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Bechtel Associates Professional Corporation
Ann Arbor, Michigan

Appendix K
Spec C-208


TECHNICAL SPECIFICATIONS
FOR
BACKFILL
FOR THE
CONSUMERS POWER CO.
MIDLAND PLANT, UNITS 1 & 2
MIDLAND, MICHIGAN

| △

Consisting Of:

1. Technical Specification

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| 8 | 11-1-79 | Revised as noted on facing sht. Inc SCN 9002 | MF | LHM | DA | RO | LWC |
| 7 | 6-27-79 | Revised as noted on facing sheet; Incorporated comments on rev. 6 | AKC | HA | DA | RO | RLC |
| 6 | 5/18/78 | Major revision. Incorporated SCN 9001 Revised as noted on facing sheet | AKC | HA | DA | RO | RLC |
| 5 | 10/23/78 | Revised as noted on Facing Sheet, Incorporated SCN 8001 | WJW | DAE | DA | RO | RLC |
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| 3 | 11-8-76 | Rev. as noted on Facing Sht.; Inc, SCN 6001 & 6002 | RJM | DA | RO | RO | RLC |
| 2 | 6-4-76 | Revised as noted on Facing Sheet | RLC | DA | RO | RO | RLC |
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| 1 | 8 | | | | | | | | | | | | |
| 11 | 8 | | | | | | | | | | | | |
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| 7 | 6-27-74 | revised shts 1 thru 9 added sht. 10 | CHA | RC | RC | | | | | | | | |
| 6 | 5/16/74 | Expanded shts 1-4 into sheets 1-9 | CHA | RC | RC | | | | | | | | |
| 5 | 10/23/73 | Revised Sh 1 thru 6 | die | RC | RC | | | | | | | | |
| 4 | 2-21-77 | Revised Sh 1, 11, 1, 2 | RC | RC | RC | | | | | | | | |
| 3 | 11-2-73 | Revised Shts. 1, 11, 2, 3, & 3A | RC | RC | RC | | | | | | | | |
| 2 | 6-4-73 | Revised shts. 1, 11, 1, 2, 3, added sht. 3A | RC | RC | RC | | | | | | | | |
| 1 | 1-15-75 | Revised shts 1, 11, 1, 2, 3 | RC | RC | RC | | | | | | | | |
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| NO | DATE | REVISIONS | BY | CHK'D | APP'D | NO. | DATE | REVISIONS | BY | CHK'D | APP'D | | |

MIDLAND



FACING SHEET
 MIDLAND PLANT UNITS 1 & 2
 BACKFILL
 CONSUMERS POWER COMPANY



JOB No. 7220

Specification No.
 C-211 (Q)
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TECHNICAL SPECIFICATIONS
 FOR
 BACKFILL
 FOR THE
 CONSUMERS POWER COMPANY
 MIDLAND PLANT UNITS 1 AND 2
 MIDLAND, MICHIGAN



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TECHNICAL SPECIFICATION
FOR
BACKFILL

1.0 WORK INCLUDED

1.1 STRUCTURAL BACKFILL

The term "structural backfill" as used in this specification includes backfill materials to be placed within 3 feet of the exterior wall of any plant area structure. Materials used as described above may, subsequent to such usage, also support part of another structure.

1.2 PLANT AREA BACKFILL

The term "plant area backfill" as used in this specification shall include placement of all embankment materials required to construct the fill in the plant area, berm backfill, and dikes within the plant area except backfill materials to be placed within 3 feet of any plant area structures. Only sand from offsite sources may be used in backfill areas inaccessible to motorized rollers.

1.3 GENERAL

This specification applies to backfill material placed by Bechtel. When Specification 7220-C-210 is referenced, the term "Subcontractor" shall mean Bechtel work forces, and the term "Contractor" shall mean Bechtel's onsite geotechnical soils engineer. In case of conflict, this specification shall prevail.

The backfill material as described in this Specification contains both Q-listed and non-Q-listed work.

2.0 RELATED WORK NOT INCLUDED

The following items of related work are not included:

2.1 Site clearing and grubbing

2.2 Slurry trench

2.3 Soils testing

3.0 ABBREVIATIONS

ASTM - American Society of Testing and Materials

MIOSHA - Michigan Occupational Safety and Health Act

4.0 CODES AND STANDARDS

Unless otherwise specified herein or shown in the drawings, materials, construction requirements, and testing shall be in accordance with the following codes and standards to the extent indicated by references herein. The date of issue (or revision) indicated shall apply.

ASTM D 1557-70 Structural Method of Test for Moisture-Density Relations of Soils Using 10-Pound Rammer and 18-Inch Drop

ASTM D 422-63 Standard Method of Test for Particle-Size Analysis of Soils

ASTM D 2049-69 Standard Method of Test for Relative Density of Cohesionless Soils

ASTM D 2216-71 Standard Method of Laboratory Determination of Moisture Content of Soil

5.0 EXCAVATIONS

All necessary precautions shall be taken to preserve all material below and beyond the limits of required excavation in a sound and firm condition. If, as determined by the onsite geotechnical soils engineer, materials below and beyond the required excavation limits were disturbed because of excavation methods employed, such material shall be removed and replaced with suitable compacted material as required by this specification. All excavations shall conform to MIOSHA requirements (MIOSHA compliance is non-Q).

Immediately upon completion and approval of each excavation for building foundations, a minimum of 4 inches of lean concrete mudmat (in accordance with Specification 7220-C-230) shall be poured on the bottom.

6.0 FOUNDATION PREPARATION

No fill shall be placed on any foundation until the onsite geotechnical soils engineer has approved the foundation and reviewed the applicable tests.

Approval for the foundation shall be made immediately before placement of the material. Foundations shall be cut to firm material and shall be free of all loose and wet material.

7.0 RECONDITIONING EXISTING EARTHWORK

Prior to each year of backfill placement, the onsite geotechnical soils engineer shall approve all areas in which backfill material is to be placed. Criteria for this approval shall include, but not be limited to, the following:

- 7.1 The ground surface and the subgrade does not contain any frozen or disturbed material.
- 7.2 The ground surface and the subgrade shall be firm material and shall be free of all loose and wet material.
- 7.3 The layer upon which the fill is to be placed shall be tested. The number and type of tests shall be determined by the onsite geotechnical soils engineer.

8.0 BACKFILL

8.1 STRUCTURAL MATERIAL REQUIREMENTS

Unless otherwise approved, materials for structural backfill shall be obtained from a source approved in accordance with Section 8.1.1 of this specification. Designation and approval of a source does not necessarily indicate that all material from that source is suitable for structural backfill. The suitability of the material is to be determined by the onsite geotechnical soils engineer in accordance with Section 8.7 of this specification. Only suitable material from the approved sources shall be placed in the backfill. If unsuitable material is placed in any part of the backfill, all such material shall be removed and replaced with suitable material. Material containing brush, roots, peat, sod, or other organic, perishable, or deleterious matter, snow, ice, or frozen soil shall not be placed in the backfill.



- 8.1.1 The materials used for structural backfill within 3 feet of the exterior wall of any plant area structure shall be cohesionless and free-draining. The grain-size gradation, as determined by ASTM D 422 without the hydrometer test, shall be within the range shown below:

| <u>Sieve Size</u> | <u>Percent Retained*</u> | |
|-------------------|--------------------------|---------------|
| | <u>Fine</u> | <u>Course</u> |
| 1 inch | 0 | 0 |
| #4 | 0 | 25 |
| #10 | 0 | 50 |
| #40 | 40 | 95 |
| #200 | 95 | 100 |

*This gradation range shall not be skip graded and is not meant to represent or coincide with materials (Zones 1, 2, 3, etc) defined in Specification 7220-C-210.



Project engineering shall be informed of the grain size distribution and characteristics of the material proposed for use as structural backfill (see Section 8.7.1).

- 8.1.2 In lieu of the structural backfill materials described above, lean concrete, as specified in Specification 7220-C-230, may be used when approved by the onsite geotechnical soils engineer. Lean concrete backfill shall be made of non-Q material and workmanship.



8.2 PLANT AREA BACKFILL

- 8.2.1 Except for sand from offsite sources, the materials used for plant area backfill are to be in accordance with the material portion of Section 13.3 of Specification 7220-C-210.



- 8.2.2 For plant area structures where depth of foundations is 6 feet or more, the top 2 feet of backfill may consist of Zone 1 material as defined in Specification 7220-C-210. When approved by the onsite geotechnical soils engineer, the top 6 inches may consist of Zone 4A material conforming to Specification 7220-C-210.



8.2.3 Sand from offsite sources shall be approved by the onsite geotechnical soils engineer. This sand shall be 100% passing the 3/4-inch sieve and a maximum of 12% passing the Number 200 sieve. Sand from offsite sources used as random fill needs no gradation requirements.



8.2.4 In lieu of sand from offsite sources, lean concrete, as specified in Specification 7220-C-230, may be used when approved by the onsite geotechnical soils engineer. Lean concrete backfill shall be made of non-Q material and workmanship.

8.3 PLACEMENT

8.3.1 After the completion of footings and walls and prior to placement of backfill, all forms will be removed, and the excavation shall be cleaned of all trash, debris, and unsuitable material.

8.3.2 No backfill material shall be placed in any excavation until the condition of the subgrade has been approved by the onsite geotechnical soils engineer.

The gradation and distribution of materials throughout the backfill shall be such that the completed backfill will be uniform and free from lenses, pockets, streaks, or other material imperfections except as required for utilities and other applications as determined by the onsite geotechnical soils engineer. Material placed in the backfill shall not contain large solid lumps or clods of material which will not break down and compact satisfactorily when compacted as specified. No backfill shall be placed upon a frozen surface, nor shall any frozen material be incorporated in the backfill.



The uncompacted lift thickness of the backfill material shall be determined by the onsite geotechnical soils engineer after evaluation of the proposed compaction equipment. However, in no case shall the uncompacted lift thickness exceed

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8 inches for heavy, self-propelled equipment and 4 inches for hand-operated equipment.

- 8.3.3 Unless otherwise specified, backfill areas being placed shall be raised simultaneously with the top surface of the backfill to form an approximately horizontal plane or parallel with the final grade.
- 8.3.4 When placing material next to an area that has already been compacted, the intersecting surfaces shall extend into the previously compacted area. This benching into the previously placed material for each lift shall be a minimum of the lift thickness.
- 8.3.5 All soils work shall be performed under the direction of a qualified onsite geotechnical soils engineer.
- 8.3.6 Backfilling in which moisture conditioning is required shall be suspended when the ambient temperature is 32F and falling unless otherwise approved by the onsite geotechnical soils engineer.

8.4 MOISTURE CONTROL

- 8.4.1 Structural backfill and sand materials from offsite sources shall have adequate moisture content to obtain the required density. If the material does not have sufficient moisture content to adequately compact the material, such material shall be conditioned by sprinkling, aerating, harrowing, disking, draining, or by other approved means as determined by the onsite geotechnical engineer.



8.4.2 Plant Area Backfill

Moisture control for plant area backfill, except for sand from offsite sources, shall be $\pm 2\%$ of optimum in accordance with Section 13.6 of Specification 7220-C-210.



8.4.3 Moisture Content

The method to determine moisture content at the time of density testing (i.e., point of acceptance) shall be in accordance with ASTM D 2216.

The method to determine moisture content for information purposes (i.e., before and during compaction) may be made by using rapid determination methods, provided the following is met.

- a. The code and/or manufacturer's instructions shall be followed.
- b. The results using rapid determination methods shall be compatible with those obtained using ASTM D 2216.
- c. Compatibility of the methods shall be determined by the onsite geotechnical soils engineer.
- d. Nuclear density devices shall not be used to determine moisture content.

8.5 COMPACTION EQUIPMENT

8.5.1 Selection and approval of all of the proposed compaction equipment shall be on the basis of demonstrated ability to accomplish adequate compaction without damage to, or overstressing of, the adjacent structural members.

8.5.2 Structural backfill and sand from offsite sources shall be compacted using either rubber-tired rollers, vibratory rollers or compactors, or power tampers. Use of compaction equipment other than operator-held equipment within 3 feet of the structural walls shall be reviewed by project engineering. The onsite geotechnical soils engineer shall provide information regarding the proposed compaction equipment and location sufficient for an adequate review of the adjacent structural members.

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