in SD-40 dated July 22, 1977, that "the field does not take moisture control tests prior to and during placement of the backfill, but rather rely on the moisture results taken from the in-place soil density tests."

The following is a summary of the documentation that followed the identification of the above deviation from specification C-210.

1. Letter BCBE-1533R (dated August 15, 1977) field to project engineering states, "it was found that densities meeting specification requirements could be attained, irrespective of the use of moisture tests," and that "moisture tests were not used to control backfill moisture." The field requested "that project engineering agree to acceptance of backfill materials installed in the past, along with the records thereof, irrespective of the use of the moisture tests."

2. Letter BEBC-1859 (dated September 30, 1977) responded to the field request in BCBE-1533R. Engineering states, "It should be noted that it is ideal to control the moisture of backfill material at the borrow areas by conditioning" and that "the procedure used to take moisture content tests after compaction would not have direct impact on the quality of work." Engineering then agreed with the field request that "backfill placed prior to modification of testing methods to be accepted as is."
3. Telecon October 10, 1977, (Bechtel QA Site to Bechtel Engineering, Ann Arbor) indicated that, "there are no moisture requirements at the time of density testing, only density requirement. The moisture requirement is prior to compaction."
4. Telecon October 13, 1977, (Bechtel Engineering to Bechtel QA Site) changed what was indicated in the telecon on October 10, 1977, (Item 3 above). Engineering then stated, "The moisture requirement (+ 2% of optimum) is mandatory and must be implemented at the time of placement and testing." This is contrary to what was stated on October 10, 1977.
5. Letter BCBE-1669R (dated November 18, 1977) once again is a field request to Bechtel engineering requesting, "written clarification of the 2% tolerance on backfill moisture content during compaction."
6. Letter BEBC-1998 (dated December 15, 1977) provides engineering's response to BCBE-1669R requesting clarification of the moisture requirement. Engineering stated, "The moisture content of the soil should be within 2% of optimum during placement and compaction. However, this property of the soil is not necessarily a measure of its adequacy after compaction."
7. Letter O-1631 (dated December 21, 1977) closes QA Action Request SD-40 (dated July 22, 1977) which first identified the moisture control deficiency.
8. Telecon (dated April 7, 1978) from Field Engineering and Quality Control to Project Engineering once again requests them "to clarify BEBC-1998" (December 15, 1977), Item 6 above. Two situations were presented to engineering as follows: (a) The moisture sample taken from the borrow area at the start of the shift is acceptable, however, the moisture test taken in conjunction with the density test fails while compaction was attained; and (b) The moisture sample taken from the borrow area at the start of the shift fails and the material is conditioned to meet moisture content required.

however, the moisture test later fails at the time the passing compaction test is taken. Engineering responded, "the above two situations are acceptable as is." This response is contrary to the direction previously given in telecon dated October 13, 1977 (see Item 4 above).

9. Letter GLR-249 (April 16, 1978) is a Bchtel Site QA request to Project Engineering to resolve the moisture content situation and "to provide clear direction for the control of moisture content." QA recommends "one possible solution would be to delete the requirement to control the moisture content and rely on the compaction requirement only for completion of soils work."
10. Letter BEBC-2286 (June 1, 1978) was Project Engineering's response to GLR-249 (Item 9 above). It states, "moisture content is not necessarily a measure of a soil's adequacy to act as a foundation or backfill material," and that "soil with the specified density following compaction would not be rejected on the basis that its moisture content was not controlled in the borrow area."

Based on the reviews of documentation, moisture control had not been implemented as the specification required. In addition, the matter had not been resolved for the period of time from the issuance of QA Action Request SD-40 on July 22, 1977, until June, 1978, during which time soils safety-related work continued.

According to the licensee, although moisture control was not strictly followed in accordance with specification requirements, final density tests were used as a basis for acceptance of soil placement.

As pointed out to the licensee, moisture control is a required control point to assure attainment of percent compaction specified in specification C-210.

This failure to assure that conditions adverse to quality are promptly identified and corrected to preclude repetition is considered an item of noncompliance with 10 CFR 50, Appendix B, Criterion XVI as identified in Appendix A. (329/78-20-04; 330/78-20-04)

#### Review of Subgrade Preparation for Plant Area Fill

The Dames and Moore report on foundation investigation submitted with PSAR Amendment 3, dated August 13, 1969, states, "the clay soils are susceptible to loss of strength due to frost action, disturbance and/or the presence of water. If the construction schedule requires that foundation excavation be left open during the winter, it is recommended that excavation operations be performed such that at least

3 1/2 feet of natural soil or similar cover remain in place over the final subgrade or overlying the mud mat. This layer of protective material is necessary to prevent the softening and disturbance of subgrade soils due to frost action." The licensee indicated that instructions for winter protection of foundation excavations were transmitted by sketch C-271.

The Dames and Moore report also stated, "If filling and backfilling operations are discontinued during periods of cold weather, it is recommended that all frozen soils be removed or recompacted prior to the resumption of operations."

After review of the applicable sections of specification C-210 (i.e. Sections 12.5.1, 12.10, 10.1 and 11) the inspector has determined that the Bechtel specification did not provide specific instructions for removal or recompaction of frozen/thawed soils upon resumption of work after the winter period to preclude the effects of frost action on the compacted subgrade materials.

This failure to assure that regulatory commitments as specified in the license application are translated into specification, drawings or instructions is considered an item of noncompliance with 10 CFR 50, Appendix B, Criterion III. (329/78-20-05; 330/78-20-05)

#### Review of Nonconformance Reports Identified for Plant Area Fill

The following examples of nonconformance and audit reports regarding the plant area fill were reviewed relative to the cause of the nonconformance and the engineering evaluation and corrective action:

<u>No.</u>	<u>Nonconforming Condition</u>	<u>Engineering Evaluation</u>
(1) CPCo QF-29 (10/14/74)	Failure to perform inspection and testing of structural backfill (sand) delivered to jobsite 29 of 30 day in Aug. and Sept. 74. Bechtel QC not informed of deliveries.	"Use as is" based on samples taken from stock pile.
(2) CPCo QF-52 (8/7/75)	Moisture control out of tolerance of specification C-210, Section 13.6.	Accepted in place material with low moisture.
(3) CPCo QF-68 (10/17/75)	Compaction test had been calculated using incorrect maximum lab density. Test recorded as passing was actually a failure.	Failing tests were cleared by subsequent passing tests.

- (4) Bechtel Material placed did not  
NCR 421 meet moisture require-  
(5/5/76) ments.

Engineering stated that this ramp area is temporary and would be removed. This was removed based on note added to NCR 421 on 3/18/77.

Note: In the vicinity of this ramp a Geotech engineer determined the material to be "soft" and directed a test pit to be dug for investigation in September 1978 after the D. G. Bldg. settlement was identified.

- (5) CCo Lift thickness exceeded  
QF-120 maximum of 4" in areas  
(9/21/76) not accessible to roller  
equipment. Insufficient  
monitoring of placing  
crews. Laborer foreman  
not familiar with re-  
quirements.
- (6) CCo Inspection plan C-210-4,  
QF-130 Rev. 0, permits 12" lift  
(10/18/76) thickness for areas in-  
accessible to rollers  
caused by "misinterpre-  
tation of specification  
requirements. Spec. per-  
mitted 4" lift thickness.
- (7) CCo Failure to perform inspec-  
QF-147 tion and testing of struc-  
(2/2/77) tural backfill (sand) on  
12/1/76, 12/14/76 and  
1/11/77 (same as QF-29  
dated 10/14/74) material  
lacked gradation test  
requirements.
- (8) CCo Moisture control out-of-  
QF-172 tolerance and compaction  
(7/8/77) criteria not met.
- (9) CCo Gradation requirements  
QF-174 for Zone 1 materials not  
(7/15/77) met.
- Material was removed and recompact.
- Corrected inspection plan requirements.
- Engineering accepted the material in place "use as is."
- Engineering accepted materials.
- Engineering accepted materials.

- |      |  |  |  |
|------|--|--|--|
| (10) | CPCo<br>QF-199<br>(11/4/77)                  | Moisture content not met; compaction requirements for cohesive and cohesionless soil not met. Materials had been accepted using incorrect testing data.      | Issued Bechtel NCR's No. 1004 and 1005; No. 1004 still open; No. 1005 "accepted as is."            |
| (11) | CPCo<br>QF-203<br>(11/22/77)                 | Gradation requirement not met yet materials accepted.  | Engineering "accepted as is."  |
| (12) | CPCo<br>Audit<br>F-77-21<br>(5/77 &<br>6/77) | Moisture content requirements not met; test frequency not met.   | Bechtel QC to inform foreman <u>directing</u> soils work of requirements.                          |
| (13) | CPCo<br>Audit<br>F-77-32<br>(10/3/77)        | Compaction requirement for both cohesive and cohesionless materials not met; moisture requirements not met; tests had been accepted yet failed requirements. | Project Engineering to justify the materials these failing tests represent. NCR QF-195 still open. |
| (14) | Bechtel<br>NCR 686<br>(2/1/77)               | Same deficiency as NCR 698.  | Accepted, "use as is."   |
| (15) | Bechtel<br>NCR 698<br>(2/9/77)               | Structural backfill (sand) was delivered without acceptance tests on Oct. 26, 29, Nov. 12, 1976 and Jan. 11, 12, 1977.                                       | Engineering accepted "use as is."  |
| (16) | Bechtel<br>NCR 1005<br>(10/26/77)            | Moisture content requirements not met.   | "Accepted as is" based on density test only.   |

Based on a review of the above nonconformance and audit reports corrective action regarding nonconformances related to plant fill was insufficient or inadequate as evidenced by the repeated deviations from specification requirements.

This failure to assure that the cause of conditions adverse to quality are identified and that adequate corrective action be taken to preclude

repetition is considered an item of noncompliance with 10 CFR 50, Appendix E, Criterion XVI as identified in Appendix A. (329/78-20-06; 330/78-20-06)

#### Review of Calculations of Settlement for Plant Area

A review of the settlement calculations for the structures in the plant area was performed during a visit to the Bechtel, Ann Arbor Engineering office. Specific attention was given to structures founded on plant area "compacted fill." The following specific findings were made:

1. FSAR, Section 3.8.4.1.2 (Diesel Generator Building) indicates the foundation of the DGB to be continuous footings with independent pedestals for each of the Diesel Generators. Contrary to the structural arrangement described in the FSAR, the settlement calculations for the DGB were performed on the premise that the building and equipment loads would be uniformly distributed to the foundation material by a 154' x 70' foundation mat. The settlement calculations were performed between August 1976 and October 1976 by Bechtel Geotech Division.

Discussion with the Geotech Engineer who performed the settlement calculations indicated that he had not been informed of the design change of the foundation until late August 1978 when the excessive settlements of the DGB and pedestal became apparent.

2. FSAR Figure 2.5-47 indicates the load intensity for the DGB to be 4 KSF (4000 lbs. per sq. ft.); however, the settlement calculations reviewed indicate a uniform load of 3 KSF (3000 PSF). This appears to be a conflict between the FSAR and settlement calculations.
3. The settlement calculations for the borated water storage tanks were performed assuming a 54' diameter circular foundation mat with an assumed uniform load of 2500 PSF. Instead, the tanks are supported on a continuous circular spread footing and compacted structural backfill as detailed on the construction drawings. The Geotech engineer was also not made aware of the revised foundation detail.

FSAR Figure 2.5-48 (Estimated Ultimate Settlements) indicates the anticipated ultimate settlement for Unit 1 and 2 plant structures. The values indicated for the Diesel Generator Building and Borated Water Storage Tanks are the values developed assuming uniformly distributed loads founded on mat foundations as was indicated in the settlement calculations reviewed even though the actual design and construction utilizes spread footings. The FSAR does not indicate the foundation

type assumed in the settlement calculations and therefore the values in the FSAR figure appear to represent the settlements estimated for the as-constructed spread footing foundation.

4. During a review of the settlement calculations, it was observed that the compression index (C) for the compacted fill between elevations 603 and 634 in the plant area was assumed to be 0.001 (estimate based on experience). FSAR Section 2.5.4.10.3.3 (Soil Parameters) indicates the soil compressibility parameters used in the settlement calculation are presented in Table 2.5-16. This table indicates that for the plant fill elevations 603 to 634, the compression index used was 0.003. Contrary to the FSAR value, 0.001 was used in the settlement calculations reviewed. This value is directly used to determine the estimated ultimate settlement of structure supported by plant fill material.

Based on the above examples, measures did not assure that specific design bases, included in design documents, were translated into the license application resulting in inconsistencies between design documents and the FSAR. This is considered an item of noncompliance with 10 CFR 50, Appendix B, Criterion III as identified in Appendix A. (329/78-20-07; 330/78-20-07)

Discussions with CPCo personnel responsible for the technical review and format indicated that a comparison between the design documents and FSAR had not been performed. Likewise, Bechtel personnel indicated that a detailed comparison for the technical accuracy of design documents to the FSAR statements had not been performed; instead reliance was placed on the originator's input.

According to the Civil Engineering Group Supervisor, a mat foundation was considered for the DGB only during the conceptual stage. All drawings generated show a spread footing foundation. The supervisor stated that the Geotech engineer apparently based his calculations on the conceptual stage information. He went on to say that an individual in Geotech was responsible for checking the calculations and the first thing he is supposed to do is determine that the basis for the calculations is correct. He said that apparently this was not done.

#### Review of Settlement of Administration Building Footings

During the investigation, it was disclosed that the Administration Building at the Midland Site had experienced excessive settlement of the foundation footings. Although the Administration Building is a non-safety-related structure, it is supported by plant area fill material compacted and tested to the same requirements as material



supporting safety-related structures and therefore pertinent to the current settlements being experienced by the Diesel Generator Building. The following are the events relating to the settlement of the Administration Building footings.

During the end of August, 1977, a Bechtel field engineer observed a gap between a slab and the grade beam of the Administration Building. On August 23, 1977, a survey was taken of the settlement. The results indicated that the footings supporting the grade beam had experienced settlement ranging from 1.32" (north side) to 3.48" (south side). This settlement took place between July 1977, and the end of August 1977. The footings were supported by "random fill" (Zone 2 material).

The concrete footings on the order of 7' 6" by 7' 6" by 1' 9" deep were removed along with the grade beam. The random fill material was also removed. According to U. S. Testing personnel, it was observed during excavation of the fill material that there were voids of 1/4" to 2" or 3" within the fill and these were associated with large lumps of unbroken clay measuring up to 3 feet in diameter.

The Civil Field Engineer assigned responsibility for plant fill work said that, although he was no soils expert, it was his opinion that the problem was caused by the presence of pockets of water due to drainage from the steam tunnel. The Lead Civil Field Engineer also indicated a drainage problem caused the Administration Building footings settlement. They were, however, unclear as to how the water pockets were formed, i.e. whether they were formed as the fill was being placed or how they could develop after the fill was compacted.

The excavated fill was replaced with concrete and the design of individual footings was changed to a continuous spread footing design for support of the building.

As a result of the settlement of the Administration Building footings a total of seven borings were taken of which five were in the Administration Building area, one in the Evaporator Building area and one south of the Diesel Generator Building. In the Administration Building area the foundation material was found to be "soft" with "spongy characteristics." The two other borings did not indicate unusual material properties in that the blow counts were reasonable. These borings were taken in September 1977.

The licensee indicated that reports from Bechtel concluded that the primary cause of the settlement in the Administration Building area was insufficient compaction of the fill. Bechtel also concluded that "deviations from specific compaction requirements was the result of

repeated erroneous selection of compaction standard," i.e. the incorrect optimum moisture-density curve was used for the soil material being compacted. In effect, the moisture-density curve was erroneously assumed to represent the soil being used and therefore soil was compacted to less than maximum density.

Bechtel personnel including the Civil Group Supervisor, Project Engineering, the Field Project Engineer, the Lead Civil Field Engineer, and the Chief Civil QC Inspector, all stated that the Administration Building footing settlement was regarded as a localized problem. The question as to the adequacy of the entire plant area fill did not arise even though the following similarities existed between the Administration Building area and rest of plant fill; (1) same soil specification applied, (2) same material (random fill) was used and (3) same control procedures and selection of laboratory compaction standards was used. The Diesel Generator Building area required even more fill than other safety-related structures since its base is located at a higher elevation than the others.

#### Review of Interface Between Diesel Generator Building Foundation and Electrical Duct Banks

A review of the design interface between the electrical and civil sections of the Bechtel organization was performed to determine whether the design accounted for the interaction of the electrical duct banks and spread footings on the differential settlement of the northside of the DGB. It was determined that the electrical and civil groups made accommodations in the design to permit settlement of the spread footings around the electrical duct banks by including a styrofoam "bond breaker" around the duct banks. Both electrical and civil groups reviewed and approved electrical Drawing E-502 which includes the appropriate detail.

However, Bechtel Drawing C-45 which identifies Class I fill material areas permits the use of Zone 2 (random fill) which includes "any material free of humus, organic or other deleterious material." This, in effect, does not preclude the use of concrete around the electrical duct banks beneath the spread footings. Due to the difficulty in compacting, Bechtel elected to replace the soil material with concrete. Letter from project engineering to field construction, dated December 27, 1974, states, "lean concrete backfill is considered acceptable for replacement of Zone 1 and 2." The instruction is considered inadequate, in that, the concrete placed around the duct banks restricted the settlement on the north side of the DGB where electrical duct banks enter through the footing. This contributed to the excessive differential settlement in the North-South direction across the building.

This failure to prescribe adequate instructions for activities affecting the quality of safety-related structures is considered an item of noncompliance with 10 CFR 50, Appendix B, Criterion V as identified in Appendix A; (329/78-20-07; 330/78-20-07)

#### Review of Soils Placement and Inspection Activities for Plant Area Fill

A subcontractor, Canonie Construction Company, South Haven, Michigan, performed the major portion of the earthwork at the Midland site. Although Canonie was primarily engaged to construct the cooling pond dike, they also performed most of the plant area fill work. Bechtel, however, also performed plant fill work prior to and after Canonie left the site in mid-October 1977. The last Canonie daily QA/QC fill placement report is dated October 16, 1977.

According to Canonie QA/QC records the first fill in the DGB area was placed in late October and early November 1975. No further fill was placed in the area until July 1976. After that time, fill work in the area was interspersed with soils work in other areas.

While it would be difficult to identify the soil work performed by Bechtel versus that performed by Canonie, records reviewed indicated that most of the Bechtel work was done during the latter part of 1976 and continued through 1977 and 1978. Although most of the Bechtel work related to placing sand around piping and ducts after they were laid and placing sand adjacent to walls, some motorized work compacting clay fill was also done by Bechtel.

Regarding the plant fill work performed by Bechtel, CPCo Audit Report No. F-77-21 dated June 10, 1977, identified a number of deficiencies which recommended the corrective action to be as follows: (1) "the foremen directing the soils work should be instructed as to the required moisture content limits" and (2) "the foreman directing the soils work should be instructed as to the correct test frequency requirements." Interviews with two such Bechtel foremen confirmed the fact that they were directing soil operations. They indicated they received their instruction regarding lift thicknesses and testing requirements verbally from field engineering through a general foreman.

Bechtel design criteria C-501 (Page 8) and PSAR Amendment No. 3 (Dames and Moore Report, Page 16) states that, "Filling operations should be performed under the continuous technical supervision of a qualified soils engineer who would perform in-place density tests in the compacted fill to verify that all materials are placed and compacted in accordance with the recommended criteria."

Based on the above, the soils activities were not accomplished under the continuous technical supervision in accordance with Bechtel design criteria. This failure to provide a qualified soils engineer to perform technical supervision for activities affecting quality as required by specifications and the PSAR is considered an item of noncompliance with 10 CFR 50, Appendix B, Criterion V. (329/78-20-08; 330/78-20-08)

The foremen indicated that Bechtel Field Engineers and QC inspectors were rarely in the areas where soils activities were going on. The foremen decided when and where tests were taken. The locations of tests were approximated by pacing or visually estimating distances from columns or building walls. Lift thicknesses were determined visually, usually without the use of grade stakes.

Soils testing services are provided by U. S. Testing Company based on the requirements of Specification C-208. The two U. S. Testing technicians who said they performed an estimated 90% of the soil testing during the years 1975-77 indicated that they rarely saw a Bechtel field engineer or QC inspector in the areas where plant fill activities were going on. One technician said he could recall only one occasion when a QC inspector was present when he took an in-place density test. The other technician estimated he had contact with a QC inspector in the field about once a month. A Bechtel QC inspector, however, was assigned to the testing laboratory on a full-time basis.

U.S. Testing personnel stated that erroneous test locations were a chronic problem regarding the Bechtel placed fill. The location of a test was usually given at the time of the test by a labor foreman or a laborer if the foreman wasn't there. Sometimes, however, a foreman was not familiar with the area in which he was working and the location was not provided until sometime after the test. It became necessary on occasion to withhold test results as a means of getting the test location. Test elevations were approximated sequentially.

The technicians further advised that rarely did a Bechtel QC inspector request a test. Normally, labor foremen requested them. On occasion a technician passing through an area would be asked by a foreman if a test should be taken. Upon completion of in-place tests, the results were usually communicated to the foreman directing the work. Test failures were also reported by telephone to QC or Field Engineering. A weekly report of test was provided to Bechtel QC and Field Engineering who reviewed any test failures and resolved them.

U. S. Testing personnel advised that they were requested to take tests of clay fill while it was raining and in order to do so, plastic was held over them to protect their equipment while the test was made. Even though it was raining, the fill placement work was not stopped on

some occasions. A Bechtel foreman confirmed that density tests were on occasion taken while it was raining. While this is not contrary to the specification instructions, it is contrary to standard practice.

U. S. Testing personnel indicated that when moisture was added, the procedure did not include blending the material which resulted in mushy seams. It is commonly accepted good practice to disc the fill after spraying it with water to add needed moisture. A Bechtel foreman stated that if moisture was needed they compacted 6" then sprinkled it and then added another 6".

The field engineer who was assigned responsibility for plant fill work stated he did not spend full time on soils work since he also had responsibility for two structures, the steam tunnel and general yard work. He said he tried to get out to the area where fill work was being done once a day. Some times he did and sometimes he did not. He indicated it was his impression that the QC Inspector responsible for the soils work on the day shift visited those work areas once or twice a week. He confirmed that only oral instructions were furnished to the foremen whom he felt were conscientious. The main problem he experienced with the foreman was maintaining proper lift thickness.

The QC inspector who was primarily responsible for the plant fill work is no longer employed by Bechtel. The QC inspector who was responsible for the plant fill work on the night shift stated that he tried to devote about one hour a night to the plant fill activities. He indicated that during 1976-1977 there was much emphasis being placed on cadwelding and rebar work and it was necessary to spend the majority of his time on those activities. He maintained that he did have fairly frequent contacts with the technicians who performed the in-place density tests, particularly when test failures occurred. He indicated it was his impression that the labor foremen were directing fill placement adequately.

#### Review of Inspection Procedures

The following procedures which are relative to backfill operations at Midland Units 1 and 2 between August 1974 through December 1977 were reviewed.

- a. Bechtel Master Project QC Instruction for Compacted Backfill - C-1.02 was issued for construction October 18, 1976, and it is presently the current instruction which is used by Bechtel QC (when Bechtel is the inspection agency, providing first level inspections during backfill operations). Further, this instruction was used by Bechtel QC when monitoring the activities of

other inspection agencies (Canonie) when such agencies were performing the first level inspections of backfill operations during the time periods of October 18, 1976, until June 28, 1977.

- b. Bechtel Quality Control Master Inspection plan for Plant Foundation Excavation and Cooling Pond Dikes (Plant Area Backfill and Berm Backfill) - Procedure No. C-210-4 was the instruction utilized by Bechtel QC when monitoring the activities of other inspection agencies that were providing the first level inspections of backfill operations (this instruction was utilized during time periods prior to October 18, 1976).
- c. Bechtel Quality Control Master Inspection Plan for Structural Backfill Placement - No. C-211-1 is an instruction utilized by Bechtel QC when performing first level inspection of backfill activities prior to October 18, 1976.

Bechtel Procedure C-1.02, listed above, was written as a replacement for both Procedures C-210-4 and C-211-1. The inspection activities which were delineated in Procedures C-210-4 and C-211-1 were compared with those described in Procedure C-1.02. The following are some of those activities which were compared:

Activities/Task Description	Inspection Code for--		
	C-210-4	C-211-1	C-1.02
<u>Backfill Material</u>			
(*) 1. Free of brush, roots, sod, snow, ice or frozen soil.		I	S(V)
(*) 2. Material moisture conditioned to required moisture content.	S	I	S(V)
3. Structural backfill used with 3" of plant structure, shall be cohesionless and free-draining.		I	
(*) 4. Material not placed upon frozen surface.		I	S(V)
5. Foundation approved prior to backfill placement.	H	H	R/H
6. Prior to start of work, area free of debris, trash and unsuitable material.			I(V)

### Compaction Requirements

1.	Cohesionless material compacted not less than 80% relative density.	S	S	S(V)
(*) 2.	Cohesive material compacted to not less than 95% max. density.	W	S	S(V)
(*) 3.	Zones 1, 1A, 2 and 3 material in uncompacted lifts not exceeding 12"; areas not accessible to roller equipment the material placed in uncompacted lifts no exceeding 4".	W	I	S(V)

### Material Testing

1.	Verify testing and test results are as per engineering requirements.			
a.	Materials	S	S	S(V)
b.	Moisture	S	S	S(V)
c.	Compaction	S	S	S(V)
2.	Review lab test report verifying:			
a.	Proper test method.	R	R	R
b.	Proper test frequency.	R	R	R
c.	Technical adequacy.	R	R	R

I - Inspection point  
H - Hold point  
W - Witness point  
S - Surveillance (V) - visual  
R - Review records

Those activities identified by an (\*) asterisk indicate inspection requirements which have been relaxed from the original procedural requirements.

It is considered that the relaxation of actions relating to the confirmation that soils placement activities were conducted according to

Specific reasons contributed to inadequate compaction of foundation and fill material and the increase incidence of deviations from specifications regarding lift thickness, moisture control and frequency of testing.

This failure to provide adequate inspection of activities affecting quality is considered an item of noncompliance with 10 CFR 50, Appendix B, Criterion X. (392/78-20-09; 330/78-20-09)

#### Exit Meetings

Members of the NRC staff met with Consumers Power Company and Bechtel Corporation at the NRC Region III office on February 23, 1979 to present the scope, purpose, and preliminary findings of the investigation. That meeting was subsequently followed by a second meeting held on March 5, 1979, during which Consumers Power Company responded to the preliminary investigation findings. The documents used during these meetings were transmitted to Consumers Power Company by NRC letter dated March 15, 1979.



NRC Dep Ev # 2 for J.D.  
10-21-80 (Horn)  
August 21, 1980

Ms. Barbara Stamiris  
5795 North River Road  
Freeland, Michigan 48623

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

Dear Ms. Stamiris:

Per your request of Messrs. William Paton and Darl Hood of the NRC last week, enclosed please find copies of the nonconformance reports and the quality action requests referenced in paragraph 4 in Appendix A of the December 6, 1979 Order Modifying Construction Permits for the Midland plant. The two related audit reports you mentioned are also enclosed.

Sincerely,

Steven C. Goldberg  
Counsel for NRC Staff

Enclosures:

Action Request No. <sup>5</sup> 5D-40  
Nonconformance Report Nos. QF-29, QF-52, QF-68, QF-120, QF-130  
QF-147, QF-172, QF-174, QF-199, QF-203  
Audit Report Nos. 77-21 and 77-22

cc w/enc.:

Frank J. Kelley, Esq.  
Myron M. Cherry, Esq.  
Ms. Mary Sinclair  
Michael I. Miller, Esq.  
Grant J. Merritt, Esq.  
Judd L. Bacon, Esq.  
Mr. Steve Gadler  
Wendell H. Marshall  
Michael A. Race  
Ms. Sandra D. Reist  
Ms. Sharon K. Warren  
Patrick A. Race  
George C. Wilson, Sr.  
Ms. Carol Gilbert  
William A. Thibodeau  
Terry R. Miller

Internal Distribution:

NRC Central  
OELD-FF (2)  
Shapar/Engelhardt  
Christenbury/Scinto  
Olmstead/Karman  
Paton/Chron (2)  
Goldberg/Chron  
Jones  
D. Hood -116-C  
IJLee - 147

OFFICE	OELD J				
SURNAME	SCGoldberg:eat				
DATE	8/21/80				

# QUALITY ACTION REQUEST

From: G. L. Richardson	Site QA	Job 7220	①
To: J. F. Mewgen/ G. P. Connolly	② Control Document ref.: 7220-C-210	③ CAR Issue No.: 50-40	④
Action Requested: Section 13.0 of specification 7220-C-210, Rev. 4 provides the requirements for Q-listed backfill in the plant area. Section 13.6 states that the moisture control in this area shall be in accordance with Section 12.6 of the same specification. Section 12.6 states in part: "The water content during compaction shall not be more than 2 percentage points below optimum moisture content and shall not be more than 2 percentage points above optimum moisture content." Tests done in accordance with para. 12.5 will indicate the degree of moistening of aerating necessary to comply with para. 12.5. After placement of loose material on the embankment fill, the moisture content shall be further adjusted as necessary to bring such material within the moisture content limits required.			
Signature: <i>G. L. Richardson</i>	⑥ Date: 7/22/77	⑦ Reply Requested by: 1) 7/25/77 2) 8/19/77	⑧
Reply:			⑨
<b>RECEIVED</b>	JUL 22 1977	QUALITY CONTROL BECHTEL JOB 7220	
	<input checked="" type="checkbox"/> ELECT. <input type="checkbox"/> PIPING <input type="checkbox"/> MECH. <input type="checkbox"/> WELDING <input type="checkbox"/> RECEIVING <input type="checkbox"/> ASST TO <input type="checkbox"/> YES <input type="checkbox"/> NO DATE:		
Signature:		⑩ Date:	⑪
Action Verified:		⑫ Date:	⑬

WHITE - Return to sender  
 #PC 20977  
 21721649-05

CANARY - Addressee's file

PINK - Sender's file


for compaction."

"Rolling of any section of embankment containing material too wet or too dry to obtain the required compaction shall be delayed until the moisture content of the material is brought to within the required limits or the material shall be removed and replaced with suitable material. . ."

Contrary to the above: The field does not take moisture control tests prior to and during placement of the backfill, but rather rely on the moisture results taken from the in-place soil density tests.

#### Recommended Corrective Action

- 1) A system for testing the soil for moisture content prior to compaction should be developed and implemented by Bechtel and the subcontractor. QC should make any necessary revisions to the QCI.
- 2) Recognizing that the soil has been tested for moisture content after compaction and meets the requirements of the specification it is not necessary to identify these materials as nonconforming. However Project Engineering should be apprized of the past testing methods. In addition it is recommended that engineering concur with the interpretation that moisture contents taken after compaction are for determining dry densities and should not be used for specified moisture control.
- 3) Assure responsible personnel are aware of the testing system.

Copy For S. H. Howell W. E. Kessler (2) W. F. Holub File	 U.S. TESTING FILE Nonconformance No <u>QF29</u>	File No. <u>16.3.6</u> Issue Date <u>October 14, 1974</u> Project <u>Midland 1 &amp; 2</u> File Title <u>NCRs on Bechtel Quality Control</u>
--	---	---

This Nonconformance Report is Issued to: Mr. J. P. Connolly Bechtel Project Field Quality Control Engineer who is responsible for correction action.	Prepared By <u>[Signature]</u> Date <u>10-14-74</u> Reviewed By <u>[Signature]</u> Date <u>10/17/74</u> Written Reply Required By Date <u>10-24-74</u> Action Required By Date <u>11-14-74</u>
---	---

Nonconformance Description and Supporting Details: Specification C-211 Rev. 0 and SCN No. C-211-4001, 5.6.2 states "Material delivered to the jobsite for use as structural backfill shall be visually inspected, and tested in accordance with ASTM C-117 and C-136 by the contractors representative once per day when material is being delivered." Structural backfill material was delivered on thirty (30) days in August and September, but the QC File only has test reports for one (1) of the thirty (30) days. U.S. Testing File only has test reports for eleven (11) of the thirty (30) days.

AEC Reportable: Yes  No  See Procedure 9 - Reporting of Deficiencies to AEC  
 AEC Notified on \_\_\_\_\_ By \_\_\_\_\_ Method \_\_\_\_\_

Recommended Corrective Action (If Appropriate): (1) Evaluate the structural backfill material in place and in the stockpile with additional tests. (2) Locate the missing test reports. (3) Correct the problem of U.S. Testing not being notified of incoming structural backfill material.

Corrective Action To Be Taken: (1) Evaluate the structural backfill material in the stockpile with additional tests. (2) Locate the missing test reports. (3) Correct the problem of U.S. Testing not being notified of incoming structural backfill material.

Underlying Cause of Nonconformance: The underlying cause of this nonconformance is Bechtel Quality Control was not being fully informed of material deliveries, therefore U.S. Testing was not being informed by Bechtel Quality Control.

(Corrective Action Implemented and Nonconformance Closed) Confirmed By [Signature]  
 (1) Bechtel NCR 198 was initiated. 26 additional samples Date February 12, 1975 were taken from the stockpile. Bechtel Project Engineering's Disposition is to "use as is" as per the results of the additional samples. (2) The ten missing reports were found and added in the QC File (3) A memorandum from E. E. Felton directing that Quality Control be notified of all incoming shipments of structural backfill material was issued on October 29, 1974.

To Be Provided by Addressee.

3/15/74

\*\*Released January 19, 1976  
 File 16.3.6  
 Issue Date August 7, 1975\*\*  
 Project Midland 1 & 2  
 File Title NCR's on Bechtel Quality Control

Route To	This Copy For
FMSouthworth	SHHowell
HWSlager	GSKeeley (2)
CQHills	TCCooke
	JMilandin
	WFHolub
	GLRichardson
	Subject File



Consumers Power

Nonconformance  
 Report No QF-52

This Nonconformance Report is Issued To:

Mr. J. P. Connolly  
 Bechtel Project Field Quality Control  
 Engineer

who is responsible for corrective action.

Prepared By Donald E. Horn Date 8-7-75

Approved By [Signature] Date 8/1/75

Written Reply Requested By Date 9-5-75

Corrective Action Requested By Date 9-5-75

\* Nonconformance Description and Supporting Details: (1) Specification C-210 Rev. 4 Section 13.6 for plant area backfill and berm backfill states "Moisture control of the plant area and berm materials shall conform to section 12.6". Under section 12.6, 12.6.1 states in part that "the water content during compaction shall not be more than two percentage points below optimum moisture content and shall not be more than two percentage points above optimum moisture content". Contrary to this requirement, test no. MD202 for plant area fill located 14' east of 8.7 line and 36' north of A line at elevation 594.5 had a moisture content 2.9 below optimum moisture content. Approximately 7 feet of material has been placed over this failing material.

(Contd)

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

Stop Work Necessary Yes  No  See Procedure 16 - Stop Work No \_\_\_\_\_

Recommended Corrective Action: (1) Receive a Project Engineering evaluation on the acceptability of the material in question or remove the material. (2) U.S. Testing should have training sessions to take corrective action to preclude repetition. (3) Quality Control should have training sessions to take corrective action to preclude repetition. The written replies to these items is requested with the Project Engineering evaluation.

1 Corrective Action Taken: (1) Project Engineering has evaluated and accepted the in place material with low moisture content based on a satisfactory compaction test result. (2) United States Testing and Bechtel Quality Control have each had training sessions re-emphasizing the acceptance criteria for soil tests.

1 Verification of Corrective Action Required Yes  No

1 Method of Verification: Reviewed Bechtel NCR #324 covering item (1) of this NCR (QF-52) and the Project Engineering disposition. Also reviewed letter FQCL-049 dated 8-13-75\* that states U.S. Testing and Bechtel Quality Control have each had training sessions to re-emphasize the acceptance criteria for soil tests.

1 Nonconformance Closure Confirmed By Donald E. Horn  
 Date 8-14-75

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

File 16.3.6  
Issue Date August 7, 1975\*\*  
Project Midland 1 & 2  
File Title NCR's on Bechtel Quality Control


\*\*Reissued January 19, 1976

Nonconformance Report No QF-52 (Contd)

Nonconformance Description and Supporting Details: (Contd)

(2) This failing test was shown on the compacted fill density test report form QC-C1 as passing by U.S. Testing in the remarks column.

(3) On the back of the QC-C1 form, in the FIM, it states the entry information. For Block no. 3 the entry information states "to be signed and dated by the QC Engineer signifying the form has been reviewed for completeness and correctness". Contrary to this requirement, the Quality Control Engineer had signed on the compacted fill density test report the acceptance of MD202 which had actually failed.

Route To	This Copy For	 <b>Consumers Power</b> Nonconformance Report No <u>QF-68</u>	File <u>16.3.6</u>
FMSouthworth HWSlager CQHills	SHHowell GSKeeley TCCooke JMilandin WFHolub GLRichardson Subject File		Issue Date <u>October 17, 1975</u> Project <u>Midland 1 &amp; 2</u>
			File Title <u>NCR's on Bechtel Quality Control</u>

This Nonconformance Report is Issued To:

J. P. Connolly  
Bechtel Project Field Quality Control  
Engineer

who is responsible for corrective action.

Prepared By Donald E. Horn Date 10-17-75

Approved By J. P. Connolly Date 10-17-75

Written Reply Requested By Date 11-17-75

Corrective Action Requested By Date 11-17-75

Nonconformance Description and Supporting Details: Specification C-210 Revision 4, section 13.7 states in part "All backfill in the plant area and the berm shall be compacted to not less than 95 percent of maximum density as determined by modified Proctor method..." Contrary to this requirement, the compaction test MD142 taken in the West Plant Dike had been calculated using the wrong maximum laboratory dry density for Bechtel Modified Proctor, resulting in a 96% compaction which is passing. Using the correct maximum laboratory dry density results in 92% compaction which is failing.

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

Stop Work Necessary Yes  No  See Procedure 16 - Stop Work No \_\_\_\_\_

Recommended Corrective Action:

See Attachment A.

<sup>1</sup> Corrective Action Taken:

See Attachment A.

<sup>1</sup> Verification of Corrective Action Required Yes  No

<sup>1</sup> Method of Verification: (1) Compared 17 Bechtel Modified Proctors to Field Work Sheets. (2) Reviewed revised reports for correctness. (3) Reviewed U.S. Testing's system for checking tests against a Master Proctor List and a Master Log Book.

<sup>1</sup> Nonconformance Closure Confirmed By Donald E. Horn  
Date 11-21-75

<sup>1</sup> To be completed at time of closure by Consumers Power QA Services.

File 16.3.6  
Issue Date October 17, 1975  
Project Midland 1 & 2  
File Title NCR's on Bechtel  
Quality Control

Attachment A  
Nonconformance Report No QF-68

Recommended Corrective Action:


- (1) Review all Bechtel Modified Proctors (BMP) and Field Work Sheets used by U.S. Testing to assure the maximum laboratory dry densities and optimum moisture contents on the BMP's agree with the Field Work Sheets.
- (2) If there is a discrepancy between the maximum laboratory dry densities and/or the optimum moisture contents, review all compacted Fill Density Test Reports that used the maximum laboratory dry densities and/or optimum moisture contents in error.
- (3) Resubmit all test reports that used the maximum laboratory dry densities and/or optimum moisture contents in error.
- (4) Receive a Project Engineering evaluation on the acceptability of the failing test MD142 and any failing tests that are found during the review.
- (5) Take corrective action to preclude these occurrences.

The written reply to these items is requested with the Project Engineering evaluation.

Corrective Action Taken:

- (1) A complete comparison of all Bechtel Modified Proctors to Field Work Sheets was performed by United States Testing.
- (2) Three additional discrepancies were found during this review. A total of twelve Field Tests were affected by the discrepancies.
- (3) Revised reports have been submitted for the twelve Field Tests.
- (4) Failing test MD142 has been cleared by passing test MD160. None of the twelve Field Tests were found failing after corrections had been made. A Project Engineering evaluation was not necessary.
- (5) U.S. Testing has devised a system for checking tests against a Master Proctor List and a Master Log Book.



Route To	This Copy For	 Consumers Power Nonconformance Report No QF-120	File <u>16.3.4 &amp; 16.3.6</u>
FMSouthworth HWSlager CQHills	SHowell GSKeeley TCCooke JMilandin JMKlacking GLRichardson Subject File		Issue Date <u>September 21, 1976</u> Project <u>Midland 1 &amp; 2</u>

This Nonconformance Report is Issued To:  
 J. P. Connolly  
 Bechtel Project Field Quality Control  
 Engineer  
 J. F. Newgen  
 Bechtel Project Superintendent  
 who is responsible for corrective action.

Prepared By Donald E. Horn Date 9-21-76  
 Approved By [Signature] Date 9-21-76  
 Written Reply Requested By Date 10-8-76  
 Corrective Action Requested By Date 10-8-76

Nonconformance Description and Supporting Details: Specification C-210, Revision 4 sections 12.5.2, 12.5.3 and 12.5.4 state in part that (1) The uncompacted lift thickness of soil placement shall be not more than 12 inches. (2) In areas not accessible to roller equipment, the material shall be placed in lifts not to exceed 4 inches in uncompacted thickness. Contrary to these requirements, (1) soil was placed between manhole #5 and #6 above the Sanitary Sewer in the West Plant Dike in an uncompacted lift thickness varying between 9 and 14 inches, (2) in an area not accessible to roller equipment, soil was placed between manhole #4 and #5 above the Sanitary Sewer in the West Plant Dike in uncompacted lift thickness of 6 inches. The material was removed down to the required lift thicknesses and compacted, prior to continued work in this area.

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:

- (1) Determine why the original uncompacted lift thicknesses exceeded the maximum lift thicknesses.
- (2) Take corrective action to preclude repetition.

Corrective Action Taken:

- (1) This was the result of insufficient monitoring of the placing crews and the work was done in accordance to the note on Detail 6 of Drawing C-130, Rev. 3 which is in conflict with Specification C-210.
- (2) A Training Session was given to the Laborer General Foreman and Laborer Foreman and Drawing Change Notice No. 5 to Drawing C-130, Rev. 3 corrected the conflict between Drawing C-130, Rev. 3 and Specification C-210.

Verification of Corrective Action Required Yes  No

Method of Verification:

Reviewed Training Session BT94, letters BCCC-2068 and FQCL-114, and DCN No. 5 on Drawing C-130, Rev. 3.

Nonconformance Closure Confirmed By Donald E. Horn  
 Date 11-9-76

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

Route To	This Copy For
BWMarguglio	SHilowell
HWSliger	GSKeeley
JHMaclaren	TCCooke
	JMilandin
	JMKlacking
	GLRichardson
	Subject File



Consumers Power  
Nonconformance  
Report No QF-130

File 16.3.6  
Issue Date October 18, 1976  
Project Midland 1 & 2  
File Title NCR's on Bechtel  
Quality Control

This Nonconformance Report is Issued To:

J. F. Connolly  
Bechtel Project Field Quality  
Control Engineer

Prepared By Donald E. Horn Date 10-18-76

Approved By [Signature] Date 10/19/76

Written Reply Requested By Date 11-1-76

Corrective Action Requested By Date 11-8-76

who is responsible for corrective action.

Nonconformance Description and Supporting Details:

Field Inspection Plan C-210-4-55 Rev. 0 for Placing Plant Area Backfill, North of "A" line, "4.55" to "8.7" line, elevation 610' ± to 634.5, under section 2.20 Activity/Task for "Placement" item 1 states "Zone 1, 1A, 2 and 3 material placed in uncompacted lifts not exceeding 12 inches. Areas not accessible to roller equipment, the material placed in uncompacted lifts not exceeding 4 inches".

Contrary to this Activity/Task, Quality Control Engineers have observed material placed in approximate 12 inch uncompacted lifts where roller equipment was not used to compact the material.

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:

- (1) Review other C-210-4 Field Inspection Plans for similar problems.
- (2) Determine the cause of the nonconformance above and similar problems in (1) above, if any found.
- (3) Take corrective action to preclude repetition.

Corrective Action Taken:


- (1) All closed C-210-4 Field Inspection Plans have been reviewed and similar situations as described in QF-130 existed (i.e., that 12 inch lifts were placed in areas where roller equipment was not used).
  - (2) Cause of nonconformance was misinterpretation of specification requirements.
  - (3) To preclude repetition QCI C-1.02 will be used to inspect compacted backfill and a training/discussion session was held on 2/22/77.
- Verification of Corrective Action Required Yes  No

Method of Verification:

Reviewed letter FQCL-142.

Nonconformance Closure Confirmed By Donald E. Horn  
Date 3-3-77

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

Route To BWMarguglio HWSlager JHMaclaren WRBird	This Copy For SHHowell GSKeeley TCCooke JMilandin JMKlacking GLRichardson Subject File	 Consumers Power Nonconformance Report No QF-147	File <u>16.3.4 &amp; 16.3.6</u> Issue Date <u>February 2, 1977</u> Project <u>Midland 1 &amp; 2</u> File Title <u>NCR's on Bechtel</u> Construction and Bechtel Quality Control
---	---	---	--

This Nonconformance Report is Issued To:  
 Mr. J. F. Newgen  
 Bechtel Project Superintendent  
 Mr. J. P. Connolly  
 Bechtel Project Field Quality Control  
 Engineer  
 who is responsible for corrective action.

Prepared By Donald E. Horn Date 2-2-77  
 Approved By [Signature] Date 2/3/77  
 Written Reply Requested By Date 2-14-77  
 Corrective Action Requested By Date 3-15-77

*put  
in  
2F-29  
on 14/1/77*

Nonconformance Description and Supporting Details: (1) Specification C-211 Revision 3 section 5.6.2 states "Material delivered to the jobsite for use as structural backfill shall be visually inspected, and tested in accordance with ASTM C-136 (and C-117 when required by the Field Engineer) by the Contractor's representative once per day when material is being delivered". (2) Project QC Instruction No. 7220/C-1.02 Compacted Backfill Revision 0 section 2.3 D states in part "The following tests shall be taken at the specified frequencies: 4. During each day's delivery of structural backfill material, a minimum of one representative sample tested in accordance with ASTM C-136 (and ASTM C-117 as determined by Field Engineering) to the gradation requirements specified, prior to placement". (Contd)

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

Stop Work Necessary Yes  No  See Procedure 16 - Stop Work No \_\_\_\_\_  
 Bechtel applied hold tags to the structural backfill stockpile.

Recommended Corrective Action:

See attachment.

1 Corrective Action Taken:

See attachment.

1 Verification of Corrective Action Required Yes  No

1 Method of Verification:

Verified review of structural backfill deliveries for October and November, 1976 for lack of testing on February 9, 1977. Reviewed letters FQCL-140 and BCCC-2373, Training File BT-117 and NCR's 686 and 698.

1 Nonconformance Closure Confirmed By Donald E. Horn  
 Date 6-10-77

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

File 16.3.4 & 16.3.6  
Issue Date February 2, 1977  
Project Midland 1 & 2  
File Title NCR's on Bechtel  
Construction and Bechtel Quality  
Control

Attachment to Report No QF-147

Nonconformance Description and Supporting Details: (Contd)

Contrary to (1) and (2) above, structural backfill delivered on December 1, 1976, December 14, 1976 and January 11, 1977 was not tested for gradation requirements.

Recommended Corrective Action:

- (1) Review October and November structural backfill delivered in 1976 for similar lack of testing.
- (2) Receive a Project Engineering evaluation on the material lacking gradation tests including any found in the review in (1) above.
- (3) This same problem of structural backfill material lacking gradation tests was identified in CPCo NCR QF-29 issued October 14, 1974. The corrective action to preclude repetition for this NCR was a memorandum from the Project Superintendent directing that Quality Control be notified of all incoming shipments of structural backfill material was issued. Recently, Bechtel QA identified this same problem in QADR SD-6 issued October 21, 1976. The corrective action to preclude repetition for this QADR was to use the following system:
  - a) Each day's delivery of structural backfill is stockpiled separately.
  - b) On the following day the responsible field engineer verifies that the material was tested and is acceptable.
  - c) If the material wasn't tested, a test will be taken at this time or if the material is acceptable, it will be placed in the acceptable pile.

It is evident that the corrective action taken for NCR QF-29 and QADR SD-6 is not adequate.

Determine the underlying cause(s) and propose further corrective action to preclude repetition.

Corrective Action Taken:

- (1) Shipments of structural backfill delivered in October and November, 1976 have been reviewed. NCR's 686 and 698 have been written identifying the lack of testing in this NCR and in the review of October and November, 1976 delivery tickets.
- (2) Project Engineering has evaluated the materials lacking gradation tests in NCR's 686 and 698 and has dispositioned it "use as is".

File 16.3.4 & 16.3.6  
Issue Date February 2, 1977  
Project Midland 1 & 2  
File Title NCR's on Bechtel  
Construction and Bechtel Quality  
Control

Attachment to Report No QF-147

<sup>1</sup>Corrective Action Taken: (Contd)

- (3) Starting Friday, February 4, 1977 incoming structural backfill was controlled in accordance with the Quality Control Receipt Inspection Program.

In addition, a training session was held on February 10, 1977 on the control of Q-list backfill sand to preclude repetition.

Attachment A  
 \*\* Reissued July 19, 1977 to indicate time nonconformances  
 File 16.3.4, 16.3.6 occurred.

Route To	This Copy For
RBird (Third)	JLBarclay
OESkaggs (Second)	JLooke
BWMarguglio (First)	EHermeston
	SHHowell
	DRJohnson
	GSKeelley
	DMKlackring
	PAMartinez
	JMilandin



Consumers Power  
 Nonconformance  
 Report No OF-172

Issue Date July 8, 1977  
 Project Midland 1 & 2  
 File Title NCP's on Bechtel Construction & Quality Control

This Nonconformance Report is Issued To:  
 G. L. Richardson  
 Bechtel Project Field Quality Assurance  
 Engineer

Prepared By [Signature] Date 7-8-77  
 Approved By [Signature] Date 7/9/77  
 Written Reply Requested By Date 7-25-77  
 Corrective Action Requested By Date 8-26-77

who is responsible for corrective action.

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:

Have Project Engineering evaluate the acceptability of these materials and determine what action is needed to correct these problems if the material is unacceptable.

Corrective Action Taken:

Project Engineering evaluated the nonconforming conditions and determined these materials acceptable.  
 Percent compaction for MD 342 in North East Dike was incorrect and has been revised identifying the correct (passing) result.

Verification of Corrective Action Required Yes  No

Method of Verification:

Reviewed the revised North East Dike test MD 342, IOM R. L. Castleberry to G. L. Richardson dated 8/31/77, Bechtel QA Letter GLR-9-77-317, CCo Letter 151FQA77, IOM R. L. Castleberry to G. L. Richardson dated 10/4/77 and Bechtel QA Letter GLR-10-77-390.

Nonconformance Closure Confirmed By Donald E. Horn  
 Date 10-11-77

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

Date: July 8, 1977 \*\* July 19, 1977  
Project: Midl J1 & 2  
Title: NCR's on Bechtel Construction & Quality Control

Attachment to Report No QF-172

During a review of test reports for partial cooling ponds and dikes turnover, the following were found:

Specification C-210, Revision 4, Section 13.6 states:

"Moisture control of the plant area and berm material shall conform to Section 12.6.

Section 12.6.1 states in part:

"The water content during compaction shall not be more than 2 percentage points below optimum moisture content ..."

Contrary to this requirement, test report MD 359 for the North East Dike Station 29+00 5'R  $\bar{C}$  Zone 2 @ elevation 622 had moisture content of 2.8 percent below optimum moisture content. This test had been marked P - for pass, when actually the test failed.

Specification C-210, Revision 4, Section 13.7 states in part:

"All backfill in the plant area and berm shall be compacted to not less than 95 per cent of maximum density as determined by modified Proctor method (ASTM 1557, Method D)..."

Contrary to this requirement, test reports for the North East Dike MD 342 Station 30+00,  $\bar{C}$  Zone 2 @ elevation 622 had 94.5 percent compaction; MD 354 Station 31+00, 100'R of  $\bar{C}$  sand drain Zone 2 @ elevation 622 had 93.7 percent compaction; and MD 356 Station 29+00, 100'R of  $\bar{C}$  of sand drain Zone 2 @ elevation 622 had 92.2 percent compaction. Test MD 342 had been marked P - for pass, when actually the test failed. Tests MD 354 and MD 356 had been marked F - for fail and accepted by 4 roller passes. The 4 roller passes are not the acceptance criteria in this area.

\*\* Test MD 342 was taken May 25, 1974, Tests MD 354 and MD 356 were taken May 28, 1974, and Test MD 359 was taken May 30, 1974.

\*\*Reissued July 19, 1977 to indicate time nonconformances occurred.

Route To	This Copy For
Bird (Third)	W.Barclay
Skaggs (Second)	TCooke
Marguglio (First)	R.Hermeston
	SIHowell
	DRJohnson
	GSKeeley
	JMKlacking
	PAMartinez
	JMilandin



Consumers Power

Nonconformance Report No QP-174

File 16.3.4, 16.3.6 occurred.  
 Issue Date July 15, 1977  
 Project Midland 1 & 2  
 File Title NCR's on Bechtel Construction & Quality Control

This Nonconformance Report is Issued To:

G. L. Richardson  
 Bechtel Project Field Quality Assurance Engineer

who is responsible for corrective action.

Prepared By [Signature] Date 7-15-77

Approved By [Signature] Date 7-15-77

Written Reply Requested By Date 8-19-77

Corrective Action Requested By Date 9-2-77

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:

Have Project Engineering evaluate the acceptability of these materials and determine what action is needed to correct these problems if the material is unacceptable.

Corrective Action Taken:

Project Engineering evaluated the nonconforming conditions and determined these materials acceptable.

Verification of Corrective Action Required Yes  No

Method of Verification:

Reviewed IOM R. L. Castleberry to G. L. Richardson dated 8/31/77, Bechtel QA Letter GLR-9-77-317, CCo Letter 151FQA77, IOM R. L. Castleberry to G. L. Richardson dated 10/4/77 and Bechtel QA Letter GLR-10-77-390.

Nonconformance Closure Confirmed By [Signature]  
Date 10-11-77

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



16.3.16.3.6  
Date: July 19, 1977 \*\* July 19, 1977  
Project: Midland 1 & 2  
Title: NCR's on Bechtel Construction and  
Quality Control

Attachment to Report No QF-174

Nonconformance Description and Supporting Details

During a review of test reports for partial cooling ponds and dikes turnover, the following was found:

Specification C-210, Revision 2, Section 12.5.2 states in part:

"Zone 1 and Zone 1A material shall be placed in the embankment fill as shown on the Drawings or as required..."

Table 12-1 in this specification states in part:

"Zone 1 Impervious Fill - Not less than 20% passing No. 200 sieve..."

Contrary to these requirements, tests 115 in North Plant Dike and MD 359 and MD 358 in North East Dike had soil classification Zone 1 (BMP 114) which has 5.2% passing No. 200 sieve. Test MD 830 in North East Dike had soil classification Zone 1 (BMP 139) which has 3.4% passing No. 200 sieve.

\*\* Test 115 was taken May 28, 1974, Tests MD 358 and MD 359 were taken May 30, 1974 and Test MD 830 was taken August 8, 1974.

Route To	This Copy For
RBird (last)	WBarclay
BWMarguglio (first)	TCooke
DATaggart (second)	RHermeston
	SHHowell
	DRJohnson
	GSKeeley
	JMKlacking
	PAMartinez
	JLlandin



Consumers Power  
 Nonconformance  
 Report No OP-129

File 16 3 4 & 16 3 6  
 Issue Date November 4 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 11-4-77  
 Approved By [Signature] Date 11/9/77  
 Written Reply Requested By Date 11-23-77  
 Corrective Action Requested By Date 12-15-77

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.

<sup>1</sup>Corrective Action Taken:

See attachment.

<sup>1</sup>Verification of Corrective Action Required Yes  No

<sup>1</sup>Method of Verification:

<sup>1</sup>Nonconformance Closure Confirmed By \_\_\_\_\_  
 Date \_\_\_\_\_

<sup>1</sup>To be completed at time of closure by Consumers Power QA Services.

Attachment to NCR QF-199

Nonconformance Description and Supporting Details:

Specification C-210, Revision 5 Section 12.6.1 states in part, "The water content during compaction shall not be more than 2 percentage points below optimum moisture content and shall not be more than 2 percentage points above moisture content..."

Specification C-210, Revision 5 Section 13.7.1 states, "All cohesive backfill in the plant area and the berm shall be compacted to not less than 95 percent of maximum density as determined by ASTM D 1557, Method D".

Specification C-210, Revision 5 Section 13.7.2 states in part, "All cohesionless backfill in the plant area and the berm shall be compacted to not less than 80 percent of relative density as determined by ASTM D 2049..."

Part 1

Contrary to these requirements, the following tests had been passed using incorrect testing data. Using the correct testing data, the tests fail.

North Plant Dike

MD 290 (sampled 7-16-74) shows optimum moisture content 11.6. It should have been 9.5. Using the correct optimum moisture content of 9.5%, the actual moisture content is 2.2% above optimum moisture content.

MD 360 (sampled 7-31-74) shows optimum moisture content as 21.4. It should have been 15.2. This also shows maximum lab dry density as 103.2. It should have been 115.1. Using the correct optimum moisture content of 15.2%, the actual moisture content is 5.4% above optimum moisture content. Also using the correct maximum lab dry density of 115.1, the correct percent of maximum density is 86.4%.

MD 377 (sampled 8-6-74) shows optimum moisture content as 18.0. It should have been 15.2. Using the correct optimum moisture content of 15.2%, the actual moisture content is 4.5% above optimum moisture content.

Structural Backfill

MDR 621 (sampled 10-14-76) shows minimum dry lab density as 94.2. It should have been 112.2. Using the correct minimum dry lab density of 112.2, the correct percent of relative density is 41.5.

Part 2

Also contrary to these requirements, the following tests had failing results and did not indicate being cleared by passing tests or had been marked passing.

Attachment to NCR QF-199

Nonconformance Description and Supporting Details:

Part 2 (Contd)

North Plant Dike

MD 142 (sampled 5-30-74) shows optimum moisture content 8.0, moisture content 10.3. This test failed but it is shown as passing.

MD 143 (sampled 5-30-74) shows optimum moisture content 13.8, moisture content 11.4. This failed but it is shown as passing.

West Plant Dike

MD 227 (sampled 10-6-75) failed moisture but has not been cleared.

Plant Area Fill

<u>Test No.</u>	<u>Date Sampled</u>	<u>Compaction</u>	<u>Moisture</u>	
			<u>Actual</u>	<u>Optimum</u>
MD 1311	5-03-77	61.6% of Relative Density		
1326	5-10-77		18.5%	15.2%
1328	5-10-77		12.2%	15.2%
1412	6-07-77		10.4%	15.2%

Structural Backfill

MDR 621	10-14-76	78.0% of Relative Density
671	11-12-76	74.8% of Relative Density
672	11-23-76	75.4% of Relative Density
685	11-24-76	56.2% of Relative Density
686	11-24-76	70.9% of Relative Density
691	11-24-76	62.0% of Relative Density

Recommended Corrective Action:

- (1) Determine if there are passing tests in the same area to clear these failing tests.
- (2) If these failing tests cannot be cleared by passing tests in the same area, 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 justify the material these failing tests represent.
- (3) Determine the underlying cause(s) and take corrective action to preclude repetition.

File 16.3.4 & 16.3.6  
Issue Date November 4, 1977  
Project Midland 1 & 2  
File Title NCR's on Bechtel  
Construction and Quality Control

Attachment to NCR QF-199  
(Contd) -

<sup>1</sup>Corrective Action Taken:

Part 1

- (1) Bechtel QC has determined that none of the above failing tests have passing tests in the same area to clear them.
- (2) North Plant Dike MD 290 and MD 377 have been identified on Bechtel NCR 1005. North Plant Dike MD 360 and Structural Backfill MDR 621 density problems have been identified on Bechtel NCR 1004. North Plant Dike MD 360 moisture problem has been identified on revised NCR 1005.

Part 2

- (1) Bechtel QC has determined that none of the above failing tests have passing tests in the same area to clear them.
- (2) North Plant Dike MD 142 and MD 143, West Plant Dike MD 227 and Plant Area Fill MD 1326, 1328 and 1412 have been identified on Bechtel NCR 1005. Structural Backfill MDR 621, 671, 672, 685, and 686 have been identified on Bechtel NCR 1004. Plant Area Fill MD 1311 has been identified on revised NCR 1004.
- (3) Corrective action has been taken as of the last of July 1977 by Bechtel QC and U.S. Testing to more adequately clear failing tests. Therefore, the corrective action to preclude repetition for not clearing failing tests need not be addressed.

Route To	This Copy For
	W. Barclay
	W. Baird
	W. Cooke
	W. Hermonston
	W. Howell
	W. Johnson
	W. Neeley
	W. Racking
	W. Arguello
	W. Martinez
	W. Landin
	W. Newgen



Consumers Power

Nonconformance  
Report No QF-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 <u>Donald E. Horn</u> Date <u>11-22-77</u>
	Approved By <u>[Signature]</u> Date <u>11/22/77</u>
	Written Reply Requested By Date <u>12/16/77</u>
	Corrective Action Requested By Date <u>12/30/77</u>

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.

Corrective Action Taken:

See attachment.

Verification of Corrective Action Required Yes  No

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 O-1621 and O-1651 from J. Newgen to G. Richardson; Bechtel QC Training Session QCFM-4250; and NCR's 1055 and 1094.

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

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:

<u>Sieve Size</u>	<u>% Passing</u>
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:

<u>Sieve Size</u>	<u>% Passing</u>
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:

<u>Sieve Size</u>	<u>% Passing</u>
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

<sup>1</sup> 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 O-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 OCIR 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, 1978

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

JLC	
CRS	
KGW	
FOR	
GE	
FIS	

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 ~~2-1621~~, dated 1/17/78, Field Engineering stated in part:

*0-1651 JLR 2/2/78*

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

Interface Memorandum

G. L. Richardson  
Job 7 Midland Project  
FMR Preparation  
0-185

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

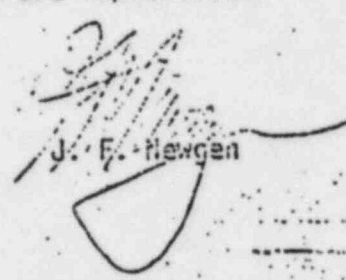
This memo is in response to reference 1 and is numbered similarly.

- 1. Reason for specifying a 12-20% range of aggregate passing through number 200 sieve, when Specification C-210, Rev. 5 allowed a range of 12-20%, 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 signing the FMR, rather than noting to "use as is".
- 2. The intent of our previous response to blank signature blocks on FMR's C-171, 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-3.000.

FIR Preparation  
0-1551  
Pg: 2

Bechtel Power Corporation

3. We disagree that a generic problem currently exists in the approval completeness of FIR's. The PFE and APFE's have indicated the frequency of signature omission is negligible on "Q" FIR's. Those which have lacked signatures were returned when discovered.
4. The PFE and APFE's have intensified their surveillance of "Q" FIR's to assure the requirements of FPG-8.000 are implemented.

  
J. F. Hergen

JFH/LFS/re

WBarclay  
WRBird  
SIHowell  
JMKlacking  
BWMarguglio  
JFNewgen  
GLRichardson  
QA SUBJ FILE



Consumers  
Power  
Company

QUALITY ASSURANCE  
PROGRAM

REPORT NO F-77-32

DATE October 3-7, 1977  
PLANT: Midland UNIT 1 & 2  
SUBJECT OF AUDIT: Soil Placement  
Records

### I. AUDIT SCOPE

The purpose of this record review audit is to verify the documentation associated with the placement of Structural Backfill, North Plant Dike, West Plant Dike, and Plant Area Fill conforms to the specifications and to expedite dike turnover.

### II. AUDITORS

- \*\*\*D. A. Blumenthal, CPCo QAE (IE&TV) - Team Member
- \*\*D. E. Horn, CPCo QAE Civil Supervisor - Team Leader

### III. PERSONNEL CONTACTED

- \*\*Ben Cheek, Bechtel Lead Civil Quality Control Engineer
- \*Keith Berk, Bechtel QCE (QC Vault)
- \*Pat Guiette, Bechtel QCE (QC Vault)
- \*Mary Kerridge, Bechtel QC Documentation Clerk
- \*Jim Miller, Bechtel QC Documentation Lead
- \*Tom Lieb, Bechtel QCE (Civil)
- \*\*\*\*Daryl Osborn, Bechtel Assistant Lead Civil QCE
- \*John Speltz, U.S. Testing Lab Chief

### IV. SUMMARY OF AUDIT

- A. A Pre-Audit Conference was held on August 31, 1977 in Ben Cheek's office with those in attendance as noted in Sections II and III above. The audit scope was the only item discussed. The audit scope originally was to observe soil placement, however, due to heavy rains and no soil placement in "Q" areas, the audit scope was changed to that given in Section I.
- B. The audit was performed on soil reports North Plant Dike MD 72 (5-23-74) through MD 514 (9-21-74), West Plant Dike MD 25 (9-12-74) through MD 307 (9-27-76), Structural Backfill MDR 611 (10-7-76) through MDR 1121 (8-11-77), Plant Area Fill MD 1122 (10-7-76) through MD 1854 (8-12-77) and gradation reports for structural backfill material received February 4, 1977 through August 31, 1977 to assure failing tests have been cleared by passing tests; correct optimum moisture contents, maximum and minimum dry lab densities have been used; the test results were properly evaluated for acceptance; and test reports could be located in the Quality Control Documentation Vault using the attached checklist.
- C. The findings associated with this audit are noted in Section V.

- \*Contacted during Audit
- \*\*Attended Pre-Audit Conference and Post-Audit Conference
- \*\*\*Attended Post-Audit Conference
- \*\*\*\*Contacted during Audit and attended Post-Audit Conference

BY Donald E. Horn

DATE 11-4-77

SHEET 1 OF 12

Donald A. Blumenthal

11/4/77

Reviewed by John J. ...

FILE: F 4.3.4 & 18.4.3.6  
DATE: October -7, 1977  
PLANT: Midland UNIT 1 & 2  
SUBJECT OF AUDIT: Soil Placement  
Records

AUDIT REPORT NO F-77-32

IV. SUMMARY OF AUDIT (Contd)

D. Future audits will be run the same, when scheduled.

E. A Post-Audit Conference was held on October 11, 1977 in Ben Cheek's office with those in attendance as noted in Sections II and III above. The audit findings were presented to those in attendance by D. A. Blumenthal and D. E. Horn. Bechtel QC understood and agreed with the findings and recommended corrective action.

V. CLOSED OUT FINDINGS

Finding 1

West Plant Dike

MD-276 and 277 (sampled 9-15-76), 278 (sampled 9-16-76), and 285 (sampled 9-17-76) have NA in the optimum moisture content column.

North Plant Dike

MD-92 (sampled 5-25-74) shows maximum dry lab density 110.6. It should have been 103.4.

MD-93 (sampled 5-25-74) shows maximum dry lab density 110.6. It should have been 103.4.

MD-109 (sampled 5-28-74) shows maximum dry lab density 103.4. It should have been 115.1.

MD-119 (sampled 5-28-74) shows maximum dry lab density 127.2. It should have been 128.0.

MD-155 (sampled 6-4-74) shows optimum moisture content 18.8. It should have been 18.4.

MD-195 (sampled 6-24-74) shows optimum moisture content 11.0. It should have been 11.6.

MD-223 (sampled 6-25-74) shows optimum moisture content 10.3. It should have been 11.6.

MD-224 (sampled 6-25-74) shows optimum moisture content 13.5. It should have been 13.0.

MD-257 (sampled 7-11-74) shows optimum moisture content 9.8. It should have been 10.4. This also shows maximum dry lab density 126.8. It should have been 127.4.

FILE: 18.4.3.6 & 18.4.3.6  
DATE: October 3-7, 1977  
PLANT: Midland UNIT 1 & 2  
SUBJECT OF AUDIT: Soil Placement Records

13

AUDIT REPORT NO F-77-32

V. CLOSED OUT FINDINGS

Finding 1

North Plant Dike (Contd)

- MD-269 (sampled 7-12-74) shows maximum dry lab density 116.2. It should have been 116.3.
- MD-290 (sampled 7-16-74) shows maximum dry lab density 125.2. It should have been 128.3.
- MD-318 (sampled 7-19-74) shows optimum moisture content 13.0. It should have been 13.3.
- MD-336 (sampled 7-20-74) shows optimum moisture content 20.5. It should have been 20.0.
- MD-341 (sampled 7-25-74) shows optimum moisture content 17.0. It should have been 15.5.
- MD-377 (sampled 8-6-74) shows maximum lab dry density 109. It should have been 112.9.
- MD-476 (sampled 8-19-74) shows optimum moisture content 17.0. It should have been 17.1.
- MD-512 (sampled 8-28-74) shows maximum lab dry density 109.4. This should have been 109.0.

Structural Backfill Area

- NDR-919 (sampled 5-25-77) shows maximum dry lab density of 109.3. It should have been 125.3. It also shows minimum dry lab density as 90.3. It should have been 109.3.

Plant Area Fill

- MD-1262 (sampled 4-8-77) gives maximum dry lab density of 117.0. It should have been 117.1.
- MD-1300 (sampled 5-2-77) gives optimum moisture content of 11.1. It should have been 10.4.
- MD-1385 (sampled 6-2-77) gives optimum moisture content of 13.5. It should have been 13.4.

FILE: 18.4.3.4 & 18.4.3.6  
DATE: October 3-7, 1977  
PLANT: Midland UNIT 1 & 2  
SUBJECT OF AUDIT: Soil Placement  
Records

AUDIT REPORT NO F-77-32

V. CLOSED OUT FINDINGS

Finding 1

Plant Area Fill (Contd)

MD-1420 (sampled 6-8-77) gives optimum moisture content of 9.3. It should have been 8.6. It also gives maximum dry lab density of 127.3. It should have been 132.9.

MD-1521 (sampled 6-17-77) gives maximum dry lab density of 117.0. It should have been 117.1.

Corrective Action Requested: Recalculate the test results using the proper values and determine the acceptability of the corrected test results.

Corrective Action Taken: The test results were recalculated and corrections made. The above errors did not change the acceptance of these tests even though they did change the test results.

Corrective action verified October 25-26, 1977.

For further corrective action see Section VI "Open Findings" Finding 1.

Finding 2

Specification C-210, Revision 5 Section 12.6.1 states in part, "The water content during compaction shall not be more than 2 percentage points below optimum moisture content and shall not be more than 2 percentage points above optimum moisture content..."

Specification C-210, Revision 5 Section 13.7.1 states, "All cohesive backfill in the plant area and the berm shall be compacted to not less than 95 percent of maximum density as determined by ASTM D 1557, Method D".

Specification C-210, Revision 5 Section 13.7.2 states in part, "All cohesionless backfill in the plant area and the berm shall be compacted to not less than 80 percent of relative density as determined by ASTM D 2049..."

Contrary to these requirements, the following tests had failing results and did not indicate being cleared by passing tests.



AUDIT REPORT NO 7-77-32

V. CLOSED OUT FINDINGS

Finding 2 (Contd)

Plant Area Fill

Test No.	Date Sampled	Compaction	Moisture	
			Actual	Optimum
MD 1153 ✓	10-21-76	61.6% of Relative Density		
1155 ✓	10-21-76	73.5% of Relative Density		
1191 ✓	11-03-76	74.6% of Relative Density		
1194 ✓	11-02-76	75.4% of Relative Density		
1317 ✓	5-09-77			
1318 ✓	5-09-77		18.0%	15.2%
1319 ✓	5-09-77		11.5%	15.2%
1320 ✓	5-09-77		11.7%	15.2%
1321 ✓	5-09-77		12.2%	15.2%
1337 ✓	5-17-77	94.0% of Maximum Density		
1388 ✓	6-02-77			
1393 ✓	6-03-77		12.4%	15.2%
1398 ✓	6-03-77		9.8%	15.2%
1404 ✓	6-03-77		11.1%	13.4%
1415 ✓	6-03-77		11.2%	13.4%
1498 ✓	6-07-77		10.2%	13.4%
1509 ✓	6-15-77		9.9%	13.4%
	6-16-77	88.2% of Maximum Density	14.5%	10.0%
			12.9%	15.2%

North Plant Dike

MD 418	8-14-74		17.2%	20.0%
--------	---------	--	-------	-------

Structural Backfill

MDR 620	10-13-76	72.3% of Relative Density		
625 ✓	10-12-76	51.5% of Relative Density		
629	10-20-76	79.2% of Relative Density		
632	10-20-76	73.5% of Relative Density		
637	10-21-76	76.3% of Relative Density		
663 ✓	11-11-76	53.0% of Relative Density		
664 ✓	11-11-76	72.3% of Relative Density		
667 ✓	11-11-76	67.5% of Relative Density		
573	11-23-76	33.9% of Relative Density		
679	11-23-76	71.8% of Relative Density		
680 ✓	11-23-76	60.0% of Relative Density		
682 ✓	11-24-76	70.6% of Relative Density		
688 ✓	11-24-76	77.1% of Relative Density		
700	1-13-77	75.0% of Relative Density		
701	1-13-77	68.1% of Relative Density		
721 ✓	3-14-77	60.0% of Relative Density		

*grow 10%*

FILE: 4.3.4 & 18.4.3.6  
 DATE: October 3-7, 1977  
 PLANT: Midland UNIT 1 & 2  
 SUBJECT OF AUDIT: Soil Placement Records

13

AUDIT REPORT NO F-77-32

V. CLOSED OUT FINDINGS

Finding 2

Structural Backfill (Contd)

<u>Test No.</u>	<u>Date Sampled</u>	<u>Compaction</u>	<u>Moisture</u>	
			<u>Actual</u>	<u>Optimum</u>
MDR 734✓	3-17-77	34.0% of Relative Density		
736✓	3-18-77	79.0% of Relative Density		
737✓	3-18-77	41.9% of Relative Density		
738✓	3-18-77	72.4% of Relative Density		
739✓	3-18-77	70.6% of Relative Density		
740✓	3-18-77	69.3% of Relative Density		
741✓	3-21-77	77.8% of Relative Density		
744✓	3-21-77	56.2% of Relative Density		
746✓	3-21-77	54.9% of Relative Density		
757✓	3-23-77	68.7% of Relative Density		
767✓	3-29-77	54.3% of Relative Density		
768✓	3-30-77	66.9% of Relative Density		
770✓	3-30-77	65.0% of Relative Density		
785✓	4-07-77	69.3% of Relative Density		
799✓	4-12-77	78.8% of Relative Density		
825✓	4-19-77	70.4% of Relative Density		
843✓	4-28-77	66.8% of Relative Density		
845✓	4-29-77	70.4% of Relative Density		
854	5-09-77	67.4% of Relative Density		
861	5-10-77	76.3% of Relative Density		
862	5-10-77	74.0% of Relative Density		
889✓	5-13-77	56.5% of Relative Density		
914✓	5-24-77		9.0%	11.8%
922✓	5-26-77	75.7% of Relative Density		
925✓	5-27-77		11.4%	15.2%
938✓	6-08-77	56.5% of Relative Density		
940✓	6-08-77	78.6% of Relative Density		
993✓	6-25-77	60.2% of Relative Density		
998✓	6-25-77	77.4% of Relative Density		

Corrective Action Requested: Determine if there are passing tests in the same area to clear these failing tests.

Corrective Action Taken: Test reports Plant Area Fill MD 1317-1320; North Plant Dike MD 418; and Structural Backfill MDR 620, 629, 632, 637, 673, 679, 700, 701, 757, 767, 768 and 770 have been cleared by passing tests and Structural Backfill represented by MDR 854, 861 and 862 was removed.

Corrective Action Verified October 26, 1977.

FILE: 14.3.4 & 18.4.3.6  
DATE: tober 3-7, 1977  
PLANT: Midland UNIT 1 & 2  
SUBJECT OF AUDIT: Soil Placement  
Records

AUDIT REPORT NO F-77-32

V. CLOSED OUT FINDINGS

Finding 2 (Contd)

Corrective Action Taken: Test reports Plant Area Fill MD 1153, 1155, 1191, 1194, 1321, 1337, 1388, 1393, 1398, 1404, 1415, 1498, 1509 and Structural Backfill MDR 625, 663, 664, 667, 680, 682, 688, 721, 734, 736-741, 744, 746, 757, 768, 770, 785, 799, 826, 843, 845, 889, 914, 922, 925, 938, 940, 993 and 998 are in a "Non-0" area and have been given to CPCo Project Management Organization (Field) for resolution in letter 186FOA77.

For further corrective action see Section VI "Open Findings" Finding 2.

Finding 3

Relative Density Reports 59 and 61 were missing from the QC Vault.

Corrective Action Requested: Obtain copies of these reports and place them in the QC Vault.

Corrective Action Taken: Copies have been obtained and placed in the QC Document Vault.

Corrective action verified October 26, 1977.

VI. OPEN FINDINGS

Finding 1

Specification C-210, Revision 5 Section 12.6.1 states in part, "The water content during compaction shall not be more than 2 percentage points below optimum moisture content and shall not be more than 2 percentage points above moisture content..."

Specification C-210, Revision 5 Section 13.7.1 states, "All cohesive backfill in the plant area and the berm shall be compacted to not less than 95 percent of maximum density as determined by ASTM D 1557, Method D".

Specification C-210, Revision 5 Section 13.7.2 states in part, "All cohesionless backfill in the plant area and the berm shall be compacted to not less than 80 percent of relative density as determined by ASTM D 2049..."

Contrary to these requirements, the following tests had been passed using incorrect testing data. Using the correct testing data, the tests fail.

FILE: 18.4.3.6  
DATE: October 3-7, 1977  
PLANT: Midland UNIT 1 & 2  
SUBJECT OF AUDIT: Soil Placement  
Records

AUDIT REPORT NO F-77-32

VI. OPEN FINDINGS

Finding 1 (Contd)

North Plant Dike

MD 290 (sampled 7-16-74) shows optimum moisture content 11.6. It should be 9.5. Using the correct optimum moisture content of 9.5%, the actual moisture content is 2.2% above optimum moisture content.

MD 360 (sampled 7-31-74) shows optimum moisture content as 21.4. It should be 15.2. This also shows maximum lab dry density as 103.2. It should be 115.1. Using the correct optimum moisture content of 15.2%, the actual moisture content is 5.4% above optimum moisture content. Also using the correct maximum lab dry density of 115.1, the correct percent of maximum density is 86.4%.

MD 377 (sampled 8-6-74) shows optimum moisture content as 18.0. It should be 15.2. Using the correct optimum moisture content of 15.2%, the actual moisture content is 4.5% above optimum moisture content.

Structural Backfill

MDR 621 (sampled 10-14-76) shows minimum dry lab density as 94.2. It should be 112.2. Using the correct minimum dry lab density of 112.2, the correct percent of relative density is 41.5.

Corrective Action Requested:

- (1) Determine if there are passing tests in the same area to clear these failing tests.
- (2) If these failing tests cannot be cleared by passing tests in the same area, 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 justify the material these failing tests represent.
- (3) Determine the underlying cause(s) and take corrective action to preclude repetition.

Corrective Action Taken:

- (i) North Plant Dike MD 290 and MD 377 have been identified on Bechtel NCR 1005. North Plant Dike MD 360 and Structural Backfill MDR 621 density problems have been identified on Bechtel NCR 1004.

Corrective action verified October 26, 1977.

North Plant Dike MD 360 moisture problem has been identified on revised NCR 1005.

Corrective action verified October 28, 1977.

FILE: 18.4.3.6 & 18.4.3.6  
DATE: October 3-7, 1977  
PLANT: Midland UNIT 1 & 2  
SUBJECT OF AUDIT: Soil Placement Records

AUDIT REPORT NO F-77-32

VI. OPEN FINDINGS

Finding 1 (Contd)

NCR QF-199 has been written to resolve the corrective action still open.

Finding 2

Specification C-210, Revision 5 Section 12.6.1 states in part, "The water content during compaction shall not be more than 2 percentage points below optimum moisture content and shall not be more than 2 percentage points above optimum moisture content..."

Specification C-210, Revision 5 Section 13.7.1 states, "All cohesive backfill in the plant area and the berm shall be compacted to not less than 95 percent of maximum density as determined by ASTM D 1557, Method D".

Specification C-210, Revision 5 Section 13.7.2 states in part, "All cohesionless backfill in the plant area and the berm shall be compacted to not less than 80 percent of relative density as determined by ASTM D 2049".

Contrary to these requirements, the following tests had failing results and did not indicate being cleared by passing tests or had been marked passing.

North Plant Dike

MD 142 (sampled 5-30-74) shows optimum moisture content 8.0, moisture content 10.3. This test failed but it is shown as passing.

MD 143 (sampled 5-30-74) shows optimum moisture content 13.8, moisture content 11.4. This failed but it is shown as passing.

West Plant Dike

MD 227 (sampled 10-6-75) failed moisture but has not been cleared.

Plant Area Fill

<u>Test No.</u>	<u>Date Sampled</u>	<u>Compaction</u>	<u>Moisture</u>	
			<u>Actual</u>	<u>Optimum</u>
MD 1311	5-03-77	61.6% of Relative Density		
1326	5-10-77			
1328	5-10-77		18.5%	15.2%
1412	6-07-77		12.2%	15.2%
			10.4%	15.2%

AUDIT REPORT NO F-77-32

VI. OPEN FINDINGS

Finding 2 (Contd)

Structural Backfill

<u>Test No.</u>	<u>Date Sampled</u>	<u>Compaction</u>	<u>Moisture</u>	
			<u>Actual</u>	<u>Optimum</u>
MDR 621	10-14-76	78.0% of Relative Density		
671	11-12-76	74.8% of Relative Density		
672	11-23-76	75.4% of Relative Density		
685	11-24-76	56.2% of Relative Density		
686	11-24-76	70.9% of Relative Density		
691	11-24-76	62.0% of Relative Density		

Corrective Action Requested:

- (1) Determine if there are passing tests in the same area to clear these failing tests.
- (2) If these failing tests cannot be cleared by passing tests in the same area, 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 justify the material these failing tests represent.
- (3) Determine the underlying cause(s) and take corrective action to preclude repetition.

Corrective Action Taken:

- (1) Bechtel QC has determined that none of the above have passing tests in the same area to clear the failing tests.
- (2) North Plant Dike MD 142 and MD 143, West Plant Dike MD 227 and Plant Area Fill MD 1326, 1328 and 1412 have been identified on Bechtel NCR 1005. Structural Backfill MDR 621, 671, 672, 685, and 686 have been identified on Bechtel NCR 1004.
- (3) Corrective action has been taken as of the last of July, 1977 by Bechtel QC and U.S. Testing to more adequately clear failing tests. Therefore, the corrective action to preclude repetition for not clearing failing tests need not be addressed.

Corrective action verified October 26, 1977

Plant Area Fill MD 1311 has been identified on revised NCR 1004.

Corrective action verified November 1, 1977.

NCR QF-199 has been written to resolve the corrective action still open.

AUDIT REPORT NO F-77-32

VI. OPEN FINDINGS (Contd)

Finding 3

Specification C-211 Revision 3 Section 5.6.2 states in part, "Material delivered to the jobsite for use as structural backfill shall be visually inspected, and tested in accordance with ASTM C-136..."

ASTM C136-71 Section 4.2 states in part, "In no case, however, shall the fraction retained on any sieve at the completion of the sieving operation weigh more than 4g/in.<sup>2</sup> of sieving surface."

Note 2 - This amounts to 200g for the usual 8 in. (203-mm) diameter sieve".

To preclude repetition to NCR QF-152 (the same deficiency as this), U.S. Testing developed a new gradation form that has check points that include documenting that the 200 gram material limit on any individual 8 inch sieve has not been exceeded. In addition, a training session was held on February 21, 1977.

Project Quality Control Instruction No. SC-1.05 "Material Testing Services and Concrete Production" Rev. 3 Section 2.7.2 Reports, Item A states, "Perform a daily review of the subcontractor's jobsite inspection and test reports for acceptability, completeness, and the laboratory chief's signature for concrete, steel, and soils. Sign and date on the report verifying the acceptable status".

Contrary to these requirements:

<u>Structural Backfill</u> <u>Log Number</u>	<u>Date Sampled</u>	<u>Amount Retained</u>
G- 270	1-13-77	#40 Sieve - 225.2g
0364	4-27-77	#10 Sieve - 217.1g
0417	5-11-77	#10 Sieve - 221.4g
0431	5-16-77	#10 Sieve - 260.1g
0451	5-18-77	#10 Sieve - 211.7g
0505	6-02-77	#200 Sieve - 228.0g
0704	7-18-77	#10 Sieve - 249.5g

Corrective Action Requested:

- (1) Present these findings to Bechtel Project Engineering and obtain engineering rationale from Bechtel Project Engineering as to the acceptability of the material these tests represent.
- (2) Evidently the corrective action taken in NCR QF-152 was not adequate. Determine the underlying cause(s) and take further corrective action to preclude repetition.

FILE: 4.3.4 & 18.4.3.6  
DATE: October 3-7, 1977  
PLANT: Midland UNIT 1 & 2  
SUBJECT OF AUDIT: Soil Placement  
Records

AUDIT REPORT NO F-77-32

VI. OPEN FINDINGS

Finding 3 (Contd)

Corrective Action Taken:

(1) These findings have been identified on Bechtel NCR 1006.

Corrective action verified October 26, 1977.

NCR QF-195 has been written to resolve the corrective action still open.

VII. NONCONFORMANCE REPORTS

QF-195

QF-199



W. J. Lackie  
J. F. Newge  
G. L. Richardson  
H. W. Slager



Foyner  
Company

QUALITY ASSURANCE  
PROGRAM

DATE: July 23, 1977

PLANT: Midland UNIT 1 & 2

SUBJECT OF AUDIT: Soils Placement  
and Inspection

QA SUBJ FILE

REPORT NO F-77-21

I. AUDIT SCOPE

The purpose of this audit is to verify that soils placement and inspection are being accomplished in accordance with Bechtel's procedures, specifications and codes.

II. AUDITOR

G. B. Johnson, CPCo Field Quality Assurance Engineer (Civil)

III. PERSONNEL CONTACTED

- \*\*Ben Cheek, Bechtel Lead Civil Quality Control Engineer
- \*Daryle Osborn, Bechtel Quality Control Engineer (Civil)

IV. SUMMARY OF AUDIT

- A. A Pre-Audit Conference was held on May 23, 1977 at Daryle Osborn's desk with those in attendance as noted in Sections II and III above. The audit scope was the only item discussed.
- B. The audit was performed on the placement and inspection of zone 2 material in the plant area South of the Turbine Building at elevations 620' - 622'. The backfilling operation was centered around plant coordinates S 5070 and E 36Q. The attached checklist was used.
- C. The soils placement and inspection seemed adequate except as described in Section V of this report.
- D. Future audits will be run the same, when scheduled.
- E. A Post-Audit Conference was held on June 16, 1977 in Ben Cheek's office with those in attendance as noted in Sections II and III above. The Post-Audit Conference consisted of telling Ben Cheek and Daryle Osborn that the results of this audit were adequate except for Findings #1 & #2 in Section V

V. CLOSED OUT FINDINGS

Finding #1

Bechtel Specification 7220-C-210, Rev. 4, Section 12.6.1, states in part:

→ The water content during compaction shall not be more than 2 percentage points below optimum moisture content and shall not be more than 2 percentage points above optimum moisture content. . . . .

- \*Attended Pre-Audit Conference and Post-Audit Conference
- \*\*Attended Post Audit Conference

BY: Gary B. Johnson

DATE 5 July 77

SHEET 1 OF 3

1-25-78

Report No F-77-21

V. CLOSED OUT  
FINDINGS

Finding #1 (Contd)

Contrary to These Requirements:

Backfill was placed on a lift which was determined to be greater than 2% below optimum moisture content (Plant Backfill Test #1352, optimum 15.2%, actual 12.8%). When questioned, the Foreman directing the soils work stated that he would continue backfilling since satisfactory compaction had been obtained.

Recommended Corrective Action:

1. The Foreman directing the soils work should be instructed as to the required moisture content limits.
2. Bechtel QC should determine if a re-test had been accomplished on the lift in question. If a re-test had not been accomplished, it will be necessary to obtain one. If the affected material is found to be nonconforming, an evaluation will have to be made as to the acceptability of the in-place material by Project Engineering.

Corrective Action Taken:

1. Bechtel QC informed the foreman directing the soils work of the required moisture content limits and what to do if a failing test occurs.
2. A retest was taken in the area and the retest passed (Plant Backfill Test 1414).

Finding #2

Bechtel Specification C-205, Rev. 10, Table 9-1, states in part:

Field Densities and Moisture Contents will be taken at the frequency of one test per every 500 cubic yards of fill.

Contrary to These Requirements:

During the audit it was discovered that the Foreman directing the soils work believed that the required frequency for testing of field density and moisture content was one test per 1000 cubic yards of fill.

Recommended Corrective Action:

1. The foreman directing the soils work should be instructed as to the correct test frequency requirements.

Report No F-77-21

12

V. CLOSED OUT FINDINGS

Finding #2 (Contd)

Recommended Corrective Action: (Contd)

2. Bechtel QC should determine if the 1/500 cy test frequency has been exceeded. If the test frequency has been exceeded, an evaluation will have to be made as to the acceptability of the in-place material by Project Engineering.

Corrective Action Taken:

1. Bechtel QC informed the foreman directing the soils work of the correct test frequency requirements.
2. Bechtel QC made an evaluation concerning the frequency of testing in the affected area. It was determined that between 5/13/77 and 6/17/77, 18,200 cy of random backfill was placed South and East of the Turbine Building. 57 tests were taken on this material which results in an overall test frequency of 320 cy/test. The majority of this 18,200 cy was placed in a NON-Q area.

VI. NONCONFORMANCE REPORTS

None

CONSUMERS POWER COMPANY

RECEIVED  
FEB 10 1978

MIDLAND PLANT PROJECT  
MIDLAND, MICHIGAN

T. C. Cooke  
Bechtel Power Corporation

Post Office Box 2167  
Midland, Michigan 48640

February 1, 1978

NRC Dup Ex 3 find  
Tom (10-22-80)

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

Attention: Mr. D. Edley

Job 7220 Midland Project  
Subcontract 7220-C-208  
Failure of Fill Supporting the  
Administration Building Grade  
Beam at Column Line 0.4  
C-208-B-286

Reference: Telex Number C-208-B-283 Dated December 30, 1977 From J. F. Newger

Dear Mr. Edley:

Pursuant to the referenced Telex, we have conducted an evaluation of the subject failure condition. Our engineering analysis has determined that the failure was caused by insufficient compaction of the fill which was placed in May and June of 1977. A careful review of the test data provided by U. S. Testing Company indicates that this fill was erroneously reported to be in conformance with Bechtel Specification requirements by U. S. Testing Company. This conclusion is supported by the following facts.

1. A summary of fifteen (15) compacted fill density tests taken by U. S. Testing to evaluate the subject fill as it was compacted is provided in Table #1. The location of each test is plotted in Figure #1. Although several initial tests indicate test failure due to insufficient compaction, each failure is properly cleared by a passing test at or near the location of the failure.
2. Maximum laboratory dry density values (from Bechtel Modified Proctor Tests) used as the standards for evaluating acceptability of fill compaction were selected by U. S. Testing Lab Technicians. In a Jobsite meeting with F. Teague and B. Check of Bechtel, J. Speltz of U. S. Testing stated that the testing technician uses a visual comparison between soil characteristics (primarily color) of the in-place sample and bottled samples of material with known maximum laboratory dry density, to select the appropriate standard. Visual examination by Bechtel soils engineers of the subject fill during the subsequent grade beam removal indicated the material was uniform in appearance with minimal variation in soil characteristics (color and plasticity) over the full extent of the fill placement.

RECEIVED
BHP
DJV
RL3
DAK
RAW
DES
WFS
GBI
JGB
WLB
EAE
GWR
ODJ
ZAJ
JJD
JSS
CMD
TC
PAW
ASP
PAT
VICKI
PEGG
FILE C-2

3. The value of maximum laboratory dry density selected for comparison of the in-place dry densities in the subject fill varies between 132.9 lb./ft.<sup>3</sup> and 116.0 lb./ft.<sup>3</sup>. This variation includes most of the full range of maximum laboratory density standards which represent significantly differing soil characteristics of the clay soils in use on this project. A graph of the maximum laboratory dry density plotted with the corresponding in-place dry density for each test is given in Figure #2. Note that for three compacted fill density tests (1469, 1494 and 1493) taken within a few feet of each other and at the same elevation, two significantly different maximum laboratory densities were used as the compaction standard by the same U. S. Testing technician.
4. Testing during removal of the subject fill was conducted by U. S. Testing in accordance with Bechtel direction and Specification 7220-C-203 requirements. A summary of test data and results is given in Table #2. The results of compacted fill density tests taken during subject fill removal confirm dry density values taken during initial fill. Bechtel modified proctor tests taken during fill removal in three locations (one at the north and south edges of the fill and one approximately in the center) confirm that the maximum laboratory dry density was uniform as the appearance of the material indicated. In addition, the subsequent testing indicates the value of maximum laboratory dry density was between 130.5 lb./ft.<sup>3</sup> and 133.1 lb./ft.<sup>3</sup>. From these test results it is apparent that the lower maximum laboratory dry density standards selected during the original fill testing were not appropriate. As shown in Table #2, this error resulted in actual compaction in the range of 33.1% to 90.5% of optimum for three areas of the subject fill, a substantial deviation from the 95% of optimum compaction required by Specification 7220-C-203.

In conclusion, the U. S. Testing Company failure to report deviations from specified compaction requirements which was the result of repeated erroneous selection of compaction standards by U. S. Testing Company employees represents a violation of the Specification 7220-C-203, Section II, requirements and U. S. Testing Company is therefore liable for costs associated with the subsequent failure of the fill. Such costs include but are not limited to the cost of removal and investigation of the original beam and its supporting fill in addition to all replacement costs which amounts to a total of \$134,600.00. An outline itemizing these costs is provided as Attachment #2 of this letter.

We trust U. S. Testing Company, Inc. will fulfill its contractual obligations with respect to this matter in a timely manner.

Very truly yours,

  
S. F. Nevgen

JFN/CNC/JB/djg  
Attachments

cc: P. A. Bechtel  
T. C. Cooke  
R. Hermeston  
P. A. Martinez  
J. Spaltz

*Handwritten notes:*  
Sheet 7-7H  
a desc of P. A. Bechtel  
of what U.S. Testing did  
in this area

*Handwritten notes:*  
Bechtel Test

MIDLAND POWER PLANT 7220 DATE: 7/24/77

INSTRUMENT NO.

START COUNT	DENSITY		MOISTURE	
	COUNT ONE		COUNT ONE	
COUNT TWO		COUNT TWO		
COUNT THREE		COUNT THREE		
COUNT FOUR		COUNT FOUR		
TOTAL		TOTAL		
AVERAGE COUNT	426	AVERAGE COUNT	403	

AREA: \$ ADMEN, BLUD.

IDENTIFICATION	TEST NUMBER					
	DATE OF TEST	9/8/22/77	9/22/77			
	STATION OR LOCATION	0.4 PA	0.4 PA			
	OFFSET FROM CENTERLINE	E. EDGE OF FOOTING	W. EDGE OF FOOTING			
	ELEVATION	613	613.0			
	DEPTH OF TEST	6"	6"	6"	6"	6"
	ZONE NUMBER	1	1			

DENSITY	DENSITY COUNT	460	423		
	COUNT RATIO (DENSITY)	1.080	1.993		
	WET DENSITY #/ft <sup>3</sup>	138.5	144.5		
	TOTAL DENSITY DRY #/ft <sup>3</sup>	118.7	127.5		

MOIST.	MOISTURE COUNT	330	270		
	COUNT RATIO (MOISTURE)	.819	.720		
	MOISTURE FROM MANUAL CHART #/ft <sup>3</sup>	19.8	17.0		
	MOISTURE %	16.7	13.3		

DATA	PROCTOR CURVE NUMBER	BMP-270	BMP-269		
	MAXIMUM DENSITY #/ft <sup>3</sup>	124.6	127.3		
	OPTIMUM MOISTURE %	11.1	10.0		
	% DENSITY REQUIRED	95%	95%	95%	95%
	MOISTURE TOLERANCE REQUIRED				
	% FIELD DENSITY	95.7	101.6		
	P= PASS F=FAILURE	F-M	F-M		
	RETEST	NO	NO		
AREA OF TEST	PLANT	PLANT			

REMARKS: INFO ONLY GAUGE NO. 2932  
 JERRY MORRIS NOTIFIED OF RESULTS 9/22/77 @ 10:00 by R.S.  
 CHECKED BY: SEE

TESTED BY R.D. [Signature]

APPROVED BY

MIDLAND POWER PLANT 7220 DATE: 9/19/77

Quality Control  
Construction Sup  
Inspection

STANDARD COUNT	DENSITY		MOISTURE	
	COUNT ONE	COUNT TWO	COUNT ONE	COUNT TWO
	432	431	430	428
	434	429	442	431
	429	429	431	431
	1726	1726	1731	1731
	432	432	433	433

IDENTIFICATION	AREA:				
	TEST NUMBER				
DATE OF TEST	9/19/77				
STATION OR LOCATION	2' E. OF SIDE OF FUTURE 2' S. OF N. SIDE				
OFFSET FROM CENTERLINE	S. END OF ADMIN. BUILD. BEAM				
ELEVATION	622	622	622	622	622
DEPTH OF TEST	6"	6"	6"	6"	6"
ZONE NUMBER	1	1	1	1	1

DENSITY	AREA:				
	DENSITY COUNT	529	464	478	447
COUNT RATIO (DENSITY)	1.225	1.074	1.106	1.035	
WET DENSITY #/ft <sup>3</sup>	130.0	139.0	137.0	141.5	
TOTAL DENSITY DRY #/ft <sup>3</sup>	108.5	119.2	117.5	121.7	

MOIST.	AREA:				
	MOISTURE COUNT	381	338	350	353
COUNT RATIO (MOISTURE)	.880	.781	.808	.815	
MOISTURE FROM MANUAL CHART #/ft <sup>3</sup>	21.5	18.8	19.5	19.8	
MOISTURE %	19.5	15.7	16.6	16.2	

DATA	AREA:				
	PROCTOR CURVE NUMBER	BMP-218	BMP-270	BMP-262	BMP-262
MAXIMUM DENSITY #/ft <sup>3</sup>	117.0	124.6	123.9	123.9	
OPTIMUM MOISTURE %	15.2	11.1	11.8	11.8	
% DENSITY REQUIRED	95%	95%	95%	95%	95%
MOISTURE TOLERANCE REQUIRED	± 2%	± 2%	± 2%	± 2%	
% FIELD DENSITY	92.7	95.7	94.8	98.2	
P= PASS F=FAILURE	F-MD	F-M	F-MD	F-M	
RETEST	NO	NO	NO	NO	

REMARKS: GAUGE NO. 2932

INFO ONLY  
SOIL REMOVED

TESTED BY: P. Smith

APPROVED BY: SCC

CHECKED BY: SCC





Summary of Compacted Fill Density Test Data

for

Administration Building Original Fill

(Tests Grouped by General Area and Date of Test)

TEST NO.	DATE TAKEN	TESTED BY	LOCATION	ELEV.	IN-PLACE DRY DENS.	MAX. LAB. DRY DENS.	% COMP.	REMARKS
911	5-23-77	SM	2' N. of N. Steam Tunnel Wall - 25' W. of Turb. #1	614.5	133.1	132.9	100.2	Pass
914	5-24-77	SM	2' N. of Steam Tunnel Wall - 50' W. of Turb. #1	614.6	125.7	123.9	101.5	Fail - Moisture (Too Dry - 9%)
1403	6-3-77	RS	4' N. of N. Wall Steam Tunnel - 15' W. of I.O	621.5	111.0	116.0	95.7	Pass
1404	6-3-77	RS	5' N. of N. Wall Steam Tunnel - 24' W. of I.O	623.0	115.7	121.0	95.6	Fail - Moisture (Too Dry - 10.2)
1362	5-27-77	SM	10' N. of Steam Tunnel - 4' E. of E. Side	615.5	114.2	117.0	97.6	Pass
1422	6-8-77	BS BT	8' E. of E. Steam Tunnel - 24' N. of N. Steam Tunnel	622.0	117.7	123.9	95.0	Pass
1469	6-13-77	EG	8' S. Hk line - 4' E. of E. Steam Tunnel Wall	617.0	115.2	127.3	90.5	Fail - Comp.
1494	6-15-77	RS	8' S. of Hk line 4' E. of E. Steam Tunnel Wall	617.0	118.2	117.0	101.0	Pass - Retest Clears 1469, 14
1498	6-15-77	RS	8' S. of Hk line 8' E. of E. Steam Wall	617.0	112.2	127.3	88.2	Fail - Comp.
1491	6-15-77	BT	8' E. of E. Steam Tunnel Wall - 46' N. of N. Steam Tunnel Wall	618.0	113.0	127.3	88.3	Fail - Comp.
1517	6-16-77	BT	5' E. of E. Steam Tunnel Wall - 60' N. of N. Wall	620.0	119.7	123.9	96.6	Pass
1519	6-16-77	BT	8' E. of E. Steam Tunnel Wall - 48' N. of N. Wall	618.0	124.0	127.3	97.4	Pass - Retest Clears 1491
1492	6-15-77	BT	38' W. of I.O - 5' N. of N. Steam Tunnel Wall	626.0	116.2	127.3	91.3	Fail - Comp.
1518	6-16-77	BT	38' W. of I.O - 5' N. of N. Wall	626.0	122.7	127.3	96.4	Fail - Moisture
1520	6-16-77	BT	38' W. of I.O - 5' N. of N. Wall	626.0	122.7	127.3	96.4	Pass - Retest Clears 1492, 151

TABLE NO. 2

## Summary of Test Data and Results

for

Fill Below Original Beam at 0.4 Line

Administration Building (All Tests by U. S. Testing)

DESCRIPTION OF TEST	ELEVATION OF TEST	TEST RESULTS AT COLUMN HT	TEST RESULTS AT COLUMN LN	TEST RESULTS AT COLUMN PA	NO. CO.
Initial Compacted Fill Density Test	617' ±	In-Place Dry Density = 118 lb./ft. <sup>3</sup> Test No. 1494	In-Place Dry Density = 119.7 lb./ft. <sup>3</sup> Test No. 1517	In-Place Dry Density = 114.2 lb./ft. <sup>3</sup> Test No. 1362	
Proctor Selected by U.S.T. Technician for Item No. 1 Tests	617' ±	BMP - 278 Max. Lab. Dry Density = 117 lb./ft. <sup>3</sup>	BMP - 262 Max. Lab. Dry Density = 123.9 lb./ft. <sup>3</sup>	BMP - 278 Max. Lab. Dry Density = 117 lb./ft. <sup>3</sup>	
In-Place Proctor After Beam Removal	617' ±	BMP - 300 Max. Lab. Dry Density = 132.2 lb./ft. <sup>3</sup>	BMP - 299 Max. Lab. Dry Density = 133.1 lb./ft. <sup>3</sup>	BMP - 298 Max. Lab. Dry Density = 130.5 lb./ft. <sup>3</sup>	
Reported Z Compaction	617' ±	101%	96%	97.6%	B
Z Compaction Using In-Place Proctor	617' ±	89.3%	89.9%	87.5%	C
Compacted Fill Density Tested After Beam Removal	617' ±	*Dry Density = 119.7 lb./ft. <sup>3</sup>	Mp & 0.4 Dry Density = 117.5 lb./ft. <sup>3</sup>	Dry Density = 108.5 lb./ft. <sup>3</sup>	D
Z Compaction Using In-Place Proctor & Dry Density Taken After Beam Removal	617' ±	90.5%	88.3%	83.1%	

One of Three Tests at This Location

Code:

1. Test Results do not include failing tests which were cleared by retest
2. Reported Z Compaction during initial fill compaction
3. Actual Z Compaction calculated using Item No. 1 tests divided by Item No. 3 proctor information
4. Tests taken after footing removal were not numbered by U.S.T., and were submitted for information only to Bechtel. Copies of reports are included as Attachment No. 1