F7220.C210-1.5

Canonie CONSTRUCTION CO. / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

QUALITY ASSURANCE MANUAL

FOR

MIDLAND NUCLEAR POWER STATION

BECHTEL POWER CORPORATION

FOR

CONSUMERS POWER COMPANY

AUGUST, 1976

CONTROLLED COPY NUMBER 2

UNCONTROLLED COPY_____

SB178790

canonie CONSTRUCTION CO. / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

STATEMENT OF POLICY

A Quality Assurance Program has been established by Canonie Construction Co. and shall be applied to all work for which it is required, either by code, contract or regulatory requirements.

The Quality Assurance Program has been developed to conform to the requirements of Title 10, Code of Federal Regulations, Part 50, Appendix B and the American National Standard Quality Assurance Program Requirements for Nuclear Power Plants, ANSI N-45.2-1971, as these standards apply to the scope of work of Canonie Construction Co.

Quality Assurance Policy and Direction is set by executive authority and decision at my direction. The Manager of Quality Assurance has the authority to implement the Quality Assurance Program and to assure full compliance with all requirements thereof by all concerned personnel.

Further, the Manager of Quality Assurance has the responsibility and the authority to make the necessary changes, amendments and supplements to the Quality Assurance Program to insure its complete adherance to all applicable codes, standards, regulatory and contractual requirements necessary for the satisfactory execution of all work.

Concurred:
Manager of Quality
Assurance

President,
Canonie Construction Co.

SB178791

Index

SB178793

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

QUALITY ASSURANCE MANUAL

1.0 INTRODUCTION

This manual has been prepared for the purpose of presenting the Quality Assurance Program which has been adopted by the Canonie Construction Company and shall be applied to all quality related activities.* Thus, the Canonie Quality Assurance Program shall be applicable to all work for which it is required either by regulatory or contractual committments. This manual is intended both to provide regulatory agencies or clients with a description of the Canonie Program and how it is implemented and also to provide Canonie personnel guidelines on how the program is to be implemented during the course of work. This manual has been developed to fulfill the requirements of 10CFR50 Appendix B where it applies to the scope of work performed by Canonie.

The Canonie Quality Assurance Manual is intended to provide a general statement concerning the implementation of this Quality Assurance Program. Specifics concerning the actual performance of the Quality Assurance work are contained herein; however, the specifics of Quality Control work are contained in Manuals of Practice developed by Canonie. In general, these Manuals of Practice are to provide guidance for Canonie personnel relating to daily quality related tasks for our activities.

The Quality Assurance Program described in this manual is fully endorsed by the management of Canonie Construction Company. Objective

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

evidence of this is shown on the manual approval sheet by the acceptance of this manual as company policy by the President of Canonie.

---

*In general, quality related activities shall be work which is defined as Class I as defined by the USNRC. This program will be extended to Class II or other work as contractually required by the client or owner.

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

2.0 ADMINISTRATION OF THE QUALITY ASSURANCE, QUALITY CONTROL PROGRAM

2.1 Organization

Figure 1 presents the organizational structure within Canonie for the operation of the Quality Assurance Program. This organization chart is only intended to show the relationship of the Quality Assurance Staff to the Project Staff for a specific project. Independence of the Quality Assurance Staff is assured because the On Site Project Manager has no control over the members of the Quality Assurance Staff, nor can the On Site Project Manager or Construction Manager invalidate the findings of the Quality Assurance Staff.

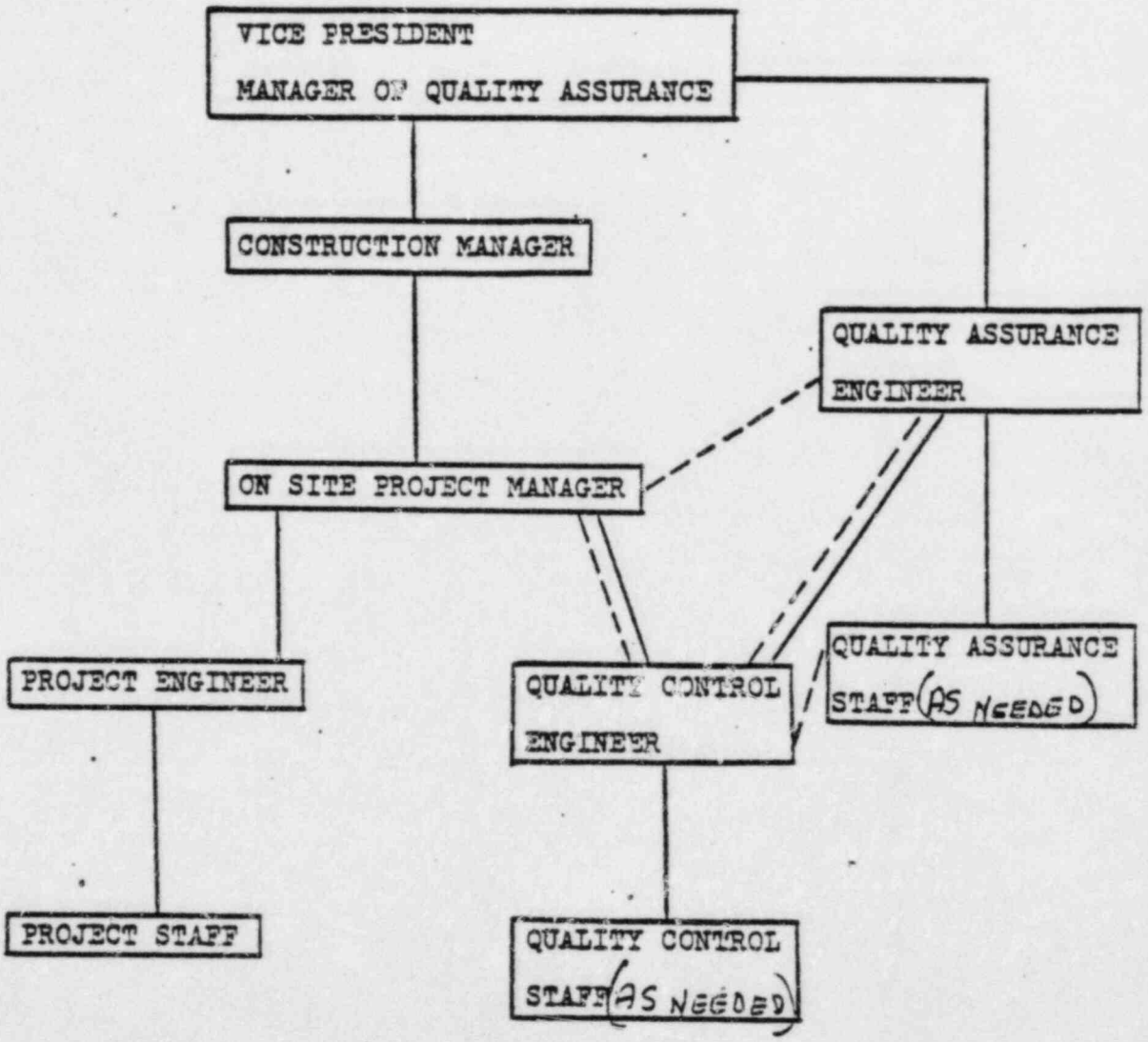
Within this organizational structure the responsibilities for Quality Assurance and Quality Control shall be as defined by ANSI Standard N45.2:

> QUALITY ASSURANCE: "All those planned or systematic actions necessary to provide adequate confidence that an item or a facility will perform satisfactorily in service."
>
> QUALITY CONTROL: "Those Quality Assurance actions which provide a means to control and measure the characteristics of an item, process or facility to established requirements."

Thus, Quality Control is intended to be the execution of daily activities, such as inspection, to established proceedures to assure compliance of the work to the pertinent specifications and/or regulatory requirements.

SB178796

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171



SB178797

FIGURE 1 ORGANIZATION CHART

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

Quality Assurance shall be an organization as defined in Figure 1 which is not responsible for any project related activities such as scheduling or cost. Rather, the Quality Assurance Staff shall be independent to determine, through scheduled or unscheduled audits, if the Quality Control Staff is fulfilling its obligations for the proper conduct of quality related activities.

2.2 MANAGER OF QUALITY ASSURANCE

As shown on Figure 1, the Canonie Vice President - Manager of Quality Assurance is assigned the overall responsibility for all activities affecting quality within the scope of project work assigned to Canonie - both Quality Assurance and Quality Control. As such, the Quality Assurance Staff will be directly responsible to this individual for the reporting of all quality related problems. The implementation of the Quality Control Program shall be the responsibility of the Quality Control Engineer. Further, the Manager of Quality Assurance is responsible for the preparation and approval of procedures or standards used by the Quality Assurance and Quality Control Staffs. This includes their implementation as well as the implementation of proceedures and standards contractually imposed on Canonie.

Basically, the Vice President - Manager of Quality Assurance is responsible for all phases of the project: quality, administration and production. However, the direct responsibility for production on all Canonie projects is assigned to the Construction Manager.

SB178798

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

2.3 QUALITY ASSURANCE ENGINEER

As stated, the Quality Assurance Engineer and Staff are directly responsible to the Vice President-Manager of Quality Assurance. Each project requiring Quality Assurance activities will be assigned to a Quality Assurance Engineer who will be responsible for the implementation of the Quality Assurance Program as described in this manual.

These responsibilities shall include the scheduling and conducting of audits, preparation of audit reports for the project and the authority to stop quality related work on a project pending review and resolution basis by the Vice-President - Manager of Quality Assurance.

2.4 QUALITY CONTROL ENGINEER

The Quality Control Engineer shall be directly responsible for the on site execution of the Quality Control Program. Quality related items shall include the daily inspection and testing work which must be performed as prescribed for the project and the resultant preparation and maintenance of Quality Control records.

In general, the duties of the Quality Control Engineer and staff shall not involve a responsibility for production. The actual supervision of work shall be the responsibility of the On Site Project Manager and the personnel assigned thereto.

Exceptions to total separation of production and quality related activities shall be for work such as surveying or supervision of backfill. In these cases the activity shall be responsible to both the Quality Assurance Engineer and the On Site Project Manager as shown in Figure 1. However, for these events the On Site Project Manager cannot instruct the personnel performing the work to not comply with quality requirements.

SB178799

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

2.5 PROJECT COMMUNICATION

Referring to Figure 1, lines of communication are shown between the On Site Project Manager and Quality Control Engineer and the Quality Assurance Engineer and Staff. For the Quality Assurance/Quality Control Program to be truly functional these lines of communication must exist. The Quality Assurance Engineer and Staff must be available to the Quality Control Staff to aid in the interpretation of the Quality Assurance Program and procedures, standards or regulatory requirements should the need arise. Conversely, the Quality Control Staff shall inform the Quality Assurance Engineer and Staff, or the Vice President-Manager of Quality Assurance, if problems arise in the daily execution of the Quality Control Program. Such occurrences could be the determination of an error in project specifications or drawings, an inadequacy in the Quality Assurance/Quality Control Program such as an inadequate calibration requirement, or the repeated deficiency of material or equipment.

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

3.0 QUALITY ASSURANCE PROGRAM

The purpose of this section of the manual is to describe the implementation of the Quality Assurance Program and the activities of the Quality Assurance personnel in executing the program.

3.1 QUALITY ASSURANCE STANDARDS

All activities within Canonie that are quality related shall be governed by written proceedures. These proceedures shall take the form of this Quality Assurance Manual, or as previously mentioned, Manuals of Practice for specific work items.

The Vice President - Manager of Quality Assurance shall be responsible for the approval of all standards - whether they be Quality Assurance or Quality Control related. Further, approval of the Quality Assurance Program, as stated by the Quality Assurance Manual, shall also be by the President. The approval of standards, such as the Quality Assurance Manual, shall make them binding upon all personnel whose work is affected by them.

Quality Assurance standards shall be initiated by the Manager of Quality Assurance with responsibility appointed to Quality Assurance personnel or an organization external to Canonie if so desired by the Manager. Quality Control standards, which will generally be working or testing proceedures or specifications pertinent to a generic activity or project, may be prepared by either Quality Control or Quality Assurance personnel or external organization. However, Quality Control standards shall be subject to review and approval by the manager of Quality Assurance, or designated Quality Assurance personnel, prior to implementation.

Canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

Activities which may be routinely performed by Canonie as part of inspection services on a project, such as concrete testing, structural earthwork control or reinforcement testing, shall whenever possible be conducted to recognized standards. Such standards shall include those prepared by the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM) and the American Concrete Institute (ACI).

Standards that are contractually imposed upon Canonie as part of a specific project shall take precedence over the equivalent Canonie standards. However, prior to the acceptance of such standards as a contractual item, the standards will be reviewed and accepted by the Manager of Quality Assurance as discussed in Section 3.5 of this manual.

3.2 MAINTENANCE OF QUALITY ASSURANCE MANUAL AND STANDARDS

3.2.1 CONTROL OF COPIES

The Quality Assurance Manual and Manuals of Practice shall be numbered with a distribution list of copyholders maintained by the Manager of Quality Assurance or member of the Quality Assurance Staff. Control of copies shall be so that in the event of revision all copyholders may be presented the revision and also to withdraw copies if necessary. Canonie considers the Quality Assurance Manual and Manuals of Practice to be proprietary documents of Canonie and as such reserves the right to withdraw copies from internal copyholders if a change in their function no longer requires the use of such manuals or if copies have been issued externally to a client for review and such work is completed.

SB178802

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

Uncontrolled copies of Manuals may be issued as part of bid documents if required for submittal by the prospective client or owner. If Canonie is awarded the work, the copies will be issued control numbers and the client notified of this number. The copyholder within the client organization will then be added to the distribution list. If Canonie is not awarded the work the return of the uncontrolled copies will be requested.

3.2.2 DISTRIBUTION OF DOCUMENTS

The Quality Assurance Manual and the Manuals of Practice shall be available to all Canonie personnel if required by their work function. This will include all members of the Quality Assurance Staff and pertinent company management. As a minimum, at least one copy of the Quality Assurance Manual and the appropriate Manuals of Practice shall be maintained at the project site. The copyholder of these documents shall be the Quality Control Engineer; however, they shall be available to all on site personnel for use.

3.2.3 REVISION OF DOCUMENTS

As necessary, the Quality Assurance Manual and the Manuals of Practice shall be revised. Revision shall be on an aperiodic basis dependent upon changes within the Canonie Quality Assurance Program or in regulatory requirements or in accepted standards for the performance of inspection functions. As a minimum, the Quality Assurance Manual and the Manuals of Practice shall be reviewed by the Manager of Quality Assurance, or a designated member of the Quality Assurance Staff or external organization, on a yearly basis. Such reviews will be documented as Quality Assurance Records.

SB178803

Canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

When documents are revised, all current copyholders shall be presented a copy of the revision. Attached to the revision shall be instructions for the filing of the revision within the appropriate manual and a revision receipt. The revision receipt shall indicate the copy number and shall state that a copyholder has filed the revision as instructed and has destroyed or removed from use and marked "Void" outdated information. The revision shall be signed and dated by the copyholder and promptly returned to the Manager of Quality Assurance. The receipts shall be maintained by the individual responsible for the copyholder list to indicate the revisions have been issued and properly included in the manuals.

Revisions may take the form of either the complete adoption of new procedures, the deletion of old procedures, or the correction of ongoing procedures. Revision pages will be noted by a line down the right hand side of the page where the revision has been made and either a number indicating the revision number or the date of revision. This is particularly relevant to revisions which affect only a portion of a page. Finally, to complete the revision, a new approval sheet shall be issued which indicates the revision number and/or date and its acceptance by the appropriate members of Canonie Management.

3.3 QUALITY ASSURANCE AUDITS

In general, Canonie shall conduct or participate in three types of Quality Assurance audits: internal audits to verify compliance with the Quality Assurance/Quality Control Programs by members of the Quality Control Staff; prequalification audits of prospective subcontractors to verify

Canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

their ability to fulfill the Quality Assurance/Quality Control functions of their intended work and the surveillance of subcontractors performing work; and cooperation with clients, owners or regulatory agencies who are auditing the work performed by Canonie. Each of these types of audits are discussed below.

3.3.1 QUALITY ASSURANCE INTERNAL AUDITS

At the beginning of work on a project, the Manager of Quality Assurance shall appoint a Quality Assurance Engineer, or an external organization to perform the function of the Quality Assurance Engineer, who shall be responsible for the implementation of the Canonie Quality Assurance Program on that project. The primary evidence of the performance of the Quality Assurance Engineer and Staff shall be by conducting audits and issuing the resulting audit reports.

The Quality Assurance Engineer shall establish a projected schedule of Quality Assurance audits to be conducted during the course of the project work. The audits shall be scheduled at least every three months or more frequently if required by the project activities. The quarterly audits may be postponed only if the project schedule has been interrupted by events such as work stoppage, for any reason, or delays due to weather. In the event that a quarterly audit is postponed or cancelled the reason shall be documented as a project Quality Assurance record.

Because quarterly audits are scheduled, the Quality Control and Project Staffs will be notified of their occurrence. However, if in

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

the opinion of the Manager of Quality Assurance and the Quality Assurance Engineer, the quarterly audits are either not sufficiently verifying the conduct of quality related activities or are not resolving quality related problems then unscheduled and unannounced audits may be conducted.

Further, additional audits may be required if activities related to the Quality Control Program are initiated or completed between quarterly audits. It is the intention of the internal audits to not only provide periodic evidence of compliance with the Quality Assurance Program but to audit activities when they begin to establish that all procedures have had provision for compliance at the onset and at completion to assure that all required documents are complete and properly maintained. If the aperiodic audits just discussed occur within one month prior to a scheduled quarterly audit or are anticipated within one month after the date for an upcoming quarterly audit, the quarterly audit can be rescheduled to coincide with this activity.

The content of all internal audits shall be prepared in advance by the Quality Assurance Engineer in the form of a checklist. The checklist shall include all on site quality related activities such as: completion of Quality Control forms for all work, completion of daily activity records, completion of all required equipment calibrations, and the proper storage and maintenance of these documents. At the conclusion of the Quality Assurance audit, the individual conducting the audit shall conduct an exit interview with the Quality Control Engineer and present on a preliminary basis the findings of the audit.

SB178806

Canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

3.3.2 PREQUALIFICATION AUDITS OF SUBCONTRACTORS AND SUBCONTRACTOR SURVEILLANCE

Subcontractors employed by Canonie shall be contractually required to provide Quality Assurance/Quality Control activities as required for their scope of work. The Quality Assurance activities for which it is intended that a subcontractor perform shall be included as part of their procurement document. To assure that the subcontractor can fulfill these activities, a prequalification audit shall be conducted prior to issuance of a contract at the direction of the Manager of Quality Assurance by a member of the Quality Assurance Staff. The prequalification audit shall determine if the intended subcontractor can provide a Quality Assurance/Quality Control Program that will satisfy their scope of work. In general this shall include testing program, equipment calibration, document completion, and subcontractor internal auditing. However, in general, auditing of the subcontractors Quality Assurance/Quality Control Program will be performed by Canonie rather than the subcontractor by the performance of Canonie conducted subcontractor surveillance audits. The surveillance audits will be conducted similarly to internal audits both as to schedule and conduct of the audit.

All audits of subcontractors will be conducted using prepared checklists in the same manner as internal audits.

3.3.3 AUDITS BY OTHERS

For audits that are conducted of Canonie by clients, owners or regulatory agencies, it is the stated policy of Canonie to provide

SB178807

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

the personnel necessary to assist in the auditing and if required exit interview. All quality related documents maintained by Canonie will be available for inspection by external auditors.

3.4 QUALITY ASSURANCE RECORDS

In this section is discussed only those records which are originated by the Quality Assurance personnel. Records such as daily activity logs or field inspection logs which are prepared by members of the Quality Control Staff are considered to be Quality Control records and are discussed as part of Section 4.0.

3.4.1 AUDIT REPORTS AND CORRECTIVE ACTION

At the conclusion of an audit conducted by Canonie Quality Assurance personnel, an audit report shall be prepared which includes the following: summary of the activities audited, personnel of both the Quality Control and Quality Assurance Staffs who were involved in the audit, findings of the audit which shall consider both positive and negative aspects, recommendations for corrective action, means for completing the recommendations for corrective action if possible, a date when the corrective action is to be completed and the means by which the corrective action will be verified. Issuance of the audit report as discussed in the following paragraph shall be in a timely manner and unless prevented by scheduling difficulties should be within ten days of the completion of the audit. Also, the time period stated in the audit report for completion of the corrective action shall be such that further deterioration of the quality related to the corrective action item does not occur.

SB178808

CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

The audit report shall be submitted to the Manager of Quality Assurance. The Manager of Quality Assurance shall review the audit report and indicate review and approval by signing and dating the audit report which will then be maintained as a project Quality Assurance record. If the Manager disagrees with any of the corrective action items, it shall be so indicated on this copy of the audit report and those items will be considered closed. After approval of the audit report by the Manager, copies of it shall be submitted to the Construction Manager, the On Site Project Manager and the Quality Control Engineer.

Upon receipt of the audit report by the On Site Project Manager and the Quality Control Engineer, action for complying with the corrective action items shall be initiated. This work shall be completed by the corrective action date set in the audit report and shall comply with the means stated in the audit report for verification of the audit report. It is noted that once approved by the Manager of Quality Assurance the corrective action items must be completed. Failure to do so by the date stated in the audit report, without proper justification as approved by the Manager of Quality Assurance or the Quality Assurance Engineer, shall constitute sufficient grounds for stopping the work activities related to those corrective action items.

Verification of the completion of corrective action items shall be performed by the Quality Assurance Staff. This may be accomplished by either reauditing the items or by reviewing the documentation submitted by the personnel identified for correction in the audit report to support completion of the corrective action if so permitted in

SB178809

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

the audit report. Reauditing shall be by returning to the location of the audit for verification. If the corrective action requested in the audit report can be resolved by the submission to the Quality Assurance Engineer of documents to show completion, reauditing is not required. Such an event would be, for example, if the Quality Assurance Engineer has requested the completion of portions of inspection records. Then, submission of copies of the completed records would be verification.

Upon verification of the completion of corrective action items, the Quality Assurance Engineer shall issue to the Manager of Quality Assurance a closure statement indicating that the audit has been satisfactorily completed. Copies of the closure statement shall also be issued to the Construction Manager, the On Site Project Manager and Quality Control Engineer.

For audits, either prequalification or in progress surveillance, conducted by Canonie on subcontractors the auditing process will be similar. After the audit report has been approved by the Manager of Quality Assurance, copies will be issued to the responsible personnel of the subcontractor. The verification of corrective action completion and a closure statement will be as stated in the preceding paragraphs.

3.4.2 MAINTENANCE OF RECORDS

For each project where the Quality Assurance Program is implemented, a file of project Quality Assurance records shall be initiated and maintained by the Quality Assurance Engineer. This file shall be separate from the project records during the course of the

SB178810

Canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

project and not available to the Project Staff. The project Quality Assurance records shall include the audit schedule, audit reports, audit checklists, verifications of corrective action, audit closure statements and objective evidence that other Quality Assurance activities such as the training of personnel and review of procurement documents have been performed.

At the completion of the project, the Quality Assurance records may be included in the general project file as a separate category. These records will be retained by Canonie in accordance with the contractual or regulatory requirements of the project or submitted to the client or owner as required.

3.4.3 PROVIDING OF RECORDS TO OTHERS

All project Quality Assurance records maintained by Canonie are available to client, owner, or regulatory agencies concerned with that project as part of their Quality Assurance activities. Further, if requested by the client or owner records for completed audits shall be provided as the audits are closed.

3.5 PROCUREMENT DOCUMENT REVIEW

To assure that procurement documents issued by Canonie to subcontractors include the proper provisions for quality related aspects of the work, the procurement document shall be reviewed by the Manager of Quality Assurance, or representative if so designated, prior to issuance. It is the intention of this review to assure that the proper aspects of the Quality Assurance activities imposed on Canonie by the client or owner are required of the subcontractor. Only those items which directly bear upon the subcontractor need be imposed.

SB178811

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

Procurement requirements may take many forms dependent upon the intended scope of work to be performed by the subcontractor. For example, Canonie could require the full implementation of 10CFR50 Appendix B upon a subcontractor or merely the daily submission of records. In general, the procurement document will require the calibration of measuring equipment, the completion of test records, the completion of field activity records and the maintenance of these records. In addition, Canonie shall require that the subcontractor provide Canonie or the client, owner or regulatory agency access to the subcontractor's facilities and quality related records for the purpose of auditing.

Conversely to the review of procurement documents issued by Canonie, the Manager of Quality Assurance or his representative shall review all procurement documents issued to Canonie for quality related items prior to their acceptance by Canonie. This review is to assure that all quality related items are understood and are properly within the scope of work to be performed by Canonie. It is hoped that during the contractual negotiations and when the review by the Manager of Quality Assurance of the proposed procurement document is completed that all quality items are resolved prior to the start of work.

Evidence of the review of procurement documents by the Manager of Quality Assurance or his representative shall by signing and dating the copy that is reviewed. If possible, this document shall be maintained as a Quality Assurance record. An alternate will be the maintenance of the signed copy in the project files.

SB178812

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

3.6 TRAINING OF PERSONNEL IN QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

Prior to the initiation of a project, a meeting will be conducted by the project Quality Assurance Engineer with the On Site Project Manager and all personnel performing or affected by Quality Control activities. The purpose of this meeting shall be for the Quality Assurance Engineer to discuss with the Project and Quality Assurance Staffs all quality related aspects of the work. This will include: a review of the pertinent portions of the Quality Assurance Program as contained in the Canonie Quality Assurance Manual, a review of the Quality Control aspects which would include both administrative and technical aspects of the Quality Assurance Manual and the pertinent Manuals of Practice, and the project contractual requirements and specifications. The review will include testing requirements, testing and inspection frequency, equipment calibration and freqcency and the preparation and maintenance of project documents. A project Quality Assurance record shall be prepared after this meeting listing the attendees, their function and the subjects discussed.

Personnel assigned to perform either Quality Assurance or Quality Control tasks shall be experienced to properly perform their function. The overall responsibility for the training of personnel shall be vested with the Manager of Quality Assurance. The Manager shall be responsible for appointing personnel to functions within the Quality Assurance organization who have demonstrated a capability to perform this work. Further, the Manager of Quality Assurance has the right to approve or prevent the assignment of personnel to Quality Control functions.

SB178813

Canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

Selection of personnel to the Quality Assurance Engineer position shall be by either formal training in Quality Assurance work or by a minimum of two years experience in Quality Assurance. If Canonie cannot provide personnel to fulfill this position on a particular project then an external organization shall be contracted to provide this service.

Quality Control personnel shall be capable of performing their functions within the stipulations of the contractual requirements of the project. For example, if the contract stipulates that inspectors shall meet a certain level requirement (Such as stated in ANSI N45.2.6) then individuals capable of meeting these requirements will be assigned to the Quality Control Staff. In general, the minimum requirements for a Quality Control Engineer shall be that of a Level II inspector as stated in ANSI N45.2.6. A Level III inspector will not in general be required on site. Again, if Canonie cannot furnish properly qualified personnel for a specific project, an external organization capable of performing the task will be contracted.

Ability to meet these requirements or other requirements which are contractually stipulated shall be demonstrated through personnel resumes which will be maintained as company documents. Backup information such as certificates or licenses will be kept with the resumes. Copies of the resumes or supporting documents will be provided to a client, owner or regulatory agency if requested.

SB178814

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

3.7 MANAGEMENT REVIEW OF PROGRAM

Management review of the Quality Assurance/Quality Control Program shall be an ongoing effort. For review of the entire quality program the Manager of Quality Assurance shall conduct an annual review of the program to assure that it is up to date and applicable to the functions being performed by Canonie. To document this review, the Manager of Quality Assurance shall issue a report to the President of Canonie stating the activities and documents reviewed and the results of the review.

Further review shall be evidenced by the signed approval of the Quality Assurance Manual and the Manuals of Practice by the Manager of Quality Assurance. As stated previously, formal acceptance of the Quality Assurance Program as a company policy shall be shown by approval of the Quality Assurance Manual by the President.

In addition to these activities to review the overall program, the Manager of Quality Assurance shall conduct a review of the Quality Assurance work being performed for each project at least annually. This activity may also be performed by an external organization if so designated by the Manager of Quality Assurance. The purpose of this annual review shall be to assure that all Quality Assurance records are complete and properly maintained. Evidence of the review and approval of individual audit reports shall be shown by the signed and dated copies of the audit reports which the Manager has approved prior to issuance. These will be maintained as Quality Assurance records.

SB178815

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

4.0 QUALITY CONTROL PROGRAM

4.1 INTRODUCTION

The Quality Control Engineer shall be responsible for the overall operation of the Quality Control Program. This includes the scheduling of inspections, the execution of these inspections and their documentation subject to the approval of the Quality Assurance Engineer. Although the Quality Control Engineer is responsible to the Project Manager for the completion of Administrative matters, such as the filing of drawings and specifications as subsequently discussed, in matters affecting quality the Quality Control Engineer shall be responsible only to the Quality Assurance Engineer. This would include the repeated failure of inspections or the repeated arrival of non-confirming materials or equipment. From this point it is the responsibility of the Quality Assurance Engineer to intercede until the issue is satisfactorily resolved.

As previously stated, it is not intended that Quality Control personnel have direct responsibility for production. However, it should be recognized that certain quality related functions are part of production. This could include the supervision of the spreading of backfill prior to compaction and the actual compaction of backfill. Also, surveying that is conducted on site is both a production and quality related function as the chief of the survey crew is responsible for both functions.

SB178816

Canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

4.2 GOVERNING PROJECT DOCUMENTS

The documents which will govern the on site work by Canonie shall be the project specifications and drawings as prepared by the client or owner, and the Canonie Quality Assurance Manual and pertinent Manuals of Technical Practice. It is expected that the client or owner prepared specifications and drawings will provide full information to Canonie concerning the scope of work to be performed and the tolerances for such work. As an alternative, standards may be cited as part of these documents such as those published by ASTM or ACI or by regulatory agencies. If such information is not provided to Canonie, the practices in the Canonie Manuals of Technical Practice shall apply.

For other items which will not normally be stipulated by the client or owner, such as calibration frequencies or tolerances, the Canonie Manuals of Technical Practice shall apply. The establishment of such items will be by the adoption of recognized standards whenever possible.

4.3 CONTROL OF PROJECT DOCUMENTS

All drawings and specifications shall be stamped received and dated at the project site. A log shall be maintained for specifications which shows the name and number of the specification, the revision number, revision date, date received on site, number of copies received and the personnel to whom the specifications were given for use. This log shall be updated as required to show the addition of new specifications or the revision of old specifications. Specifications that are revised, or

SB178817

Canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

cancelled from use, shall have marked across their entry in the log "void-revised" or "void-cancelled" as appropriate. A similar system shall be instituted for drawings.

To purge obsolete drawings and specifications from use, they will be collected from the copyholders, as shown in the log, when replaced with new revisions, or merely collected if the documents are cancelled. The purged documents will be clearly marked "VOID" across either the title block or title page.

If return receipts and disposition instructions accompany the specifications or drawings they will be completed and returned as instructed. If no instructions are provided to Canonie for either returning voided copies or destroying them, it will be the practice of Canonie to maintain one copy for reference in a separate file entitled "Void - Do Not Use." Copies beyond the first copy will be destroyed.

The foregoing discussion is intended to apply to documents that have been presented to Canonie by the owner or client or those prepared by Canonie. However, in general, Canonie will not issue specifications but shall use when possible the Manuals of Technical Practice.

The individual responsible for the maintenance of these documents shall be the Quality Control Engineer.

4.4 ESTABLISHMENT AND IMPLEMENTATION OF THE INSPECTION AND TESTING PROGRAM

At the beginning of the project, the Quality Assurance and Quality Control Engineers shall review the quality related portions of the scope of work. For all of the various activities a testing or

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

inspection schedule shall be established. Included in this schedule shall be hold points where the work must be inspected prior to continuation. All equipment which requires calibration shall be reviewed to assure it will be in current calibration when needed. Requirements for recalibration shall also be reviewed so that equipment which must be recalibrated can be serviced in a timely manner and on schedule so that the inspection and testing functions may continue uninterrupted. Finally, the inspection and testing documentation requirements will be reviewed so that all documentation forms are available and approved by Quality Assurance at the onset.

With this work completed the Project and Quality Control files will begin with the preparation of the specification and drawing logs. To this file will then be added an Organizational Chart similar to that shown on Figure 1, but including the names of the individuals called out.

4.5 ONGOING INSPECTION AND TESTING PROGRAM

After the on site Quality Control program has been established and implemented as discussed in Section 4.4 it shall be supervised by the Quality Control Engineer. It will be this individual's responsibilty to see that all inspections are conducted by the Quality Control Staff as scheduled, all hold points are observed and that all resultant documentation is completed and properly maintained.

To assure ongoing compliance with the Quality Control portions of the project, the Quality Control Engineer shall prepare a weekly

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

report of Quality Control activities stating what inspections, etc. were conducted and the results of this work. For inspections that resulted in deficiencies, a complete description of the deficiency shall be made, the remedial action shall be described. It shall be particularly noted if this is a continuing deficiency, what the cause is and the action taken or recommended to prevent reoccurrence. Copies of all deviation reports shall be attached to the weekly report.

Copies of the weekly report shall be submitted on the Monday following the report week to the On Site Project Manager and the Quality Assurance Engineer. Both individuals shall review the report, and indicate their review and acceptance by signing and dating the copy. The On Site Project Manager's copy will be filed in the Quality Control files and the Quality Assurance Engineer's copy shall become a Quality Assurance record.

If deficiencies have not been corrected or are ongoing, it then becomes the responsibility of the Quality Assurance Engineer to become actively involved in the problem until it is corrected.

4.6 CALIBRATION OF MEASURING EQUIPMENT

All production and inspection or testing equipment that involves a quality related measurement shall be subject to scheduled recalibration. The only exception to this will be items such as engineer's scales or levels that are appropriately in use. This type of instrument is of sufficient accuracy if used properly and only for the correct function.

SB178820

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

Equipment that is subject to recalibration shall be uniquely identifiable either by manufacturers serial number or a Quality Control number assigned by Canonie. Numbers assigned by Canonie shall be non-repetative and not reused if an instrument is permanently removed from service. To indicate identification, a permanent sticker shall be affixed to the instrument which gives the Quality Control number. If the manufacturer's serial number is readily apparent this may be used in lieu of the sticker. For the identification of calibration dates, a sticker shall be attached to the instrument which provides two dates - last date calibrated and date due recalibration.

For each instrument that requires recalibration, a file shall be maintained. The cover sheet for the file shall be a general log sheet suitable for use on all instruments which will indicate: the equipment number and name, calibration frequency, dates of recalibration and individual performing recalibration. Behind the log sheet for each piece of equipment will be a calibration record prepared for that type of equipment which shall include: the number and name of the equipment, the acceptable calibration tolerances, a record of the data collected as part of the calibration, and a statement that the equipment passes or fails the recalibration followed by the date and the signature of the person performing the recalibration. For equipment that is purchased, calibration and the subsequent files must be completed prior to use. For initial calibration, manufacturers calibration or statement of calibration may be accepted provided the work is traceable to the National Bureau of Standards or as appropriate for the equipment.

SB17981

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

The required frequencies for recalibration shall be determined based upon the criticality of the instrument in measuring, its sensitivity and the probability of the instrument drifting from calibration tolerances. Tolerances for recalibration will be established based on codes applicable for the specific project, or accepted standards such as ASTM. If codes or standards do not exist, the tolerances will be established by Canonie based upon the effect of the instrument on the quantity it is measuring. Frequencies for recalibration shall be at a minimum of three months and a maximum of biannually.

Recalibration shall be performed using standards and equipment that is traceable to the U. S. National Bureau of Standards. Such equipment, such as weights to recalibrate balances, shall be used only for recalibration and not used in service. This equipment shall be recalibrated every three years with identification and records maintained for it as for service equipment. In general, this equipment shall be accurate to within one-quarter of the tolerance level it is measuring to determine adequacy of service equipment.

As an alternative to recalibration within the Canonie organization, equipment may be recalibrated by external agencies who have the equipment which can perform the work. If performed by an external agency, it shall be required to have standards and equipment traceable to the National Bureau of Standards or other agency as approved by Canonie. Records of recalibration shall be required and included in the equipment files.

SB178822

[redacted]

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

Equipment that fails either recalibration or becomes inoperable during use shall be isolated to prevent possible continued use and clearly tagged "Equipment Failure - Do Not Use." This equipment must be repaired and satisfactorily recalibrated prior to reuse.

Records of the failure and repair shall be included in the equipment file. If repair is not feasible to within the specified tolerance limits the equipment shall be destroyed.

For equipment that malfunctions during service between the recalibration dates, it is the responsibility of all persons using the equipment to notify the Quality Control Engineer that the equipment is either inoperable or suspect. It will then be tagged as stated above and recalibrated immediately.

4.7 CONTROL OF PURCHASED MATERIALS AND EQUIPMENT

The purchase of materials or equipment shall be controlled prior to purchase as stated in Section 3.3.2 for subcontractor's services if appropriate. If the material or equipment is a quality related item it shall be subject to a prequalification audit of the supplier, procurement document control to assure insertion of proper specifications and codes, and ongoing surveillance.

Upon receipt of purchased materials and equipment by Canonie that is quality related, it shall be inspected for conformance to the pertinent specification, code or drawing by a member of the Quality Control Staff. This inspection shall be documented, dated and signed with

SB178823

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

the results of the inspection including the governing document clearly stated. The documentation shall be maintained as a Quality Control document.

The material and equipment that has been approved by inspection and that will be stored prior to use shall be handled in such a way to prevent damage and stored in accordance with the requirements of the materials or equipment. Storage facilities shall be either isolated or restricted from general site activity to prevent damage. Storage requirements shall be determined by the necessity of preventing environmental or man-made deterioration. For example, if the condition of the materials or equipment will be affected by rain it must be sheltered. Or if the item is susceptible to freezing, it shall be stored in a heated structure.

Purchased materials and equipment that do not pass inspection shall be isolated to prevent inadvertant use. If possible such items sball be immediately returned to their source and as a minimum the supplier shall be notified immediately of the failure. Isolation of failed equipment or materials shall be in an area which is restricted soley for this purpose. The area will be posted with signs stating "Failed Inspection - Do Not Use" to prevent accidental use.

4.8 SPECIAL PROCESS WORK

All special process work whether for production or inspection (welding versus welding inspection) shall be performed to applicable

SB178824

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

codes or standards for that work. For example, the qualification of welders, inspectors and inspection techniques shall be in accordance with the American Welding Society Code. Records as required in such codes shall be prepared and maintained as Quality Control documents.

4.9 QUALITY CONTROL DOCUMENTS

All project documents which are quality related shall be maintained as Quality Control documents by Canonie. Storage and maintenance of such documents shall be continuous during the on site work and shall be in a fire-proof and water resistant container to provide protection for them. Maintenance of the Quality Control documents shall be by the Quality Control Engineer. Also the Quality Control Engineer or member of the Quality Control Staff shall be responsible for controlling the usage and distribution of these documents.

The document file shall contain, as a minimum, separate categories for: drawing and specification logs, drawings and specifications, void specifications and drawings if pertinent, procedural manuals for the conduction of the Quality Control Program, necessary references (such as ASTM standards), equipment calibration records, inspection records, material testing reports, daily activity logs, originals and Project Manager signed copies of the weekly Quality Control reports, and copies of the resumes of personnel involved with quality related work. At the beginning of the file shall be an index listing all files by category and by number if there is more than one file per category. The file index shall be continuously updated as necessary. With the

SB178825

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

file shall be a sign out sheet stating what file has been removed, the date, and to whom it was given. The date of return shall be noted next to the borrow entry.

Access to the Quality Control files shall be limited to the individual responsible for controlling their usage. Thus, if a file is needed, this individual, or the Quality Control Engineer in an emergency if different, must be contacted for access. The files shall be kept locked except when in use and only the Quality Control Engineer and controlling individual shall have keys. It is intended that the usage of documents, except in some cases for specifications and drawings be limited to the immediate area of the record storage. If it becomes necessary to remove a document from this area it shall be copied with the original being returned to the file.

In the event of auditing or review by personnel of the client, owner or regulatory agencies, a member of the Canonie Quality Control Staff will be present to assist them. Copies of records that are requested shall be provided.

At the completion of project work by Canonie, it is anticipated that the Quality Control files will be turned over for storage in the plant vault as directed by the client or owner. With the submission of these records, Canonie will present a receipt itemizing the files. It is the request of Canonie that this receipt be signed and dated by the individual receiving them to show proper transfer of the records.

SB178826

Canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

4.10 QUALITY CONTROL WORK PERFORMED BY OTHERS

In the event that Quality Control inspection is performed directly by agents or representatives of the client or owner and not by Canonie or an agency contracted by Canonie, full cooperation will be granted by Canonie personnel to these personnel. This will include providing access when required, accompanying personnel if needed and notification of such personnel when a hold point has been reached if such personnel are not present at that time.

SB178827

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

5.0 EXAMPLES OF QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTS AND PROCEDURES

Attached as appendices to this manual are examples of Quality Assurance/Quality Control Documents and Procedures. These are provided to serve as guidelines for Canonie personnel who will be preparing such documents and to provide clients and owners with examples of these documents for review.

Briefly, the appendices contain:

APPENDIX A - An example of a checklist used for internal Quality Assurance audits. The particular portion presented deals with on site document control.

APPENDIX B - An example of the checklist used for the prequalification audit of a subcontractor. The checklist presented is based on the eighteen points of 10CFR50 Appendix B and is used to evaluate a subcontractor's Quality Assurance Program.

APPENDIX C - An example of a Quality Control procedure. This particular procedure and the attached data forms would be applicable for the control of structural fill.

APPENDIX D - An example of the written procedure for the calibration of equipment used on site for inspection measurements. The example provided is for equipment used in the control of structural fill.

APPENDIX E - Example of a deviation form used by the Quality Control Staff to record deviations, or deficiencies from the Project Documents.

It is noted that these appendices are presented only as examples.

SB178828

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

APPENDIX A

EXAMPLE OF INTERNAL AUDIT CHECKLIST

SB178829

CANONIE CONSTRUCTION COMPANY - QUALITY ASSURANCE PAGE ____ OF ____

AUDIT TITLE _____ PROJECT _____ DATE _____

QUALITY ASSRUANCE ENGINEER _____

AUDIT PARTICIPANTS _____

DOCUMENT CONTROL

1. Who is responsible for maintainance of the Quality Control records.

2. Are all records stored in an environmentally acceptable container.

3. Does the record index list all files.

4. Are the following items present and up to date.

   a. Specification and draving logs
   b. Manuals
   c. Necessary reference material
   d. Daily activity logs.
   e. Inspection records
   f. Testing records
   g. Deviation forms
   h. Weekly Quality Control reports.
   i. Void documents
   j. Resumes

5. Is the sign out record present

6. If any files are not present are they properly signed out and readily retrieved.

REMARKS/COMMENTS

SB17S830

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

APPENDIX B

EXAMPLE OF SUBCONTRACTOR PREQUALIFICATION AUDIT CHECKLIST

SB178831

CANONIE CONSTRUCTION COMPANY

SUBCONTRACTOR QUALITY ASSURANCE PROGRAM PREQUALIFICATION AUDIT CHECKLIST

SUBCONTRACTOR _____ DATE _____

SUBCONTRACTOR ACTIVITY FOR WHICH AUDIT WAS INITIATED _____

_____

CANONIE REPRESENTATIVE _____

SUBCONTRACTOR PERSONNEL CONTACTED AND THEIR POSITION _____

_____

INSTRUCTIONS: All questions are to be completed. Answers shall indicate acceptance or deficiency. If the question does not apply it may be marked NA. If additional sheets are required for answers they shall be attached to the checklist and referenced to the question.

SR178832

QUESTION	RESPONSE
I. Organization	
1. Is the Quality Assurance program maintained internally or by an external organization? If external, indicate the organization.	
2. Do Quality Assurance personnel have an organizational independence to perform their function?	
3. Are these functions properly defined?	
4. How is independence shown? Organization Chart?	
5. To whom do Quality Assurance personnel report?	
6. Is this individual independent of project functions?	
7. Do the Quality Assurance personnel have the authority to stop work?	
II. Quality Assurance Program	
1. Is the program documented in a Quality Assurance Manual?	
2. Are procedures for Quality Assurance/Quality Control documented?	

QUESTION	RESPONSE
3. Is provision made for the verification of Quality by test or inspection?	
4. How is the Quality Assurance Manual revised?	
5. How is the Manual controlled?	
6. How are copy holders notified of revision of the Manual?	
7. How is Management acceptance of the Quality Assurance Program indicated?	
III. Design Control	
1. How is it assured that the correct regulatory requirements are translated into specifications, drawings, procedures and caluclations?	
2. Who establishes design bases?	
3. How are design documents, including calculations and drawings, reviewed?	
4. Is this review independent of the originator?	

QUESTION	RESPONSE
5. How are design changes affected?	
6. Do they receive the same review as original work?	
IV. Procurement Document Control	
1. Are procurements documents reviewed by Quality Assurance personnel prior to issuance?	
2. What individual is responsible for the inclusion of the appropriate Quality Assurance requirements in the procurement document?	
V. Instructions, Procedures and Drawings	
1. Are all work activities which are quality related covered by instructions, procedures or drawings?	
2. Are acceptance criteria stated in these documents where appropriate?	
VI. Document Control	
1. Are provisions made in the Manual for the issuance of all quality related documents?	

QUESTION	RESPONSE
2. Are all quality related documents reviewed prior to issuance?	
3. How is the review accomplished?	
4. How are obsolete documents purged from use?	
VII. Control of Purchased Material, Equipment, and Services	
1. Are sources evaluated for ability to supply as required by specifications, codes, etc.?	
2. Upon receipt at the plant site are the items inspected for applicable manufacturers inspection records and conformance to the contract documents?	
3. How are these records maintained?	
VIII. Identification and Control of Materials, Parts, and Components	
1. How are materials, parts and components identified?	
2. Does this identification system provide unique traceability?	

QUESTION	RESPONSE
3. How are items controlled to prevent inadvertent use?	
IX. Control of Special Processes	
1. Are special processes controlled by written and approved procedures?	
2. Do these procedures cite applicable codes, standards, etc. as appropriate?	
3. Are provisions made to perform such work with qualified personnel and equipment?	
4. How is this qualification shown?	
X. Inspection	
1. Are provisions made for inspection of quality related items to assure compliance?	
2. Is the inspection work independent of the personnel performing the original work?	
3. How are the qualifications of inspectors shown?	
4. Are inspections conducted as a scheduled event?	

QUESTION	RESPONSE
5. Are hold points stipulated where applicable?	
XI. Test Control	
1. Are test procedures documented?	
2. Do test procedures allow for proof tests prior to installation, preoperational tests, and operational test as required?	
3. Are applicable codes, standards, etc. stated in the test procedures?	
4. Are test personnel qualified to perform the testing?	
5. Are tests properly documented and evaluated?	
XII. Control of Measuring and Test Equipment	
1. Are all instuments used in testing calibrated?	
2. Is calibration performed to written procedures which include acceptance criteria?	
3. How is equipment tagged and identified to show when calibration must be performed?	
4. Are calibration records maintained?	

QUESTION	RESPONSE
XIII Handling, Storage and Shipping	
1. Are storage facilities required to provide adequate protection for items?	
2. If special environmental conditions are required, are these stipulated in written procedures?	
3. Is shipping required to provide adequate protection?	
4. Is a system established for the proper marking of items during handling, storage and shipping?	
XIV. Inspection, Test and Operating Status	
1. Are procedures available to provide means for identifying inspection, test or operating status?	
2. What personnel are authorized to determine and identify status?	
XV. Nonconforming Materials, Parts, or Components	
1. Are procedures available to properly tag and isolate from use nonconforming items?	
2. How is the disposition of nonconforming items determined?	

QUESTION	RESPONSE
XIII Handling, Storage and Shipping	
1. Are storage facilities required to provide adequate protection for items?	
2. If special environmental conditions are required, are these stipulated in written procedures?	
3. Is shipping required to provide adequate protection?	
4. Is a system established for the proper marking of items during handling, storage and shipping?	
XIV. Inspection, Test and Operating Status	
1. Are procedures available to provide means for identifying inspection, test or operating status?	
2. What personnel are authorized to determine and identify status?	
XV. Nonconforming Materials, Parts, or Components	
1. Are procedures available to properly tag and isolate from use nonconforming items?	
2. How is the disposition of nonconforming items determined?	

QUESTION	RESPONSE
3. If items are repaired, are they reinspected?	
4. If items are totally rejected how are they disposed of?	
XVI Corrective Action	
1. Are procedures available to identify items which require correction?	
2. Is a procedure available that allows for the appropriate review of corrective action items to prevent reoccurrence?	
3. Are corrective action items reported to management?	
4. Who is this individual?	
XVII. Quality Assurance Records	
1. Are provisions made for the retention of the following records?	
a. Operating logs	
b. Results of Reviews	
c. Inspections	

QUESTION	RESPONSE
d. Tests	
e. Audits	
f. Maintaining of work performance	
g. Material analysis	
h. Personnel qualifications	
i. Procedures, drawings, etc.	
2. Do the record forms contain all pertinent information?	
3. Are the records properly protected and controlled?	
4. Are provisions made for record retention?	
XVIII. Audits	
1. Are audits conducted by the subcontractor or an external agency?	
2. If an external agency, provide information.	
3. Are personnel performing the audits properly qualified?	
4. Are audits scheduled?	
5. Are written procedures available for the performance of an audit?	

QUESTION	RESPONSE
6. Are audits conducted using checklists?	
7. Are audit results reported to management?	
8. Who is this individual?	
9. Are provisions made for corrective action and reauditing if necessary?	

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

APPENDIX C

EXAMPLE OF A QUALITY CONTROL PROCEDURE

SB178843

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

QUALITY CONTROL PROGRAM FOR STRUCTURAL FILL (SOILS)

1.0 Quality Control Staff and Responsibilities

The Earthwork Inspection Team is responsible for the complete Quality Control and documentation of all earthwork. The Inspection Team shall consist of experienced personnel properly qualified in the field of soil mechanics and earthwork construction.

Materials testing will be performed by Quality Control personnel designated by the Quality Control Engineer. A field laboratory including equipment necessary for performance of all tests subsequently described in this section, will be established at the site where all laboratory tests will be conducted. In addition, a field office will be established at the site where report preparation and documentation will be performed.

2.0 General Inspection Requirements

Should excavation be required as part of the plant construction, the excavated soil will be selectively stockpiled for later use as structural fill or spoiled, under the direction of the field inspectors. Soils stockpiled for later use as structural fill will be visually examined and classified as to suitability for use as structural fill.

During placement and compaction of the soil, the soil type, gradation, water content, compaction procedure, compaction equipment, and the layer thickness will be continually monitored. All backfilling and compaction operations will be performed under the strict inspection of the field earthwork inspectors in order to assure that the minimum required in-place densities are achieved.

3.0 Quality of Material

The material to be used as structural fill shall be approved prior to its use by the earthwork inspector. The soil shall be clean of all trash, organic matter and debris and shall contain no more minus No. 200 sieve material than stipulated in the Project Specifications. The water content of the soil used shall be within a range which will result in the required in-place density being achieved when compaction procedures are used in accordance with the Project Specifications. (Use Form QC-18a,18b)

SB178844

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

4.0 Density Requirements

1. The required minimum relative densities and/or Modified Proctor densities shall be established by the requirements shown on the Construction Drawings and called out in the Project Specifications.

2. A relative density control criteria will be used for field control of soils possessing less than 12 percent minus No. 200 sieve material where relative density is defined as follows:

$$D_d = \frac{e_{max} - e}{e_{max} - e_{min}} \times 100 = \frac{\gamma_{max}(\gamma - \gamma_{min})}{\gamma(\gamma_{max} - \gamma_{min})} \times 100$$

Where: D_d = relative density in percent

e_{max} = void ration of the granular soil in its loosest state (minimum dry density = γ_{min})

e_{min} = void ration of granular soil in its densest state (maximum dry density = γ_{max})

e = void ratio of the soil in its natural state (natural dry density = γ)

3. The relative density is a measure of the soil density with respect to a minimum and maximum density as obtained in standardized tests. The minimum density will be measured by the method described in ASTM Designation D2049. The maximum density will be established either by (1) compacting the soil in molds of a known volume such as a Modified Proctor Mold or Standard Proctor Mold with the use of a compaction rammer in such a manner that the highest maximum density achievable is obtained without causing breakdown of the soil particles, or by (2) the method described in ASTM Designation D2049*, whichever yields the highest maximum density. (Use QC-19,20)

4. A Modified Proctor compaction criterion will be used for field control of the backfill operations for soils containing more than 12 percent fines. The Modified Proctor compaction testing and control work will be performed as described in ASTM Designation D1557 Method A. (Use QC-21)

5. Any testing methods stipulated in the Project Specifications shall supercede the above.

---

* All ASTM Designations shall refer to latest issue.

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

5.0 Materials Testing Requirements

5.1 In Situ Dry Unit Weight

The in situ dry unit weight of the structural fill will be determined by the following methods:

a. Water balloon

b. Sand cone

c. Nuclear density gauge

The Washington Densometer will be used as stated in ASTM Designation D2167 (QC-22a).

The apparatus and procedure used in the sand cone method will conform to ASTM Designation D1556 (QC-22b).

The apparatus and procedure for a nuclear density gauge will conform to ASTM Designation D2922.

5.2 Plate Load Test

Plate Load Tests may be used at the discretion of the Earthwork Inspector to supplement data obtained from the direct dry density measurements. The Plate Load Test will be performed in accordance with ASTM Designation D1196.

5.3 Standard Penetration Test

The Standard Penetration Test may be used at the discretion of the Earthwork Inspector to supplement relative density data from the direct dry density measurements. The tests will be performed in accordance with ASTM Designation D1586.

5.4 Grain-Size Analysis

Grain-Size determination for the structural fill will be made by sieving and/or hydrometer analyses. Sieving will establish the grain-size distribution for the greater than No. 200 sieve size friction; a hydrometer analysis will be required for the fraction passing the No. 200 sieve. (Use QC-18a, 18b)

5.5 Water Content Determination

Water content determination will be made by oven drying soil at

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

approximately 110 degrees centigrade in accordance with ASTM Designation D2216. However, for rapid moisture determination, drying by alcohol burning techniques may be used at the discretion of the Earthwork Inspector. (Use QC-2)

6.0 Frequency of Soil Tests

6.1 Maximum and Minimum Density Tests

Maximum and minimum density tests will be conducted with every in situ density test unless the backfill materials are uniform. A soil sample will be taken during the density testing and used in the laboratory for maximum-minimum density testing.

6.2 Modified Proctor Tests

Modified Proctor Tests will be conducted with every in situ dry density test and as often as necessary to assure that the water content of the cohesive soil is not affecting the degree of compaction.

6.3 In Situ Dry Density

During the initial stages of the construction, the structural fill dry density determinations will be made for every 1,000 cubic yards of fill. After the contractor and the earthwork inspector have acquired familiarity with the soil and the procedures, less frequent testing will be necessary. However, the maximum amount of fill to be placed without a dry density determination will be 5,000 cubic yards. At least one in situ dry density test will be made each day backfill is placed.

6.4 Grain-Size Analysis

Grain-size analyses will be be conducted with every in situ dry density test and/or with every change in material. One grain-size analysis will be conducted for every 5,000 cubic yards of fill placed or each day backfill is placed.

6.5 Water Content Determinations

Water contents will be determined for every dry density test, and as required in the field to maintain proper control.

SB178847

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

7.0 Compaction Equipment Requirements

All compaction equipment shall be thoroughly checked daily to assure that it is operating properly. Vibratory compaction rollers should have a roller drum vibration frequency of at least 26 cycles per second and vibratory hand compactors should possess a plate vibration frequency of at least 35 cycles per second. In order to assure that adequate in-place densities are achieved with the compaction equipment chosen for use by the Contractor, a test fill area shall be set aside to evaluate the effectiveness of the equipment when it is used to compact the on site soils in accordance with procedures outlined in the project specifications. Should this testing indicate that a compaction procedure differing from that called for in the Project Specifications should be used to effectively densify the fill material, the client shall be immediately notified.

8.0 Quality Control Documentation for Structural Fill

1. Inspection and testing records will be kept on a daily basis in the form of daily reports, sketches and photographs where required. These reports will be submitted to the Quality Control Engineer or his agent immediately as they are completed. At the completion of the structural fill, a final report will be submitted which will contain a complete history of the backfill construction including complete descriptions of testing methods and test results.

2. Calibration records will be continuously maintained for all field and laboratory equipment used for soils testing. All equipment shall be recalibrated according to the schedule of the appropriate calibration procedure.

3. Any deviations in the structural fill requirements as established by the Project Specifications shall be thoroughly documented (Form QC-8) to include a thorough description of the deficiency and the corrective action taken.

SB178848

FORM NO. 18a

Project No. _____
Project Title _____
Boring No. _____
Depth _____

SAMPLE _____

Date _____
Tested By _____
Calc. By _____
Checked By _____

MECHANICAL ANALYSIS

Wt of Total Sample (Wet) = _____ gms
Wt of Total Sample (Dry) = A _____ gms
Wt of Total (+#10) Sample = B _____ gms
Wt of Total (-#10) Sample = C = A-B _____ gms

Wt Hydrometer Sample (Wet) = _____ gms
Wt Hydrometer Sample (Dry) = F _____ gms
Wt (+#200) Hydrom. Sample = G _____ gms
Wt (-#200) Hydrom. Sample = H = F-G _____ gms
J = C/A _____

SIEVE ANALYSIS ON (+#10) MATERIAL

Sieve Size	Wt (+#10) Passing D	Total Wt Passing C + D = E	% of A Passing E/Ax100
1-1/2			
3/4			
3/8			
# 4			
# 10			

SIEVE ANALYSIS ON (-#10) SAMPLE

Sieve Size	Wt (+#200) Passing K	Total Wt Passing H + K = L	% of A Passing (LxJ/F)x100
#10			
#20			
#40			
#60			
#140			
#200			

Water Content	Total Sample	Hydrometer Sample
Tare No.		
Wt Tare + WS		
Wt Tare + DS		
Wt Tare		
Wt DS		
Wt Water		
WC		

TEMPERATURE CORRECTIONS

Temp.	18	19	20	21	22	23	24	25	26	27
Corr.	-0.1	-0.1	0	+0.2	+0.3	+0.5	+0.6	+0.7	+0.9	+1

HYDROMETER ANALYSIS ON (-#10) MATERIAL

Q = (100/F) (SG/SG-1) = _____ P = Hydrom. Corr.+Temp. Corr.= _____

Elapsed Time (min)	Hyd. Read. x 1000 R	Temp. °C	Corrected Hyd. Read. R + P = R_h	Grain Diam. D	% Smaller Than D J x Q x R
0					
¼				.036	
½				.026	
1				.018	
4				.009	
15				.005	
60				.002	
180				.001	
1440				.0005	

Dispersing Agent - _____

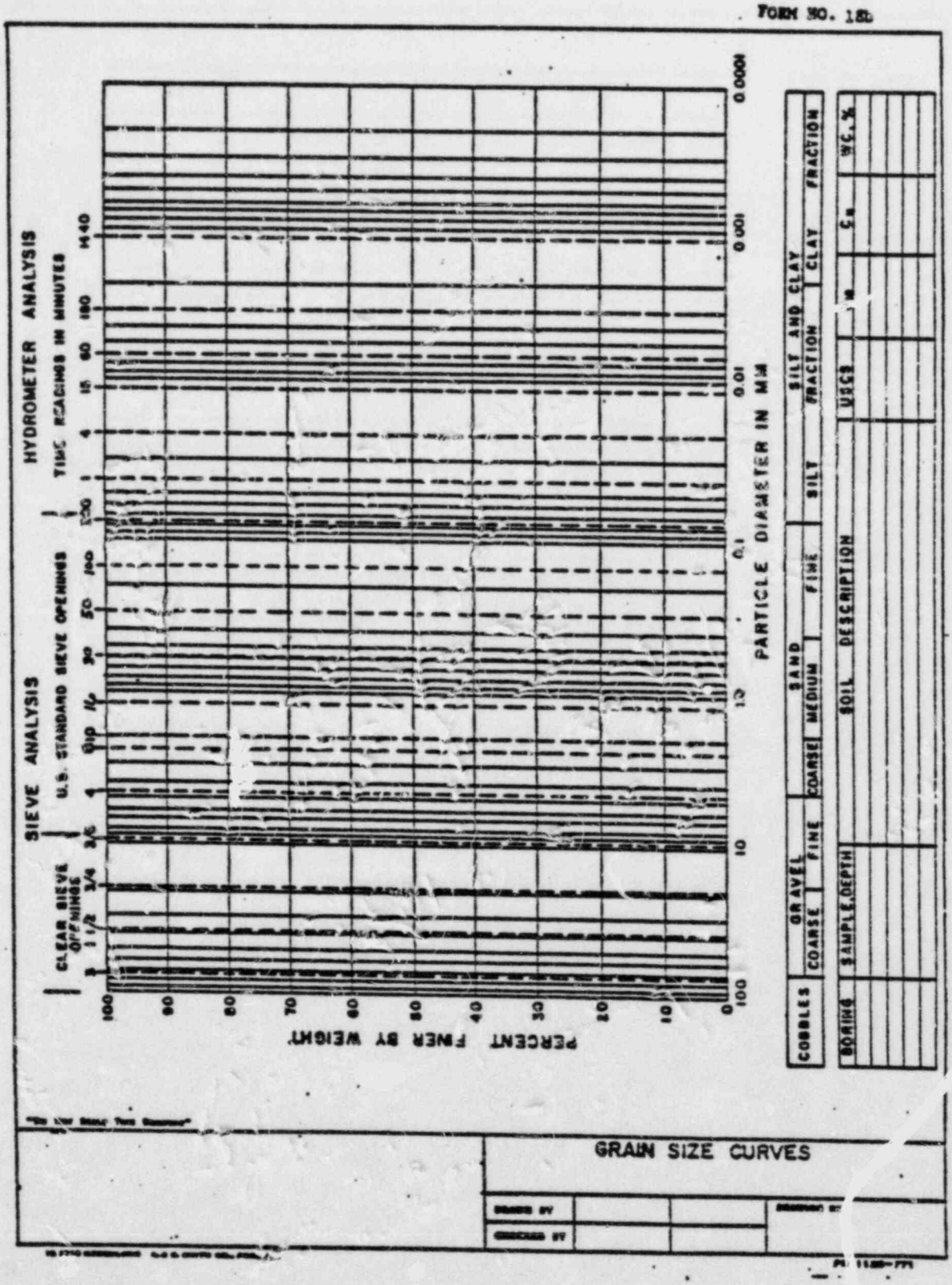
Dish No._____ Hydrometer No._____ Graduate No._____

SD1:8849

CANONIE CONSTRUCTION COMPANY / P.O. BOX 508 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

FORM NO. 18b



canonie CONSTRUCTION COMPANY / P.O. BOX 508 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

MAXIMUM-MINIMUM DENSITY TEST

PROJECT _____ NO. _____ TESTED BY _____ _____
SAMPLE NO. _____ CALC. BY _____ _____
DEPTH _____ CHECKED BY _____ _____
SOIL DESCRIPTION _____

MINIMUM DENSITY

WT MOLD + OS	(LBS)					
WT MOLD	(LBS)					
WT OS	(LBS)					
VOLUME MOLD	(CF)					
γ_{MIN}	(PCF)					

MAXIMUM DENSITY

**	WT MOLD + WS					
**	WT MOLD					
**	WT WS					
	VOL MOLD (CF)					
(PCF)	γ (WET DENSITY)					
	TARE NO.					
*	WT TARE + WS					
*	WT TARE + OS					
*	WT TARE					
*	WT OS					
*	WT WATER					
	WC (%)					
	AVERAGE WC(%)					
(PCF)	$\gamma_D = \gamma/(1+WC)$					

**LBS.
*GMS.

Remarks: _____

$\gamma_{D_{MIN}}$ = _____ PCF

$\gamma_{D_{MAX}}$ = _____ PCF

SB178851

FORM QA-19

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

RELATIVE DENSITY TESTS

DATE _____

PROJECT _____ TESTED BY _____ _____

BORING NO. _____ CALC. BY _____ _____

DEPTH _____ CHECKED BY _____ _____

SOIL DESCRIPTION _____

SG = ASSUMED _____
ACTUAL _____

NATURAL DENSITY

LENGTH RECOVERY in/cm					
DIAMETER TUBE					
AREA TUBE cm²					
VOLUME TUBE cm³					
WT TUBE + WS gm					
WT TUBE gm					
WT WS gm					

WT TARE + WS gm					
WT TARE + DS gm					
WT WATER gm					
WT TARE gm					
WT DS gm					
WC %					

γ gm/cm³/PCF					
γ_d gm/cm³/PCF					
NATURAL VOID RATIO $= \frac{SG}{\gamma} - 1$					

MINIMUM DENSITY

METHOD					
WT MOLD + DS					
WT MOLD					
WT DS					
VOLUME MOLD					
γ_L					
MAXIMUM VOID RATIO $= \frac{SG}{\gamma_L} - 1$					

MAXIMUM DENSITY

METHOD					
WT MOLD + DS					
WT MOLD					
WT DS					
VOLUME MOLD					
γ_M					
MINIMUM VOID RATIO $= \frac{SG}{\gamma_M} - 1$					

RELATIVE DENSITY

$D_R = \frac{e_{max} - e}{e_{max} - e_{min}} \times 100\%$					

FORM QA-20

SB178852

canonie CONSTRUCTION COMPANY / P.O. BOX 508 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

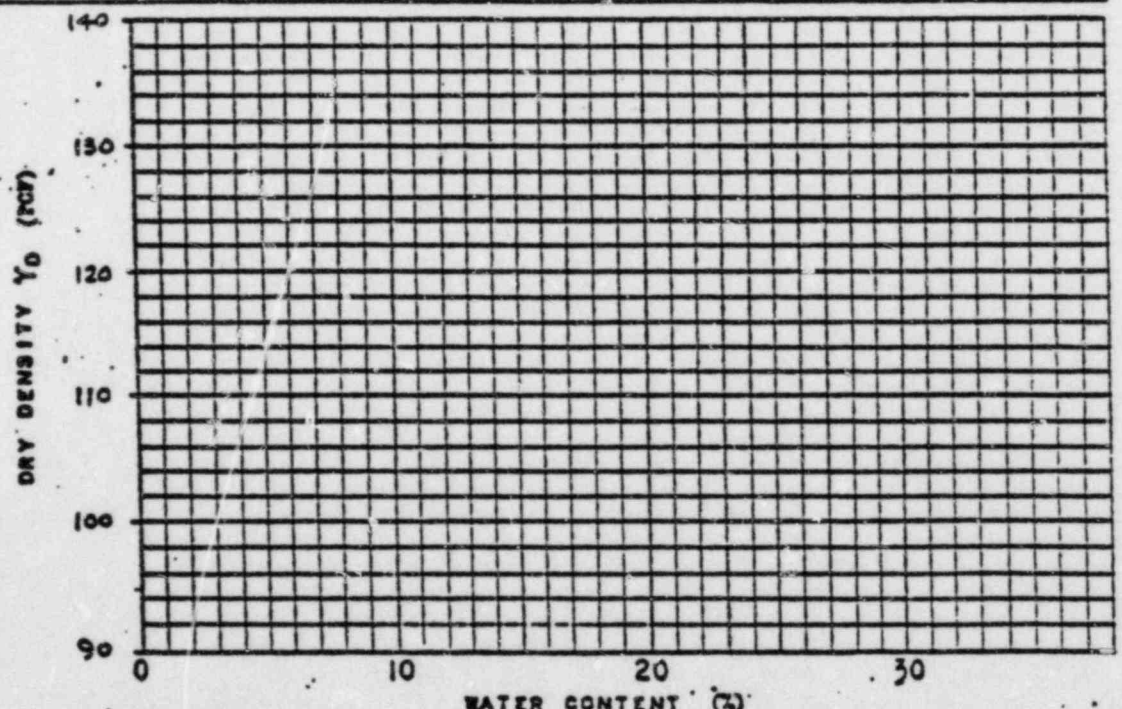
FORM QA-21

MOISTURE - DENSITY RELATIONSHIP

PROJECT _____ NO. _____ TESTED BY _____ _____
SAMPLE NO. _____ CALC. BY _____ _____
DEPTH _____ CHECKED BY _____ _____
SOIL DESCRIPTION _____

**	WT MOLD + WS								
**	WT MOLD								
**	WT WS								
	VOL MOLD (CF)	1/30		1/30		1/30		1/30	
(PCF)	Y (WET DENSITY)								
	TARE NO.								
*	WT TARE + WS								
*	WT TARE + DS								
*	WT TARE								
*	WT DS								
*	WT WATER								
	WC (%)								
	AVERAGE WC(%)								
(PCF)	$Y_D = Y/(1+WC)$								

**LBS.
*GMS.



*BLOWS/LAYER

METHOD	MATERIAL SIZE	MOLD SIZE	BLOWS*
A	ALL PASSING #4	4" DIA.	25
B	ALL PASSING #4	6" DIA.	56
C	ALL PASSING 3/8"	4" DIA.	25
D	ALL PASSING 3/8"	6" DIA.	56

DESIGNATION USED ASTM D1557-70
METHOD USED A

DESIGNATION	HAM/DROP	LAYERS
STANDARD	5.5#/12"	3
MODIFIED	10#/18"	5

SB178853

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

FIELD DENSITY TEST
Washington Dens-O-Meter Method

Sheet _____ of _____

PROJECT _____ TESTED BY _____ DATE _____

PROJECT NO. _____ Calc By _____ Date _____

LOCATION _____ Checked BY _____ DATE _____

Test No.							
North Coord:							
East Coord:							
Sample Elecation:							
DENSITY DETERMINATION							
Can No.							
Dens-O-Meter Final Reading "A"							
Ring Constant "C"							
"A" plus "C"							
Dens-O-Meter Initial Reading "B"							
Vol. of Hole-Cu.ft. (A+C-B)							
Wt. Wet Soil from Hole + Can							
Wt. of Can							
Wt. Wet Soil - lbs.							
Wet Density - lbs./cu.ft.							
Dry Density - lbs./cu.ft.							
* Max. Density/Min. Density - (pcf)							
% Relative Density							
MOISTURE DETERMINATION							
Tare No.							
Wt. of Damp Soil + Tare							
Wt. of Dry Soil + Tare							
Wt. of Moisture							
Wt. of Tare							
Wt. of Dry Soil							
% of Moisture							
Average % Moisture							

$$\text{Wet Density} = \frac{\text{Wt. of Wet Soil}}{\text{Vol. of Hole}}$$

$$\text{Dry Density} = \frac{\text{Wet Density}}{1 + \frac{\% \text{ Moisture}}{100}}$$

$$\% \text{ Moisture} = \frac{\text{Wt. of Moisture} \times 100}{\text{Wt. of Dry Soil}}$$

$$\frac{\text{Max. Density}}{\text{Field Density}} \frac{(\text{Field Density} - \text{Min. Density})}{(\text{Max. Density} - \text{Min. Density})} \times (100)$$

Remarks:

SB178854

* See results of maximum/minimum density testing for this same material.

FORM 22a

CANONIE CONSTRUCTION COMPANY / P.O. BOX 508 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

FIELD DENSITY TEST
Washington Dens-O-Meter Method

Sheet ____ of ____

Project _____ Tested By _____ Date _____

Project No. _____ Calc. By _____ Date _____

Location _____ Checked By _____ Date _____

Test No.						
North Coord:						
East Coord:						
Sample elevation:						
DENSITY DETERMINATION						
Can No.						
Dens-O-Meter Initial Reading "A"						
Ring Constant "C"						
"A" plus "C"						
Dens-O-Meter Initial Reading "B"						
Vol. of Hole-Cu. Ft. (A+C-B)						
Wt. Wet Soil from Hole + Can						
Wt. of Can						
Wt. Wet Soil - lbs.						
Wet Density - lbs./cu.ft.						
Dry Density - lbs./cu/ft.						
* Max. Density - lbs./cu.ft.						
% of Max. Density - lbs./cu.ft.						
MOISTURE DETERMINATION						
Tare No.						
Wt. of Damp Soil + Tare						
Wt. of Dry Soil + Tare						
Wt. of Moisture						
Wt. of Tare						
Wt. of Dry Soil						
% of Moisture						
Average % Moisture						

Remarks:

$$\text{Wet Density} = \frac{\text{Wt. of Wet Soil}}{\text{Vol. of Hole}}$$

$$\text{Dry Density} = \frac{\text{Wet Density}}{\frac{\% \text{ Moisture}}{100}}$$

$$\% \text{ Max. Density} = \frac{\text{Dry Density} \times 100}{\text{Max Density}}$$

$$\% \text{ Moisture} = \frac{\text{Wt. of Moisture} \times 100}{\text{Wt. of Dry Soil}}$$

1 Gram = 0.0022 lbs.

1 lb. = 453.6 grams

*Maximum Density is determined from Modified Proctor Compaction Testing.

SB178855

FORM 22b

CANNON CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

WATER CONTENT DETERMINATIONS

PROJECT NO. _____ TESTED BY _____ _____

PROJECT _____ CALC. BY _____ _____

CHECKED BY _____ _____

TARE NO.								
WT. T + WS								
WT. T + DS								
WT. TARE								
WT. DS								
WT. WATER								
WC (%)								
DEPTH SAMPLE NO.								
COMMENT								

TARE NO.								
WT. T + WS								
WT. T + DS								
WT. TARE								
WT. DS								
WT. WATER								
WC (%)								
DEPTH SAMPLE NO.								
COMMENT								

FORM NO. QC-2

SB178856

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

APPENDIX D

EXAMPLE OF CALIBRATION PROCEDURE

SB178857

canonie CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

Calibration of Washington Densometer

A Washington densometer shall be calibrated for use in determining the in-place density of soils. Specifics regarding the test may be found in ASTM Designation D2167.

Initial calibration may be performed by the manufacturer. Subsequent recalibration by Canonie shall be every six months to assure proper operation and accuracy. The volume of each of the three densometer rings and the accuracy of the piston rod scale shall be checked as subsequently discussed.

If direct measurement of the rings is employed to determine their volume, the rings shall be calibrated using a caliper which has been calibrated. Four diameters, 45 degrees apart, shall be measured and averaged, and the depth of the ring shall be measured at four points 90 degrees apart and averaged.

As an alternate method, the rings may be calibrated by precise water methods. With a rubber surface as a base and a lightly greased glass plate as a cover, fill one of the small rings with water of known weight and temperature until the water contacts the cover over the entire area of the ring. A calibrated balance and thermometer must be used. Knowing the temperature and weight of the water, calculate the volume of the ring. Repeat this procedure for each ring until three volumes are secured having a maximum range of variation of 0.0005 ft.^{3}*

---

*ASTM requirement is 0.0001 ft.^{3}; however, this tolerance is more stringent than required. Therefore, Canonie has changed the acceptable tolerance.

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

Note that the first volume calculated is not the true volume of the ring as it includes the added volume of the lap joint used to nest the rings. The true volume of the other two rings can now be determined with the above procedure using the ring discussed above as a base. To determine the true volume of the first ring, use one of the rings with a known volume as a base and follow the same procedure.

If the ring volumes agree within ± 0.0002 ft^3 of the rated volume of 0.0500 ft^3 and 0.1000 ft^3. respectively, the rated volume may be used as the ring constant. Otherwise,the ring shall be marked with its true volume.

The scale on the piston rod shall be checked by comparing it to the rings of known volume. (Calibrated Proctor molds may also be used.) The procedure is as follows:

> Clamp the filled densometer on the assembly rings and template seated on a flat smooth surface. Fill the balloon within the rings and read the rod scale. Remove one of the rings and repeat the procedure. The difference in the two readings should equal the known volume of the removed ring.

If the difference between the two readings on the rod do not equal the known volume of the ring (± 0.0002 ft^3) after two trials, refer to "Suggested Method of Test for Density of Soil in Place Using the Washington Densometer," which is found in ASTM STP479 and correct the scale on the rod.

Attached are the calibration record forms to be completed for each Washington densometer.

SB178859

canonie CONSTRUCTION COMPANY

WASHINGTON DENSOMETER CALIBRATION

EQUIPMENT NUMBER _____

EQUIPMENT NAME _____

DATE _____ DATE OF LAST CALIBRATION _____

CALIBRATION PERIOD _____

I. VOLUME OF THE RINGS (DIRECT MEASUREMENT)
ALL MEASUREMENTS TO BE TAKEN IN INCHES

RING NUMBER _____ RATED VOLUME _____ ft^3

D_1=	H_1=	$Vol. = \frac{\pi D^2_{AVE}}{6912} H_{avg}$
D_2=	H_2=	
D_3=	H_3	
D_4=	H_4	$Vol. =$ _____ ft^3
$D_{Avg.}$ =	$H_{Avg.}$ =	

RING NUMBER _____ RATED VOLUME _____ ft^3

D_1=	H_1=	$Vol. = \frac{\pi D^2_{Avg.}}{6912} H_{avg}$
D_2=	H_2=	
D_3=	H_3	
D_4=	H_4	$Vol. =$ _____ ft^3
$D_{Avg.}$	$H_{Avg.}$	

RING NUMBER _____ RATED VOLUME _____ ft^3

D_1=	H_1=	$Vol. = \frac{\pi D^2_{AVE} H_{avg}}{6912}$
D_2=	H_2=	
D_3=	H_3=	
D_4=	H_4=	$Vol. =$ _____ ft^3
D_{Avg}=	H_{Avg}=	

FOR ACCEPTANCE, VOL = rated volume ± 0.0002 ft^3

II. SCALE OF THE PISTON ROD

KNOWN VOLUME OF RING TO BE REMOVED (ft^3)		A	
READING OF ROD WITH RINGS IN PLACE (ft^3)		B	
READING AFTER REMOVAL OF RING	(ft^3)	C	
CALCULATED VOLUME OF RING	(ft^3)	D	
DIFFERENCE BETWEEN TWO VOLUMES	(ft^3) E=A-D	E	

FOR ACCEPTANCE, E < 0.0002 ft^3

SB178860

SIGNED _____

WASHINGTON DENSOMETER CALIBRATION

(ALTERNATE METHOD)

canonie CONSTRUCTION COMPANY

EQUIPMENT NUMBER _____

EQUIPMENT NAME _____

DATE _____ DATE OF LAST CALIBRATION _____

CALIBRATION PERIOD _____ CALIBRATED BY _____

I. VOLUME OF THE RINGS (WATER METHOD)

RING NO.	WEIGHT OF CONTAINER		WT. OF WATER TO FILL RING (grams)	TEMP OF WATER IN RING (°C)
	BEFORE FILLING RING (grams)	AFTER FILLING RING (grams)		

CALCULATE THE VOLUME OF EACH RING UNTIL THREE VOLUMES ARE OBTAINED HAVING A MAXIMUM VARIATION OF 0.0005 FT^3

THE FIRST VOLUME CALCULATED IS NOT THE TRUE VOLUME OF THE RING AS IT INCLUDES THE ADDED VOLUME OF THE LAP JOINT USED TO NEST THE RINGS

$$\text{VOLUME OF RING } (ft^3) = \frac{\text{WEIGHT OF WATER IN RING (grams)} \times \text{UNIT VOLUME } (ml/g)}{28317\ (ml/ft^3)}$$

RING NO.	VOLUME(ft^3)

TEMP. (C)	UNIT VOLUME(ml/g)
16.0	1.00103
17.0	1.00120
18.0	1.00138
19.0	1.00157
20.0	1.00177
21.0	1.00198
22.0	1.00220
23.0	1.00245
24.0	1.00269
25.0	1.00294
26.0	1.00320
27.0	1.00347

II. SCALE ON THE PISTON ROD

KNOWN VOLUME OF RING TO BE REMOVED (ft^3)	A	
READING OF ROD WITH RINGS IN PLACE (ft^3)	B	
READING AFTER REMOVAL OF RING (ft^3)	C	
CALCULATED VOLUME OF RING (ft^3)	D	
DIFFERENCE BETWEEN TWO VOLUMES (ft^3) E=A-D	E	

FOR ACCEPTANCE, $E < 0.0002\ ft^3$

SB178861

CANONIE CONSTRUCTION COMPANY / P.O. BOX 509 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

APPENDIX E

EXAMPLE OF DEVIATION FORM

SB178862

Canonie CONSTRUCTION COMPANY / P.O. BOX 508 / U.S. 31 & M-43 / SOUTH HAVEN, MICHIGAN 49090 / (616) 637-1171

E-1

DEVIATION REPORT

TO	DEPT.	SUBJECT		FILE NO.
SYSTEM	COMPONENT IDENTIFICATION	DATE	QUALITY ASSURANCE INSPECTOR	
		DATE	QUALITY ASSURANCE ENGINEER	

DESCRIPTION OF MATERIAL OR WORKMANSHIP FOUND TO BE UNSATISFACTORY AS INDICATED BELOW:

VENDOR	PURCHASE ORDER NO.	SERIAL NO.
DWG. NO.	SPECIFICATION NO.	DESIGNATION

REQUIRED ACTION FOR RESOLUTION OF THE ABOVE:

CORRECTIVE ACTION TAKEN:

SU1'883

FORM NO. QC-8

F7220-C-210-1-6A

canonie CONSTRUCTION CO. SOUTH BEND, INDIANA	NUCLEAR QUALITY ASSURANCE PROGRAM	Section 6.0 Revision 3 Date 4-5-77 Page 6-1
Approved	Addendum to Quality Assurance Manual	

Addendum to: Canonie Construction Co.
Quality Assurance Manual
Dated, August, 1976

Contract: Bechtel Subcontract
No. 7220-C-210

Location: Midland Station Units 1&2
Midland, Michigan

Owner: Consumers Power Company

Title: Supplemental Requirements for the Canonie Construction Co. Quality Control Program for Q Listed Areas

RECEIVED
JAN 31 1978
BECHTEL POWER CORP.
JOB 7220
PER KD

7220-C210-3-S

DEC 29 1977

BECHTEL ASSOC. PROFESSIONAL CORP.	JOB NO. 7220-001

SUPPLIER DOCUMENT STAMP

1. [X] WORK MAY PROCEED.
2. [ ] WORK MAY PROCEED. SUBMIT FINAL DOCUMENT.
3. [ ] REVISE AND RESUBMIT. WORK MAY PROCEED SUBJECT TO INCORPORATION OF CHANGES INDICATED.
4. [ ] REVISE AND RESUBMIT. WORK MAY NOT PROCEED.
5. [ ] REVIEW NOT REQUIRED. WORK MAY PROCEED.

[ ] FOR INFORMATION ONLY

PERMISSION TO PROCEED DOES NOT CONSTITUTE ACCEPTANCE OR APPROVAL OF DESIGN DETAILS, CALCULATIONS, TEST METHODS OR MATERIAL FURNISHED UNLESS EXPRESSLY SO STATED. THIS REVIEW SHALL NOT RELIEVE ANY PARTY OF THE RESPONSIBILITY FOR ERRORS OR OMISSIONS IN THE DRAWINGS, DESIGN CALCULATIONS OR OTHER DOCUMENTS PREPARED BY HIS EMPLOYEES OR CONSULTANTS FROM FULL COMPLIANCE WITH CONTRACTUAL OBLIGATIONS.

REVIEWED	A	C	C	J	M	N	P	Q	
								CD	

By R Beltzer Date 1-4-78

SB178864

F1220-C210-1-6A

canonie	NUCLEAR QUALITY ASSURANCE PROGRAM	Section 6.0
		Revision 3
		Date 4-5-77
		Page 6-2
	Addendum to Quality Assurance Manual	

Item I, changes:

Add to para. 2, section 1.0, Introduction:
The Quality Assurance manual shall be supplemented by Quality Control procedures written to clarify and further implement the Quality Assurance program of Canonie Construction Co. Prior to site implementation, these procedures shall be approved by the Manager of Quality Assurance, Canonie Construction Co. and the Contractor or appropriate owner's representative. All Quality Control procedures shall be controlled in the same manner as the Quality Assurance program and revisions and addenda shall be reviewed and approved in the same manner as originals. These procedures shall indicate the scope of activities covered therein, the personnel designated by said procedures with responsibilities by job title, and shall provide sufficient instructions to clearly indicate what activities are necessary to demonstrate compliance with the accepted Quality Assurance program.

Delete para. 3, section 2.4 as written and insert:
The Quality Control Engineer shall have the authority to stop the continuation of work that is deficient in characteristic, documentation, or procedure which renders the quality of an item unacceptable or indeterminant. This shall include, but not be limited to physical defects, test failures, incorrect or inadequate documentation, or deviation from prescribed processing, inspection or testing procedures.

Delete sentence 1, para. 4, section 3.1 as written, and insert:
Activities which may be routinely performed by Canonie Construction Co. as part of inspection services on a project, such as concrete testing, structural earthwork control or testing of reinforcement steel, shall be conducted to recognized standards or referenced specifications.

Delete sentence 4, para. 2, section 3.2.3 as written and insert:
Revision receipts shall be signed and dated by the assignee, or designated representative, and returned to the Manager of Quality Assurance within 15 days of receipt.

Delete sentence 4, para. 3, section 3.2.3 as written and insert:
A new approval sheet, signed by the President, Canonie Construction Co. and the Manager of Quality Assurance, shall be issued to indicate the current revision number and date of the manual issue in effect. This shall indicate Canonie Construction Co. acceptance of the policies and procedures defined therein.

Delete sentence 2, para. 1, section 3.4.2 as written and insert:
A file of all Quality Assurance/Control records shall be maintained to comply with all owner/constructor contractually specified requirements. These records shall be maintained as required by

this manual and applicable code and regulatory requirements. . .

Delete sentence 2, para. 1, section 4.4 as written and insert:
For all the various activities included in the scope of work for the referenced specification,

Item II, Supplements:

1.0 Organization
The Canonie Construction Co. Quality Control Organizational interface with the Bechtel Power Corp. is shown in figure 1.

1.1 The Project Manager performs overall site supervision to ensure that construction schedules are maintained and that the work is performed in compliance with drawings and specifications. He coordinates work with the site Quality Control Engineer to assure compliance to the accepted quality program.

1.2 The QC Engineer has responsibilities and duties as follows:

1.2.1 He will document the classification of the borrow by the Testing Laboratory to the Project Manager for use by the Field Foreman.

1.2.2 Based on borrow selections he prepares daily reports verifying by station, by zone, the fill placement, the moisture control, and the compaction conformance necessary to meet specs.

1.2.3 In this function, he is completely mobile and will by available for comment from the General Contractor's inspection force. He will be in communication with the Project Manager to correct any deviations in the fill requirements as established by the project specifications.

1.2.4 The Quality Control Engineer has the authority to assure total compliance to the Quality Assurance/Quality Control program by all Canonie Construction Co. personnel.

1.3 The Field Superintendent shall initiate compliance with the borrow/cut programs as outlined by the QC Engineer through the Project Manager. He shall be responsible for reporting field production requirements to the Project Manager.

1.4 The Project Engineer shall work closely with the project manager and QC Engineer to establish survey and

control methods required to assure proper definition of zone fills and lift controls.

2.0 Quality Control Program

2.1 The Quality Control Team or member shall be responsible for quality control and documentation for all Q Listed areas as designated by contractor's and/or owner's specifications. The inspection unit shall assure that the project specifications are strictly enforced. Qualified and experienced personnel shall comprise the inspection force.

2.2 The Quality Control Engineer and/or his representative shall be responsible to the Canonie Construction Co. project QC manager and shall be independent of production, construction, scheduling and procurement.

2.3 The QC Engineer shall develop, in the course of his duties and as required, adequate forms, charts and logs to compile and assimilate required QC information and documentation of Q listed work.

2.4 All QC Records and Documentation shall be stored in a fire resistant filing cabinet. The records shall identify the inspector or data recorder, the activity monitored, date of inspection or test, test results, acceptability and any corrective action required or taken. This information shall be supplemented as required.

2.4.1 The On Site Records shall be filed in an orderly fashion and shall be readily identifiable and retrievable. Upon completion of construction work, records shall be turned over to the owner's operations group or his designated representative.

2.5 The QC Engineer shall assure that the proper zoned materials are delivered to the proper location and the proper compaction control is performed as required by the specifications.

2.6 The QC Engineer shall schedule his work so that all operations, reports, documentation and related items shall be available to the contractor and/or owner and to facilitate the establishment of a functional interface between the appointed testing laboratory, general contractor and field superintendents.

2.7 The QC Representative shall become familiar with the testing laboratory personnel testing methods and individual soil classification characteristics.

2.8 The QC Engineer's level of authority shall be equal to the highest ranking production unit ie. supervisor or superintendent. The QC Engineer does not direct work forces, except through supervisory personnel, and then only in quality related areas to insure compliance with job specifications, procedures, and drawings.

6.0 Document Control

6.1 Index Card File System

6.1.1 Individual Card for Each DWG shall be maintained listing:

DWG Title and Number

Revision Number
Revision Date
Date Received
Number Received
Classification: Preliminary or Approved
Distribution: Stick Number or Name of Person drawing is issued to

6.2 A Drawing Summary List shall be maintained listing:

Stick Number
Drawing Number
Title
Revision and Date
Status: Preliminary or Approved

6.3 Drawing Awareness
New or revised drawing will be routed to assure all personnel concerned are aware of change. A list of document assignees shall be maintained to assure proper distribution.

6.4 Separate storage of Superseded Drawings and Specifications to Maintain Adequate Control shall be provided. All superseded documents shall be voided.

6.5 Document control shall not be confused with documentation control. It is not intended that document control shall be specifically a function of the quality control Engineer. An authorized agent of the QC Department may

perform the document control function. Documentation shall be a function of the QC Engineer and shall show all pertinent information as required by contractor's specifications.

8.0 Identification and Control of Materials, Parts and Components

8.1 The QC Representative, working with the general contractor's representative, shall inform subcontractor's field supervision force of soil classifications in borrow areas as designated by the testing laboratory.

15.0 Non-Conforming Materials, Parts or Components

15.1 Compaction Equipment

15.1.1 The utilization of dissimilar compaction equipment outlined in exhibit D of 7220-C-210 shall be as follows:

15.1.2 The owner's testing laboratory shall be requested to perform tests on controlled test-fills within the embankment as required to determine pass requirements for each individual type compactor.

15.2 Backfill Materials
In the event that non-conforming materials are discovered in borrow areas by the testing laboratory, the contractor shall be notified for disposition. Non-conforming material shall be removed and/or disposed of as required by contractor.

16.0 Corrective Action
When corrective action is required the following outline of activities shall be followed:

16.1 Identification of source of non-conformance.

16.2 Evaluation of causes, conditions, present requirements and potential solutions.

16.3 Implementation of corrective action.

16.4 Contractor and/or testing laboratory analysis of problem is required if caused by external, uncontrollable sources, ie. excessive precipitation causing moisture content of cohesive soils to exceed acceptance criteria and preclude conformance to compaction requirements.

16.5 When internal corrective action is required, it shall be documented for review and concurrence by the QA Manager. If the causes of non-conforming conditions are external and outside the specified jurisdiction of the subcontractor, recommended corrective action shall be requested of the contractor and/or his agent, and shall be concurred with by Canonie site quality control.

16.6 Documentation as required by owner shall be maintained in accordance with document control procedures.

17.0 Quality Control Records shall be compiled and submitted to Bechtel for their review and retention. Copies shall be maintained by Canonie Construction Co. and shall include related data such as qualifications of personnel, procedures, and equipment. Consistent with applicable regulatory requirements, the owner/contractor shall establish requirements concerning record retention and turn-over, such as record detail and type, and systems effected. Canonie Construction Co. Quality Assurance shall be notified in writing of any and all changes in documentation requirements.

17.1 The following forms shall be used to document the implementation of quality program on site.

17.1.1 Lift Thickness Control - Figure 2
By determining elevation before and after placement operations from grade stakes, the QC Engineer shall determine the lift thickness achieved. He will prepare a report from information listing the following data:

- Observation
- Zone
- Work Location
- Size of Area
- Elevation(s): Before
  After
- Lift Thickness
- Date

These random lift thickness checks shall be performed on an average of two areas daily depending on the working area conditions and the materials classification.

17.1.2 Compaction - Figure 3
On a daily basis the QC Engineer shall prepare

a report for each zone and work area listing the following information: date, shift, weather, features, foreman, station, offset, elevation obtained, results of roller speed checks, equipment numbers, type and frequency checks including vibration rate checks and time taken, and load counts.

17.1.3 Borrow Acceptance - Figure 4
The QC Engineer will obtain classification of material from the Bechtel representative and/or the testing laboratory.

17.1.4 Deficiency - Corrective Action - Figure 5
When notified by the Bechtel representative that a deficiency exists the QC Engineer shall note the date, time, feature, location, shift, foreman, elevation, and type of deficiency, ie. failing test. He shall notify the project manager or his representative and corrective actions shall be implemented. After corrective action implementation, a new test shall be performed and the results noted. Where necessary, further corrective action shall be instituted.

17.2 Quality Assurance/Control Records

All the aforementioned reports shall be compiled and submitted to Bechtel for their review and retention. Copies shall be maintained on file by Canonie Construction Co.

18.0 Audits
A system of planned, periodic, and documented internal audits has been established to verify compliance with all aspects of the accepted quality assurance program.

18.1 Audits shall be performed in accordance with written check lists by personnel qualified and trained in the performance of audits and familiar with the scope of work being performed.

18.2 Audit personnel shall be selected to preclude the possibility of personnel participating in audit activities in areas where they have direct responsibility.

18.3 Audit results are documented and revieved by management personnel having responsibility for the areas being audited.

18.4 Corrective action is implemented to correct deficiencies revealed by audit activities, and to correct system inadequacies determined to be the cause for significant conditions adverse to quality.

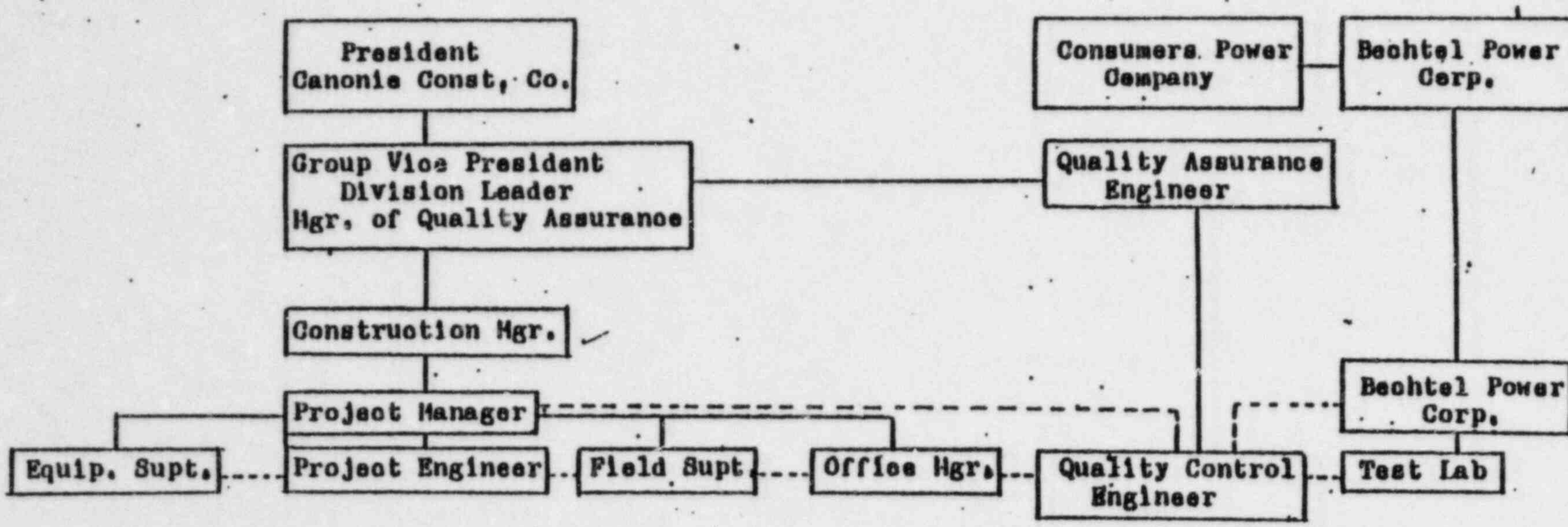
18.5 Audit results and corrective actions are revieved by the Manager of Quality Assurance and the Construction Manager to determine the adequacy of corrective actions, the effectiveness of the audit program in correctin conditions adverse to quality and to verify the implementation of corrective action.

18.6 Where necessary to establish objective evidence of implementation, corrective action shall be verified by the performance of re-audits of those areas previously determined to be non-conforming.

CANONIE CONSTRUCTION CO.
SOUTH HAVEN, MICHIGAN

Midland Station Units 1&2

Plant Foundation Excavation & Cooling Pond Dikes



———— Direct Responsibility

-------- Communication

Figure 1
Rev. 3, dated 4/5/77
Page 6-9

F7720-C210-1-67

F7270-C210-1-6A

canonie	NUCLEAR QUALITY ASSURANCE PROGRAM	Section 6.0
		Revision 3
		Date 4-5-77
		Page 6-10 Fig 2
	Addendum to Quality Assurance Manual	

MIDLAND NUCLEAR UNITS 1&2
CANONIE CONSTRUCTION CO.

P.M._____
G.S._____
F.S._____

LIFT THICKNESS CHECK

OBSERVATION NUMBER:_____ DATE:_____

ZONE:_____ LENGTH:_____

STATION:_____ TO STATION:_____ WIDTH:_____

OFFSET:_____

ELEVATION: BEFORE_____ AFTER_____ LIFT THICKNESS_____

BEFORE_____ AFTER_____ LIFT THICKNESS_____

BEFORE_____ AFTER_____ LIFT THICKNESS_____

BEFORE_____ AFTER_____ LIFT THICKNESS_____

AVERAGE LIFT THICKNESS_____

REMARKS/SKETCH:

BY:_____
CANONIE CONSTRUCTION CO.
QC REPRESENTATIVE

SB178874

Bechtel Power Corporation

Interoffice Memorandum

JOB 7220 ROUTING	A C T	R I N E T
Proj. Supt.		
P. Sup.		
P.E. Engr.		
APP. Eng. 1		
APP. Eng. 2		
Cont-Sch.		
Cont Bldg.		
Aux. Bldg.		
Yard-Turb.		
Civ. Sup.		
Civ. Eng.		
Mech. Sup.		
Mech. Eng.		
Elec. Sup.		
Elec. Eng.		
Weld. Eng.		
Off. Eng.		
P & A		
Q C		
Purch.		
Sub-Con		

To Sherif Afifi PER (1-30-78 ESH

File No.

Subject Job 7220 Midland Project
Instrumentation Progress
Report for 11/27/78-12/1/78
Midland Units 1 and 2
Midland, MI

Date December 1, 1978

From A. Marshall

Of Geotech

At Midland, MI Ext.

Copies to

J. F. Newgen
J. P. Betts
A. J. Boos
C. Willson
P. Martinez w/a
R. Castleberry w/a
K. Weidner w/a
J. Wanzeck w/a
S. Blue w/a
W. Ferris w/a

Through the end of the above mentioned period, 46 burros anchors and 26 piesometers have been installed. Installation of anchors and piezometers should be completed by December 10, 1978, pending review by our consultants.

Weather did not affect progress.

A summary table and location figure providing details of installations are attached with a copy of the daily reports.

A Goldberg-Zoino-Dunnicliff representative was on site through the period.

Mr. C. E. Willson, Chief of Parties, has been cooperating with requests made by A. Marshall. Mr. Willson has been asked to take weekly elevation measurements on all burros anchors and settlement plates, initial elevations on all piezometers, and to locate all installations. Mr. Willson was also informed all measurements are to be referenced to the subsidence benchmark #9 which should be checked monthly against the plant benchmark. Elevation measurements are to be reported in hundredths of a foot.

Mr. Willson's continued cooperation has dependence upon project engineering providing him with direction in writing as requested by A. Marshall through Jon Hook via telephone on November 27, 1978.

A. Marshall

A. Marshall

AMM/vmm

SB179691

PRELIMINARY. (WK)

BORROS ANCHOR INSTALLATION SUMMARY

ANCHOR NUMBER	BA1	BA2	BA3	BA4	BA5	BA6	BA7	BA8	BA9	BA10	BA11	BA12	BA13	BA14	BA15
ANCHOR TIP DEPTH	25'	12'	21.5'	5'	25'	18.08'	12.17'	33.47'	20.65'	13'	7'	36.5'	7'	11.08	17'
ANCHOR TIP ELEVATION		616'	606.5'	623'	608'	614.92'	620.83'	594.33'	607.35	615'	621'	591.5'	627'	622.92'	617'
EXISTING GROUND ELEVATION		628'	628'	628'	633'	635'	633'	633'	628'	628'	628'	628'	634'	634	634
BACKFILL MATERIAL	OTTAWA SAND ①	②	①	①	①	①	①	①	①	①	①	① AND ② (SEE NOTE 2)	①	①	②
DATE INSTALLED	11/10	11/10	11/11	11/11	11/11	11/11	11/12	11/12	11/11	11/11	11/12	11/11	11/13	11/14	11/15
LOCATION GPS LOCATIONS DETERMINED BY SURVEY	S 5134.4 E 190.5	S 5097.9 E 282.1	S 5094 E 282.0	S 5091.8 E 282.1	S 5126.6 E 345	S 5122.5 E 345.5	S 5120.0 E 345.1	S 5117.1 E 345.2	S 5101.2 E 320.3	S 5098 E 320.4	S 5091.9 E 320.6	S 5091.9 E 320.4	S 5257 E 457.5	S 5254.5 E 457.5	S 5251 E 457.5
COMMENTS	ADD'D 1.25' OF 3/4" ROD (3)											FRAMING UNTIL OTHERWISE NOTED — USED 1 BAG OF SAND AROUND MATERIAL TIP (∝ 5') — THEN COMPLETED BACKFILLING WITH #34 GRAVEL — SYMBOL ① ②			

(SEE INSTALLATION LOGS)

Newton Upper Falls, Mass.

File No. 7512

By PRELIMINARY

PRELIMINARY (WK)

BORROS ANCHOR INSTALLATION SUMMARY

ANCHOR NUMBER	BA16	BA17	BA18	BA19	BA20	BA21	BA22	BA23	BA24	BA25	BA26	BA27	BA25	BA29	BA30
ANCHOR TIP DEPTH	21.63'	43.42'	5.08'	10'	16'	21'	13.08'	6'	12.08'	17'	17'	21.33'	12'	6'	12.67'
ANCHOR TIP ELEVATION	612.17'	581.58'	622.92'	618'	612'	607'	614.92'	622'	615.92'	611'	617'	595.67'	622'	622'	615.33'
EXISTING GRADE ELEVATION	634'	625'	628	628'	628'	628'	628'	628'	628'	628	634'	634'	634'	628'	628'
BACKFILL MATERIAL	(1) (3)	(1) (3)	(1)	[illegible]	[illegible]	(1) (3)	(1) (3)	(1) (3)	(1) (3)	(1) (3)	(1) (3)	(1) AND BENTONITE (3)	(1) (3)	(1) (3)	(1) (3)
DATE INSTALLED	11/15	11/14	11/14	11/14	11/15	11/14	11/14	11/15	11/15	11/15	11/16	11/16	11/16	11/16	11/16
LOCATION GRID COORDINATES OF TIP OF ANCHOR	S 5248 E 457.5	S 5068.7 E 265.3	S 5072 E 262.2	S 5073.9 E 264.95	S 5075.9 E 268.3	S 5071.8 E 317.5	S 5072.5 E 321.4	S 5071.8 E 314.1	S 5075.9 E 300.4	S 5116.3 E 259.3	S 5082.5 E 157.6	S 5076.2 E 167.1	S 5073 E 165.9	S 5115.3 E 153.4	S 5112.3 E 183.8
COMMENTS												5' OF SAND BACKFILL WITH BENTONITE SLURRY			

(SEE INSTALLATION LOGS)

SB179693

PRELIMINARY (WF)

* "BORROS" ANCHOR INSTALLATION SUMMARY

ANCHOR NUMBER	BA31.	BA32	BA33.	BA34	BA35	BA36	BA37	BA38	B139	BA40	BA41	BA42	BA43	BA44	BA45
ANCHOR TIP DEPTH	13'	6.25'	19'	9.33'	19'	26.83'	21.83'	15'	6'	13'	20	36.67'	7'	28.93'	28'
ANCHOR TIP ELEVATION	615'	621.75'	609'	624.67	615'	607.17'	606.17'	613	622'	615	608	591.33	621'	599.07	606'
EXISTING GRADE ELEVATION (APPROX)	628	628	628	634'	634'	634'	628	628	628	628	628	628	628	628	634'
BACKFILL MATERIAL	(1) (3)	(1) (3)	(1) (3)	(1) (3)	(1) (3)	(1) (3)	(1) (4) (3)	(1) (3)	(1) & BENTONITE PELLETS (4) (3)	(1) (3)	(1) (3)	(1) (3)	(1) (1)	(1) (3)	[illegible]
DATE INSTALLED	11/15	11/16	11/17	11/17	11/18	11/16	11/13	11/17	11/18	11/19	11/20	11/21	11/21	11/13	11/2[illegible]
LOCATION GRID LOCATIONS DETERMINED BY ENGINEERING	S5113.2 E260.75	S5110.9 E246.65	S5109.0 E183.2	S5268 E120	S5268 E125	S5265 E131	S5067.4 E232.8	S5067.5 E227.3	S5070.8 E230.8	S5066.8 E194	S5070.8 E194	S5067 E188	S5071 E191	S5070.4 E234.4	S5036 E167.5
COMMENTS				CONTROL AREA AWAY	CONTROL AREA FROM GENERATOR	CONTROL AREA DIESEL BLDG.									

(SEE INSTALLATION LOGS)

79694

BORRO'S ANCHOR INSTALLATION SUMMARY

Norton Upper Falls, Mass.

File No. 2222

By PRELIMINARY

ANCHOR NUMBER	BA46
ANCHOR TIP DEPTH	10'3"
ANCHOR TIP ELEVATION	-112.93'
DATE INSTALLED	1/12
LOCATION	SB179695
COMMENTS	

PRELIMINARY (WK)

PIEZOMETER INSTALLATION SUMMARY

PIEZOMETER NUMBER			PZ16	PZ17	PZ18	PZ19	PZ20	PZ21	PZ22	PZ23	PZ24	PZ25	PZ26
PIEZOMETER INTERVAL	DEPTH	TOP		[illegible]	20'4"	10'4"	17'10"	10'10"	43'4"	17'10"	26'10"	7'10"	9'4"
		BOTTOM		29'3"	21'4"	11'4"	18'10"	11'10"	44'4"	18'10"	25'10"	8'10"	10'4"
	ELEV.	TOP		606'	613.5	623.5	610'	617'	584.5	610'	603	620'	618.5
		BOTTOM		605'	612.5'	622.5	609'	616'	583.5	609'	602'	619'	617.5
EXISTING GRADE ELEVATION		(APPX.)		634'	634'	631'	628'	628'	628'	628'	628'	628'	628'
OTTAWA SAND COLUMN HEIGHT				30"	24"	24"	24	24"	[illegible]	24	24"	24"	29"
BENTONITE PELLET SEAL THICKNESS				30"	39"	36"	SEE [illegible]	42"	36"	36"	30"	36"	36"
DATE INSTALLED				11/19	11/20	11/21	11/21	11/21	11/28	11/28	11/28	11/28	11/29
LOCATION			S5105.9 E317.2	S5268 E126	S5268 E141	S5268 E145	S5068 E239	S5064 E167	S5060 E167	S5072 E200	S5073 E239	S5095 E236	S5065. E198.5
COMMENTS				First N.306 [illegible]									

<— Control Area —>

Away From Diesel Gen. Bldg.

SB173636

PRELIMINARY (WE)

PIEZOMETER INSTALLATION SUMMARY

PIEZOMETER NUMBER		PZ31	PZ32
PIEZOMETER INTERVAL	DEPTH TOP	4'10"	11'10"
	DEPTH BOTTOM	5'10"	12'10"
	ELEV. TOP	623'	616'
	ELEV. BOTTOM	622'	615'
EXISTING GRADE ELEVATION		628'	628'
OTTAWA SAND MINIMUM HEIGHT		24"	24"
BENTONITE PELLET SEAL THICKNESS		36"	36"
DATE INSTALLED		11/30	12/1
LOCATION			
CONDITIONS			

SB179697

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 1220
REVISION NO. 0
DATE 11/27/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON; MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	10	O'BOYLE	1	
2	ACE	ACKER	10	Sweeney	1	
3	CME-45	CME-45	10	Gendalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

SB179698

H&CF GS-204 8-74

4&CF DIVISION BECHTEL INCORPORATED	**BECHTEL** **DAILY FIELD REPORT**	JOB NO. 7220 REVISION NO. 0 DATE 11/28/78 PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON; MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	10	O'BOYLE	1	
2	ACE	ACKER	10	Sweeney	1	
3	CME-45	CME-45	10	Gaudalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

SB179699

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 7220
REVISION NO. 0
DATE 11/29/78
PAGE 1 OF 1

CONTRACTOR RAYMOND   SUPERINTENDENT O'BOYLE

TIME STARTED *   TIME STOPPED *   WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	12	O'BOYLE	1	
2	ACE	ACKER	12	Sweeney	1	
3	CME-45	CME-45	12	Gandalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BORROS ANCHORS

OVERTIME

STANDBY

SB179700

H&CF GS-224 8/74

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 7220
REVISION NO. 0
DATE 11/30/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST ANDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	12	O'BOYLE	1	
2	ACE	ACKER	12	Sweeney	1	
3	CME-45	CME-45	12	Gendalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

SB179701

H&CF GD-234 8/74

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 7220
REVISION NO. 0
DATE 12/1/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	16	O'BOYLE	1	
2	ACE	ACKER	16	SWEENEY	1	
3	CME-45	CME-45	16	Gaudalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURRO ANCHORS

OVERTIME

STANDBY

SB179702

H&CF 55-204 8/74

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 7220
REVISION NO. 0
DATE 11 | 78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER		O'BOYLE	1	
2	ACE	ACKER		SWEENEY	1	
3	CME-45	CME-45		GUDALFO	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

SB179703

H&CF 25-204 8-74

Bechtel Power Corporation

Interoffice Memorandum

To Sherif Afifi

Date November 22, 1978

Subject Job 7220 Midland Project
Instrumentation Progress
Report for 11/19/78-11/22/78
Midland Units 1 and 2
Midland, MI

From A. S. Marshall

Of Geotech

At Midland, MI

Copies to

S. Blue
J. Wanzeck
K. Weidner
P. Martinez
R. Castleberry
[redacted]
W. Ferris
1310, 3440

Through the end of the above mentioned period, 43 burros anchors and 19 piezometers have been installed. Installation of anchors and piezometers should be completed by December 15, 1978.

Weather did not affect progress.

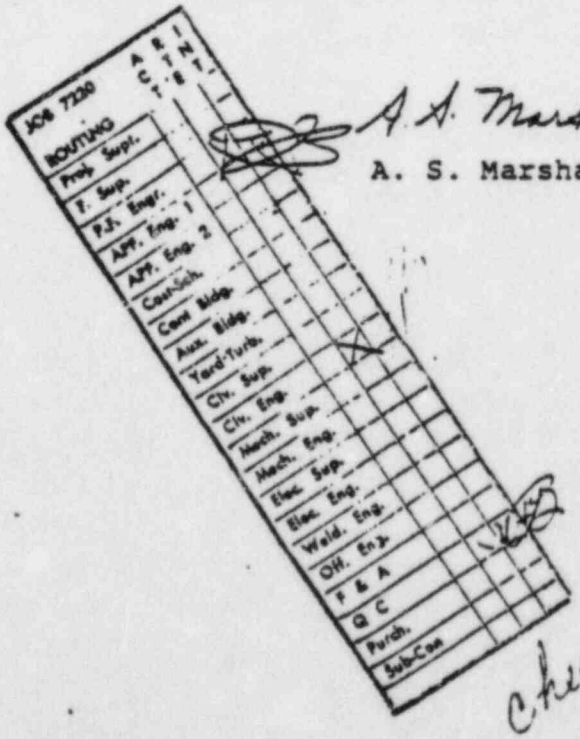
A summary table and location figure showing details of installations are attached with a copy of the daily reports. Details of the piezometers are also attached.

A Goldberg-Zoino-Dunnicliff representative was on-site during the period.

A. S. Marshall

ASM/ems

Attachments



Check SB179717

PRELIMINARY (WK)

PIEZOMETER INSTALLATION SUMMARY

PIEZOMETER NUMBER:		PZ16	PZ17	PZ18	PZ19	PZ20	PZ21	PZ22	PZ23	PZ24	PZ25	PZ26	PZ27	PZ28	PZ29	PZ30
PIEZOMETER INTERVAL ELEV. DEPTH	TOP		28'3"	21'4"	10'4"	17'10"										
	BOTTOM		29'3"	22'4"	11'4"	18'10"										
	TOP															
	BOTTOM															
EXISTING GROUND ELEVATION (FEET)																
OTTAWA SAND COLUMN HEIGHT			30"	24"	24"	24"										
BENTONITE PELLET SEAL THICKNESS			30"	39"	36"											
DATE INSTALLED			11/19	11/20	11/21	11/21										
LOCATION	N 5105.9 E 317.2															
COMMENTS:			FIRST M-206 INSTALLED													
			← CONTROL AREA FROM DIGITIZED DATA. →													

STA 17+78

Newton Upper Falls, Mass. File No. 2220 By PRELIMINARY

PRELIMINARY (WK)

PLATFORM INSTALLATION SUMMARY

PLATFORM NUMBER	PD1	PD2	PD3	PD4	PD5	PD6	PD7	PD8	PD9	PD10	PD11	PD12	PD13	PD14	PD15
PLATFORM SIZE	4"x4"x¼"	3"x4"x¼"	4"x4"x¼"	3"x4"x¼"	3"x4"x¼"	4"x4"x¼"	4"x4"x¼"	4"x4"x¼"	4"x4"x¼"	4"x4"x¼"	3"x4"x¼"	3"x4"x¼"	3"x4"x¼"	4"x4"x¼"	3"x4"x¼"
EXISTING GRADE ELEVATION		[illegible]	[illegible]	11'-1											
PLATFORM ELEVATION															
½" PIPE ELEV. (MSL) 1" PIPE ELEV. (MSL)															
		[illegible]	[illegible]	[illegible]											
		[illegible]	[illegible]	36											
DATE INSTALLED			[illegible]	[illegible]											
LOCATION	BAY #4 (WEST)					BAY #3					BAY #2				
COMMENTS	PD1 THROUGH PD20 ALL 2" HIGH – 1" COUPLINGS 1¾" HIGH – ½" COUPLINGS														

SB179719

PRELIMINARY (WK)

PLATFORM INSTALLATION SUMMARY

PLATFORM NUMBER	PD16	PD17	PD18	PD19	PD20	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	PL9
PLATFORM SIZE						2'x2'x½"	2'x2'x½"	2'x2'x½"	2'x2'x½"	2'x2'x½"	2'x2'x½"	1'x1'x½"	2'x2'x½"	2'x2'x½"
EXISTING GRADE ELEVATION														
PLATFORM ELEVATION														
" ROD ELEV. (DATE) " PIPE ELEV. (DATE)														
DATE INSTALLED														
LOCATION	← BAY 1 (EAST) →					S5047.4 E339.9	S5139.8 E284.7	S5139.9 E203.4	S5047.5 E166	S5133.9 E168.6	S5138.8 E252	S5106.8 E317.8	S5127 E363.1	S5095.5 E339.9
COMMENTS												INSIDE BAY 1 (EAST)		

SB179720

PRELIMINARY (WK)

BORRO'S ANCHOR INSTALLATION SUMMARY

ANCHOR NUMBER	BA16	BA17	BA18	BA19	BA20	BA21	BA22	BA23	BA24	BA25	BA26	BA27	BA28	BA29	BA30
ANCHOR TIP DEPTH	21.53'	43.42'	5.08'	10'	16'	21'	13.08'	6'	12.08'	17'	17'	21.33'	12'	6'	12.67'
ANCHOR TIP ELEVATION	612.17'	581.58'	622.92'	618'	612'	607'	619.92'	622'	615.92'	611'				622'	615.33
[illegible] ELEVATION	634'	625'	628	628'	628'	625'	625'	628'	628'	628				628'	628'
BACKFILL MATERIAL	(1)(3)	(1)(2)	(1)	(1)(2)	(1)(3)	(1)(3)	(1)(2)	(1)(2)	(1)(2)	(1)(3)	(1)(2)	(1) AND BENTONITE (3)	(1)(3)	(1)(3)	(1)(3)
DATE INSTALLED	11/15	11/14	11/14	11/14	11/15	11/14	11/14	11/15	11/15	11/15	11/16	11/16	11/16	11/16	11/16
LOCATION (GRID LOCATIONS DETERMINED BY BECHTEL SURVEY)	[illegible]48 [illegible]57.5	S 5068.7 E 265.3	S 5072 E 262.2	S 5073.9 E 264.95	S 5075.9 E 268.3	S 5071.8 E 317.5	S 5072.5 E 321.4	S 5071.8 E 314.1	S 5075.9 E 300.4	S 5116.3 E 259.3	S 5082.5 E 157.6	S 5076.2 E 157.1	S 5093 E 166.9	S 5115.3 E 163.4	S 5112.3 E 183.6
COMMENTS												5' of SAND BACKFILL THEN BENTONITE SLURRY			

SR1797[illegible]

(SEE ATTACHED [illegible])

PRELIMINARY (WK)

BORING ANCHOR INSTALLATION SUMMARY

ANCHOR NUMBER	BA1	BA2	BA3	BA4	BA5	BA6	BA7	BA8	BA9	BA10	BA11	BA12	BA13	BA14	BA15
ANCHOR TIP DEPTH	25'	12'	21.5'	5'	25'	18.08'	12.17'	39.67'	30.65'	13'	1'	36.5'	7'	11.08'	17'
ANCHOR TIP ELEVATION		616'	606.5'	623'	608'	611.92'	623.83'	591.33'	607.35	615'	631'	591.5'	617	622.92'	617'
EXISTING GROUND ELEVATION		628'	628'	628'	633'	633'	635'	633'	628'	628'	628'	628'	634	634	634
BACKFILL MATERIAL	STANDARD SAND ①	①	①	①	①	①	①	①	①	①	①	① AND #4 GRAVEL ②	①	①	①
DATE INSTALLED	11/10	11/10	11/11	11/11	11/11	11/11	11/12	11/12	11/11	11/11	11/12	11/11	11/13	11/14	11/15
LOCATION GRID LOCATIONS DETERMINED BY SURVEY	S 5130 E 190	S 5097.9 E 282.1	S 5094 E 282.0	S 5091.8 E 282.1	S 5126.6 E 345	S 5122.5 E 345.5	S5120.0 E 345.1	S 5117.1 E 345.2	S 5101.2 E 320.3	S 5098 E 320.4	S 5094.9 E 320.6	S 5091.9 E 320.4	S 5257 E 467.5	S 5254.5 E	S 5251 E
REMARKS	ALLOW 1.25' FOR ½ END ③											FINISH UNTIL STEADY NOTED — USED 3 SACKS OF SAND AROUND ANCHOR TIP (± 5') — THEN COMPLETED BACKFILLING WITH #4 GRAVEL — SYMBOL ②			

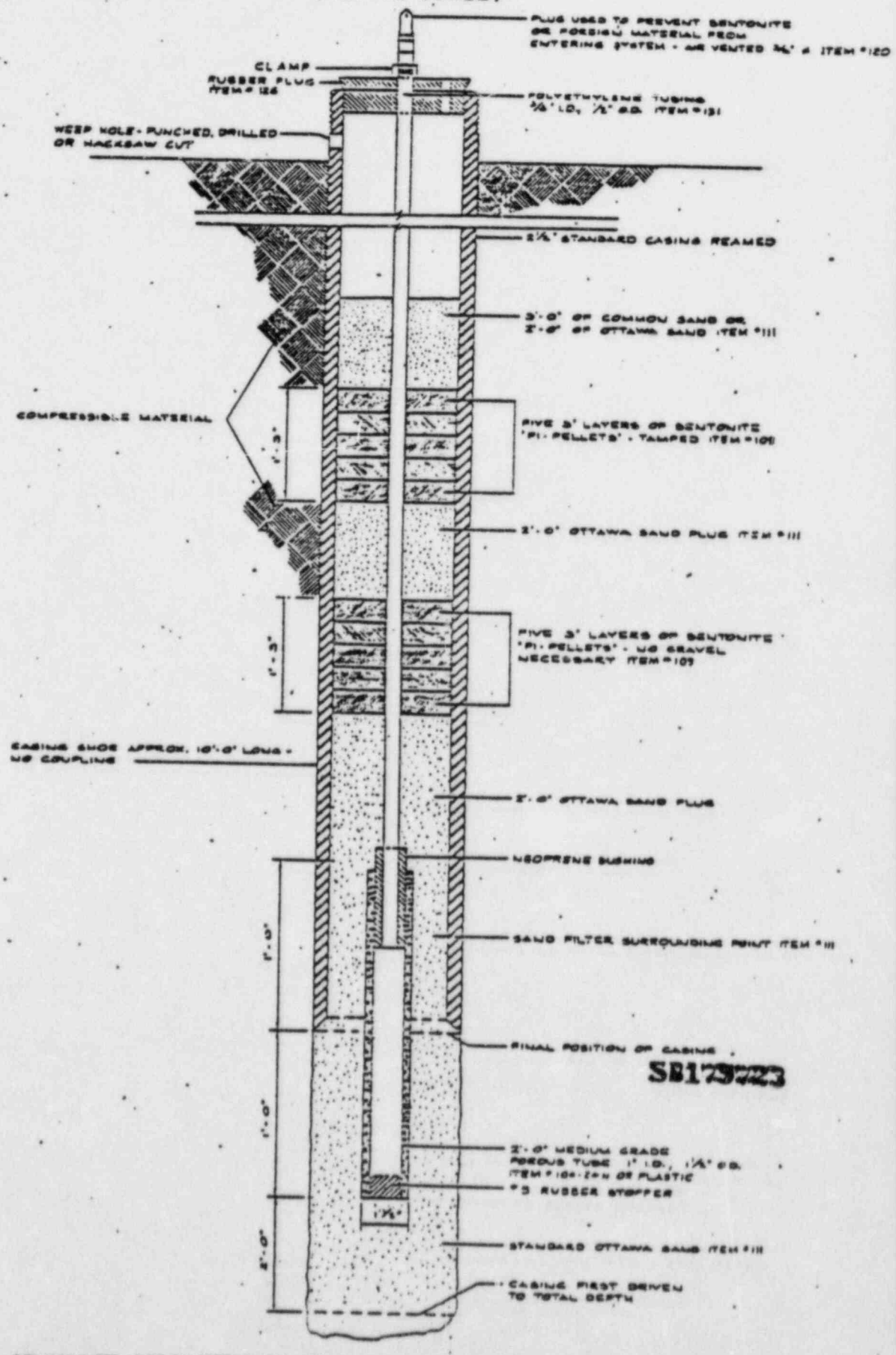
(SEE INSTALLATION LOG) -

SB179722

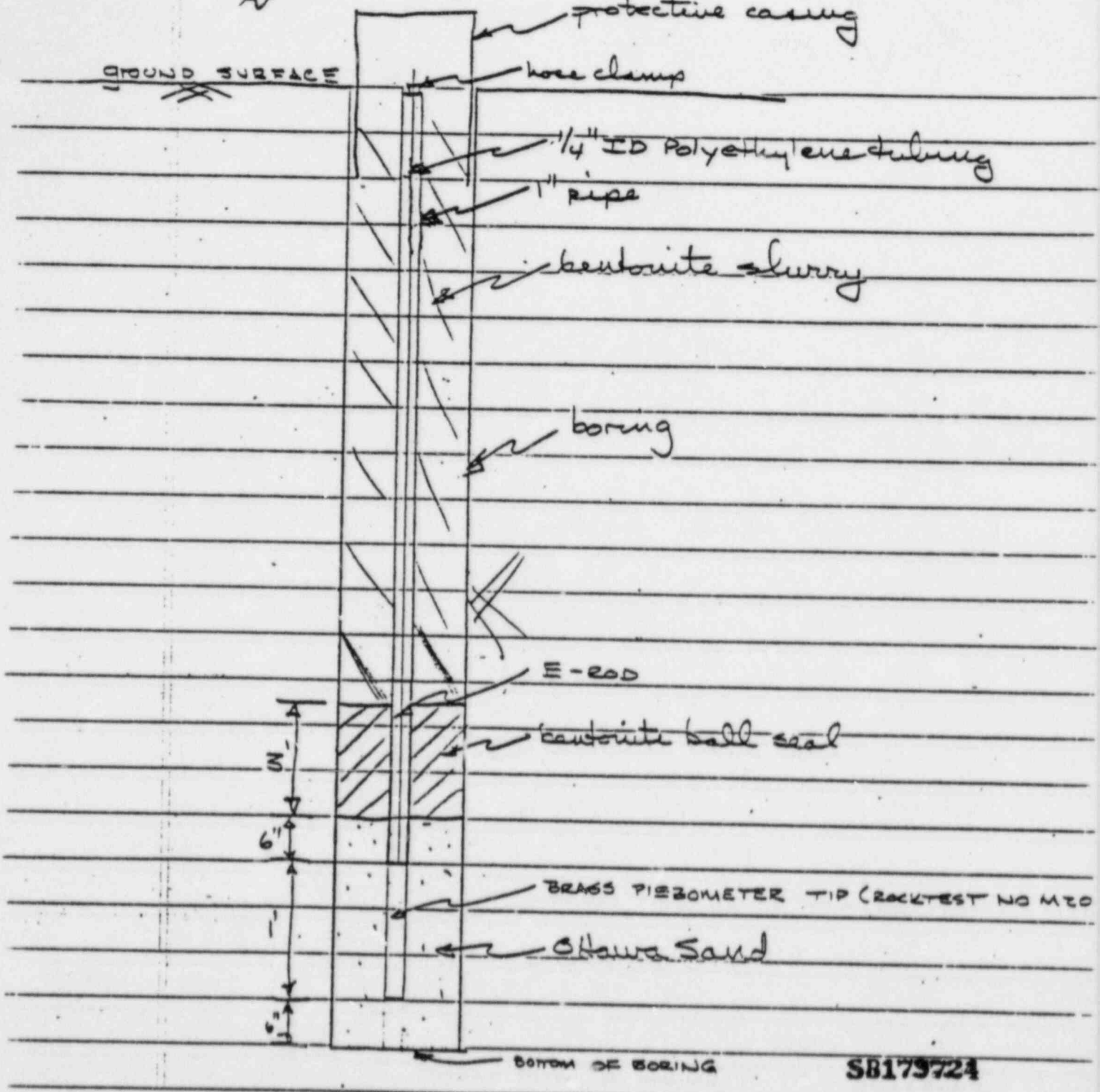
SCHEMATIC FOR PZ1 – PZ-16, except As noted

SINGLE-TUBING PIEZOMETER

(NOT TO SCALE)



SB1739723



PIEZOMETER DETAIL FOR PZ-□ THROUGH PZ-21

FIELD PIEZOMETER

MODEL M-206

The piezometer consists of a hollow stem in the lower end on which is screwed a conical point. Three sintered bronze filters are mounted on the stem. Chamfered brass rings are employed as support and sealing for the filters. The top of the filter stem is provided with external "E-rod" threads for connection to the extension tubing.

For the piezometer tube itself, 1/4" i/d plastic tubing is usually used. (Plastic tubing with 3/8" i/d, or a two-tube system corresponding to that used in pore pressure cells for earth dams, can also be employed.) The plastic tubing is screwed inside the top of the piezometer stem and sealed by a rubber "O" ring which is compressed by a gland nut. The plastic tubing can be lengthened by the use of special connections.

For the extension tubing, diamond core drill rods (E) are employed. Other tubes with flush joints and an outer diameter of 1 1/4" or more can also be used.

The point is pressed or driven into the ground, without preboring, so that leakage along the outside of the extension tubes is avoided. Because of the small cross-section of the piezometer tube and the relatively large filter area, it has a very small time lag, satisfactorily small for most practical applications. The equipment is genererally used as an open system with a plastic piezometer tube.

TECHNICAL DATA FOR PIEZOMETER:

Maximum diameter	1 5/16" (33 mm)
Maximum length	17" (430 mm)
Material in point and stem	Brass
Tensile strength at failure	36 Tons/Sq.in. (55 kg/mm²)
Extension at failure	30 %
Brinell Hardness number	145
Material in filter	S. M. filter-bronze
Filter area	35 Sq.in. (226 cm²)

SB179725

MEASURING OF PORE PRESSURE

The water level in the piezometer tube is measured with the help of an electric circuit which is completed when a thin cable, which is lowered down the piezometer tube, reaches the water surface. For excess pressures a Bourdon gauge can be fitted.

ROCTEST

ROCTEST INC
POND STREET P.O. BOX
PLATTSBURGH N.Y.
TEL: (518)
CABLE: ROCTEST

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 7220
REVISION NO. 0
DATE 11/9/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	8	O'BOYLE	1	
2	ACE	ACKER	8	Sweeney	1	
3	CME-45	CME-45	8	Gendalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

SB173726

H&CF 05-214 8-74

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 7270
REVISION NO. 0
DATE 11/20/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	12	O'BOYLE	1	
2	ACE	ACKER	12	SWEENEY	1	
3	CME-45	CME-45	12	Gaudalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

SB179727

HACF 35-204 8-74

Bechtel Power Corporation

Interoffice Memorandum

To Sherif Afifi PER [illegible]

Date November 20, 1978

Subject Job 7220 Midland Project
Instrumentation Progress
Report for 11/12/78-11/18/78
Midland Units 1 and 2
Midland, MI

From A. S. Marshall

Of Geotech

At Midland, MI

Copies to

S. Blue
J. Wanzeck
K. Weidner
P. Martinez
R. Castleberry
W. Fernie
[redacted]
1310, 3440

Through the end of the above mentioned period, 16 piezometers and 4 burros anchors have been installed. Installation of anchors and piezometers should be completed by December 15, 1978.

Weather did not affect progress.

A summary table and location figure showing details of burros anchor installations are attached with a copy of the daily reports.

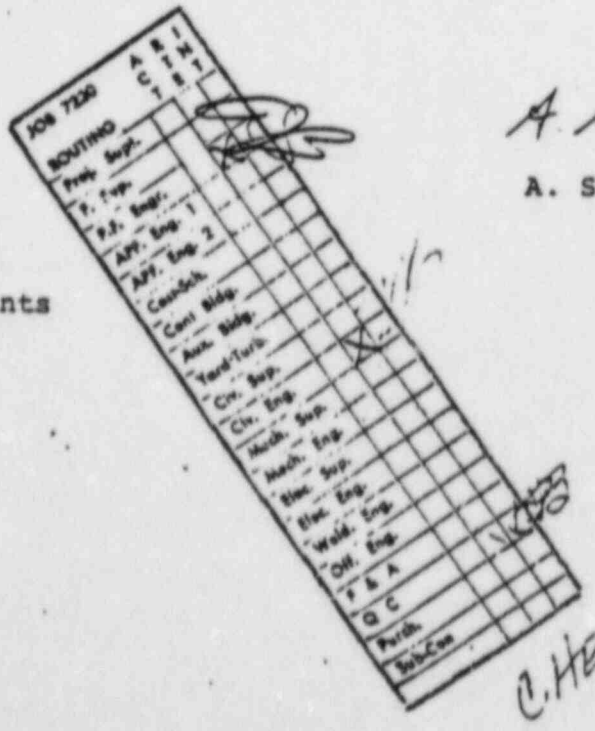
A Goldberg-Zoino-Dunnicliff representative has been on-site each day since 11/11/78.

A. S. Marshall

A. S. Marshall

ASM/ems

Attachments



C. HEEK

SB179729

File No. 2220 By: [illegible]

Preliminary. (WK)

Boring Anchor Installation Summary

Anchor Number	BA1	BA2	BA3	BA4	BA5	BA6	BA7	BA8	BA9	BA10	BA11	BA12	BA13	BA14	BA15
Anchor Tip Depth	25'	12'	21.5'	5'	25'	18.08'	12.17'	38.67'	20.65'	13'	7'	36.5'	7'	11.08	17'
Anchor Tip Elevation		616'	606.5'	623'	608'	614.92'	620.83'	594.33'	607.35	615'	621'	591.5'	627'	622.92'	617'
Existing Ground Elevation		628'	628'	628'	633'	633'	633'	633'	628'	628'	628	628'	634	634	634
Backfill Material	Filter Sand (2)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1) and [illegible]	(1)	(1)	(1)(2)
Date Installed	11/10	11/10	11/11	11/11	11/11	11/11	11/12	11/12	11/11	11/11	11/12	11/11	11/13	11/14	11/15
Location (Grid locations determined by [illegible] survey)	S 5134.4 E 190.5	S 5097.9 E 282.1	S 5094 E 282.0	S 5091.8 E 282.1	S 5126.6 C 345	S 5122.5 E 345.5	S 5120.0 E 345.1	S 5117.1 E 345.2	S 5101.2 E 320.3	S 5098 E 320.1	S 5094.9 E 320.6	S 5091.9 E 320.4	S 5257 E 467.5	S 5254.5 E	S 5251 E
Comments	Added 1.25" of 3/8" [illegible] (?)											Fractions until otherwise noted — used 1 sack of sand around anchor tip (≈ 5') - then completed backfilling with pea gravel - symbol (1)(2)			

(See instructions)

88179730

PRELIMINARY (WK)

BORROS ANCHOR INSTALLATION SUMMARY

ANCHOR NUMBER	BA16	BA17	BA13	BA19	BA20	BA21	BA22	BA23	BA31	BA25	BA26	BA27	BA25	BA29	BA30
ANCHOR TIP DEPTH	21.53'	43.42'	5.08'	10'	16'	21'	13.08'	6'	12.08'	17'	17'	21.33'	12'	6'	12.67'
ANCHOR TIP ELEVATION	612.17'	581.58'	622.92'	618'	612'	607'	614.92'	622'	615.92'	611'				622'	615.33
EXISTING GRADE ELEVATION	[illegible]	625'	628	628'	628'	625'	625'	628'	628'	628				625	628'
BACKFILL MATERIAL	[illegible]	[illegible]	(1)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(1) AND BENTONITE (3)	(1) (3)	[illegible]	[illegible]
DATE INSTALLED	11/15	11/14	11/14	11/14	11/15	11/14	11/14	11/15	11/15	11/15	11/16	11/16	11/16	11/16	11/16
LOCATION (GRID LOCATIONS DETERMINED BY ...)	S 5218 E 457.5	S 5068.7 E 265.3	S 5072 E 262.2	S 5073.9 E 264.95	S 5075.9 E 268.3	S 5071.8 E 317.5	S 5072.5 E 321.4	S 5071.8 E 314.1	S 5075.9 E 300.4	S 5116.3 E 259.3	S 5082.5 E 167.6	S 5076.2 E 167.1	S 5073 E 166.9	S 5115.3 E 183.4	S 5112.3 E 183.8
REMARKS												5' of SAND BACKFILL THEN BENTONITE SLURRY			

(SEE ...)

PRELIMINARY (WE)

BOARD'S ANCHOR INSTALLATION SUMMARY

ANCHOR NUMBER	BA31	BA32	BA33	BA34	BA35	BA36	BA37	BA38	BA39	BA40	BA41	BA42	BA43	BA44	BA45
ANCHOR TIP DEPTH	1.5'	6.25'	19'	9.33'	19'	26.83'	21.83'	15'	6'	13'	20	36.67'		28'	
ANCHOR TIP ELEVATION	615'	611.75'	609'				606.17'	613	622	615	608	591.33		599'	
EXISTING GRADE ELEVATION	628	628	628				628	628	628	628	628	628		628	
BACKFILL MATERIAL				(1) (3)	(1) (3)	(1) (3)	(1) (4) (5)		(1) & BENTONITE PELLETS (3)						
DATE INSTALLED	11/15	11/16		11/17	11/18	11/18	11/19		11/18						
LOCATION GRID LOCATIONS DETERMINED BY ELECTRIC SURVEY	S5113.2 E260.75	S5110.9 E246.45	S5109.0 E183.2				S5067.4 E232.8	S5067.5 E227.3	S5070.8 E230.8	S5066.8 E194	S5070.8 E194			S5070.9 E234.4	
COMMENTS				CONTROL AREA AWAY FROM GENERATOR	CONTROL AREA FROM GENERATOR	CONTROL AREA DIESEL BLDG.									

(SEE INSTALLATION CONT.)

SB179232

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. TZZO
REVISION NO. 0
DATE 11/2/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	16	O'BOYLE	1	
2	ACE	ACKER	16	SWEENEY	1	
3	CME-45	CME-45	16	GUDALFO	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

SB179733

H&CF 38-204 8.74

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 7220
REVISION NO. 0
DATE 11/8/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	16	O'BOYLE	1	
2	ACE	ACKER	16	SWISHER	1	
3	CME-45	CME-45	16	Gondalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

S3179734

H&CF 03-234 8/74

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 7220
REVISION NO. 0
DATE 11/14/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	16	O'BOYLE	1	
2	ACE	ACKER	16	SWEENEY	1	
3	CME-45	CME-45	16	GANDALFO	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

SB179735

ACI GS-204 8/74

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. TZZO 1
REVISION NO. 0
DATE 11/15/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	16	O'BOYLE	1	
2	ACE	ACKER	16	SWEENEY	1	
3	CME-45	CME-45	16	Gendalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BLRRDS ANCHORS

OVERTIME

STANDBY

SB179736

H&CF 05-204 8.74

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 7220
REVISION NO. 0
DATE 11/16/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	16	O'BOYLE	1	
2	ACE	ACKER	16	SWEENEY	1	
3	CME-45	CME-45	16	GUDALFO	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

SB179737

STANDBY

H&CF 35-204 8 74

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. T220
REVISION NO. 0
DATE 11/7/78
PAGE 1 OF 1

CONTRACTOR RAYNOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	10	O'BOYLE	1	
2	ACE	ACKER	10	SWEENEY	1	
3	CME-45	CME-45	10	Gendalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

SB179738

H&CF GS-204 3/74

H&CF DIVISION

BECHTEL INCORPORATED

BECHTEL
DAILY FIELD REPORT

JOB NO. 7220
REVISION NO. 0
DATE 11/18/78
PAGE 1 OF 1

CONTRACTOR RAYMOND SUPERINTENDENT O'BOYLE

TIME STARTED * TIME STOPPED * WEATHER COLD

BECHTEL ENGINEER/GEOLOGIST HENDERSON, MARSHALL

* RIGS START/STOP AT DIFFERENT TIMES

RIGS				RIG CREWS		REMARKS
NO.	TYPE	MAKE	RIG TIME	OPERATOR	HELPERS (No.)	
1	ACE	ACKER	8	O'BOYLE	1	
2	ACE	ACKER	8	SWEENEY	1	
3	CME-45	CME-45	8	Gendalfo	1	

HOLE NO.	SOIL DRILLING					ROCK DRILLING					SAMPLES			
	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	FROM	TO	FEET	TYPE	SIZE	NO.	

MISCELLANEOUS ACTIVITY	RIG NO.	HOURS	REMARKS
MOVING – MAKING SET-UPS			
CASING REMOVAL/INSTALLATION			
PIEZOMETER INSTALLATION			
HAULING WATER			
TEST EXCAVATION			
BACK FILLING			
DOWNTIME			

OTHER ACTIVITIES: WORK CONSISTS TOTALLY OF INSTALLING PIEZOMETERS AND/OR BURROS ANCHORS

OVERTIME

STANDBY

SB179739

H&CF GS-204 8/74

Bechtel Associates Professional Corporation

Inter-office Memorandum

To	S. S. Afifi	Date	5 September 1978
Subject	Midland Units 1 & 2-Job 7220-001 Progress Report No. 1 for Week Ending September 1, 1978 Drilling Program	From	A. S. Marshall
		Of	Geotechnical Services
Copies to	S. L. Blue J. O. Wanzeck 1310, 3410	At	Midland Jobsite

Six borings were drilled to depths of about 50 feet along the south side of the diesel generator building. One boring was drilled to a depth of about 50 feet on the east side of the building. Three dutch cone penetrations were made in the east cell of the building.

One boring was drilled at the primary makeup water tank to a depth of about 50 feet.

Dr. R. D. Woods of the University of Michigan visited the site on August 29 and 30, 1978 to provide a dutch cone machine.

Daily field reports pertaining to drilling operations are attached.

During the period, observations were made on the items discussed below:

1. Cracks were observed in the diesel generator building walls and footings with the majority of cracking on the outside of the east wall. Mssrs. Dean and Betts were informed of these observations.

2. Excavations for installation of piping had been cut vertical as much as four feet below the southeast corner of the diesel generator building. Mr. J. Dean was informed of this action.

3. Soft clay backfill was observed in the foundation excavation just north of the radwaste building. Geotech informed Mr. A. Boos that a boring should be drilled to verify the adequacy of the foundation soils.

4. Soft clay backfill was observed at the surface just northwest of the primary makeup water tank. Upon notification, Mr. J. Dean had this area excavated for inspection. (Size was 20' x 25' x 14' deep below El. 633.). Soft materials were observed above the bottom of the excavation. This excavation is to be backfilled and other exploratory excavations will be made to locate unacceptable materials.

SB179749

A.S. Marshall (cas)

A. S. Marshall

ASM/lag

Attachments: Bechtel Daily Field Reports dated 8/26/78 thru 9/1/78

Bechtel Associates Professional Corporation

Inter-office Memorandum

RECEIVED
JUN 0 3 1980
KARL WIEDNER

To L. H. Curtis

Date June 3, 1980

Subject Midland Plant Units 1 & 2
Job 7220
Permanent Plant Dewatering
System Criteria

From B. Dhar

Of Engineering

At Ann Arbor

Copies to

S. Afifi w/o
K. Bailey w/o
S. Blue w/o
L. Curtis w/o
M. Elgaaly w/o
Com Log w/o
T. Johnson w/o
W. Paris w/o
J. Rutgers w/a
J. Wanzeck w/o
[redacted]

File: 0294

The following is a complete response to your IOM dated May 23, 1980 regarding the permanent dewatering system.

1) An analyses had been done which indicated that we have a safety factor of 1.5 against liquefaction for an SSE with a maximum ground acceleration of 0.12g for the Diesel Generator and Auxiliary Building. Nevertheless due to the hetrogenous nature of the backfill, there is a possibility that some loose pockets could liquefy under the SSE of 0.12q, and if the SSE were raised to a higher level, then liquefaction of much of the sand backfill might become a problem. General area dewatering was recommended as a positive form to resolve all questions associated with potential liquefaction. Dewatering was considered a more positive remedial measure than chemical grouting because the process can be positively monitored, whereas it may never be possible to prove positively the beneficial effects of grouting. This system has no other design function.

2) The original proposal was initiated by the Diesel Generator Building Task Force consultants headed by Dr.s Peck and Hendron in a meeting in Ann Arbor on June 19, 1979.

3) The final decision to adopt a permanent dewatering system was made by the D. G. Task Force in a meeting held in Denver on June 28, 1979. This meeting was attended by the Task Force which consisted of Bechtel engineering and Geotechnical personal, Consumers Power personal, and the 5 consultants; also in attendance were Bechtel and Consumers Power Management Personal. The Denver meeting was in preparation for the July 18, 1978 meeting with the NRC at which the system was accepted by the NRC.

B. Dhar

BD/CR/bc
5/31/80

Enclosures: MOM June 22, 1979
MOM July 28, 1979

Response Requested: No

8170622

Bechtel Associates Professional Corporation

Inter-office Memorandum

RECEIVED
MAY 27 1980
KARL WIEDNER

To B. Dhar

Date May 23, 1980

Subject Midland Plant Units 1 and 2
Bechtel Job 7220
Permanent Plant Dewatering
System Criteria

From L.H. Curtis

Of Engineering

At Ann Arbor Office

File 0294

Copies to

K. Bailey
S. Blue
M. Elgaaly
W. Paris
J. Rutgers
J. Wanzeck
[redacted]
Tickler File

On May 22, 1980, J. Rutgers asked me to obtain answers to the following questions. He said that he has already discussed the first one with M. Elgaaly; therefore, action is probably already in progress:

1. If the seismic design criteria for the permanent dewatering system were 0.12g SSE, would the system still be necessary to prevent liquefaction and/or meet any other design objectives of the system?

2. Who originated the idea of installing a permanent dewatering system? Bechtel Geotech? Bechtel Project personnel? other Bechtel person? Consumers Power Company? one or more consultants?

3. When and by whom was the decision made to utilize a permanent dewatering system as part of the remedial action for plant fill problems?

By Monday, June 2, 1980, please provide me responses to these questions, with copies at least to J. Rutgers, K. Wiedner, and M. Elgaaly. If you are unable to give me answers to these questions by that date, please advise me prior to that date of an alternate date.

L.H. Curtis

L.H. Curtis

LHC/db

Response Requested: Yes

SB170623

Bechtel Associates Professional Corporation

Inter-office Memorandum

RECEIVED
MAY 23 1980
KARL WEDNER

To Distribution

Subject Midland Plant Units 1 and 2
Bechtel Job 7220
Subcontract 7220-C-208,
NRC Question 23, Part 1
[50.54(f)]

Copies to

Date May 22, 1980

From L.H. Curtis

Of Engineering

At Ann Arbor Office

File 0534, C-208, C-1122

Reference Response to NRC Question 23, Action Items 45 and 46

To respond to the referenced Nuclear Regulatory Commission question, Specification for Materials Testing 7220-C-208(Q), was reviewed by D.E. Graham (concrete specialist SFPD) and D.J. Puchy (materials and quality services). In-depth investigations were performed at the jobsite to review implementation of the specification for testing concrete, steel, and grease. Formal reports on the effectiveness of U.S. Testing in accurately reporting the test results were submitted to the project.

These reports are submitted for your review. Please forward your comments to the project by May 30, 1980.

Specification for monitoring fines for the dewatering contract is being reviewed by the geotechnical group and the report will be forwarded to you as soon as possible.

M. Elgaaly
For L.H. Curtis

BD/VP/bjm
5/19/3

Enclosures: 1. Review of U.S. Testing, by D.E. Graham
2. IOM, D. Puchy to L. Curtis, 4/23/80, with attachments

Distribution
L.H. Curtis w/a
L.E. Davis w/a
M. Elgaaly w/a
V. Manta w/a
V. Patankar w/a
R. Rixford w/a
[redacted]
Com Log

Response Requested: Yes

8006170624

TELECOPY TO D.W. HALLIGAN
MET 36

007239

Bechtel Power Corporation

Inter-office Memorandum

RECEIVED
APR 14 1980
KARL WIEDNER

To D.W. Halligan

Subject Midland Units 1 and 2
Bechtel Job 7220
Plant Fill Settlement

Copies to R.D. Allen
P.A. Becnel
L.H. Curtis
H.B. Friend
P.K. Hansen
F.A. Hollenbach
M.G. Johnson
B.C. McConnel
L.C. McKillip
H.O. Reinsch
E.A. Rumbaugh
H.W. Wahl
[redacted]
R.K. Vassar

Date April 11, 1980

From J. A. Rutgers

Of Project Management

At Ann Arbor Office

Following is a bi-weekly update on the activities related to the plant area fill settlement:

(1) The requirements to grout the gap which occurred under the Diesel Generator Building footing due to differential settlement prior to surcharging the area were issued for bid. This completes all engineering documents which have restricted completing construction and placement of the two Unit #2 Diesel Generators.

J.A. Rutgers

JAR/BCM/kb

Response Required: No

Com Use: N/A

SB170645

TELECOPY TO D. W HALLIGAN
MET ?

006923

Bechtel Power Corporation

Inter-office Memorandum

RECEIVED
APR 0 2 1980
KARL WIEDNER

To D. W. Halligan

Date April 1, 1980

Subject Midland Plant Units 1 and 2
Consumers Power Company
Bechtel Job 7220
Plant Fill Settlement

From J. A. Rutgers

Of Project Management

At Ann Arbor Office

Copies to

R. D. Allen
P. A. Becnel
L. H. Curtis
H. B. Friend
P. K. Hansen
F. A. Hollenbach
M. G. Johnson
B. C. McConnel
L. C. McKillip
H. O. Riensch
E. A. Rumbaugh
H. W. Wahl
[redacted]
R. K. Vassar

Following is an update on the activities related to the plant area fill settlement:

(1) The observation wells for the permanent dewatering system planned at the present have been completely installed.

(2) The temporary dewatering system around the service water pump structure is in operation and the site is starting to draw down. The system is stabilized at approximately 50 gpm pumping rate, which is about 1/3 of the predicted rate.

(3) The repair of damaged duct bank in the service water pump structure area has been completed.

J. A. Rutgers

JAR/BCM/kb

Response Required: No

Com Use: N/A

S3170648

Bechtel Associates Professional Corporation

Inter-office Memorandum

RECEIVED
MAR 2 8 1980
KARL WIEDNER

To	R.L. Rixford	Date	March 27, 1980
Subject	Midland Plant Units 1 & 2 Job 7220 NRC 14 CFR 50.54(f) Item 10, Page I-7	From	L.H. Curtis
		Of	Engineering
Copies to	File: C-2645	At	Ann Arbor

T. Johnson
K. Wiedner

Reference: Action Items from Response to 50.54(f) Question 1, Action Item 1, Page 1, Paragraph I-7(c.5.b)

A review of buried electrical duct banks has been performed. A total of 44 individual or groups of similar duct banks were reviewed. The terminations of each case were reviewed resulting in 24 possible vertical interfaces identified. Based on geometry, depth of vertical leg, and details on the design drawing, 13 cases were eliminated, leaving 11 cases which required detailed investigation. Additional information was obtained from the jobsite to define how the interface was constructed and whether any unusual behavior was observed.

The review concludes that only several nonsafety-related transformer pads experience differential settlement, which may be exaggerated by the duct bank interface. Except for the diesel generator building, in no case, has settlement been completely restricted or do design details, geometry of structures, or bedding conditions indicate that settlement would be completely restricted.

A copy of the draft review is attached.

M. Slaughter
FOR: L.H. Curtis

BCM/pd
9/13/4

Enclosure: Underground Duct Bank Investigation

S3170649

File Backfill Soils

(8)

JUL 22 1980

DISTRIBUTION

BECHTEL

J. Rutgers
P. Hansen
[redacted]
R. Simanek
L. Curtis
E. Newman
O. Holman
A. Boos
J. Wanzeck
L. Davis
N. Eidsmoe
K. Wiedner
L. Dreisbach
P. Corcoran
J. Betts
R. Davis

844

CPCo

J. Cook
H. Leonard
B. Wheeler
D. Horn

SB1677707

Bechtel Power Corporation

Post Office Box 2167
Midland, Michigan 48640

July 18, 1980

Consumers Power Company
1945 West Parnall Road
Jackson, MI 49201

Attention: W. R. Bird

Job 7220 Midland Project
Soils Committee Meeting Minutes
LAD-1648

Dear Mr. Bird:

Attached is the Soils Committee Meeting Report of July 10, 1980, which evolved as a result of the CPCo Soils Audit. This report has been reviewed and approved by representatives of CPCo and Bechtel Power Corporation.

Very truly yours,

L. A. Dreisbach,
Project Quality Assurance
Engineer

LAD/RED/sjc

Attachment

cc: B. Marguglio
D. Miller
J. Corley

The Soils Committee, appointed in the Monthly Project Management Meeting of the same date, started the soils meeting at 12:00 Noon on July 10, 1980. The meeting concluded at 7:20 p.m. that day. The following personnel were in attendance:

D. Horn	CPCo QAE
H. Leonard	CPCo QAE
R. M. Wheeler	CPCo - Construction
J. P. Betts	Bechtel Field Engineer
R. E. Davis	Bechtel QAE
*M. Elgaaly	Bechtel Assistant Project Engineer
J. Milandin	Bechtel Manager of QA - Ann Arbor Power Division
R. Simanek	Bechtel Project QC Supervisor and CCQCE
J. O. Wanzeck	Bechtel Geotech

*Chairman

Items discussed were:

1. 10 Preliminary Audit Findings identified in CPCo Soils Audit.
2. What actions are preventing the lifting of the Stop Work Order.

CPCo AUDIT FINDINGS AND ACTIONS PREVENTING THE LIFTING OF THE STOP WORK ORDER

Based on the review of this committee there are no actions from the audit or audit findings to prevent the lifting of the Stop Work Order.

1. AUDIT FINDING NUMBER 1

This item (to be rewritten) is a Finding.

The finding is that tests resulting in over 105% of Relative Density are not being retested as required.

CORRECTIVE ACTION:

A. Spec. C-208 will be revised to include a requirement that tests resulting in a 105% or greater Relative Density for cohesionless materials or 105% of maximum dry lab density for cohesive materials shall be evaluated and dispositioned by Geotech. Date to be completed by 7/17/80.

B. Bechtel NCR 3041 must be dispositioned. To be completed by 7/17/80.

C. Quality Control Inspection Records will show disposition by Geotech Engineer's signature for test results over 105% or greater.

No actions preventing the lifting of the Stop Work Order noted in this Finding. Bechtel will implement the "retest" criteria pending revision to the specification.

2. AUDIT FINDING NUMBER 2

This is considered a Finding.

The Finding is that the Compacted Fill Density Test Report issued by U. S. Testing Company for test number 6083 has an error in the elevation of the test. The test elevation was listed on the report as 627.5 elevation; the test should have been listed at 626.5 elevation.

CORRECTIVE ACTION

The test elevation must be corrected on the U. S. Testing Report. To be completed by 7/17/80.

No actions preventing the lifting of the Stop Work Order noted in this Finding.

3. AUDIT FINDING NUMBER 3

This item is considered an Observation.

The Observation expressed a question as to the method of documenting the exact placement of soil by listing coordinates when length and width measurements are approximate.

RESPONSE

The "coordinates" and the length and width measurements are not intended to convey precisely the same information. No corrective action is required, but a fuller explanation will be given in response to the audit report.

No action preventing the lifting of the Stop Work Order noted in this Finding/Observation.

4. AUDIT FINDING NUMBER 4

This item was considered a Finding.

The finding is that QC is documenting the passes observed of the compaction equipment, whereas the QCI, as written, requires recording of the passes used.

CORRECTIVE ACTION

Quality Control to revise instruction 8 for the Daily Soils Placement Report to record which lift passes were observed. Date to be completed by 7/17/80.

The original intent was to record what was observed.

No action preventing the lifting of the Stop Work Order noted in this Finding.

5. AUDIT FINDING NUMBER 5

This item is considered to be an Observation.

The Observation expressed is the concern that Quality Control Inspection Records are not "signed off" in a timely manner by a Level II Quality Control Engineer

RESPONSE

A. All QCIR's (applicable) are to be signed off by August 1, 1980.

B. Level II to sign off Daily Placement Reports daily.

C. CPCo and Bechtel agree that quicker signoff by Level II Engineer is desired. Bechtel and CPCo will address this concern.

No action preventing the lifting of the Stop Work Order noted in this Observation.

6. AUDIT FINDING NUMBER 6

This item is considered Unresolved pending further investigation by CPCo QA.

The unresolved item concerns the method by which Quality Control determines the actual frequency taken.

CPCo QA will investigate this process with Quality Control as to the acceptabilityof the process. Date to be completed by 7/17/80.

No actions preventing the lifting of the Stop Work Order noted in this Unresolved item.

7. AUDIT FINDING NUMBER 7

This item is considered to be an Observation.

The observation noted the lack of definition of "represented" and "rework". The specification intent is not clear.

RESPONSE

CPCo QA and Bechtel QA to write a Quality Action Request (QAR) to provide both Project Engineering and Geotech rationale as to the answers to the subject questions. Date to be completed by 7/17/80.

No actions preventing the lifting of the Stop Work Order noted in the Finding/Observation.

8. AUDIT FINDING NUMBER 8

This item (to be rewritten) is considered a Finding.

The finding is that QC did not inspect three Q placements in accordance with the QCI.

CORRECTIVE ACTION

A. Two of the three cases are not actually Q placements, and a fuller explanation will be given in response to the audit report.

B. In the third case, the placement need not have been Q classified to meet SAR commitments; therefore, no compromise of safety exists. Project Engineering will consider declassifying these placements.

No action preventing the lifting of the Stop Work Order noted in this Finding.

9. AUDIT FINDING NUMBER 9

This item is considered a Finding.

The rewritten finding concerned the fact that Spec. C-211 Rev. 10 Section 8.6 requires the Geotech engineer verify attributes of the equipment such as frequency (revolutions per minute), speed of horizontal motion, and overlap per pass of equipment for soil compaction equipment.

CORRECTIVE ACTION

Verification of speed or frequency is not practical for some (small) equipment. Spec. C-211 to be revised to reflect intent of requirement and clarify how verification is to be accomplished. Date to be completed by 7/17/80.

10. AUDIT FINDING NUMBER 10

This rewritten item is considered a Finding.

This finding concerns the fact that Spec. C-211, Rev. 10, para. 8.11 states in part that the Geotech Engineer shall "approve each" test report. There is no documented evidence that he does, in fact, "approve each" report.

CORRECTIVE ACTION

A. Project Engineering to clarify spec. to define the actions required of, and the objectives to be satisfied by, the Geotech engineer intended by "approve". Spec. C-211 will be updated by 7/17/80.

7/28/80

B. CPCo to interview Geotech engineer tc obtain confidence that technical overview by Geotech has been accomplished despite lack of "approval" evidence. CPCo review will be completed by 7/11/80.