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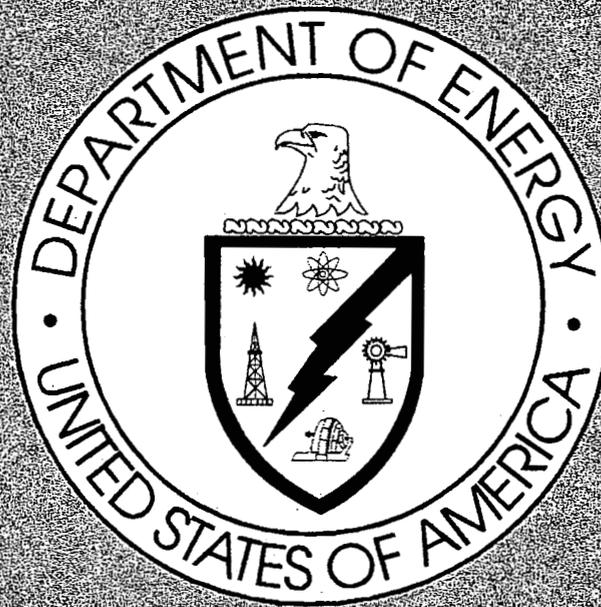
**SUBMITTAL OF INTERMEDIATE DESIGN PACKAGE (60%) FOR THE  
ON-SITE DISPOSAL FACILITY - INTERMEDIATE DESIGN  
SPECIFICATION PACKAGE - REVISION D - APRIL 1996**

04/10/96

**DOE-0771-96  
DOE-FN        EPAS  
300  
DESIGN**

**INTERMEDIATE DESIGN  
SPECIFICATION PACKAGE  
ON-SITE DISPOSAL FACILITY**

**REVISION D  
APRIL 1996**



**United States Department of Energy  
Fernald Environmental Management Project  
Fernald, Ohio**

prepared by

**GEOSYNTEC CONSULTANTS**

1100 Lake Haven Drive, NE, Suite 200  
Atlanta, Georgia 30342

under

**Fernald Environmental Restoration Management Corporation**

Subcontract 95PS005028

**INTERMEDIATE DESIGN  
SPECIFICATION PACKAGE**

**ON-SITE DISPOSAL FACILITY**

EDC

**April 1996  
Revision D**

**United States Department of Energy**

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**Fernald Environmental Management Project**  
**April 1996**

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Note: \* Indicates specification sections included in the Intermediate Design Package. Remaining specification sections will be included in the Certified-for-Construction Package.

SPECIFICATION COVER SHEET

SPECIFICATION SECTION: 02110 TITLE: CLEARING AND GRUBBING

Specifications By: Signature J.F. Beetz 23 Oct 95  
 (Cognizant Engineer) Date  
 Printed Name J.F. BEETZ, PRINCIPAL  
 and Title

Scope and Format  
 Checked By: Signature R. Neil Davies  
 (Checker) Date 10/23/95  
 Printed Name R. NEIL DAVIES, SENIOR PROJ. ENG.  
 and Title

Detailed Requirements  
 Checked by: Signature Not Used for 30% Submittal Mark H. Gleason 9 Feb 96  
 (Checker) Date  
 Printed Name MARK H. GLEASON  
 and Title Assistant Project Engineer

Overall Review By: Signature Not Used for 30% Submittal KW 19 Feb 96  
 (PDP) Date  
 Printed Name Kenneth W Carroll  
 and Title Associate

Approved by: Signature Not Used for 30% Submittal J.F. Beetz 24 Feb 96  
 (DTL) Date 8 April 96  
 Printed Name Beetz Kenneth W Carroll  
 and Title PRINCIPAL Associate

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
A	30% Submittal				
B	Preliminary Design for EPA Submittal	14 Dec 95	JFB	RND	NVA
C	Intermediate Design	27 Feb 96	MTH	MTH	JFB
D	Intermediate Design - EPA Submittal	8 April 96	KW		

## SECTION 02110

## CLEARING, GRUBBING, AND STRIPPING

## PART 1 GENERAL

## 1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary to perform clearing, grubbing, and stripping as specified herein and shown on the Construction Drawings.
- B. The work shall include, but not be limited to clearing and grubbing the areas indicated on the Construction Drawings. In addition, the work shall include stripping topsoil from impacted and non-impacted areas, and transporting it to stockpile locations as indicated on the Construction Drawings or as directed by the Construction Contract Manager.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 01050 - Surveying
- D. Section 02200 - Earthwork
- E. Section 02270 - Erosion and Sediment Control

## 1.03 MEASUREMENT AND PAYMENT

Measurement and payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].
- B. Site Health and Safety Plan.

1     **1.05     DEFINITIONS**

- 2
- 3     A. Clearing shall consist of the removal of trees, bushes, above-ground vegetation, and  
4     other surface debris from above the ground surface.
- 5
- 6     B. Grubbing shall consist of the removal of stumps, roots, and vegetation from below the  
7     ground surface.
- 8
- 9

10    **PART 2 PRODUCTS**

11

12    **2.01     MATERIALS**

- 13
- 14    A. Materials to be cleared and grubbed include trees, shrubs, and any debris or other  
15    foreign matter identified by the Engineer as not suitable for inclusion directly  
16    underneath the construction site.
- 17
- 18    B. Existing topsoil is defined as the surficial material occurring within the limits of  
19    stripping to a depth ranging from zero to approximately 6 inches (or deeper as  
20    identified by the Engineer) beneath the ground surface.
- 21
- 22

23    **PART 3 EXECUTION**

24

25    **3.01     FAMILIARIZATION**

26

27    Prior to implementing any of the work described in this Section, the OSDF  
28    Construction Subcontractor shall become thoroughly familiar with the site, the site  
29    conditions, all portions of the work falling within this Section, and the general  
30    requirements as detailed in Section 01012.

31

32    **3.02     EROSION AND SEDIMENT CONTROL**

33

34    Prior to implementing any of the work described in this Section, the OSDF  
35    Construction Subcontractor shall install all erosion and sediment controls in the  
36    relevant areas of construction as shown on the Construction Drawings and detailed in  
37    Section 02270. The OSDF Construction Subcontractor is solely responsible for  
38    selecting, implementing, and maintaining proper and fully adequate temporary erosion  
39    and sediment controls associated with clearing and grubbing activities.

40

41

1     **3.03     CLEARING AND GRUBBING**

- 2
- 3     A. Clearing and grubbing shall only be performed in the areas identified on the
- 4     Construction Drawings and approved by the Construction Contract Manager.
- 5
- 6     B. In those areas where only clearing shall be performed, the OSDF Construction
- 7     Subcontractor shall perform the clearing in a manner that minimizes disturbance to the
- 8     existing ground surface.
- 9
- 10    C. The OSDF Construction Subcontractor shall perform clearing and grubbing as separate
- 11    activities.
- 12
- 13    D. The OSDF Construction Subcontractor shall chip cleared materials of a woody nature
- 14    to a size that is suitable for use as mulch. Cleared material to be chipped shall be kept
- 15    as free of inorganic matter as possible. Grubbed material shall not be chipped unless
- 16    directed by the Construction Contract Manager.
- 17
- 18    E. The OSDF Construction Subcontractor shall stockpile all cleared material in an area
- 19    approved by the Construction Contract Manager and shall dispose of the material in
- 20    accordance with the instructions of the Construction Contract Manager.
- 21
- 22    F. The OSDF Construction Subcontractor shall establish an area or areas approved by the
- 23    Construction Contract Manager for the placement of all grubbed materials. Materials
- 24    grubbed from areas designated for impacted soil removal shall be handled and
- 25    stockpiled separately from materials grubbed outside the impacted soil removal areas.
- 26    The OSDF Construction Subcontractor shall provide plastic sheeting to separate
- 27    grubbed impacted material from the existing ground surface and to cover the grubbed
- 28    impacted material to prevent rainfall infiltration. The Construction Contract Manager
- 29    shall be responsible for scheduling testing of the stockpiled impacted material to
- 30    determine the appropriate disposal option. Grubbed materials determined by the
- 31    Construction Contract Manager to not be impacted may be reused in construction as
- 32    allowed by these specifications. Stumps from non-impacted areas shall be chipped
- 33    only if directed by the Construction Contract Manager. Stumps from impacted areas
- 34    shall not be chipped.

35

36     **3.04     STRIPPING**

- 37
- 38     A. Existing topsoil shall be removed from areas within the limits shown on the
- 39     Construction Drawings, the borrow area, and other areas of the construction site
- 40     required to facilitate equipment traffic. Topsoil shall be transported by the OSDF

1 Construction Subcontractor to a location designated by the Construction Contract  
2 Manager for stockpiling or reuse.

- 3  
4 B. Equipment and methods of operation shall be selected by the OSDF Construction  
5 Subcontractor with the intent of minimizing disturbance to underlying soils.  
6  
7 C. If soil or weather conditions are unsuitable for topsoil stripping, as determined by the  
8 CQC Consultant, the OSDF Construction Subcontractor shall cease stripping activities  
9 until permission to resume stripping activities is obtained from the CQC Consultant.  
10

### 11 3.05 SOIL STOCKPILING

12 Stripped topsoil shall be placed in stockpiles of neat configurations and having  
13 sideslopes no steeper than .3H:1V unless approved by the Construction Contract  
14 Manager. The surface of each stockpile shall be shaped and tracked prior to the end  
15 of each working day during which soil is stockpiled. Tracking shall be up and down  
16 the slope.  
17  
18

### 19 3.06 SURVEYING AND CONSTRUCTION TOLERANCES

20 The OSDF Construction Subcontractor shall be responsible for providing survey  
21 control of his work. All surveying shall be performed in accordance with Section  
22 01050 of these Specifications.  
23  
24

### 25 3.07 PROTECTION OF WORK

- 26  
27 A. The OSDF Construction Subcontractor shall use all means necessary to protect all  
28 prior work, including all materials and completed work of other Sections, as detailed  
29 in Section 01012.  
30  
31 B. In the event of damage, the OSDF Construction Subcontractor shall immediately make  
32 all repairs and replacements necessary, to the approval of the Construction Contract  
33 Manager and at the OSDF Construction Subcontractor's expense.  
34  
35  
36  
37  
38  
39

[END OF SECTION]

**SPECIFICATION COVER SHEET**

**SPECIFICATION SECTION:** 02200 **TITLE:** EARTHWORK  
**Specifications By:** Signature J.F. Beeth 23 Oct 95  
 (Cognizant Engineer) Date  
 Printed Name J.F. BEETH, PRINCIPAL  
 and Title

**Scope and Format**  
**Checked By:** Signature R. Neal Davis 10/23/95  
 (Checker) Date  
 Printed Name R. NEAL DAVIS Senior Proj. Eng.  
 and Title

**Detailed Requirements**  
**Checked by:** Signature Not Used for 30% Submittal Mark H. Gleson 9 Feb 96  
 (Checker) Date  
 Printed Name MARK H. GLESON  
 and Title Assistant Project Engineer

**Overall Review By:** Signature Not Used for 30% Submittal Kenneth W. Cargill 19 Feb 96  
 (PDP) Date  
 Printed Name Kenneth W Cargill  
 and Title Associate

**Approved by:** Signature Not Used for 30% Submittal J.F. Beeth 21 Feb 96  
 (DTL) Date  
 Printed Name BEETH, PRINCIPAL  
 and Title Associate

**Record of Revision (Number and initial all revisions)**

Rev. No.	Reason	Date	By	Checked	Approval
0A	30% Submittal				
<del>B</del>	<del>Reprint for EPA Submittal</del>	<del>14 Dec 95</del>	<del>NA</del>	<del>NA</del>	<del>NA</del>
B	Reprint for EPA Submittal	14 Dec 95	NA	NA	NA
C	Intermediate Design	27 Feb 96	-	-	JFB
D	Intermediate Design - EPA Submittal	6 Apr 96	-	-	-

**SECTION 02200**

**EARTHWORK**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary to perform all earthwork. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. The work shall include, but not be limited to excavating, hauling, backfilling, compacting, and grading. Earthwork shall conform to the dimensions, lines, grades and sections shown on the Construction Drawings or as directed by the Construction Contract Manager.

**1.02 RELATED SECTIONS**

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 01050 - Surveying
- D. Section 02110 - Clearing, Grubbing, and Stripping
- E. Section 02140 - Dewatering
- F. Section 02210 - Subgrade Preparation
- G. Section 02215 - Trenching
- H. Section 02230 - Road Construction
- I. Section 02270 - Erosion and Sediment Control
- J. Section 02930 - Vegetation

**1.03 MEASUREMENT AND PAYMENT**

Measurement and payment shall be in accordance with Section 01025.

1  
2 **1.04 REFERENCES**  
3

- 4 A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site*  
5 *Disposal Facility*", dated [REDACTED].  
6  
7 B. Site Health and Safety Plan.  
8  
9 C. Site Construction Quality Assurance (CQA) Plan  
10  
11 D. Latest version of American Society for Testing and Materials (ASTM) standards:  
12 1. ASTM D 422. Standard Method for Particle-Size Analysis of Soils.  
13 2. ASTM D 698. Standard Test Methods for Moisture-Density Relations of  
14 Soils and Soil-Aggregate Mixtures Using a 5.5-lb (2.49-kg)  
15 Rammer and 12-in. (305-mm) Drop.  
16 3. ASTM D 2216. Standard Method for Laboratory Determination of Water  
17 (Moisture) Content of Soil, Rock, and Soil-Aggregate  
18 Mixtures.  
19 4. ASTM D 2487. Standard Test Method for Classification of Soils for  
20 Engineering Purposes.  
21 5. ASTM D 2922. Standard Test Methods for Density of Soil and Soil-Aggregate  
22 In Place by Nuclear Density Methods (Shallow Depth).  
23 6. ASTM D 2937. Standard Test Method for Density of Soil in Place by the  
24 Drive-Cylinder Method.  
25 7. ASTM D 3017. Standard Test Method for Water Content of Soil and Rock In  
26 Place by Nuclear Methods (Shallow Depth).  
27 8. ASTM D 4318. Standard Test Method for Liquid Limit, Plastic Limit, and  
28 Plasticity Index of Soils.  
29

30 **1.05 SUBMITTALS**  
31

- 32 A. The OSDF Construction Subcontractor shall submit to the Construction Contract  
33 Manager a description of equipment methods proposed for earthwork at least 14 days  
34 prior to the start of activities covered by this Section.  
35  
36 B. If the work of this Section is interrupted for reasons other than inclement weather, the  
37 OSDF Construction Subcontractor shall notify the Construction Contract Manager a  
38 minimum of 24 hours prior to the resumption of work.  
39  
40  
41

1 **1.06 QUALITY ASSURANCE**

- 2
- 3 A. The OSDF Construction Subcontractor shall ensure that the materials and methods
- 4 used for earthwork meet the requirements of the Construction Drawings and this
- 5 Section. Any material or method that does not conform to these documents, or to
- 6 alternatives approved in writing by the Engineer will be rejected and shall be repaired
- 7 or replaced by the OSDF Construction Subcontractor at his expense.
- 8
- 9 B. The OSDF Construction Subcontractor shall be aware of all monitoring and
- 10 field/laboratory conformance testing required by the CQA Plan. This monitoring and
- 11 testing, including random conformance testing of construction materials and completed
- 12 work, will be performed by the CQC Consultant. If nonconformances or other
- 13 deficiencies are found in the OSDF Construction Subcontractor's materials or
- 14 completed work, the OSDF Construction Subcontractor will be required to repair or
- 15 replace the deficiency at his expense.
- 16

17 **1.07 EXISTING CONDITIONS**

- 18
- 19 A. Existing site surface and subsurface conditions, based on available site data, are
- 20 indicated on the Construction Drawings. Topographic and subsurface conditions may
- 21 vary from those shown on the Construction Drawings. It shall be the OSDF
- 22 Construction Subcontractor's responsibility to verify the accuracy of all existing
- 23 conditions shown on the Construction Drawings. The OSDF Construction
- 24 Subcontractor shall immediately notify the Construction Contract Manager in writing
- 25 of variations to the existing conditions indicated on the Construction Drawings.
- 26
- 27 B. The approximate locations of all known underground and above ground utility lines
- 28 and structures are shown on the Construction Drawings. The OSDF Construction
- 29 Subcontractor shall immediately notify the Construction Contract Manager if other
- 30 utility lines or structures, not shown on the plans, are encountered during execution
- 31 of the work.
- 32
- 33 C. The OSDF Construction Subcontractor is hereby advised that the ground-water
- 34 elevation varies during the year and may be different than that shown on the
- 35 Construction Drawings.
- 36
- 37
- 38

1     **PART 2 PRODUCTS**

2  
3     **2.01 MATERIALS**

- 4  
5         A. All compacted fill for general earthwork shall be obtained from on-site borrow sources  
6         identified on the Construction Drawings or by the Construction Contract Manager.  
7  
8         B. Compacted fill shall consist of relatively homogeneous, natural soils that are free of  
9         debris, foreign objects, large rock fragments, roots, and organics. No materials larger  
10        than 2 inches shall be allowed. The compacted fill shall be classified according to the  
11        Unified Soil Classification System (per ASTM D 2487) as GC, ML, CL, or CH. The  
12        OSDF Construction Subcontractor may propose the use of other soil types as  
13        compacted fill, but then such use shall be at the sole discretion of the Engineer.  
14

15     **2.02 EQUIPMENT**

- 16  
17         A. The OSDF Construction Subcontractor shall furnish, operate, and maintain compaction  
18         equipment as is necessary to produce the required in-place soil density and moisture  
19         content.  
20  
21         B. The OSDF Construction Subcontractor shall furnish, operate and maintain tank trucks,  
22         pressure distributors, or other equipment designed to apply water uniformly and in  
23         controlled quantities to variable surface widths.  
24  
25         C. The OSDF Construction Subcontractor shall furnish, operate; and maintain  
26         miscellaneous equipment such as scarifiers, disks, spring tooth or spike tooth harrows,  
27         earth hauling equipment, and other equipment, as necessary for earthwork  
28         construction.  
29  
30

31     **PART 3 EXECUTION**

32  
33     **3.01 FAMILIARIZATION**

- 34  
35         A. Prior to implementing any of the work in this Section, the OSDF Construction  
36         Subcontractor shall become thoroughly familiar with the site, the site conditions, and  
37         all portions of the work falling within this Section, and the general requirements as  
38         detailed in Section 01012 of these Specifications.  
39  
40  
41

1 B. Inspection:

- 2 1. Prior to implementing any of the work in this Section, the OSDF Construction  
3 Subcontractor shall carefully inspect the installed work of all other Sections and  
4 verify that all work is complete to the point where the installation of the work  
5 specified in this Section may properly commence without adverse impact.  
6 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
7 work of other Sections, the Construction Contract Manager shall be notified in  
8 writing prior to commencing work. Failure to notify the Construction Contract  
9 Manager or continuance of the work of this Section will be construed as OSDF  
10 Construction Subcontractor's acceptance of the related work of all other Sections.  
11

12 **3.02 SITE PREPARATION**

- 13
- 14 A. The OSDF Construction Subcontractor shall install all erosion and sediment controls  
15 in the relevant areas of construction as shown on the Construction Drawings and as  
16 detailed in Section 02270 of these Specifications. The OSDF Construction  
17 Subcontractor shall maintain the erosion and sediment controls for the duration of  
18 construction and until the contained areas are successfully revegetated. Accumulated  
19 sediment behind silt fences shall be disposed of in a manner approved by the  
20 Construction Contract Manager.  
21
- 22 B. The OSDF Construction Subcontractor shall construct the construction haul roads and  
23 access corridors in accordance with the Construction Drawings and Section 02230 of  
24 these Specifications.  
25
- 26 C. The OSDF Construction Subcontractor shall perform clearing and grubbing in  
27 accordance with the Construction Drawings and Section 02110 of these Specifications  
28 prior to any earthwork activity.  
29
- 30 D. The OSDF Construction Subcontractor shall be responsible for identifying any  
31 manholes, drop structures, monitoring wells, piezometers, utilities, and other  
32 subsurface structures in the work area. The OSDF Construction Subcontractor shall  
33 preserve and maintain these structures during the excavation and grading activities.  
34

35 **3.03 SUBGRADE SURFACE PREPARATION**

- 36
- 37 A. The subgrade shall be prepared and made suitable as a foundation for placement and  
38 compaction of analyzing soil material. The subgrade shall be firm and able to support  
39 the OSDF Construction Subcontractor's construction equipment and OSDF loads  
40 without the development of depressions or ruts. In addition, the subgrade provide

1 adequate support such that the specified fill material may be placed and compacted to  
2 the specified density.

- 3
- 4 B. The subgrade shall be prepared such that the top 6 inches is compacted to at least 95  
5 percent of its standard Proctor maximum dry density (ASTM D 698).
- 6
- 7 C. After preparation, the subgrade shall be proofrolled to confirm the absence of  
8 underlying unsuitable soils. Proofrolling shall be performed by driving a heavily  
9 loaded dump truck (minimum of 20 tons) or other high-pressure pneumatic-tired  
10 vehicle back and forth across the prepared subgrade. The passes shall overlap such  
11 that one set of tires on each pass runs between the two sets of tire tracks from the  
12 previous pass. This activity will be observed by the CQC Consultant. Any areas that  
13 exhibit excessive rutting, deflection, shearing, or pumping in the opinion of the CQC  
14 Consultant shall be documented and marked for subsequent remedial activities.
- 15
- 16 D. For areas of the subgrade that are identified by the CQC Consultant as having  
17 unsuitable materials, the soils shall be over-excavated to a minimum depth of 3 feet  
18 below the proposed subgrade elevation. The area shall be backfilled with compacted  
19 fill in accordance with the requirements of Section 02220 of these Specifications. The  
20 material shall be compacted such that the requirements of Part 3.02 B of this Section  
21 are met.
- 22
- 23 E. In excavations or other areas where water accumulates, the OSDF Construction  
24 Subcontractor shall implement measures to remove the water in accordance with  
25 Section 02140 of these Specifications. The resulting subgrade surface shall be free of  
26 standing water and shall be suitable as a foundation for compaction of fill material, as  
27 determined by the CQC Consultant. Dewatered areas shall be maintained in this  
28 condition until overlying construction is complete.
- 29
- 30 F. All on-site surface water shall be managed as described in Section 02270 and in the  
31 Surface-Water Management and Erosion Control Plan.
- 32

### 33 3.04 STOCKPILING

- 34
- 35 A. Excavated soil shall be stockpiled in designated areas free of incompatible soil,  
36 clearing, clearing debris, or other objectionable materials. Stockpile areas for non-  
37 impacted soil will be designated by the Construction Contract Manager.
- 38
- 39 B. Stockpiles of fill shall be no steeper than 3H:1V (horizontal:vertical) or other slope  
40 approved by the Engineer, graded to drain, sealed by tracking parallel to the slope  
41 with a dozer or other means approved by the Engineer, and dressed daily during

1 periods when fill is taken from the stockpile. The OSDF Construction Subcontractor  
2 may cover fill stockpiles with plastic sheeting or other material approved by the  
3 Engineer in order to minimize erosion and/or preserve the moisture content of the fill.  
4 The OSDF Construction Subcontractor shall employ temporary erosion and sediment  
5 control measures as directed by the Construction Contract Manager around stockpile  
6 areas.

- 7
- 8 C. Stockpiles that will remain out of active use for a period greater than 6 months shall  
9 be stabilized by revegetation in accordance with the requirements stated in Section  
10 02930 of these Specifications.
- 11
- 12 D. Excavated soil that is impacted shall be stockpiled in the Impacted Materials Stockpile  
13 Areas shown on the Construction Drawings. The OSDF Construction Subcontractor  
14 shall provide plastic sheeting to separate grubbed impacted material from the existing  
15 ground surface and to cover the grubbed impacted material to prevent rainfall  
16 infiltration.
- 17

18

19 **3.05 SURFACE-WATER CONTROL**

20

- 21 A. The OSDF Construction Subcontractor shall establish perimeter surface-water controls  
22 around work areas to control runoff and prevent run-on in accordance with the  
23 Surfacewater Management and Erosion Control Plan.
- 24

25 **3.06 EXCAVATION**

26

- 27 A. The excavation procedures of this Part shall generally apply to the OSDF excavation  
28 areas and to borrow area excavation as identified in the Construction Drawings.
- 29
- 30 B. Designated areas shall be excavated to the subgrade elevations and grades on the  
31 Construction Drawings or as directed by the Construction Contract Manager. The  
32 subgrade shall be prepared in accordance with Section 02210 of these Specifications.
- 33
- 34 C. The OSDF Construction Subcontractor shall minimize sluffing and caving of the  
35 excavation. Areas of the excavation which cave or sluff shall be over excavated and  
36 backfilled with compacted fill in accordance with Part 3.08 of this section.
- 37
- 38 D. Excavation shall not be considered complete, and no fill shall be placed on the  
39 subgrade, until the OSDF Construction Subcontractor confirms and records that the  
40 elevations, grades, and limits shown on the Construction Drawings have been achieved  
41 in the field. The OSDF Construction Subcontractor shall notify the Construction

1 Contract Manager that the excavation (or a significant portion thereof) is complete.  
2 The OSDF Construction Subcontractor shall allow adequate time for the Construction  
3 Contract Manager to conduct any independent testing or surveying.  
4

5 E. No soil shall be removed from the site or disposed of by the OSDF Construction  
6 Subcontractor except in a manner approved by the Engineer.  
7

8 F. The OSDF Construction Subcontractor shall conduct his activities in such a manner  
9 that equipment hauling fill does not operate on impacted material haul roads. Any  
10 equipment which operates on impacted material haul roads or in an impacted area shall  
11 be decontaminated by the OSDF Construction Subcontractor prior to being used for  
12 earthwork activities.  
13

14 **3.07 EXCAVATION DEWATERING**

15  
16 The OSDF Construction Subcontractor shall anticipate seepage into excavations due to  
17 perched ground water within the construction area. The OSDF Construction Subcontractor  
18 shall be responsible for managing perched ground water and other water, including  
19 precipitation runoff, in accordance with Section 02140 of these Specifications.  
20

21 **3.08 COMPACTED FILL**

22  
23 A. The compacted fill used during construction shall be placed to the lines and grades  
24 shown on the Construction Drawings.  
25

26 B. Soil used for the compacted fill shall meet the requirements of Part 2.01B of this  
27 Section.  
28

29 C. Soil used for the compacted fill shall be placed in a loose lift that results in a  
30 compacted lift thickness of no greater than 6 inches. The maximum permissible pre-  
31 compaction soil clod size is 3 inches. The OSDF Construction Subcontractor may use  
32 discing, blading, or other means to reduce clod size.  
33

34 D. The OSDF Construction Subcontractor shall compact each lift to at least 95 percent  
35 of its standard Proctor maximum dry density (ASTM D 698). Soil shall be compacted  
36 at a moisture content within 2 percentage points of the standard Proctor optimum  
37 moisture content (ASTM D 698). The OSDF Construction Subcontractor shall utilize  
38 compaction equipment suitable for achieving the soil compaction requirements.  
39

40 E. If the moisture content of the soil to be used as compacted fill is not within  $\pm 2$   
41 percentage points of the optimum moisture content as determined by the CQC

1 Consultant, the OSDF Construction Subcontractor shall moisture condition the soil.  
2 Wetting shall be accomplished using a water truck and spray nozzle, unless the  
3 Engineer approves in writing an alternative method. During wetting or drying, the  
4 material shall be regularly disced or otherwise mixed so that uniform moisture  
5 conditions in the appropriate range are obtained. Drying shall be achieved by  
6 spreading, discing, or other appropriate methods.  
7

8 F. The OSDF Construction Subcontractor shall not place frozen soil, nor shall soil be  
9 placed on frozen ground. The limits of frozen fill and frozen ground will be  
10 determined by the CQC Consultant.  
11

12 G. If the compacted fill freezes during construction, the OSDF Construction Subcontractor  
13 shall remove the frozen compacted fill, scarify the remaining unfrozen fill, and then  
14 place and compact unfrozen fill in accordance with this Section to the satisfaction of  
15 the CQC Consultant. The removed frozen compacted fill shall not be reused until it  
16 has thawed, been disced, and then reworked to an acceptable uniform moisture  
17 content.  
18

### 19 3.09 FIELD TESTING

20  
21 A. The minimum frequency and details of quality control testing are provided below.  
22 This testing will be performed by the CQC Consultant. The OSDF Construction  
23 Subcontractor shall take this testing frequency into account in planning his construction  
24 schedule.  
25

26 1. Fill material quality control testing:

- 27 a. particle-size analyses conducted in accordance with ASTM D 422  
(mechanical sieve method only) at a frequency of one test per 5,000 yd<sup>3</sup>;
- 28 b. moisture content tests conducted in accordance with ASTM D 2216 at a  
29 frequency of one test per 5,000 yd<sup>3</sup>;
- 30 c. soil classification tests conducted in accordance with ASTM D 2487 at a  
31 frequency of one test per 5,000 yd<sup>3</sup>;
- 32 d. standard Proctor compaction tests conducted in accordance with ASTM D  
33 698 at a frequency of one test per 5,000 yd<sup>3</sup>; and

34 2. The CQC Consultant will perform conformance tests on placed and compacted fill  
35 to evaluate compliance with these Specifications. These tests will include in-situ  
36 moisture content and dry density. The frequency and procedures for moisture-  
37 density testing are given in the CQA Plan. At a minimum, the dry density and  
38 moisture content of the soil will be measured in-situ in accordance with ASTM  
39 D 2922 and ASTM D 3017, respectively.

- 1 3. A special testing frequency will be used by the CQC Consultant when visual  
2 observations of construction performance indicate a potential problem. Additional  
3 testing will be considered when:  
4 a. the rollers slip during rolling operation;  
5 b. the lift thickness is greater than specified;  
6 c. the fill is at improper and/or variable moisture content;  
7 d. fewer than the specified number of roller passes are made;  
8 e. dirt-clogged rollers are used to compact the material;  
9 f. the rollers do not have optimum ballast; or  
10 g. the degree of compaction is doubtful.
- 11 4. During construction, the frequency of testing will be increased by the CQC  
12 Consultant in the following situations:  
13 a. adverse weather conditions;  
14 b. breakdown of equipment;  
15 c. at the start and finish of grading;  
16 d. if the material fails to meet specifications; or  
17 e. the work area is reduced.
- 18
- 19 B. The OSDF Construction Subcontractor shall fill perforations resulting from testing with  
20 a soil similar to that used in the earthwork. This soil shall be compacted using hand  
21 tamping equipment, or other suitable equipment, to the satisfaction of the CQC  
22 Consultant.
- 23
- 24 C. Defective Areas:
- 25 1. If a defective area is discovered in the earthwork, the CQC Consultant will  
26 evaluate the extent and nature of the defect. If the defect is indicated by an  
27 unsatisfactory test result, the CQC Consultant will determine the extent of the  
28 defective area by additional tests, observations, a review of records, or other  
29 means that the CQC Consultant deems appropriate. If the defect is related to  
30 adverse site conditions, such as overly wet soils or surface desiccation, the CQC  
31 Consultant shall define the limits and nature of the defect.
- 32 2. Once the extent and nature of a defect is determined, the OSDF Construction  
33 Subcontractor shall correct the deficiency to the satisfaction of the CQC  
34 Consultant. The OSDF Construction Subcontractor shall not perform additional  
35 work in the area until the CQC Consultant approves the correction of the defect.  
36 The corrective actions shall be performed at the OSDF Construction  
37 Subcontractor's expense.
- 38 3. Additional testing may be performed by the CQC Consultant to verify that the  
39 defect has been corrected. This additional testing will be performed before any  
40 additional work is allowed in the area of deficiency. The cost of the additional  
41 testing shall be borne by the OSDF Construction Subcontractor.



SPECIFICATION COVER SHEET

SPECIFICATION SECTION: 02225 TITLE: COMPACTED CLAY LINER AND CAP  
 Specifications By: Signature J.F. Beeth 23 Oct 95  
 (Cognizant Engineer) Date  
 Printed Name J.F. BEETH, PRINCIPAL  
 and Title

Scope and Format  
 Checked By: Signature R. Neil Davis 10/23/95  
 (Checker) Date  
 Printed Name R. NEIL DAVIS Senior Proj. Eng.  
 and Title

Detailed Requirements  
 Checked by: Signature Not Used for 30% Submittal 10/24/95  
 (Checker) Date  
 Printed Name Patrick Rhodes / PATRICK RHODES  
 and Title STAFF ENGINEER

Overall Review By: Signature Not Used for 30% Submittal Mark H. Gleason 20 Feb 96  
 (PDP) Date  
 Printed Name MARK H. GLEASON  
 and Title Assistant Project Engineer

Approved by: Signature Not Used for 30% Submittal 22 Feb 96  
 (DTL) Date  
 Printed Name J.F. Beeth  
 and Title BEETH, PRINCIPAL

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
A	30% Submittal				
B	Report for EPA Submittal	16 Dec 95	NA	NA	NA
C	Intermediate Design	22 Feb 96	-	-	SF13

SECTION 02225

COMPACTED CLAY LINER AND CAP

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**PART 1 GENERAL**

**1.01 SCOPE**

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the construction of the clay liner and cap for the OSDF. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. The work shall include but not be limited to: moisture conditioning, placing, discing or otherwise processing as necessary, and compacting the compacted clay liner and cap components of the OSDF. Compacted clay liner and cap material shall be constructed to the dimensions, lines, and grades shown on the Construction Drawings or as directed by the Construction Contract Manager.

**1.02 RELATED SECTIONS**

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 01050 - Surveying
- D. Section 02200 - Earthwork
- E. Section 02210 - Subgrade Preparation
- F. Section 02714 - Geotextile Filter and Cushion
- G. Section 02772 - Geosynthetic Clay Liner

**1.03 MEASUREMENT AND PAYMENT**

Measurement and payment shall be in accordance with Section 01025.

**1.04 REFERENCES**

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].

- 1 B. Site Health and Safety Plan.  
2  
3 C. Soil Liner Test Pad Program Final Report.  
4  
5 D. Site Construction Quality Assurance (CQA) Plan.  
6  
7 E. Latest version of American Society for Testing and Materials (ASTM) standards:  
8 1. ASTM D 422. Standard Test Method for Particle-Size Analysis of Soils.  
9 2. ASTM D 698. Standard Test Methods for Moisture-Density Relations of  
10 Soils and Soil-Aggregate Mixtures using a 5.5 pound Rammer  
11 and a 12-in. drop.  
12 3. ASTM D 1556. Standard Test Method for Density of Soil in Place by the  
13 Sand-Cone Method.  
14 4. ASTM D 2216. Standard Test Method for Laboratory Determination of Water  
15 (Moisture) Content of Soil and Rock.  
16 5. ASTM D 2487. Classification of Soils for Engineering Purposes (Unified Soil  
17 Classification System).  
18 6. ASTM D 2922. Standard Test Methods for Density of Soil and Soil-Aggregate  
19 in Place by Nuclear Methods (Shallow Depth).  
20 7. ASTM D 2937. Standard Test Method for Density of Soil in Place by the  
21 Drive-Cylinder Method.  
22 8. ASTM D 3017. Standard Test Method for Water Content of Soil and Rock In  
23 Place by Nuclear Methods (Shallow Depth).  
24 9. ASTM D 4318. Standard Test Method for Liquid Limit, Plastic Limit, and  
25 Plasticity Index of Soils.  
26 10. ASTM D 5084. Standard Test Method for Measurement of Hydraulic  
27 Conductivity of Saturated Porous Materials using a Flexible  
28 Wall Permeameter.  
29

### 30 1.05 SUBMITTALS

- 31  
32 A. The OSDF Construction Subcontractor shall provide the Construction Contract  
33 Manager with a list of the equipment to be used for compacted clay liner and cap  
34 construction at least 14 days prior to the start of the activities covered by this Section.  
35 The equipment proposed by OSDF Construction Subcontractor shall be identical to that  
36 identified in the Soil Liner Test Pad Program Final Report, unless alternative  
37 equivalent equipment is approved by the Engineer. The Engineer will only consider  
38 alternative equipment if the OSDF Construction Subcontractor provides a detailed  
39 demonstration that the proposed equipment is functionally equivalent to the equipment  
40 described in the Soil Liner Test Pad Program Final Report and that the equipment  
41 produces a soil liner with similar hydraulic conductivity and other properties as

1 produced by construction of the soil liner test pads. This latter requirement will  
2 necessitate that the OSDF Construction Subcontractor construct and field test a soil  
3 liner test pad using his proposed equipment and at his own expense.

- 4  
5 B. If the work of this Section is interrupted for reasons other than inclement weather, the  
6 OSDF Construction Subcontractor shall notify the Construction Contract Manager a  
7 minimum of 24 hours prior to his resumption of work.

8  
9 **1.06 QUALITY ASSURANCE**

- 10  
11 A. The OSDF Construction Subcontractor shall ensure that the materials and methods  
12 used for construction of the compacted clay liner and cap meet the requirements of the  
13 Construction Drawings and this Section. Any material or method that does not  
14 conform to these documents, or to alternatives approved in writing by the Engineer,  
15 will be rejected and shall be repaired or replaced at the OSDF Construction  
16 Subcontractor's expense.  
17  
18 B. The OSDF Construction Subcontractor shall be aware of all monitoring and testing  
19 required by the CQA Plan. This monitoring and testing, including random  
20 conformance testing of construction materials and completed work, will be performed  
21 by the CQC Consultant. If nonconformances or other deficiencies are found in the  
22 OSDF Construction Subcontractor's materials or completed work, the OSDF  
23 Construction Subcontractor will be required to repair or replace the deficiency at his  
24 expense.  
25

26  
27 **PART 2 PRODUCTS**

28  
29 **2.01 MATERIALS**

- 30  
31 A. Material for compacted clay liner and cap construction shall be obtained from on-site  
32 borrow areas or stockpiles identified by the Construction Contract Manager. Borrow  
33 areas will be identified on the Construction Drawings. The OSDF Construction  
34 Contractor shall segregate granular lenses and other identified nonconforming soils in  
35 the borrow areas and only utilize those materials meeting the requirements of Part  
36 2.01B for compacted clay liner and cap construction.  
37  
38 B. Material for compacted the clay liner and cap construction shall meet all of the  
39 following requirements:  
40 1. Be classified according to the Unified Soil Classification System (ASTM D 2487)  
41 as \_\_\_\_ [to be established from test pad program]

- 1           2. Have a plasticity index (ASTM D 4318) of at least \_\_\_\_, but less than \_\_\_\_ [to be  
2           established from test pad program.]
- 3           3. Meet the following particle size requirements (ASTM D-422) unless alternate  
4           particle sizes are given in the Soil Liner Test Pad Program Final Report and  
5           approved by the Construction Contract Manager:
- 6           a. 100 percent of the particles having a maximum dimension not greater than  
7           2 in. (50 mm);
- 8           b. no more than 10 percent of the particles, by weight, having a dimension  
9           greater than 0.75 in. (20 mm);
- 10          c. not less than 50 percent of the particles, by weight, passing through the  
11          standard U.S. No. 200 standard sieve; and
- 12          d. not less than 25 percent of the particles, by weight, having a maximum  
13          dimension not greater than 0.002 mm.
- 14
- 15          4. Have a hydraulic conductivity of not more than  $1 \times 10^{-7}$  cm/s when compacted in  
16          lifts in accordance with this Section and when tested in the laboratory in  
17          accordance with ASTM D 5084 at a confining pressure of 5 pounds per square  
18          inch.
- 19
- 20          C. The top surface of the compacted clay liner or cap (i.e., the surface in contact with the  
21          overlying GCL) shall have no particles larger than 0.5 inches (in largest dimension).  
22          The OSDF Construction Subcontractor shall have the option of either processing clay  
23          to achieve this requirement or inspecting the top lift of the clay and manually removing  
24          oversized particles. Holes or indentations in the compacted clay caused by particle  
25          removal shall be backfilled with clay or with bentonite to the satisfaction of the CQC  
26          Consultant.
- 27
- 28          D. Water used for moisture conditioning compacted clay liner or cap material shall be  
29          obtained from an on-site potable water source identified by the Construction Contract  
30          Manager.

## 31

### 32 2.02 EQUIPMENT

- 33
- 34          A. The OSDF Construction Subcontractor shall only use equipment that conforms with  
35          Part 1.05A of this Section.
- 36
- 37          B. The OSDF Construction Subcontractor shall furnish, operate, and maintain mechanical  
38          rakes, discs, and (if needed based on the Soil Liner Test Pad Program Final Report)  
39          transverse rotary mixers, necessary to process the soil to meet the requirements of this  
40          Section.
- 41

- 1 C. The OSDF Construction Subcontractor shall furnish, operate, and maintain tank trucks,  
2 pressure distributors, and other equipment (designed to apply water uniformly and in  
3 controlled quantities) necessary to moisture condition compacted clay liner and cap  
4 material.  
5
- 6 D. The OSDF Construction Subcontractor shall furnish, operate, and maintain grading  
7 equipment as necessary to produce uniform layers, sections, and smoothness of grade  
8 for compaction and drainage.  
9
- 10 E. The OSDF Construction Subcontractor shall furnish, operate, and maintain compaction  
11 equipment as necessary to produce the required in-place soil density and moisture  
12 content.  
13

### 14 PART 3 EXECUTION

#### 15 3.01 FAMILIARIZATION

- 16  
17  
18  
19 A. Prior to implementing any of the work of this Section, the OSDF Construction  
20 Subcontractor shall become thoroughly familiar with the site, the site conditions, all  
21 portions of the work falling within this Section, and the general requirements of  
22 Section 01012 of these Specifications.  
23
- 24 B. Inspection:
- 25 1. Prior to implementing any of the work of this Section, the OSDF Construction  
26 Subcontractor shall carefully inspect the installed work of all other Sections and  
27 verify that all work is complete to the point where the work of this Section may  
28 properly commence without adverse impact.
  - 29 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
30 work of other Sections, he should notify the Construction Contract Manager in  
31 writing prior to commencing work. Failure to notify the Construction Contract  
32 Manager or continuance of the work of this Section will be construed as OSDF  
33 Construction Subcontractor's acceptance of the related work of all other Sections.  
34

#### 35 3.02 COMPACTED CLAY LINER AND CAP COMPACTION CRITERIA

- 36  
37 A. The compaction moisture content of clay liner material shall be between [1 and 4]  
38 percentage points wet of the standard Proctor optimum moisture content (ASTM D  
39 698). The clay liner material shall be compacted to a dry unit weight of at least [95  
40 percent] of the standard Proctor maximum dry unit weight (ASTM D 698). In  
41 addition, each compacted lift shall meet the hydraulic conductivity requirement of

1 Part 2.01. [Note: actual range of acceptable moisture content and dry densities to be  
2 established based on the results of test pad program]  
3

- 4 B. The compaction moisture content of the clay cap material shall be between [1 and 4]  
5 percentage points wet of the optimum moisture content (ASTM D 698). The clay cap  
6 material shall be compacted to a dry unit weight of at least [95 percent] of the standard  
7 Proctor-maximum dry unit weight (ASTM D 698). In addition, each compacted lift  
8 shall meet the hydraulic conductivity requirement of Part 2.01. [Note: actual range  
9 of acceptable moisture content and dry densities to be established based on the results  
10 of test pad program]  
11

### 12 3.03 MATERIAL PLACEMENT

- 13  
14 A. Compacted clay liner and cap shall be constructed to the elevations, grades, and  
15 thicknesses shown on the Construction Drawings. The thickness of the compacted clay  
16 liner and cap at any location shall be measured perpendicular to the plane of the slope  
17 at that location.  
18  
19 B. Compacted clay liner and cap placement shall begin only after placement of the  
20 subgrade or contouring material, respectively. Placement shall not begin until the  
21 sampling and testing activities of the CQC Consultant are complete and until the CQC  
22 Consultant documents that the OSDF Construction Subcontractor's work is in  
23 conformance with the Construction Drawings and Specifications.  
24  
25 C. Prior to clay compacted liner or cap placement, the surface on which the material is  
26 to be placed shall be free of debris, branches, vegetation, mud, ice, or other  
27 deleterious material.  
28  
29 D. Prior to placement of the first lift of compacted clay liner or cap, the subgrade shall  
30 be scarified and moisture conditioned to the satisfaction of the CQC Consultant.  
31  
32 E. The OSDF Construction Subcontractor shall construct the compacted clay liner and cap  
33 in lifts. The maximum lift thickness after compaction shall be no more than 6 inches.  
34 The loose thickness of the lift shall be 8 inches (nominal).  
35  
36 F. Prior to placement of a lift of material, the CQC Consultant will complete quality  
37 control testing of the previous lift to determine compliance with this Section. The  
38 OSDF Construction Subcontractor shall not place a new lift of material over a  
39 preceding lift until approval is given by the CQC Consultant. Should the OSDF  
40 Construction Subcontractor choose to cover a previously placed lift prior to receiving  
41 approval from the CQC Consultant, he does so at his own risk. If the lift is not in

1 compliance with this Section, the OSDF Construction Subcontractor will be required  
2 by the Construction Contract Manager to remove and replace all non-complying work  
3 at his own expense.  
4

- 5 G. Prior to placement of a new lift of material over a previous lift, the previous lift shall  
6 be thoroughly scarified to a nominal depth of 2 inches to provide good bonding  
7 between lifts. Scarification shall be accomplished by discing, unless an alternative  
8 method is approved by the Engineer based on a written request from the OSDF  
9 Construction Subcontractor.  
10
- 11 H. The trafficking of scarified surfaces by trucks or other equipment is not permitted.  
12
- 13 I. The maximum acceptable soil clod size is 3 inches. The technique that the OSDF  
14 Construction Subcontractor shall use to break up clods is \_\_\_\_\_. [Note: The  
15 required processing methods will be obtained from the Soil Liner Pad Program Final  
16 Report].  
17
- 18 J. Moisture conditioning of the compacted clay liner and cap material shall be  
19 accomplished prior to compaction. Moisture conditioning should occur in the borrow  
20 area, soil stockpiling area, or other area acceptable to the Construction Contract  
21 Manager. Moisture shall be uniformly distributed throughout the compacted clay liner  
22 and cap material. The soil shall be moisture conditioned as described below:  
23 1. If the borrow material is drier than required, as determined by the CQC  
24 Consultant, water shall be thoroughly mixed into the soil using a harrowing disc,  
25 grader, transverse rotary mixer, or other means identified based on the Soil Liner  
26 Test Pad Program final Report and as acceptable to the Construction Contract  
27 Manager.  
28 2. If the borrow material is wetter than required, as determined by the CQC  
29 Consultant, the material shall be dried using a harrowing disc, grader, transverse  
30 rotary mixer, or other means identified in the Soil Liner Test Pad Program Final  
31 Report and as acceptable to the Construction Contract Manager.  
32
- 33 K. The moisture content of the clay liner and cap material will be measured by the CQC  
34 Consultant after the material is placed, but prior to compaction. Based on the test  
35 results, the OSDF Construction Subcontractor shall make final minor adjustments to  
36 the soil moisture content. No more than 1.5 percent moisture shall be added to the  
37 clay liner or cap material after is placed, but prior to compaction. If the moisture  
38 content is drier than the target moisture content but within 1.5 percentage points of the  
39 target moisture content, the clay liner or cap material may be sprinkled or sprayed  
40 with water, then mixed using a method described in Part 3.02J of this Section to  
41 achieve a uniform moisture content. If the moisture content is more than 1.5

1 percentage points below the target moisture content, the clay material shall be  
2 removed, returned to a processing area, and conditioned until a uniformly acceptable  
3 moisture content is achieved. If the in-place moisture content is too high, the clay  
4 liner or cap material may be dozed, windrowed, disced, and/or mixed in-place to  
5 facilitate drying.  
6

7 L. No compacted clay liner or cap material shall be placed or compacted during a  
8 sustained period of temperature below 32°F. With the written approval of the  
9 Engineer based on a written request from the OSDF Construction Subcontractor,  
10 compacted clay liner and cap material may be placed during periods of early morning  
11 freezing temperatures, but only if above-freezing temperatures are anticipated during  
12 the day. Regardless of approval, the OSDF Construction Subcontractor shall not place  
13 frozen clay nor shall the OSDF Construction Subcontractor place clay on frozen  
14 ground.  
15

16 M. If compacted clay liner or cap material freezes after compaction, the OSDF  
17 Construction Subcontractor shall remove the frozen material, scarify the remaining  
18 unfrozen material, and then place and compact new material in accordance with this  
19 Section. The frozen material shall not be reused until it has thawed, been disced or  
20 mixed, and reworked to an acceptable moisture content. The OSDF Construction  
21 Subcontractor shall be responsible for protecting completed lifts of compacted clay  
22 liner or cap material from freezing. If freezing conditions are anticipated, the OSDF  
23 Construction Subcontractor shall prepare a written plan for approval by the Engineer  
24 in writing which outlines the measures he will take to protect finished work. Such  
25 measures may include the use of thermal blankets or a sacrificial soil layer.  
26

27 N. Compacted clay liner or cap material shall not be placed during periods of precipitation  
28 or other periods of unfavorable weather conditions identified by the CQC Consultant.  
29

### 30 3.04 MATERIAL COMPACTION

31  
32 A. The sequence of compaction of the clay liner or cap shall be as described in this  
33 Section and as shown on the Construction Drawings.  
34

35 B. Compaction of lifts shall be performed using the minimum number of passes and the  
36 acceptable compaction equipment established from the test pad program and identified  
37 in the Soil Liner Test Pad Program Final Report.  
38

39 C. The daily work area shall extend a sufficient distance so as to maintain soil moisture  
40 conditions within an acceptable range to allow continuous operations. Crusting and  
41 desiccation of the lift surface shall be avoided as much as possible. In the event

1 crusting or desiccation occurs, the OSDF Construction Subcontractor shall rework the  
2 soil in accordance with Part 3.07 of this Section.

- 3  
4 D. The transition from an existing full-depth section of compacted clay liner or cap to the  
5 beginning of an adjacent section that is to be constructed subsequently shall be  
6 accomplished by sloping (cutting back) the end of the full-depth section at 5:1  
7 (horizontal:vertical) or flatter, scarifying the slope of the existing full-depth section at  
8 the transition, and then immediately placing the adjacent lifts of material.  
9
- 10 E. A compaction pass is defined as one trip of a single-drum compactor up and back over  
11 the area being compacted. If a dual-drum compactor without laterally separated front  
12 and rear drums is used, one trip up and back over the area being compacted will be  
13 considered two passes. If a dual-drum compactor which has the drums laterally  
14 separated by the operator's cab and the differential is used, one trip up and a staggered  
15 trip back to cover the uncompacted area between the drums will be considered one  
16 pass.  
17
- 18 F. Corners and other areas inaccessible to driven compaction equipment shall be  
19 compacted using hand operated equipment (such as a walk-behind roller) approved by  
20 the Engineer.
- 21 G. Compaction adjacent to pipes and BV penetrations shall be performed using hand  
22 operated equipment approved in writing by the Engineer. Operation of the equipment  
23 shall not damage the pipe or BV penetration.  
24  
25

### 26 3.05 FIELD TESTING

- 27  
28 A. The CQC Consultant will perform soil conformance testing of candidate compacted  
29 clay liner and cap materials. The test results will be provided to the OSDF  
30 Construction Subcontractor for his use in selecting soil material for construction. The  
31 compacted clay liner and cap conformance testing requirements are contained in the  
32 Section 8 of the CQA Plan and listed below. The OSDF Construction Subcontractor  
33 shall take this testing frequency into account in planning his construction schedule.  
34 1. The minimum frequency of testing is:  
35 a. particle-size analysis conducted in accordance with ASTM D 422 (including  
36 hydrometer) at 1 test per 1,500 cubic yards;  
37 b. moisture content conducted in accordance with ASTM D 2216 at 1 test per  
38 1,500 cubic yards;  
39 c. Atterberg limits conducted in accordance with ASTM D 4318 at 1 test per  
40 1,500 cubic yards;

- 1 d. soil classification conducted in accordance with ASTM D 2478 at 1 test per  
2 1,500 per cubic yards;
- 3 e. standard Proctor compaction conducted in accordance with ASTM D 698 at  
4 1 test per 3,000 cubic yards; and
- 5 f. hydraulic conductivity on remolded (compacted) specimens conducted in  
6 accordance with ASTM D 5084 at 1 test per 3,000 cubic yards.
- 7
- 8 B. The CQC Consultant will perform soil performance testing on compacted lifts of clay  
9 liner and cap material to evaluate compliance with this Section. The compacted clay  
10 liner and cap performance testing requirements are contained in Section 8 of the CQA  
11 Plan and listed below. The OSDF Construction Subcontractor shall take this testing  
12 frequency into account in planning his construction schedule.
- 13 1. The minimum frequency of testing is:
- 14 a. in-situ moisture content in accordance with ASTM D 3017 at a frequency of  
15 5 tests per acre per lift, with a minimum of 2 tests per day of active  
16 compacted clay liner or cap construction;
- 17 b. in-situ dry density in accordance with ASTM D 2922 at a frequency of 5  
18 tests per acre per lift, with a minimum of 2 tests per day of active compacted  
19 clay liner or cap construction;
- 20 c. sand cone or drive cylinder testing in accordance with ASTM D 1556 or  
21 D 2937, respectively, at a frequency of 1 test per 25 nuclear tests;
- 22 d. laboratory hydraulic conductivity testing on thin-walled (i.e., Shelby) tube  
23 samples in accordance with ASTM D 5084 at a frequency of 1 test per acre  
24 per lift.
- 25
- 26 C. The CQC Consultant will obtain thin-walled tube samples of each compacted lift of  
27 clay liner and cap material to perform the laboratory hydraulic conductivity testing  
28 indicated in Part 3.05B above. The thin-walled tubes will be pushed perpendicular to  
29 the soil using available on-site equipment as defined in the CQA Plan. The OSDF  
30 Construction Subcontractor shall provide equipment and labor to assist the CQC  
31 Consultant in sampling, if requested.
- 32
- 33 D. Notwithstanding the conformance testing performed by the CQC Consultant, the  
34 OSDF Construction Subcontractor is solely responsible for constructing the compacted  
35 clay liner cap in a manner that satisfies all of the requirements of this Section.
- 36
- 37 E. If the CQC Consultant's tests indicate that any portion of the compacted clay liner and  
38 cap does not meet the requirements of this Section, the CQC Consultant will establish  
39 the extent of the nonconforming area. The nonconforming area shall be reworked by  
40 the OSDF Construction Subcontractor at his own expense until acceptable test results  
41 are obtained by the CQC Consultant.

1     **3.06     PERFORATIONS**

- 2
- 3     A. Perforations in the compacted clay liner and clay cap resulting from construction and
- 4       CQC activities shall be filled to the satisfaction of the CQC Consultant. Such
- 5       perforations may include, but are not limited to, the following:
- 6       1. nuclear density test probe locations;
- 7       2. hydraulic conductivity sampling locations;
- 8       3. sand-cone test locations;
- 9       4. test pit locations; and
- 10      5. survey stake locations.
- 11
- 12     B. Perforations in the compacted clay liner and cap resulting from nuclear density tests
- 13       will be filled by the CQC Consultant. Perforations in the compacted clay liner and cap
- 14       resulting from construction activities and from thin-walled tube samples, sand-cone
- 15       tests, and test pits shall be filled by the OSDF Construction Subcontractor. The CQC
- 16       Consultant will identify for the OSDF Construction Subcontractor the locations of any
- 17       thin-walled tube samples, test pits, and sand-cone tests made as part of CQC activities.
- 18
- 19     C. Small perforations in the compacted clay liner and cap from nuclear density testing
- 20       will be backfilled with bentonite (sodium montmorillonite) powder or pellets or a soil-
- 21       bentonite mixture and compacted by hand tamping. Perforations from thin-walled tube
- 22       samples, sand-cone tests, and test pits shall be backfilled by the OSDF Construction
- 23       Subcontractor with clay liner and cap material. The clay liner and cap material shall
- 24       be placed in these perforations in thin lifts and compacted to the satisfaction of the
- 25       CQC Consultant.

26

27     **3.07     SURVEY CONTROL**

- 28
- 29     A. The OSDF Construction Subcontractor shall survey the limits and elevations of the
- 30       finished surface of the compacted clay liner and cap.
- 31
- 32     B. Surveying shall be performed in accordance with Section 01050 of these Specifications.
- 33

34     **3.08     TOLERANCE**

35

36     The OSDF Construction Subcontractor shall construct the compacted clay liner and cap

37     to within  $\pm 0.1$  ft of the grades indicated on the Construction Drawings.

38

1     **3.09     PROTECTION OF WORK**

- 2
- 3     A.   The OSDF Construction Subcontractor shall use all means necessary to protect the
- 4         completed work of this Section.
- 5
- 6     B.   In the event of damage, the CQC Consultant will identify areas requiring repair, and
- 7         the OSDF Construction Subcontractor shall make all repairs and replacements at his
- 8         own expense.
- 9
- 10    C.   The OSDF Construction Subcontractor shall minimize, to the maximum extent feasible,
- 11         crusting and desiccation cracking of compacted clay liner and cap.
- 12         1.   The OSDF Construction Subcontractor shall regularly moisture condition the
- 13             surface of the compacted clay liner and cap, and if cracking is observed or if
- 14             directed by the CQC Consultant, shall scarify, moisture condition, and recompact
- 15             the surface. The OSDF Construction Subcontractor may seal roll the surface of
- 16             the clay to reduce evaporation. The OSDF Construction Subcontractor may also
- 17             protect exposed surfaces using light-colored or translucent membranes, such as
- 18             Visqueen, that will inhibit drying of the clay.
- 19         2.   The CQC Consultant, at his sole discretion, will identify any areas of crusting or
- 20             desiccation cracking requiring repair. The OSDF Construction Subcontractor
- 21             shall scarify the surface of such areas to a nominal depth of 2 inches or to the
- 22             depth identified by the CQC Consultant, and then moisture condition, disc or mix
- 23             as necessary, and recompact the area in accordance with the full requirements
- 24             Part 3 of this Section. In the event the moisture conditioning requirement of
- 25             Section 3.03 is not met, the OSDF Construction Subcontractor shall remove and
- 26             replace the material.
- 27
- 28    D.   If the CQC Consultant observes a soft spot or otherwise unsuitable area in the
- 29         compacted clay liner or cap, he may, at his sole discretion, require the OSDF
- 30         Construction Subcontractor to proofroll the soft spot or otherwise unsuitable area using
- 31         a smooth-drummed roller or other equipment. If proofrolling confirms the existence
- 32         of unacceptable conditions in the opinion of the CQC Consultant, the OSDF
- 33         Construction Subcontractor shall excavate the soft spot or unsuitable material and fill
- 34         the excavated area with new material placed and compacted in full accordance with the
- 35         requirements of this Section.
- 36
- 37    E.   The compacted clay liner or cap surface shall be seal rolled and made smooth and free
- 38         from ruts or indentations at the end of every working day when precipitation is
- 39         forecast.
- 40

- 1 F. The compacted clay liner or cap surface on which the geosynthetic clay liner is to be  
2 placed shall be seal rolled and made smooth and free from ruts or indentations to  
3 facilitate intimate contact between the geosynthetic clay liner and the underlying  
4 compacted clay liner or cap surface.  
5
- 6 G. A compacted clay protective layer shall be placed over the compacted clay liner and  
7 cap if construction of overlying layers or lifts are to be delayed more than 10 working  
8 days. The protective layer shall be clay placed and loosely compacted by tracking with  
9 a bulldozer, or other Engineer-approved equipment. The thickness of the protective  
10 layer shall be 8 inches (nominal).  
11
- 12 H. The compacted clay protective layer shall be removed prior to placement of overlying  
13 lifts or the geosynthetic clay liner. The protective layer may be removed in sections  
14 in coordination with ongoing construction. Where the protective layer is removed, the  
15 surface shall be prepared to receive an overlying lift or the geosynthetic clay liner and  
16 the finished surface shall be protected and maintained as required by this Section.  
17
- 18 I. No synthetic sealants or other chemical treatments shall be applied to the compacted  
19 clay liner and cap material.  
20  
21  
22  
23

[END OF SECTION]

**SPECIFICATION COVER SHEET**

SPECIFICATION SECTION: 02240 TITLE: PROTECTIVE AND CONTOUR LAYERS

Specifications By: J.F. Beech 23 Oct 95  
 (Cognizant Engineer) J.F. BEECH, PRINCIPAL  
 Signature Date  
 Printed Name and Title

Scope and Format  
 Checked By: Kenneth W Cargill 23 Oct 95  
 (Checker) Associate  
 Signature Date  
 Printed Name and Title

Detailed Requirements  
 Checked by: Mark H. Gleason 9 Feb 95  
 (Checker) Not Used for 30% Submittal  
 Signature Date  
 Printed Name and Title  
MARK H. GLEASON  
ASSISTANT PROJECT ENGINEER

Overall Review By: Kenneth W Cargill 19 Feb 96  
 (PDP) Not Used for 30% Submittal  
 Signature Date  
 Printed Name and Title  
Kenneth W Cargill  
Associate

Approved by: Kenneth W Cargill 8 Apr 96  
 (DTL) Not Used for 30% Submittal J.F. Beech 21 Feb 96  
 Signature Date  
 Printed Name and Title  
BEECH, PRINCIPAL  
Associate

**Record of Revision (Number and initial all revisions)**

Rev. No.	Reason	Date	By	Checked	Approval
<u>NA</u>	<u>30% Submittal</u>				
<u>B</u>	<u>Reprint for EPA Submittal</u>	<u>14 Dec 95</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>C</u>	<u>Intermediate Design</u>	<u>9 Feb 96</u>	<u>NA</u>		<u>JFB</u>
<u>D</u>	<u>Intermediate Design - EPA Submitted</u>	<u>8 Apr 96</u>	<u>K</u>		

## SECTION 02240

## PROTECTIVE AND CONTOURING LAYERS

## PART 1 GENERAL

## 1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary for the construction of the protective and contouring layers. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. The work shall include, but not be limited to, placement, compaction, and grading of protective and contouring layers in the areas indicated on the Construction Drawings. The protective and contouring layers shall conform to the dimensions, lines, grades, and sections, shown on the Construction Drawings or as directed by the Construction Contracts Manager.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 01050 - Surveying
- D. Section 02200 - Earthwork
- E. Section 02710 - Granular Drainage Layers
- F. Section 02714 - Geotextiles
- G. Section 13010 - Impacted Material Placement

## 1.03 MEASUREMENT AND PAYMENT

- A. Measurement and payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].

- 1 B. Site Health and Safety Plan.  
2  
3 C. Site Construction Quality Assurance (CQA) Plan.  
4  
5 D. Impacted Materials Placement Plan.  
6  
7 E. Latest version of American Society for Testing and Materials (ASTM) standards.  
8 1. ASTM C 136. Standard Test Method for Sieve Analysis of Fine and Course  
9 Aggregates.  
10 2. ASTM D 698. Standard Test Methods for Moisture-Density Relations of  
11 Soils and Soil-Aggregate Mixtures using a 5.5 pound Rammer  
12 and a 12-in. drop.  
13 3. ASTM D 2434. Standard Test Method for Permeability of Granular Soils  
14 (Constant Head).  
15 4. ASTM C 3042. Standard Test Method for Insoluble Residue in Carbonate  
16 Aggregates.  
17

## 18 1.05 QUALITY ASSURANCE

- 19  
20 A. The OSDF Construction Subcontractor shall ensure that the materials and methods  
21 used for construction of the protective and contouring layers meet the requirements of  
22 the Construction Drawings in this Section, and the Impacted Materials Placement Plan.  
23 Any material or method that does not conform to these documents, or to alternatives  
24 approved by the Engineer, will be rejected by the CQC Consultant and shall be  
25 repaired or replaced by the OSDF Construction Subcontractor at his expense.  
26  
27 B. The OSDF Construction Subcontractor shall be aware of all monitoring and testing  
28 required by the CQA Plan. This monitoring and testing, including random  
29 conformance testing of construction materials and completed work, will be performed  
30 by the CQC Consultant. If nonconformances or other deficiencies are found in the  
31 OSDF Construction Subcontractor's materials or completed work, the OSDF  
32 Construction Subcontractor will be required to repair or replace the deficiency at his  
33 expense.  
34  
35

## 36 PART 2 PRODUCT

### 37 2.01 MATERIAL

- 38 A. The material used for the contouring layer and the protective layer shall consist of  
39 impacted material removed during excavation at the site. Material suitable for the  
40  
41

1           contouring layer and the protective layer is outlined in the Impacted Materials  
2           Placement Plan. Alternate sources will be identified by the Construction Contracts  
3           Manager in the event sufficient impacted material is not available. The protective and  
4           contouring layer materials shall not include sharp objects, debris, or other deleterious  
5           material.  
6

7           B. The granular protective layer shall meet the following requirements.

- 8           1. The granular material shall consist of relatively homogeneous, crushed or angular  
9           soil that is free of any metals, roots, trees, stumps, concrete, construction debris,  
10           or any other organic matter or deleterious material.
- 11           2. Unless other material is approved in writing by the Engineer, the material for the  
12           granular protective layer shall be classified as GW or GP in accordance with the  
13           Unified Soil Classification System (per ASTM D 2487), not be gap graded, and  
14           have a gradation (per ASTM C 136) that meets the following requirements:

<u>Sieve</u>	<u>Total Percent Passing</u>
3/4 in.	100
1/2 in.	90 to 100
3/8 in.	40 to 75
No. 4	5 to 25
No. 8	0 to 10
No. 16	0 to 5
No. 200	0 to 2

- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22
- 23
- 24
- 25
- 26           3. The material shall have a minimum hydraulic conductivity of  $1 \times 10^{-1}$  cm/s based on  
27           laboratory permeability testing conducted in accordance with ASTM D 2434.
- 28           4. The material for the granular component of the protective layer shall have less than a  
29           5 percent loss of weight when tested according to ASTM D 3042 at a pH of 4.  
30

31  
32           **PART 3 EXECUTION**

33  
34           **3.01 FAMILIARIZATION**

- 35
- 36           A. Prior to implementing any of the work described in this Section, the OSDF  
37           Construction Subcontractor shall become thoroughly familiar with the site, the site  
38           conditions, and all portions of the work falling within this Section.  
39  
40  
41

1 B. Inspection:

- 2 1. Prior to implementing any of the work in this Section, the OSDF Construction  
3 Subcontractor shall carefully inspect the installed work of all other Sections and  
4 verify that all work is complete to the point where the installation of this Section  
5 may properly commence without adverse impact.  
6 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
7 work of other Sections, he should notify the Construction Contract Manager in  
8 writing prior to commencing the work. Failure to notify the Construction  
9 Contract Manager or installation of the protective or contouring layers will be  
10 construed as OSDF Construction Subcontractor's acceptance of the related work  
11 of all other Sections.  
12

13 **3.02 INSTALLATION**

- 14
- 15 A. Placement of the protective and contouring layers shall not commence until CQC  
16 conformance evaluations by the CQC Consultant of previous work are complete,  
17 including evaluations of the OSDF Construction Subcontractor's survey results to  
18 confirm that the previous work was constructed to the required grades, elevations, and  
19 thicknesses. Should the OSDF Construction Subcontractor begin the work of this  
20 Section prior to the completion of CQC evaluations, he does so at his own risk. The  
21 OSDF Construction Subcontractor shall account for the CQC conformance evaluations  
22 in his schedule.  
23
- 24 B. The OSDF Construction Subcontractor shall construct the protective, contouring, and  
25 granular protective layers to the dimensions, thicknesses, grades, and limits shown on  
26 the Construction Drawings.  
27
- 28 C. The protective and granular protective layers shall be placed directly on top of the  
29 geotextile filter as shown on the Construction Drawings. The protective layers should  
30 be placed and carefully spread using a low ground-pressure dozer or other equipment  
31 approved in writing by the Engineer. The tracked equipment shall operate only over  
32 previously placed protective layer material.  
33
- 34 D. The protective layer shall be placed in a single lift and tracked with four passes of the  
35 low-ground-pressure dozer. The final thickness of the protective layer shall not be less  
36 than 12 inches.  
37
- 38 E. The equipment used to place, spread, and compact the protective and granular  
39 protective layers shall comply with the following:  
40  
41

Maximum Allowable Equipment Ground Pressure (psi)	Thickness of Granular Soil over Geotextiles (in.)
< 5	12
< 10	18
< 20	24
> 20	36

- F. The contouring layer shall be placed in two 6- to 8-inch thick loose lifts. Each of the contouring layers shall be compacted to a minimum of 95 percent relative compaction based on the standard Proctor (ASTM D 698).

### 3.03 FIELD QUALITY CONTROL

- A. The OSDF Construction Subcontractor shall be aware of all field quality control testing activities, as these may affect his schedule.
- B. Field quality control testing activities for the protective and contouring layers are presented in the Impacted Materials Placement Plan.

### 3.04 SURVEY CONTROL

- A. The OSDF Construction Subcontractor shall survey the locations and elevations of the top of the protective layers and the top of the contouring layer.
- B. Surveying shall be performed in accordance with Section 01050 of these Specifications.

### 3.05 CONSTRUCTION TOLERANCE

The OSDF Construction Subcontractor shall construct the protective and contouring layers to within +0.2 ft of the limits and grades shown on the Construction Drawings.

### 3.06 PROTECTION OF WORK

- A. The OSDF Construction Subcontractor shall maintain the condition of the protective and contouring layers until placement of overlying materials. Any rutting, erosion, or other disturbance to the protective and contouring layer shall be corrected.
- B. The OSDF Construction Subcontractor shall use all means necessary to protect all prior work.

1 C. In the event of damage, the OSDF Construction Subcontractor shall immediately make  
2 all repairs and replacements necessary, to the approval of the Construction Contract  
3 Manager and at the OSDF Construction Subcontractor's expense.  
4  
5  
6  
7

8 [END OF SECTION]  
9

**SPECIFICATION COVER SHEET**

SPECIFICATION SECTION: 02250 TITLE: VEGETATIVE SOIL LAYER

Specifications By: Signature J.F. Beech 23 Oct 95  
 (Cognizant Engineer) Date

Printed Name J.F. BEECH, PRINCIPAL  
 and Title

Scope and Format  
 Checked By: Signature R. Neal Davis 10/23/95  
 (Checker) Date

Printed Name R. NEAL DAVIS Senior Proj. Eng.  
 and Title

Detailed Requirements  
 Checked by: Signature Not Used for 30% Submittal Bob Mazanti 2/22/96  
 (Checker) Date

Printed Name B.B. MAZANTI  
 and Title Consultant

Overall Review By: Signature Not Used for 30% Submittal Mark H. Gleason 20 Feb 96  
 (PDP) Date

Printed Name MARK H. GLEASON  
 and Title Assistant Project Engineer

Approved by: Signature Not Used for 30% Submittal J.F. Beech 8 AM '96  
 (DTL) 21 Feb 96 Date

Printed Name Kenneth W Cargill  
 and Title Associate

**Record of Revision (Number and initial all revisions)**

Rev. No.	Reason	Date	By	Checked	Approval
<u>PA</u>	<u>30% Submittal</u>				
<u>B</u>	<u>Report for EPA Submittal</u>	<u>14 Dec 95</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>C</u>	<u>Intermediate Design</u>				<u>JFB</u>
<u>D</u>	<u>Intermediate Design - EPA Submittal</u>	<u>8 AM '96</u>	<u>KB</u>		

## SECTION 02250

## VEGETATIVE SOIL LAYER

## PART 1 GENERAL

## 1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, equipment and incidentals necessary for the construction of the vegetative soil layer. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. The work shall include, but not limited to excavation, hauling, placing, compacting, and grading. The vegetative soil layer shall be constructed to the dimensions, lines, grades, and sections on the Construction Drawings or as directed by the Construction Contracts Manager.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 01050 - Surveying
- D. Section 02270 - Erosion and Sediment Control
- E. Section 02712 - Granular Filter
- F. Section 02735 - Geocomposite Drainage Layer
- G. Section 13030 - Seasonal Closure

## 1.03 MEASUREMENT AND PAYMENT

Measurement and payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].
- B. Site Health and Safety Plan.

- 1 C. Site Construction Quality Assurance (CQC) Plan.  
2  
3 D. Latest version of American Society for Testing and Materials (ASTM) standards:  
4 1. ASTM D 422. Standard Method for Particle-Size Analysis of Soils.  
5 2. ASTM D 698. Standard Test Methods for Moisture-Density Relations of  
6 Soils and Soil-Aggregate Mixtures Using a 5.5 pound Rammer  
7 and 12-inch Drop.  
8 3. ASTM D 2216. Standard Method for Laboratory Determination of Water  
9 (Moisture) Content of Soil, Rock, and Soil-Aggregate  
10 Mixtures.  
11 4. ASTM D 2487. Standard Test Method for Classification of Soils for  
12 Engineering Purposes (Unified Soil Classification System).  
13 5. ASTM D 2922. Standard Test Methods for Density of Soil and Soil-Aggregate  
14 in Place by Nuclear Methods (Shallow Depth).  
15 6. ASTM D 3017. Standard Test Method for Water Content of Soil and Rock in  
16 Place by Nuclear Methods (Shallow Depth).  
17 7. ASTM D 4318. Standard Test Method for Liquid Limit, Plastic Limit, and  
18 Plasticity Index of Soils.  
19 8. ASTM D 5084. Standard Test Method for Measurement of Hydraulic  
20 Conductivity of Saturated Porous Materials using a Flexible  
21 Wall Permeameter.

### 22 23 1.05 SUBMITTALS

- 24  
25 A. If the work of this Section is interrupted for reasons other than inclement weather, the  
26 OSDF Construction Subcontractor shall notify the Construction Contract Manager a  
27 minimum of 24 hours prior to the resumption of the work.  
28

### 29 1.06 QUALITY ASSURANCE

- 30  
31 A. The OSDF Construction Subcontractor shall ensure that the materials and methods  
32 used for construction of the vegetative soil layer meet the requirements of the  
33 Construction Drawings and Specifications. Any materials or method that does not  
34 conform to these documents, or to alternatives approved in writing by the Engineer,  
35 will be rejected and shall be repaired or replaced at the OSDF Construction  
36 Subcontractor's expense.  
37  
38 B. The OSDF Construction Subcontractor shall be aware of all monitoring and testing  
39 required by the CQC Plan. This monitoring and testing, including random  
40 conformance testing of construction materials and completed work, will be performed  
41 by the CQC Consultant. If nonconformances or other deficiencies are found in the

1 OSDF Construction Subcontractor's materials or completed work, the OSDF  
2 Construction Subcontractor will be required to repair or replace the deficiency at his  
3 expense.  
4

5  
6 **PART 2 PRODUCTS**

7  
8 **2.01 MATERIAL**

- 9  
10 A. All soil for the vegetative soil layer shall be obtained from on-site borrow sources  
11 identified on the Construction Drawings or approved by the Construction Contract  
12 Manager.  
13  
14 B. The vegetative soil layer shall consist of relatively homogeneous, natural soil that is  
15 free of debris, foreign objects, large rock fragments, roots, and organics. No particles  
16 larger than 2 inches shall be allowed. The soil shall be classified according to the  
17 Unified Soil Classification System (per ASTM D 2487) as SC, CL, or combinations  
18 thereof, or other material approved in writing by the Engineer. The soils selected  
19 shall not be gap-graded or susceptible to piping.  
20

21  
22 **PART 3 EXECUTION**

23  
24 **3.01 FAMILIARIZATION**

- 25  
26 A. Prior to implementing any work of this Section, the OSDF Construction Subcontractor  
27 shall become thoroughly familiar with the site, the site conditions, and all portions of  
28 the work falling within this Section.  
29  
30 B. Inspection:  
31 1. Prior to implementing any work of this Section, the OSDF Construction  
32 Subcontractor shall carefully inspect the installed work of all other Sections and  
33 verify that all such work is complete to the point where the work of this Section  
34 may properly commence without adverse impact.  
35 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
36 work of other Sections or the site, he shall notify the Construction Contract  
37 Manager prior to commencing the work. Failure to notify the Construction  
38 Contract Manager of installation of the cover soil will be construed as OSDF  
39 Construction Subcontractor's acceptance of the related work of all other Sections.  
40  
41

1     **3.02 MATERIAL PLACEMENT**  
2

- 3     A. Placement of the vegetative soil layer shall not commence until CQC conformance  
4     evaluations of previous work are completed by the CQC Consultant, including  
5     evaluations of the OSDF Construction Subcontractor's survey results to confirm that  
6     the previous work was constructed to the required grades, elevations, and thicknesses.  
7     Should the OSDF Construction Subcontractor begin the work of this Section prior to  
8     the completion of CQC evaluations, he does so at his own risk. The OSDF  
9     Construction Subcontractor shall account for the CQC conformance evaluations in his  
10    schedule.
- 11
- 12    B. The OSDF Construction Subcontractor shall construct the vegetative soil layer to the  
13    dimensions, grades, and limits shown on the Construction Drawings and as specified  
14    in this Section.
- 15
- 16    C. The OSDF Construction Subcontractor shall not place, spread, or compact vegetative  
17    soil layer during periods of precipitation. Likewise, no frozen or partially-thawed  
18    vegetative soil layer material shall be placed, spread, or compacted.
- 19
- 20    D. No vegetative soil layer material shall be placed or spread while the surface on which  
21    the material is to be placed is excessively wet, frozen, thawing, or during otherwise  
22    unfavorable weather conditions.
- 23
- 24    E. The vegetative soil layer surface shall be made smooth and free from ruts or  
25    indentations at the end of every working day when precipitation is forecast and/or at  
26    the completion of the compaction operations in that area. Smooth surfaces shall be  
27    scarified before the next lift of vegetative soil layer material is placed.
- 28
- 29    F. The entire area shall be left in a manner to promote runoff at the end of each day.
- 30
- 31    G. The vegetative soil layer material shall be placed in loose lifts that result in a  
32    compacted lift thickness of 6 inches ( $\pm 1$  inch). The minimum total compacted  
33    thickness of the cover soil layer shall be as shown on the Construction Drawings.
- 34
- 35    H. Each vegetative soil layer lift shall be compacted using a bulldozer or other equipment  
36    necessary to meet the compaction requirements of this Section.
- 37
- 38    I. The vegetative soil layer material shall be compacted to at least 90 percent of the  
39    maximum dry unit weight as measured according to ASTM D 698. In all cases the  
40    moisture content shall be maintained within the range established by the Engineer  
41    based on the results of tests performed by the CQC Consultant. The OSDF

1 Construction Subcontractor shall moisture condition or dry out cover soil that is too  
2 dry or too wet prior to placement.

3  
4 J. The upper surface of the vegetative soil layer shall be scarified or roughened with a  
5 dozer track prior to placing overlying lifts of topsoil.

6  
7 **3.03 FIELD TESTING**

8  
9 A. The CQC Consultant will perform conformance testing of the vegetative soil layer  
10 material. The OSDF Construction Subcontractor shall take this testing frequency into  
11 account in planning his construction schedule.

- 12 1. The minimum frequency of testing is:
  - 13 a. particle-size analyses conducted in accordance with ASTM D 422
  - 14 (mechanical sieve method only) at a frequency of one test per 5,000 yd<sup>3</sup>;
  - 15 b. soil classification tests conducted in accordance with ASTM D 2487 at a
  - 16 frequency of one test per 5,000 yd<sup>3</sup>;
  - 17 c. liquid and plastic limit tests conducted in accordance with ASTM D 4318 at
  - 18 a frequency of one test per 5,000 yd<sup>3</sup>;
  - 19 d. standard Proctor compaction tests conducted in accordance with ASTM D
  - 20 698 at a frequency of one test per 5,000 yd<sup>3</sup>.
- 21 2. The CQC Consultant will perform construction quality control tests of placed and
- 22 compacted vegetative soil layer to evaluate compliance with these Specifications.
- 23 These tests will include in-situ moisture content and dry density. The frequency
- 24 and procedures for moisture-density testing are given in the CQC Plan. At a
- 25 minimum, the dry density and moisture content of the soil will be measured in-
- 26 situ in accordance with ASTM D 2922 and ASTM D 3017, respectively.
- 27 3. The CQC Consultant shall perform at least one hydraulic conductivity test in
- 28 accordance with ASTM D 5084. Additional testing may be required if variations
- 29 in the vegetative soil layer material is observed.

30  
31 B. Perforations resulting from testing shall be filled with soil compacted to the satisfaction  
32 of the CQC Consultant.

33  
34 C. If a defective area is discovered in the vegetative soil layer, the CQC Consultant will  
35 evaluate the extent and nature of the defect. If the defect is indicated by an  
36 unsatisfactory test result, the CQC Consultant will determine the extent of the defective  
37 area by additional tests, observations, a review of records, or other means that the  
38 CQC Consultant deems appropriate. If the defect is related to adverse site conditions,  
39 such as overly wet soils or surface desiccation, the CQC Consultant shall define the  
40 limits and nature of the defect.  
41

- 1 D. After determining the extent and nature of a defect, the OSDF Construction  
2 Subcontractor shall correct the deficiency to the satisfaction of the CQC Consultant.  
3 The OSDF Construction Subcontractor shall not perform additional work in the area  
4 until the CQC Consultant approves the correction of the defect.  
5

6 **3.04 SURVEY CONTROL**  
7

- 8 A. The OSDF Construction Subcontractor shall survey the location and elevation of the  
9 top surface of the vegetative soil layer.  
10  
11 B. Surveying shall be performed in accordance with Section 01050 of these Specifications.  
12

13 **3.05 TOLERANCE**  
14

15 The OSDF Construction Subcontractor shall construct the vegetative soil layer to within  
16  $\pm 0.1$  ft of the limits and grades indicated on the Construction Drawings.  
17

18 **3.06 PROTECTION OF WORK**  
19

- 20 A. The OSDF Construction Subcontractor shall use all means necessary to protect  
21 completed work of this Section.  
22  
23 B. In the event of damage to prior work or work completed as specified in this Section,  
24 the OSDF Construction Subcontractor shall immediately make all repairs and  
25 replacements necessary to the approval of the Construction Contract Manager and at  
26 the OSDF Construction Subcontractor's expense.  
27  
28  
29  
30

[END OF SECTION]

**SPECIFICATION COVER SHEET**

**SPECIFICATION SECTION:** 02270 **TITLE:** EROSION AND SEDIMENT CONTROL

**Specifications By:** Signature J.F. Becht 23 Oct 95  
 (Cognizant Engineer) \_\_\_\_\_ Date  
 Printed Name J.F. BECHT, PRINCIPAL  
 and Title \_\_\_\_\_

**Scope and Format**  
**Checked By:** Signature R. Neal Davies 10/28/95  
 (Checker) \_\_\_\_\_ Date  
 Printed Name R. Neal Davies Senior Proj. Eng.  
 and Title \_\_\_\_\_

**Detailed Requirements**  
**Checked by:** Signature Not Used for 30% Submittal - B.B. Mazanti 2/22/96  
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 Printed Name B.B. MAZANTI  
 and Title CONSULTANT

**Overall Review By:** Signature Not Used for 30% Submittal - Mark H. Gleason 20 Feb 96  
 (PDP) \_\_\_\_\_ Date  
 Printed Name MARK H. GLEASON  
 and Title Assistant Project Engineer

**Approved by:** Signature Not Used for 30% Submittal - J.F. Becht 8 Apr 96  
 (DTL) \_\_\_\_\_ 21 Feb 96 Date  
 Printed Name BECHT, Kenneth W Cargill  
 and Title PRINCIPAL Associate

**Record of Revision (Number and initial all revisions)**

Rev. No.	Reason	Date	By	Checked	Approval
NA	30% Submittal				
B	Reprint for EPA submittal	14 Dec 95	NA	NA	NA
C	Intermediate Design	21 Feb 96	-	-	JFB
D	Intermediate Design, EPA Submittal	8 Apr 96	NA	-	-

## SECTION 02270

## EROSION AND SEDIMENT CONTROL

## PART 1 GENERAL

## 1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals required to install and maintain erosion and sediment control throughout the duration of the project. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. Erosion and sediment control shall be provided for those areas shown on the Construction Drawings and all other areas disturbed by the OSDF Construction Subcontractor. The work shall include, but not be limited to, installing and maintaining silt fence, erosion mat, straw bales, check dams and ditches, and temporary vegetation. The work also includes the removal of erosion and sediment control at the completion of the project unless otherwise directed by the Construction Contract Manager.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 02110 - Clearing, Grubbing, and Stripping
- D. Section 02200 - Earthwork
- E. Section 02271 - Riprap
- F. Section 02930 - Vegetation

## 1.03 MEASUREMENT AND PAYMENT

Measurement and Payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].

- 1 B. Site Health and Safety Plan.  
2  
3 C. Rainwater and Land Development, 2nd. ed.; 1996, Ohio Department of Natural  
4 Resources.  
5  
6 D. Latest version of Ohio Department of Transportation Construction and Material  
7 Specifications.  
8  
9 E. Surface Water Management and Erosion Control Plan.  
10  
11 F. Latest version of American Society for Testing and Materials (ASTM) standards:  
12 1. ASTM D 3786. Standard Test Method for Hydraulic Bursting  
13 Strength of Knitted Goods and Nonwoven Fabric -  
14 Diaphragm Bursting Strength Tester Method.  
15 2. ASTM D 4355. Standard Test Method for Deterioration of  
16 Geotextiles from Exposure of Ultraviolet Light and  
17 Water (Xenon-Arc Type Apparatus).  
18 3. ASTM D 4632. Standard Test Method for Breaking Load and  
19 Elongation of Geotextiles (Grab Method).  
20 4. ASTM D 4751. Standard Test Method for Determining Apparent  
21 Opening Size of a Geotextile.

### 22 23 1.05 SUBMITTALS

24  
25 The OSDF Construction Subcontractor shall submit the following to the  
26 Construction Contract Manager for inspection and acceptance at least 14 days prior  
27 to starting the work specified in this Section:

- 28 1. samples of proposed materials; and  
29 2. manufacturers' product data and recommended methods of installation.  
30

### 31 1.06 CONSTRUCTION QUALITY ASSURANCE

- 32  
33 A. The OSDF Construction Subcontractor shall ensure that the materials and methods  
34 used for construction of the erosion and sediment control measures specified in this  
35 section meet the requirements of the Construction Drawings and this Section. Any  
36 material or method that does not conform to these documents, or to alternatives  
37 approved in writing by the Engineer, will be rejected by the Construction Contract  
38 Manager and shall be repaired or replaced by the OSDF Construction  
39 Subcontractor at his expense.  
40  
41

1 **PART 2 PRODUCTS**2  
3 **2.01 SILT FENCE**

- 4
- 5 A. Silt fence fabric may be either woven or nonwoven:
- 6 1. Woven fabric shall consist of slit films of polypropylene treated with
- 7 ultraviolet light stabilizers.
- 8 2. Nonwoven fabric shall consist of long chain polymeric filaments or
- 9 polyester yarns.
- 10 3. Silt fence fabric shall be inert to chemicals commonly found in soils and
- 11 to hydrocarbons.
- 12 4. Silt fence fabric shall be resistant to mildew, rot, insects, and rodent
- 13 attack.
- 14 5. Silt fence fabric shall conform to the following test criteria:

<u>Test and Method</u>	<u>Specification Limits</u>
Grab Tensile Strength, ASTM D 4632, lbs (min)	90
Burst Strength, ASTM D 3786, psi (min)	190
Apparent Opening Size, U.S. Standard Sieve Size, ASTM D 4751	40 to 80
Ultraviolet Radiation Stability, ASTM D 4355 %	90

- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22
- 23
- 24 B. Fence Post (for fabricated units): The length shall be 32 inches minimum. Wood
- 25 posts shall be of sound quality hardwood with a nominal cross sectional area of 2 x 2
- 26 inches. Steel posts will be standard "T" and "U" sections weighing not less than 1.33
- 27 pounds per linear foot with a minimum length of 42 inches.
- 28
- 29 C. Wire Fence (for fabricated units): Wire fencing shall be a minimum 14-1/4 gage
- 30 welded wire fabric with a maximum 6-inch mesh opening, or as approved by the
- 31 Engineer.
- 32

33 **2.02 EROSION MAT**

- 34
- 35 A. Erosion mat used for sediment control shall be made of natural material, synthetic
- 36 material or a combination.
- 37
- 38 B. Regardless of the material used for the erosion mat shall be sufficiently resistant to
- 39 degradation for a 12 month period after installation.
- 40

- 1 C. The erosion mat shall be capable of resisting shear stresses generated by water flowing  
2 across its upper surface of 0.4 psf.  
3

4 **2.03 STRAW BALE**  
5

6 Straw bales used for sediment control shall be made of tightly baled straw bound with  
7 at least two individual strands of poly-type twine. Bale dimensions shall be at least 1.5  
8 feet by 2.5 feet long. Anchors for straw bales shall be wooden stakes that are a  
9 minimum of 1.5 inches by 1.5 inches by 3 feet in length.  
10

11  
12 **PART 3 EXECUTION**  
13

14 **3.01 FAMILIARIZATION**  
15

- 16 A. Prior to implementing any of the work described in this Section, the OSDF  
17 Construction Subcontractor shall become thoroughly familiar with the site, the site  
18 conditions, and all portions of the work falling within this Section and general  
19 requirements as detailed in Section 01012 of these Specifications.  
20

21 B. Inspection:

- 22 1. Prior to implementing any of the work in this Section, the OSDF Construction  
23 Subcontractor shall carefully inspect the installed work of all other Sections and  
24 verify that all work is complete to the point where the installation of this Section  
25 may properly commence without adverse impact.  
26 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
27 work of other Sections, he should notify the Construction Contract Manager in  
28 writing prior to commencing the work. Failure to notify the Construction  
29 Contract Manager or continuing with the work outlined in this Section will be  
30 construed as OSDF Construction Subcontractor's acceptance of the related work  
31 of all other Sections.  
32

33 **3.02 INSTALLATION**  
34

35 A. Silt Fence

- 36 1. Silt fencing shall be provided at the locations indicated on the Construction  
37 Drawings, at any other locations where drainage leaves the work areas, and at any  
38 other locations identified by the Engineer.  
39 2. Silt fences shall be constructed before upslope land disturbance begins.  
40 3. All silt fence shall be placed as close to the contour as possible so that water will  
41 not concentrate at low points in the fence and so that small swales or depressions

- 1 which may carry small concentrated flows to the silt fence are dissipated along  
2 its length.
- 3 4. To prevent water ponded by the silt fence from flowing around the ends, each end  
4 shall be constructed upslope so that the ends are at a higher elevation.
- 5 5. Where possible, silt fence shall be placed on the flattest area available.
- 6 6. Where possible, vegetation shall be preserved for 5 ft. (or as much as possible)  
7 upslope from the silt fence. If vegetation is removed, it shall be reestablished  
8 within 7 days from the installation of the silt fence.
- 9 7. The height of the silt fence shall be a minimum of 16 inches above the original  
10 ground surface.
- 11 8. The silt fence shall be placed in a trench cut a minimum of 6 inches deep. The  
12 trench shall be cut with a trencher, cable laying machine, or other suitable device  
13 which will ensure an adequately uniform trench depth.
- 14 9. The silt fence shall be placed with the stakes on the downslope side of the  
15 geotextile so that 8 inches of cloth are below the ground surface. Excess  
16 geotextile material shall lay on the bottom of the 6 inch deep trench. The trench  
17 shall be backfilled and compacted.
- 18 10. Seams between section of silt fence shall be overlapped with the end stakes of  
19 each section wrapped together before driving into the ground.
- 20 11. Silt fence shall allow runoff to pass only as diffuse flow through the geotextile.  
21 If runoff overtops the silt fence, flows under or around the ends, or in any other  
22 way becomes a concentrated flow, one of the following shall be performed, as  
23 appropriate:
- 24 a. The layout of the silt fence shall be changed,  
25 b. Accumulated sediment shall be removed, or  
26 c. Other practices shall be installed.

27  
28 **B. Erosion Mat**

- 29 1. Erosion mat shall be provided at the locations indicated on the Construction  
30 Drawings. Erosion mat shall be installed within 48 hours after seeding operations  
31 have been completed in a work area.
- 32 2. The mat shall be placed on a smooth surface that is free of vegetation, trash, ruts  
33 and rocks.
- 34 3. Erosion mat shall be placed flat, conforming to the contours of soil surface.
- 35 4. Placement:
- 36 a. Terminal trenches shall be located at the upstream and downstream end of  
37 the drainage swale and shall be at least 12 inches deep. Transverse check  
38 slots shall be located at 25-foot intervals along the length of the swale and  
39 shall be at least 6 inches deep.
- 40 b. Any anchorage requirements such as trenches or fasteners shall be in  
41 accordance with the Manufacturer's instructions

- 1           5. Adjacent erosion mats shall be overlapped in a manner such that they are shingled  
2           in the direction of water flow.  
3           6. The dimension of overlaps shall be in accordance with the manufacturer's  
4           recommended action.  
5

6           **C. Straw Bales:**

7           1. **Sheet Flow Applications:**

- 8           a. Bales shall be placed in a single row, lengthwise on the contour, with ends  
9           of adjacent bales tightly abutting one another.  
10          b. Bales shall be installed so that bindings are oriented around the sides rather  
11          than along the tops and bottoms of the bales to prevent deterioration of the  
12          bindings.  
13          c. Straw bales shall be placed directly on top of the ground surface in vegetated  
14          areas.  
15          d. Bales shall be entrenched and backfilled on bare ground where there is no  
16          vegetation. The trench shall be excavated the width of a bale and the length  
17          of the proposed barrier to a minimum depth of 6 inches. Excavated soil  
18          shall be backfilled against the barrier after the bales are staked and chinked.  
19          e. Each bale shall be securely anchored with a minimum of two stakes driven  
20          through the bale. Drive the first stake in each bale toward the previously  
21          laid bale to force the bales together. Drive stakes deep enough into the  
22          ground to securely anchor the bales.  
23          f. The gaps between bales (filled by wedging) shall be chinked with straw to  
24          prevent water from escaping between the bales. Perpendicular bale checks  
25          shall be installed at 100-foot maximum on-center along sloping areas where  
26          surface flow follows the bale line.

27          2. **Channel Flow Applications:**

- 28          a. Bales shall be placed in a single row, lengthwise, perpendicular to the  
29          channel, with ends of adjacent bales tightly abutting one another.  
30          b. All steps for installing a bale barrier for sheet flow as specified above shall  
31          be applied.  
32          c. Extend the length of the barrier so that the bottoms of the end bales are  
33          higher in elevation than the top of the lowest middle bale to ensure that  
34          sediment-laden runoff will flow either through or over the barrier but not  
35          around it.  
36

37           **3.03 ADDITIONAL PROVISIONS FOR EROSION CONTROL DURING**  
38           **CONSTRUCTION**

- 39  
40           A. The OSDF Construction Subcontractor shall conform with all requirements stated in  
41           the Surface Water Management and Erosion Control Plan.

- 1 B. The OSDF Construction Subcontractor shall take sufficient precautions during  
2 construction to prevent the run-off of polluting substances such as silt, clay, fuels, oils,  
3 and contaminated soils into the water supplies and surface waters of the State. Special  
4 precautions shall be taken in the use of construction equipment to prevent operations  
5 which promote erosion.  
6
- 7 C. Accumulated silt and debris shall be removed by the OSDF Construction Subcontractor  
8 from behind the face of the silt fence when the silt deposits reach approximately one  
9 half the height of the fence. Silt fence fabric or woven wire fence fabric damaged  
10 during maintenance operations shall be replaced at the OSDF Construction  
11 Subcontractor's expense.  
12
- 13 D. The OSDF Construction Subcontractor shall be prepared to implement other methods  
14 to control erosion of sediment at the site. The measures shall be conducted in  
15 accordance with the surface water Management and Erosion Control Plan.  
16

17 **3.04 PROTECTION OF WORK**

- 18
- 19 A. The OSDF Construction Subcontractor shall use all means necessary to protect  
20 completed work of this Section.  
21
- 22 B. In the event of damage to prior work, the OSDF Construction Subcontractor shall  
23 make repairs and replacements to the satisfaction of the Construction Contract Manager  
24 and at the OSDF Construction Subcontractor's expense.  
25  
26  
27  
28

[END OF SECTION]

**SPECIFICATION COVER SHEET**

**SPECIFICATION SECTION:** 02280 **TITLE:** BIOINTRUSION BARRIER

**Specifications By:** Signature J.F. Beech 23 Oct 95  
 (Cognizant Engineer) Date

Printed Name J.F. BEECH, PRINCIPAL  
 and Title

**Scope and Format**  
**Checked By:** Signature R. Neil Davies 10/23/95  
 (Checker) Date

Printed Name R. NEIL DAVIES, Senior Proj. Eng.  
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Printed Name B. B. MAZANTI  
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**Overall Review By:** Signature Not Used for 30% Submittal Mark H. Gleason 20 Feb 96  
 (PDP) Date

Printed Name Mark H. Gleason  
 and Title Assistant Project Engineer

**Approved by:** Signature Not Used for 30% Submittal Kenneth W. Cargill 8 Apr 96  
 (DTL) 21 Feb 96 Date

Printed Name BEECH, PRINCIPAL  
 and Title Associate

**Record of Revision (Number and initial all revisions)**

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0A	30% Submittal				
B	Report for EPA Submittal	14 Dec 95	NA	N/A	N/A
C	Intermediate Design	23 Feb 96	-	-	JFB
D	Intermediate Design, EPA Submittal	8 Apr 96	KE		

## SECTION 02280

## BIOINTRUSION BARRIER

## PART 1 GENERAL

## 1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals required to construct a biointrusion barrier. The work shall be carried out as specified herein and in accordance with the Construction Drawings.

Work shall include delivery, placement, and grading of the biointrusion barrier material. The biointrusion barrier shall conform to the dimensions, lines, grades, and sections on the Construction Drawings or as directed by the Construction Contracts Manager.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 01050 - Surveying
- D. Section 02270 - Erosion and Sediment Control
- E. Section 02710 - Granular Drainage Layers
- F. Section 02712 - Granular Filter

## 1.03 MEASUREMENT AND PAYMENT

Measurement and payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].

- 1 B. Site Health and Safety Plan.  
2  
3 C. Site Construction Quality Assurance (CQA) Plan.  
4  
5 D. Latest version of Ohio Department of Transportation Construction and Material  
6 Specifications.  
7  
8 E. Latest version of American Society for Testing and Materials (ASTM) standards.  
9 1. ASTM C 136. Standard Test Method for Sieve Analysis of Fine and Course  
10 Aggregates.  
11  
12 F. UMTRA-DOE "Technical Approach Document," Revision 11, UMTRA Mill Tailings  
13 Remedial Action Project, December 1989.  
14

#### 15 1.05 SUBMITTALS

- 16  
17 A. The OSDF Construction Subcontractor shall submit the following information to the  
18 Construction Contract Manager for review and acceptance at least 28 days prior to the  
19 start of biointrusion barrier placement.  
20 1. the source of the biointrusion barrier; and  
21 2. written certification from the supplier that the biointrusion barrier meets the  
22 requirements of Part 2.01 of this section.  
23  
24 B. If the work of this Section is interrupted for reasons other than inclement weather, the  
25 OSDF Construction Subcontractor shall notify the Construction Contract Manager a  
26 minimum of 24 hours prior to his resumption of work.  
27

#### 28 1.06 QUALITY ASSURANCE

- 29  
30 A. The OSDF Construction Subcontractor shall ensure that the materials and methods  
31 used for construction of the biointrusion barrier meet the requirements of the  
32 Construction Drawings and Specifications. Any material or method that does not  
33 conform to these documents, or to alternatives approved in writing by the Engineer,  
34 will be rejected and shall be repaired or replaced by the OSDF Construction  
35 Subcontractor at no additional cost to the Construction Contract Manager.  
36  
37 B. The OSDF Construction Subcontractor shall be aware of all monitoring and  
38 conformance testing required by the CQC Plan. This monitoring and testing, including  
39 random conformance testing of construction materials and completed work, will be  
40 performed by the CQC Consultant. If nonconformances or other deficiencies are

1 found in the OSDF Construction Subcontractor's materials or completed work, the  
2 OSDF Construction Subcontractor will be required to repair or replace the deficiency  
3 at his expense.  
4

5  
6 **PART 2 PRODUCTS**

7  
8 **2.01 STONE BIOINTRUSION BARRIER**

- 9
- 10 A. All stone used for the biointrusion barrier shall consist of field stone, rough unhewn
- 11 quarry stone, or excavated rock with angular or fractured faces. The stone used for
- 12 biointrusion barrier shall have a quality rating of 60 percent or higher according to the
- 13 procedures described in Part 1.04F. The stone used for biointrusion barrier purposes
- 14 shall be approved in writing by the Engineer as to source, size, and quality prior to
- 15 its delivery to the site.
- 16
- 17 B. Stone used for the primary structure of the biointrusion barrier shall be free of soil and
- 18 be Type C as defined in Item 601 of the State of Ohio, Department of Transportation
- 19 Construction and Material Specifications, with the following modifications:
- 20 1. The maximum rock dimension shall be 18 inches;
- 21 2. The fraction of material smaller than a 6 inch square opening shall consist of
- 22 rocks no smaller than a 1 inch square opening with the exception of <5% by
- 23 total weight of rock spalls and rock fines; and
- 24 3. The material shall have a  $d_{15} = 150$  to 350 mm.
- 25
- 26 C. A choke stone shall be placed in the upper 6 in. of the biointrusion barrier. The choke
- 27 stone shall have a quality rating of 60 percent or higher according to the procedures
- 28 described in Part 1.04F. The choke stone shall have a gradation (per ASTM C 136)
- 29 that meets the following requirements:

<u>Sieve</u>	<u>Total Percent Passing</u>
4 in.	100
3 1/2 in.	90 to 100
2 1/2 in.	25 to 60
1 1/2 in.	0 to 15
3/4 in.	0 to 5

1     **PART 3 EXECUTION**

2  
3     **3.01 FAMILIARIZATION**

- 4
- 5     A. Prior to implementing any of the work described in this Section, the OSDF
- 6       Construction Subcontractor shall become thoroughly familiar with the site, the site
- 7       conditions, and all portions of the work falling within this Section.
- 8
- 9     B. Inspection:
- 10       1. Prior to implementing any of the work in this Section, the OSDF Construction
- 11         Subcontractor shall carefully inspect the installed work of all other sections and
- 12         verify that all work is complete to the point where the installation of this Section
- 13         may properly commence without adverse impact.
- 14       2. If the OSDF Construction Subcontractor has any concerns regarding the installed
- 15         work of other sections, he should notify the Construction Contract Manager in
- 16         writing prior to commencing the work. Failure to notify the Construction
- 17         Contract Manager or installation of the biointrusion barrier will be construed as
- 18         OSDF Construction Subcontractor's acceptance of the related work of all other
- 19         sections.
- 20

21     **3.02 INSTALLATION**

- 22
- 23     A. Placement of the biointrusion barrier shall not commence until CQC conformance
- 24       evaluations of previous work are completed by the CQC Consultant, including
- 25       evaluations of the OSDF Construction Subcontractor's survey results to confirm that
- 26       the previous work was constructed to the required grades, elevations, and thicknesses.
- 27       Should the OSDF Construction Subcontractor begin the work of this Section prior to
- 28       the completion of quality control and CQC evaluations, he does so at his own risk.
- 29       The OSDF Construction Subcontractor shall account for the quality control and CQC
- 30       conformance evaluations in his schedule.
- 31
- 32     B. Biointrusion barrier material of the required type shall be placed to the thickness,
- 33       grades, and locations shown on the Construction Drawings.
- 34
- 35     C. Biointrusion barrier material shall be placed over the cover drainage layer as shown
- 36       on the Construction Drawings as described in Section 02710 of these Specifications.
- 37
- 38     D. Biointrusion barrier material shall be carefully placed on top of the cover drainage
- 39       layer as shown on the Drawings such that barrier disturbance of the underlying
- 40       material is avoided. Any disturbance to the cover drainage layer during placement of

1 biointrusion barrier shall be repaired to the satisfaction of the CQC Consultant. All  
2 repair costs shall be the responsibility of the OSDF Construction Subcontractor.

- 3  
4 E. The biointrusion barrier material shall be placed in such a manner as to produce a  
5 well-graded mass with the minimum practicable percentage of voids. The larger pieces  
6 shall be well distributed throughout the entire mass and the finished biointrusion  
7 barrier shall be free from objectionable pockets of small or large pieces. Hand  
8 placing, to a limited extent, may be required, but only to the extent necessary to obtain  
9 the results specified above.
- 10  
11 F. Biointrusion barrier material shall be placed from the toe of the slope. All material  
12 shall be buttressed from below. Placement of the material from the top of the slope  
13 is not allowed.
- 14  
15 G. Placing the biointrusion barrier material by dumping into chutes or by similar methods  
16 likely to cause segregation of various sizes will not be permitted.
- 17  
18 H. The choke stone shall be placed as a separate layer. The choke stone shall be graded  
19 into the top six inches of the material described in Part 2.01B of this Section.

20  
21 **3.03 FIELD TESTING**

- 22  
23 A. The OSDF Construction Subcontractor shall take the frequency of CQC testing into  
24 account in planning his construction schedule. The choke stone shall be tested in  
25 accordance with ASTM C 136 at a frequency of one per 5,000 yd<sup>3</sup>.
- 26  
27 B. If a defective area is discovered in the biointrusion barrier layer, the CQC Consultant  
28 will evaluate the extent and nature of the defect. After determining the extent and  
29 nature of a defect, the OSDF Construction Subcontractor shall correct the deficiency  
30 to the satisfaction of the CQC Consultant. The OSDF Construction Subcontractor shall  
31 not perform additional work in the area until the CQC Consultant approves the  
32 correction of the defect.

33  
34 **3.04 SURVEY CONTROL**

- 35  
36 A. The OSDF Construction Subcontractor shall survey the locations and elevations of the  
37 top of the biointrusion barrier layer.
- 38  
39 B. All surveying shall be performed in accordance with Section 01050 of these  
40 specifications.

1     **3.05     CONSTRUCTION TOLERANCE**

2  
3     The OSDF Construction Subcontractor shall construct protective and contouring layers to  
4     within  $\pm 0.2$  ft of the limits and grades indicated on the Construction Drawings.

5  
6     **3.06     PROTECTION OF WORK**

- 7  
8     A.   The OSDF Construction Subcontractor shall use all means necessary to protect all  
9     prior work and materials and completed work of other Sections.
- 10  
11    B.   In the event of damage, the OSDF Construction Subcontractor shall immediately make  
12    all repairs and replacements necessary, to the approval of the Construction Contract  
13    Manager and at the OSDF Construction Subcontractor's expense.
- 14  
15  
16  
17  
18

[END OF SECTION]

**SPECIFICATION COVER SHEET**

**SPECIFICATION SECTION:** 02610 **TITLE:** HDPE PIPE, FITTINGS, AND THERMOPLASTIC VALVES

**Specifications By:** Signature J.F. Beeth 230495  
 (Cognizant Engineer) Date  
 Printed Name J.F. BEETH, PRINCIPAL  
 and Title

**Scope and Format**  
**Checked By:** Signature R. Neil Davies 10/23/95  
 (Checker) Date  
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**Overall Review By:** Signature Not Used for 30% Submittal Mark H. Gleason 20 Feb 96  
 (PDP) Date  
 Printed Name Mark H. Gleason  
 and Title Assistant Project Engineer

**Approved by:** Signature Not Used for 30% Submittal J.F. Beeth 8 Apr 96  
 (DTL) 21 Feb 96 Date  
 Printed Name BEETH PRINCIPAL  
 and Title Associate

**Record of Revision (Number and initial all revisions)**

Rev. No.	Reason	Date	By	Checked	Approval
<u>A</u>	<u>30% Submittal</u>				
<u>B</u>	<u>Request for EPA Submittal</u>	<u>14 Dec 95</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>C</u>	<u>Intermediate Design</u>	<u>21 Feb 96</u>	<u>-</u>	<u>-</u>	<u>JFB</u>
<u>D</u>	<u>Intermediate Design, EPA Submittal</u>	<u>8 Apr 96</u>	<u>KB</u>	<u>-</u>	<u>-</u>

## SECTION 02610

HIGH DENSITY POLYETHYLENE PIPE, FITTINGS,  
AND THERMOPLASTIC VALVES

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary for installation of all high density polyethylene (HDPE) pipe, fittings, and appurtenances, and thermoplastic valves. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. The work shall include, but not limited to, delivery, storage, placement, joining, testing of all HDPE pipes, fittings, and thermoplastic valves.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 02200 - Earthwork
- D. Section 02605 - HDPE Manholes
- E. Section 15000 - Mechanical

## 1.03 MEASUREMENT AND PAYMENT

- A. Measurement and payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project (FEMP) On-Site Waste Disposal Facility*," dated [REDACTED].
- B. Site Health and Safety Plan.

- 1 C. Latest version of the American Society for Testing and Materials (ASTM) standards:  
2 1. ASTM D 1248. Standard Specification for Polyethylene Plastics Molding and  
3 Extrusion Materials  
4 2. ASTM D 1603. Standard Test Method for Carbon Black in Olefin Plastics  
5 3. ASTM D 1693. Standard Test Method for Environmental Stress-Cracking of  
6 Ethylene Plastics  
7 4. ASTM D 2657. Standard Practice for Heat-Joining for Polyolefin Pipe and  
8 Fittings  
9 5. ASTM D 2837. Test Method for Obtaining Hydrostatic Design Basis for  
10 Thermoplastic Pipe Materials  
11 6. ASTM D 3350. Standard Specification for Polyethylene Plastics Pipe and Fittings  
12 Materials  
13 7. ASTM F 714. Standard Specification for Polyethylene (PE) Plastics Pipe (SDR-  
14 PR) Based on Outside Diameter.

15  
16 **1.05 SUBMITTALS**

- 17  
18 A. The OSDF Construction Subcontractor shall submit to the Construction Contract  
19 Manager for approval at least 28 days prior to the start of pipe delivery, complete,  
20 detailed shop drawings of all HDPE pipe, fittings, and thermoplastic valves, a list of  
21 materials to be furnished, the names of the suppliers and the proposed dates of delivery  
22 of the materials to the site.  
23  
24 B. The OSDF Construction Subcontractor shall submit to the Construction Contract  
25 Manager the HDPE pipe manufacturer's certification of compliance with these  
26 Specifications for all materials delivered to the site, and shall comply with the HDPE  
27 pipe manufacturer's recommendations for handling, storing, and installing HDPE pipes  
28 and fittings.  
29  
30 C. The OSDF Construction Subcontractor shall submit to the Construction Contract  
31 Manager in writing at least ten days prior to the start of pipe placement the following  
32 documentation from the HDPE pipe manufacturer on the raw materials used to  
33 manufacture the HDPE pipe and fittings prior to transporting any HDPE pipe or fittings  
34 to the site:  
35 1. certificate stating the specific resin, its source and the information required by  
36 ASTM D 1248; and  
37 2. certification that no recycled compound has been added to the resin.  
38  
39 D. The OSDF Construction Subcontractor shall submit to the Construction Contract  
40 Manager certification from the HDPE pipe manufacturer at least ten days prior to the  
41 start of pipe placement that stress regression testing has been performed in accordance

1 with ASTM D 2837. The manufacturer shall supply HDPE pipe having a minimum  
2 Hydrostatic Design Basis (HDB) of 1,600 psi, as determined in accordance with ASTM  
3 D 2837.

4  
5 E. If the work of this Section is interrupted for reasons other than inclement weather, the  
6 OSDF Construction Subcontractor shall notify the Construction Contract Manager a  
7 minimum of 24 hours prior to his resumption of work.

8  
9 F. Prior to the completion of the project, the OSDF Construction Subcontractor shall  
10 provide the Construction Contract Manager with all operations and users manuals or  
11 instructions for all valves and other equipment associated with the polyethylene pipes,  
12 fittings, and thermoplastic valves.

### 13 14 **1.06 QUALITY ASSURANCE**

15  
16 A. It is the responsibility of the OSDF Construction Subcontractor to ensure that the  
17 materials and methods used for construction of the HDPE pipe, fittings, and  
18 appurtenances meet the requirements of the Construction Drawings and Specifications.  
19 Any material or method that does not conform to these documents, or to alternatives  
20 approved by the Construction Contract Manager, will be rejected by the Construction  
21 Contract Manager and shall be repaired or replaced by the OSDF Construction  
22 Subcontractor at no additional cost to the Owner.

23  
24 B. The OSDF Construction Subcontractor shall be aware of all monitoring and  
25 conformance testing required by the CQA Plan. This monitoring and testing, including  
26 random conformance testing of construction materials and completed work, will be  
27 performed by the CQC Consultant. If nonconformances or other deficiencies are found  
28 in the OSDF Construction Subcontractor's materials or completed work, the OSDF  
29 Construction Subcontractor will be required to repair or replace the deficiency at his  
30 expense.

### 31 32 **1.07 GUARANTEE**

33  
34 The OSDF Construction Subcontractor shall guarantee to correct all defects in material,  
35 equipment, or workmanship disclosed within a period of one (1) year from date of  
36 project acceptance by the Construction Contract Manager.  
37  
38  
39

1     **PART 2     PRODUCTS**

2  
3     **2.01     HIGH DENSITY POLYETHYLENE COMPOUND**

- 4  
5     A.   The HDPE pipe, fittings, and appurtenances shall be Type SDR11 manufactured from  
6       new, high performance, high molecular weight, HDPE resin conforming to ASTM D  
7       1248 (Type III, Class C, Category 5, Grade P 34), ASTM D 3350 (Cell Classification  
8       PE 345434C), and having a Plastic Pipe Institute (PPI) Rating of PE 3408.  
9  
10    B.   The polyethylene compound shall contain a minimum of 2 percent carbon black in  
11       accordance with ASTM D 1603 to withstand outdoor exposure without loss of  
12       properties.  
13  
14    C.   The polyethylene compound shall have a minimum resistance of 5000 hours when tested  
15       for environmental stress cracking in accordance with requirements of ASTM D 1693,  
16       Procedure B.  
17

18     **2.02     HIGH DENSITY POLYETHYLENE PIPES, FITTINGS, AND APPURTENANCES**

- 19  
20    A.   All HDPE pipe, fittings, and appurtenances shall comply with the ASTM F 714.  
21  
22    B.   All HDPE pipe and fittings shall have a maximum Standard Dimension Ratio (SDR) of  
23       11 unless otherwise stated on the Drawings.  
24  
25    C.   HDPE pipe shall be supplied in standard laying lengths not exceeding 50 feet.  
26  
27    D.   HDPE pipe shall be perforated as indicated on the Construction Drawings.  
28  
29    E.   HDPE pipes and fittings shall be homogeneous throughout and free of visible cracks,  
30       holes (other than intentional manufactured perforations), foreign inclusions, or other  
31       deleterious effects, and shall be uniform in color, density, melt index and other physical  
32       properties.  
33  
34    F.   Fittings at the ends of pipes shall consist of HDPE end caps unless indicated otherwise  
35       on the Drawings.  
36  
37    G.   Thermoplastic valves shall conform to the requirements of Section 15000 of these  
38       Specifications.  
39  
40

1     **2.03    PIPE IDENTIFICATION**

- 2
- 3     A. The following shall be continuously indent printed on the pipe, or spaced at intervals
- 4     not exceeding 5 feet:
- 5         1. name and/or trademark of the pipe manufacturer;
- 6         2. nominal pipe size;
- 7         3. standard dimension ratio (SDR);
- 8         4. the letters PE followed by the polyethylene grade per ASTM D 1248, followed by
- 9         the Hydrostatic Design Stress in 100's of psi (e.g., PE 3408);
- 10        5. manufacturing Standard Reference (e.g., ASTM F-714-1); and
- 11        6. a production code from which the date and place of manufacture can be
- 12        determined.

13

14    **2.04    PIPE BEDDING MATERIAL**

- 15
- 16    A. Pipe bedding material shall be gravel conforming to the requirements of Section 02215
- 17    of these Specifications.

18

19    **2.05    DUAL CONTAINMENT PIPING SYSTEM**

- 20
- 21    A. General Requirements
- 22        1. The dual containment system shall consist of field or factory fabricated
- 23        components, joined and installed on site.
- 24        2. All dual containment pipe and fittings shall provide a continuous annular space
- 25        between the carrier and the containment pipes to accommodate possible flow of
- 26        fluid from the carrier pipe. If pre-fabricated, pipe and fittings shall be
- 27        manufactured with the carrier pipe/fitting ends extending 6 inches beyond the
- 28        containment casing pipe/fitting ends. Pre-fabricated dual containment casing pipe
- 29        shall have the carrier pipe factor installed within the containment casing pipe, with
- 30        support spacers installed on the carrier pipe. Pre-fabricated dual containment
- 31        casing pipe shall be provided in nominal lengths of 20 or 40 feet, and shall allow
- 32        for field adjustment of pipe length. Pre-fabricated dual containment fittings shall
- 33        have the carrier fitting factory installed within the containment fitting, with all
- 34        necessary support spacers installed.
- 35        3. All carrier to carrier joints, and containment to containment joints shall be made
- 36        using thermal fusion procedures recommended by the manufacturer. Carrier to
- 37        carrier joints and containment to containment joints shall be made independently
- 38        of each other. Carrier to carrier joints shall be inspected before final closure of
- 39        the containment.
- 40        4. Pipe construction work shall be performed in accordance with engineered
- 41        construction plans for the work.

1 B. Containment Casing Piping

- 2 1. Containment casing pipe, fittings, and appurtenances shall be the same as specified  
3 above in Parts 2.01 through 2.04 of this Section.  
4 2. Containment casing pipe, fittings, and other devices shall be designed to withstand  
5 earthloads or other external loads as indicated on the drawings. Containment casing  
6 pipe and containment fittings shall be leak tight, and shall accommodate up to 35  
7 psi internal pressure.  
8

9 C. Carrier Piping

- 10 1. Carrier pipe, fittings, and appurtenances shall be same as specified above in Parts  
11 2.01 through 2.04 of this Section.  
12

13  
14 **PART 3 EXECUTION**

15  
16 **3.01 FAMILIARIZATION**

- 17  
18 A. Prior to implementing any of the work described in this Section, the OSDF Construction  
19 Subcontractor shall become thoroughly familiar with all portions of the work falling  
20 within this Section.  
21

22 B. Inspection:

- 23 1. Prior to implementing any of the work in this Section, the OSDF Construction  
24 Subcontractor shall carefully inspect the installed work of all other Sections and  
25 verify that all work is complete to the point where the installation of this section  
26 may properly commence without adverse impact.  
27 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
28 work of other Sections, he shall notify the Construction Contract Manager in  
29 writing prior to commencing work. Failure to inform the Construction Contract  
30 Manager in writing or proceeding with installation of the polyethylene pipes and  
31 fittings will be construed as OSDF Construction Subcontractor's acceptance of the  
32 related work of all other Sections.  
33

34 **3.02 HANDLING AND PLACEMENT**

- 35  
36 A. Pipe installation shall not commence until CQC conformance evaluations by the CQC  
37 Consultant of previous work are complete, including evaluations of the OSDF  
38 Construction Subcontractor's survey results to confirm that the previous work was  
39 constructed to the required grades and elevations. Should the OSDF Construction  
40 Subcontractor begin the work of this Section prior to the completion of CQC

1 evaluations, he does so at his own risk. The OSDF Construction Subcontractor shall  
2 account for the CQC conformance evaluations in his schedule.

- 3  
4 B. The OSDF Construction Subcontractor shall exercise care when transporting, handling  
5 and placing HDPE pipe and fittings, such that they will not be cut, kinked, twisted, or  
6 otherwise damaged.
- 7  
8 C. Ropes, fabric or rubber-protected slings and straps shall be used when handling HDPE  
9 pipe. Slings, straps, etc. shall not be positioned at butt-fused joints. Chains, cables or  
10 hooks shall not be inserted into the pipe ends as a means of handling pipe.
- 11  
12 D. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Under no  
13 circumstances shall pipe or fittings be dropped into trenches, or dragged over sharp and  
14 cutting objects.
- 15  
16 E. HDPE pipe shall be stored on clean level ground, preferably turf or sand, free of sharp  
17 objects that could damage the pipe. Stacking shall be limited to a height that will not  
18 cause excessive deformation of the bottom layers of pipes under anticipated temperature  
19 conditions. Where necessary, due to ground conditions, the pipe shall be stored on  
20 wooden sleepers, spaced suitably and of such width as not to allow deformation of the  
21 pipe at the point of contact with the sleeper or between supports. The pipes should be  
22 stored out of direct sunlight.
- 23  
24 F. The maximum allowable depth of cuts, gouges or scratches on the exterior surface of  
25 HDPE pipe or fittings is 10 percent of the wall thickness. The interior of the pipe and  
26 fittings shall be free of cuts, gouges and scratches. Sections of pipe with excessive  
27 cuts, gouges or scratches shall be removed and the ends of the pipe rejoined at no cost  
28 to the Owner.
- 29  
30 G. Whenever pipe laying is not actively in progress, the open end of pipe that has been  
31 placed shall be closed using a watertight plug.
- 32  
33 H. Where pipes penetrate through geomembranes, an effective seal shall be established in  
34 accordance with the details shown on the Construction Drawings.

35  
36 **3.03 INSTALLATION**

- 37  
38 A. General:  
39 1. All HDPE pipe and fittings shall be installed in accordance with the manufacturer's  
40 instructions.

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41

- 2. The OSDF Construction Subcontractor shall carefully examine all pipe and fittings for cracks, damage or defects before installation. Defective materials shall be immediately removed from the site and replaced at the Construction Contractor's expense.
- 3. The interior of all pipe and fittings shall be inspected, and any foreign material shall be completely removed from the pipe interior before the pipe is moved into final position.
- 4. Field-cutting of pipes, where required, shall be made with a machine specifically designed for cutting pipe. Cuts shall be carefully made, without damage to pipe or lining, so as to leave a smooth end at right angles to the axis of pipe. Cutter ends shall be tapered and sharp edges filed off smooth. Flame cutting will not be allowed.
- 5. All pipe and fittings shall be laid or placed to the lines and grades shown on the Drawings with bedding and backfill shown on the Drawings and as specified in this Section.
- 6. No pipe shall be laid until the Engineer has approved the bedding conditions.
- 7. No pipe shall be brought into position until the preceding length has been bedded and secured in its final position.
- 8. Blocking under piping shall not be permitted unless specifically accepted by the Engineer for special conditions.
- 9. The OSDF Construction Subcontractor shall provide all necessary adapters and/or connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.
- 10. The dual containment system shall be installed in accordance with the Construction Documents and the manufacturer's recommendations. The manufacturer's technical representative shall be available upon request as required. The carrier and containment piping shall be pressure tested as described in Part 3.05 of this Section.

**3.04 JOINTS AND CONNECTIONS**

- A. HDPE carrier pipe shall be joined with thermal butt-fusion joints or electrofusion adapters. All joints shall be made in strict compliance with ASTM D 2657, [ASTM F 1055], and the manufacturer's recommendations, and shall be performed by manufacturer's authorized, trained fusion personnel.
- B. HDPE containment pipe shall be joined with thermal butt-fusion or extrusion welded HDPE sleeves. All joints shall be made in strict compliance with ASTM D 2657, the manufacturer's recommendations, and shall be performed by manufacturer's authorized, trained fusion personnel.

- 1 C. Mechanical connections of HDPE pipe to auxiliary equipment such as valves, flow  
2 meters, pumps and tanks shall consist of the following unless otherwise specified by the  
3 Engineer:
- 4 1. An HDPE flange connection, called a flange adapter, shall be butt-fused to the  
5 HDPE pipe. Outside diameter and drillings shall comply with ANSI B16.1.
  - 6 2. A 316 stainless steel back-up flange shall be provided. Outside diameter and  
7 drillings shall comply with ANSI B16.6.
  - 8 3. Other mechanical couplings, such as 360 degree full circle clamps, shall only be  
9 used if approved by the Engineer.
- 10
- 11 D. Polyethylene flange adapter and flanges must be at the ambient temperature of the  
12 surrounding soil at the time they are bolted tight to prevent relaxation of the flange bolts  
13 and loosening of the joint due to thermal contraction of the polyethylene. Bolts shall  
14 be drawn up evenly and in line.

### 16 3.05 TESTING OF HDPE PIPE AND FITTINGS

#### 18 A. General:

- 19 1. The installed HDPE force main containment and carrier pipes, LTS gravity line  
20 carrier and containment pipes, and LCS and LDS containment and carrier pipes  
21 shall be pressure tested by the OSDF Construction Subcontractor prior to placing  
22 fill over the pipe.
  - 23 2. The Construction Contract Manager shall be notified a minimum of 24 hours in  
24 advance of any testing.
  - 25 3. The OSDF Construction Subcontractor shall provide all testing apparatus, including  
26 pumps, hoses, gauges, taps, plugs, drains, temporary connections, and fittings.
  - 27 4. All tests shall be performed in the presence of the Engineer.
  - 28 5. HDPE pipe with thermal butt-fusion type joints shall be tested at 1 1/2 times the  
29 working pressure or at  psi for gravity lines.
  - 30 6. Test duration shall be a minimum of three hours after the pressure in the pipe  
31 stabilizes. The test duration does not include the initial expansion phase after the  
32 pipe is first pressurized. The duration of the expansion phase will be in keeping  
33 with the pipe manufacturer's recommendations.
  - 34 7. Criteria for acceptance of the pressure-test results shall be established using the  
35 pipe manufacturer's recommendations and approved in writing by the Engineer.
- 36

## 1 B. Repair:

- 2 1. Installed pipes or pipe joints that leak, according to the test results, shall be either  
3 repaired to the satisfaction of the CQC Consultant or replaced at the OSDF  
4 Construction Contractor's expense.  
5 2. Repaired or replaced pipe shall be successfully pressure-tested prior to filling over  
6 the pipe.  
7

## 8 C. Post Operational Testing

- 9 1. Following installation of the protective layer, the LCS and LDS pipes shall be  
10 inspected using a video camera. Any deficiencies found will be repaired at the  
11 expense of the OSDF Construction Subcontractor.  
12

13 **3.06 SURVEY CONTROL**

- 14  
15 A. The OSDF Construction Subcontractor shall survey the top of the leachate collection  
16 pipe, redundant leachate collection pipe, leak detection pipe, leachate transmission pipe  
17 and temporary force main pipe on no more than 50 foot centers.  
18  
19 B. Surveying shall be performed in accordance with Section 01050 of these Specifications.  
20

21 **3.07 PRODUCT PROTECTION**

- 22  
23 A. The OSDF Construction Subcontractor shall use all means necessary to protect all work  
24 of this Section.  
25  
26 B. In the event of damage to prior work or work completed as specified in this Section,  
27 the OSDF Construction Subcontractor shall immediately make all repairs and  
28 replacements necessary, to the approval of the Engineer at no additional cost to the  
29 Owner.  
30  
31  
32  
33  
34

[END OF SECTION]

SPECIFICATION COVER SHEET

SPECIFICATION SECTION: 02710 TITLE: GRANULAR DRAINAGE LAYER

Specifications By: Signature J.F. Beech 23 Oct 95  
 (Cognizant Engineer) Date  
 Printed Name J.F. BEECH, PRINCIPAL  
 and Title

Scope and Format  
 Checked By: Signature R. Nel Davies 10/23/95  
 (Checker) Date  
 Printed Name R NEL DAVIES, Senior Project Eng.  
 and Title

Detailed Requirements  
 Checked by: Signature Not Used for 30% Submittal B.B. Mazanti 2/23/96  
 (Checker) Date  
 Printed Name B.B. MAZANTI  
 and Title Consultant

Overall Review By: Signature Not Used for 30% Submittal Mark H. Gleason 20 Feb 96  
 (PDP) Date  
 Printed Name Mark H. Gleason  
 and Title Assistant Project Engineer

Approved by: Signature Not Used for 30% Submittal J.F. Beech 23 Feb 1996  
 (DTL) Date  
 Printed Name BEECH, PRINCIPAL  
 and Title Associate

Record of Revision (Number and initial all revisions)

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NA	30% Submittal				
B	Reprint for GPA Submittal	16 Dec 95	NA	NA	NA
C	Intermediate Design	23 Feb 96	-	-	GF3
D	Intermediate Design, EPA Submittal	8 Apr 96	JK	-	-

## SECTION 02710

## GRANULAR DRAINAGE LAYER

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary for the construction of the granular drainage layers, as specified herein, and as shown on the Construction Drawings. The granular drainage layers include the LCS drainage layer, LDS drainage layer, LCS drainage corridor, LDS drainage corridor, and cover drainage layer.
- B. Work shall include delivery, placement, and grading of the granular drainage layers. These layers shall conform to the dimensions, lines, grades, and sections on the Construction Drawings or as directed by the Construction Contracts Manager.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 01050 - Surveying
- D. Section 02714 - Geotextiles

## 1.03 MEASUREMENT AND PAYMENT

Measurement and payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].
- B. Site Health and Safety Plan.
- C. Site Construction Quality Assurance (CQA) Plan.

- 1 D. Latest version of American Society for Testing and Materials (ASTM) standards:  
2 1. ASTM C 136. Standard Test Method for Sieve Analysis of Fine and Course  
3 Aggregates.  
4 2. ASTM D 422. Standard Test Method for Particle-Size Analysis of Soils.  
5 3. ASTM D 2434. Standard Test Method for Permeability of Granular Soils  
6 (Constant Head).  
7 4. ASTM D 2487. Classification of Soils for Engineering Purposes (Unified Soil  
8 Classification System).  
9 5. ASTM D 3042. Standard Test Method for Insoluble Residue in Carbonate  
10 Aggregate.

### 11 1.05 SUBMITTALS

- 12  
13  
14 A. For the soil types specified in Part 2.01 of this Section, the OSDF Construction  
15 Subcontractor shall submit to the Construction Contract Manager the following  
16 information and samples from each proposed source, a minimum of 10 days prior to  
17 the start of construction of the granular drainage layer:  
18 1. the proposed material source or sources;  
19 2. the results of a particle-size analysis of representative material from each source,  
20 performed in accordance with ASTM C 136 or ASTM D 422;  
21 3. the results of a soil classification test of representative material from each source,  
22 performed in accordance with ASTM D 2487;  
23 4. the results of a laboratory permeability test on representative material from each  
24 source, performed in accordance with ASTM D 2434;  
25 5. the results of a test conducted in accordance with ASTM D 3042 to determine the  
26 calcium carbonate content on representative material from each source material;  
27 and  
28 6. a 50-pound representative sample of the proposed material.  
29  
30 B. If the work of this Section is interrupted for reasons other than inclement weather, the  
31 OSDF Construction Subcontractor shall notify the Construction Contract Manager a  
32 minimum of 24 hours prior to his resumption of work.  
33

### 34 1.06 QUALITY ASSURANCE

- 35  
36 A. The OSDF Construction Subcontractor shall ensure that the materials and methods  
37 used for construction of the granular soil meet the requirements of the Construction  
38 Drawings and Specifications. Any material or method that does not conform to these  
39 documents, or to alternatives approved in writing by the Engineer, will be rejected and  
40 shall be repaired or replaced at the OSDF Construction Subcontractor's expense.  
41

- B. The OSDF Construction Subcontractor shall be aware of all monitoring and testing required by the CQA Plan. This monitoring and testing, including random conformance testing of construction materials and completed work, will be performed by the CQC Consultant. If nonconformances or other deficiencies are found in the OSDF Construction Subcontractor's materials or completed work, the OSDF Construction Subcontractor will be required to repair or replace the deficiency at his expense.

**PART 2 PRODUCT**

**2.01 MATERIAL**

- A. The granular drainage material shall consist of relatively homogeneous, crushed or angular soil that is free of any metals, roots, trees, stumps, concrete, construction debris, organic matter, or any other deleterious material.
- B. Unless other material is approved in writing by the Engineer, the granular drainage material for the LCS drainage layer, the LDS drainage layer and the cover drainage layer shall be classified as GW or GP in accordance with the Unified Soil Classification System (per ASTM D 2487), not be gap graded, and have a gradation (per ASTM D 422) that meets the following requirements:

<u>Sieve</u>	<u>Total Percent Passing</u>
3/4 in.	100
1/2 in.	90 to 100
3/8 in.	40 to 75
No. 4	5 to 25
No. 8	0 to 10
No. 16	0 to 5
No. 200	0 to 2

- C. The granular drainage material for the LCS drainage layer and LDS drainage layer shall have a minimum hydraulic conductivity of  $1 \times 10^{-1}$  cm/s based on laboratory permeability testing conducted in accordance with ASTM D 2434.
- D. Unless other material is approved in writing by the Engineer, the granular drainage material for the LCS and LDS drainage corridors shall be classified as GW or GP in accordance with the Unified Soil Classification System (per ASTM D 2487), not be

1 gap-graded, and have a gradation (per ASTM C 136) that meets the following  
2 requirements:

3	<u>Sieve</u>	<u>Total Percent Passing</u>
4		
5	1-1/2 in.	100
6	1 in.	95 to 100
7	1/2 in.	25 to 60
8	No. 4	0 to 10
9	No. 8	0 to 5
10	No. 200	0 to 2

- 11
- 12 E. The granular drainage material for the LCS drainage corridor and LDS drainage  
13 corridor shall have a minimum hydraulic conductivity of 10 cm/s based on laboratory  
14 permeability testing conducted in accordance with ASTM D 2434.
- 15
- 16 F. The material for the LCS or LDS drainage layers, and LCS and LDS drainage  
17 corridors shall have less than 5 percent loss of weight, when tested according to  
18 ASTM D 3042 at a pH of 4.
- 19
- 20 G. The granular drainage material for the cover drainage layer shall have less than 10  
21 percent loss of weight when tested according to ASTM D 3042 at a pH of 4.

22

23

24 **PART 3 EXECUTION**

25

26 **3.01 FAMILIARIZATION**

- 27
- 28 A. Prior to implementing any of the work described in this Section, the OSDF  
29 Construction Subcontractor shall become thoroughly familiar with the site, the site  
30 conditions, and all portions of the work falling within this Section.
- 31
- 32 B. Inspection:
- 33 1. Prior to implementing any of the work in this Section, the OSDF Construction  
34 Subcontractor shall carefully inspect the installed work of all other Sections and  
35 verify that all work is complete to the point where the work of this Section may  
36 properly commence without adverse impact.
- 37 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
38 work of other Sections, he should notify the Construction Contract Manager in  
39 writing prior to commencing the work. Failure to notify the Construction  
40 Contract Manager or installation of the granular soil will be construed as OSDF  
41 Construction Subcontractor's acceptance of the related work of all other Sections.

1 **3.02 INSTALLATION**

- 2
- 3 A. Placement of the granular drainage layer material shall not commence until quality
- 4 control and CQC conformance evaluations of previous work are completed by the
- 5 CQC Consultant, including evaluations of the OSDF Construction Subcontractor's
- 6 survey results to confirm that the previous work was constructed to the required
- 7 grades, elevations, and thicknesses. Should the OSDF Construction Subcontractor
- 8 begin the work of this Section prior to the completion of quality control and CQC
- 9 evaluations, he does so at his own risk. The OSDF Construction Subcontractor shall
- 10 account for the quality control and CQC conformance evaluations in his schedule.
- 11
- 12 B. The OSDF Construction Subcontractor shall construct the granular drainage layer to
- 13 the thicknesses, grades, and limits shown on the Construction Drawings.
- 14
- 15 C. The granular drainage layer material shall be placed directly on top of the geotextile
- 16 cushion as shown on the Drawings. The granular drainage material shall be dumped
- 17 onto previously placed granular material and then carefully spread using a low ground-
- 18 pressure dozer meeting the ground pressure requirements of Part 3.02D of this
- 19 Section. The tracked equipment shall operate only over previously placed granular
- 20 drainage material. The OSDF Construction Subcontractor shall not operate equipment
- 21 on the geotextile cushion.
- 22
- 23 D. The equipment used to place, spread, and compact the granular drainage material shall
- 24 comply with the following:

25	26 Maximum Allowable	27 Thickness of Granular Soil
28	29 Equipment Ground Pressure	30 over Geotextiles
31	32 (psi)	33 (in.)
34	< 5	12
35	< 10	18
36	< 20	24
37	> 20	36

- 38 E. The granular drainage layer material shall be placed in a single lift with a compacted
- 39 thickness of not less than 12 inches.
- 40
- 41 F. The granular drainage layer material shall be compacted by tracking with the low
- ground-pressure dozer used for placement. Manually operated compaction equipment
- may be required in constricted locations and directly adjacent to sensitive structures.

**3.03 FIELD TESTING**

- 1  
2  
3 A. The CQC Consultant will perform soil conformance testing of candidate granular  
4 drainage materials. The OSDF Construction Subcontractor shall take this testing  
5 frequency into account in planning his construction schedule.
- 6 1. The minimum frequency of testing is:
- 7 a. particle-size analyses conducted in accordance with ASTM D 422 or  
8 ASTM C 136 at a frequency of one test per 3,000 yd<sup>3</sup>;
- 9 b. soil classification tests conducted in accordance with ASTM D 2487 at a  
10 frequency of one test per 3,000 yd<sup>3</sup>;
- 11 c. permeability tests conducted in accordance with ASTM D 2434 at a  
12 frequency of one test per 3,000 yd<sup>3</sup>; and
- 13 d. Calcium carbonate content conducted in accordance with ASTM D 3042 at  
14 a frequency of one test per 3,000 yd<sup>3</sup>.
- 15
- 16 B. If a defective area is discovered in the granular drainage layer, the CQC Consultant  
17 will evaluate the extent and nature of the defect. After determining the extent and  
18 nature of a defect, the OSDF Construction Subcontractor shall correct the deficiency  
19 to the satisfaction of the CQC Consultant. The OSDF Construction Subcontractor shall  
20 not perform additional work in the area until the CQC Consultant approves the  
21 correction of the defect.

**3.04 SURVEY CONTROL**

- 22
- 23
- 24
- 25 A. The OSDF Construction Subcontractor shall survey the locations and elevations of the  
26 top of the granular drainage layer.
- 27
- 28 B. Surveying shall be performed in accordance with Section 01050 of these Specifications.
- 29

**3.05 TOLERANCE**

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31

32 The OSDF Construction Subcontractor shall construct the granular drainage layers to  
33 within +0.1 ft of the limits and grades shown on the Construction Drawings.

34

**3.06 PROTECTION OF WORK**

- 35
- 36
- 37 A. The OSDF Construction Subcontractor shall use all means necessary to protect the  
38 completed work of this Section.
- 39

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B. In the event of damage, the OSDF Construction Subcontractor shall immediately make all repairs and replacements necessary, to the approval of the Construction Contract Manager and at the OSDF Construction Subcontractor's expense.

[END OF SECTION]

**SPECIFICATION COVER SHEET**

**SPECIFICATION SECTION:** 02712 **TITLE:** GRANULAR FILTER

**Specifications By:** Signature J.F. Beek 23 Oct 95  
 (Cognizant Engineer) Date  
 Printed Name J.F. BEEK, PRINCIPAL  
 and Title

**Scope and Format**  
**Checked By:** Signature R. Neal Davis 10/23/95  
 (Checker) Date  
 Printed Name R. Neal Davis, Senior Project Eng.  
 and Title

**Detailed Requirements**  
**Checked by:** Signature Not Used for 30% Submittal Bob Mazanti 2/22/96  
 (Checker) Date  
 Printed Name B. B. MAZANTI  
 and Title Consultant

**Overall Review By:** Signature Not Used for 30% Submittal Marie H. Gleason 20 Feb 96  
 (PDP) Date  
 Printed Name MARIE H. GLEASON  
 and Title Assistant Project Engineer

**Approved by:** Signature Not Used for 30% Submittal J.F. Beek 8 Apr 96  
 (DTL) 23 Feb 96 Date  
 Printed Name Beek Kenneth W Cargill  
 and Title Associate

**Record of Revision (Number and initial all revisions)**

Rev. No.	Reason	Date	By	Checked	Approval
PA	30% Submittal				
B	Revised for EPA Submittal	14 Dec 95	WU	N/A	N/A
C	Intermediate Design	23 Feb 96	-	-	J.F.B
D	Intermediate Design, EPA Submittal	8 Apr 96	K	-	-

## SECTION 02712

## GRANULAR FILTER

## PART 1 GENERAL

## 1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary for the construction of the granular filter. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. The work shall include, but not limited to, delivery, placement, and grading of the granular filter. The granular filter shall conform to the dimensions, lines, grades, and sections on the Drawings or as directed by the Construction Contracts Manager.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 01050 - Surveying
- D. Section 02250 - Vegetative Soil Layer
- E. Section 02280 - Biointrusion Barrier

## 1.03 MEASUREMENT AND PAYMENT

Measurement and payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].
- B. Site Health and Safety Plan.
- C. Site Construction Quality Assurance (CQA) Plan.

- 1 D. Latest version of American Society for Testing and Materials (ASTM) standards:  
 2 1. ASTM C 136. Standard Test Method for Sieve Analysis of Fine and Course  
 3 Aggregates.  
 4 2. ASTM D 422. Standard Test Method for Particle-Size Analysis of Soils.  
 5 3. ASTM D 2434. Standard Test Method for Permeability of Granular Soils  
 6 (Constant Head).  
 7 4. ASTM D 2487. Classification of Soils for Engineering Purposes (Unified Soil  
 8 Classification System).  
 9 5. ASTM D 3042. Standard Test Method for Insoluble Residue in Carbonate  
 10 Aggregate.  
 11 6. ASTM D 4253. Standard Test Method for Maximum Index Density and Unit  
 12 Weight of Soils Using a Vibratory Table.  
 13 7. ASTM D 4254. Standard Test Method for Minimum Index Density and Unit  
 14 Weight of Soils and Calculation of Relative Density.

#### 16 1.05 SUBMITTALS

- 17  
 18 A. For the soil types specified in Part 2.01 of this Section, the OSDF Construction  
 19 Subcontractor shall submit to the Construction Contract Manager the following  
 20 information and samples for each proposed source, a minimum of ten days prior to the  
 21 start of construction of the granular filter:  
 22 1. the proposed material source or sources;  
 23 2. the results of a particle-size analysis of representative material from each source,  
 24 performed in accordance with ASTM C 136 or ASTM D 422;  
 25 3. the results of a soil classification test of representative material from each source,  
 26 performed in accordance with ASTM D 2487;  
 27 4. the results of a laboratory permeability test on representative material from each  
 28 source, performed in accordance with ASTM D 2434;  
 29 5. the results of a test conducted in accordance with ASTM D 3042 to determine the  
 30 calcium carbonate content on representative material from each source material;  
 31 and  
 32 6. a 50-pound representative sample of the proposed material.  
 33  
 34 B. If the work of this Section is interrupted for reasons other than inclement weather, the  
 35 OSDF Construction Subcontractor shall notify the Construction Contract Manager a  
 36 minimum of 24 hours prior to his resumption of work.  
 37

#### 38 1.06 QUALITY ASSURANCE

- 39  
 40 A. The OSDF Construction Subcontractor shall ensure that the materials and methods  
 41 used for construction of the granular filter meet the requirements of the Construction

1 Drawings and this Section. Any material or method that does not conform to these  
2 documents, or to alternatives approved in writing by the Engineer, will be rejected and  
3 shall be repaired or replaced at the OSDF Construction Subcontractor's expense.  
4

- 5 B. The OSDF Construction Subcontractor shall be aware of all monitoring and testing  
6 required by the CQA Plan. This monitoring and testing, including random  
7 conformance testing of construction materials and completed work, will be performed  
8 by the CQC Consultant. If nonconformances or other deficiencies are found in the  
9 OSDF Construction Subcontractor's materials or completed work, the OSDF  
10 Construction Subcontractor will be required to repair or replace the deficiency at his  
11 expense.  
12

13  
14 **PART 2 PRODUCT**

15  
16 **2.01 MATERIAL**

- 17  
18 A. The material shall consist of relatively homogeneous, angular or crushed soil that is  
19 free of any metals, roots, trees, stumps, concrete, construction debris, organic matter,  
20 or any other deleterious material.  
21  
22 B. Unless other material is approved in writing by the Engineer, the granular filter shall  
23 be classified as SW or SP in accordance with the Unified Soil Classification System  
24 (per ASTM D 2487), not be gap-graded, and have a gradation (per ASTM D 422) that  
25 meets the following requirements:  
26

<u>Sieve</u>	<u>Total Percent Passing</u>
2 in.	100
3/4 in.	80 - 100
1/2 in.	70 - 85
No. 4	55 - 70
No. 8	50 - 65
No. 50	15 - 35
No. 60	0 - 30
No. 200	0 - 5

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37  
38 C. The granular filter shall have a hydraulic conductivity greater than or equal to the  
39 vegetative soil layer, based on laboratory permeability testing conducted in accordance  
40 with ASTM D 2434.  
41

- 1 D. The soil shall have less than 10 percent loss of weight, when tested according to  
2 ASTM D 3042 at a pH of 4.  
3  
4

5 **PART 3 EXECUTION**

6  
7 **3.01 FAMILIARIZATION**

- 8  
9 A. Prior to implementing any of the work described in this Section, the OSDF  
10 Construction Subcontractor shall become thoroughly familiar with the site, the site  
11 conditions, and all portions of the work falling within this Section.  
12  
13 B. Inspection:  
14 1. Prior to implementing any of the work in this Section, the OSDF Construction  
15 Subcontractor shall carefully inspect the installed work of all other Sections and  
16 verify that all work is complete to the point where the installation of this Section  
17 may properly commence without adverse impact.  
18 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
19 work of other Sections, he shall notify the Construction Contract Manager in  
20 writing prior to commencing the work. Failure to notify the Construction  
21 Contract Manager or continuance of the work of this Section will be construed as  
22 OSDF Construction Subcontractor's acceptance of the related work of all other  
23 Sections.  
24

25 **3.02 INSTALLATION**

- 26  
27 A. Placement of the granular filter material shall not commence until CQC conformance  
28 evaluations of previous work by the CQC Consultant are completed, including  
29 evaluations of the OSDF Construction Subcontractor's survey results to confirm that  
30 the previous work was constructed to the required grades, elevations, and thicknesses.  
31 Should the OSDF Construction Subcontractor begin the work of this Section prior to  
32 the completion of quality control and CQC evaluations, he does so at his own risk.  
33 The OSDF Construction Subcontractor shall account for the CQC conformance  
34 evaluations in his schedule.  
35  
36 B. The OSDF Construction Subcontractor shall construct the granular filter to the  
37 thicknesses, grades, and limits shown on the Construction Drawings.  
38  
39 C. The granular filter material shall be placed directly on the biointrusion barrier and then  
40 carefully spread using equipment approved in writing by the Engineer.  
41

- 1  
2 D. The granular filter shall be placed in a single lift with a compacted thickness of  
3 6 inches.  
4  
5 E. The granular filter layer shall be compacted to the satisfaction of the CQC Consultant  
6 by tracking with the low ground-pressure dozer used for placement or other relatively  
7 light-weight compaction equipment. Manually operated compaction equipment may  
8 be required in constricted locations and directly adjacent to sensitive structures.  
9

### 10 3.03 FIELD TESTING

- 11  
12 A. The CQC Consultant will perform conformance testing on the granular filter material.  
13 The OSDF Construction Subcontractor shall take this testing frequency into account  
14 in planning his construction schedule.  
15 1. The minimum frequency of testing is:  
16 a. particle-size analyses conducted in accordance with ASTM D 422 at a  
17 frequency of one year per 5,000 yd<sup>3</sup>;  
18 b. soil classification tests conducted in accordance with ASTM D 2487 at a  
19 frequency of one test per 5,000 yd<sup>3</sup>; and  
20 c. relative density tests conducted in accordance with ASTM D 4253 and  
21 ASTM D 4254 at a frequency of one test per 5,000 yd<sup>3</sup>.  
22  
23 B. If a defective area is discovered in the granular filter, the CQC Consultant will  
24 evaluate the extent and nature of the defect. After determining the extent and nature  
25 of a defect, the OSDF Construction Subcontractor shall correct the deficiency to the  
26 satisfaction of the CQC Consultant. The OSDF Construction Subcontractor shall not  
27 perform additional work in the area until the CQC Consultant approves the correction  
28 of the defect.  
29

### 30 3.04 SURVEY CONTROL

- 31  
32 A. The OSDF Construction Subcontractor shall survey the locations and elevations of the  
33 top of the granular filter.  
34  
35 B. Surveying shall be performed in accordance with Section 01050 of these Specifications.  
36

### 37 3.05 TOLERANCE

38  
39 The granular filter layer shall be constructed to within  $\pm 0.1$  ft of the limits and grades  
40 shown on the Construction Drawings.  
41

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**3.06 PROTECTION OF WORK**

- A. The OSDF Construction Subcontractor shall use all means necessary to protect all work of this Section.
  
- B. In the event of damage, the OSDF Construction Subcontractor shall immediately make all repairs and replacements necessary, to the approval of the Construction Contract Manager and at the OSDF Construction Subcontractor's expense.

[END OF SECTION]

**SPECIFICATION COVER SHEET**

SPECIFICATION SECTION: 02714 TITLE: GEOTEXTILE FILTER AND CUSHION <sup>JFB</sup>

Specifications By: Signature J.F. Beek 23 Feb 95  
(Cognizant Engineer) Date

Printed Name J.F. BEEK, PRINCIPAL  
and Title

Scope and Format  
Checked By: Signature R. Noel Davies 10/23/95  
(Checker) Date

Printed Name R. NOEL DAVIES, Senior Project Eng.  
and Title

Detailed Requirements  
Checked by: Signature Not Used for 30% Submittal W.M. Mason 2/22/96  
(Checker) Consultant Date

Printed Name  
and Title

Overall Review By: Signature Not Used for 30% Submittal Mark H. Gleason 20 Feb 96  
(PDP) Date

Printed Name Mark H. Gleason  
and Title Assistant Project Engineer

Approved by: Signature Not Used for 30% Submittal J.F. Beek 23 Feb 96  
(DTL) 8 Apr 96

Printed Name J.F. BEEK Kenneth W. Cargill  
and Title Principal Associate

**Record of Revision (Number and initial all revisions)**

Rev. No.	Reason	Date	By	Checked	Approval
<u>0A</u>	<u>30% Submittal</u>				
<u>B</u>	<u>Report for EPA Submitted</u>	<u>14 Dec 95</u>	<u>MA</u>	<u>N/A</u>	<u>NA</u>
<u>C</u>	<u>Intermediate Design</u>	<u>23 Feb 96</u>	<u>-</u>	<u>-</u>	<u>JFB</u>
<u>D</u>	<u>Intermediate Design, EPA Submitted</u>	<u>8 Apr 96</u>	<u>K</u>	<u>-</u>	<u>-</u>

## SECTION 02714

## GEOTEXTILES

## PART 1 GENERAL

## 1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary for the installation of the geotextile filter, cushions, and separator. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. The work shall include, but not be limited to, delivery, storage, placement, and seaming (where appropriate) of the various geotextile components of the projects.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 02215 - Trenching

## 1.03 MEASUREMENT AND PAYMENT

Measurement and payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].
- B. Site Health and Safety Plan.
- C. Site Construction Quality Assurance (CQA) Plan.
- D. Latest version of American Society for Testing and Materials (ASTM) standards:
1. ASTM D 3786. Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabric-Diaphragm Bursting Strength Test Method.
  2. ASTM D 4355. Standard Test Method for Deterioration of Geotextiles form Exposure to Ultraviolet Light and Water.

- 1           3.   ASTM D 4491.   Standard Test Method for Water Permeability of Geotextiles  
2                           by Permittivity.
- 3           4.   ASTM D 4533.   Standard Test Method for Trapezoid Tearing Strength of  
4                           Geotextiles.
- 5           5.   ASTM D 4632.   Standard Test Method for Breaking Load and Elongation of  
6                           Geotextiles (Grab Method).
- 7           6.   ASTM D 4833.   Standard Test Method for Index Puncture Resistance of  
8                           Geotextiles, Geomembranes, and Related Products.
- 9           7.   ASTM D 4751.   Standard Test Method for Determining Apparent Opening Size  
10                          of a Geotextile.
- 11          8.   ASTM D 5261.   Standard Test Method for Measuring Mass Per Unit Area of  
12                           Geotextiles.

#### 14   1.05   SUBMITTALS

- 15
- 16          A.   The OSDF Construction Subcontractor shall submit to the Construction Contract  
17              Manager at least 14 days prior to geotextile delivery the following information  
18              regarding the geotextiles proposed for use:
  - 19                  1.   manufacturer and product name.
  - 20                  2.   minimum property values of the proposed geotextiles and the corresponding test  
21                      procedures; and
  - 22                  3.   projected geotextile delivery dates.
- 23
- 24          B.   At least seven days prior to geotextile placement, the OSDF Construction  
25              Subcontractor shall submit to the Construction Contract Manager the manufacturing  
26              quality control certificates for each roll of geotextile. The certificates shall be signed  
27              by responsible parties employed by the geotextile manufacturer (such as the production  
28              manager), and notarized. The quality control certificates shall include:
  - 29                  1.   lot, batch, or roll numbers and identification; and
  - 30                  2.   results of quality control tests, including a description of the test methods used.
- 31
- 32          C.   If the work of this Section is interrupted for reasons other than inclement weather, the  
33              OSDF Construction Subcontractor shall notify the Construction Contract Manager a  
34              minimum of 24 hours prior to his resumption of work.

#### 35   1.06   QUALITY ASSURANCE

- 36
- 37
- 38          A.   The OSDF Construction Subcontractor shall ensure that the geotextiles and installation  
39              methods used meet the requirements of the Construction Drawings and this Section.  
40              Any material or method that does not conform to these documents, or to alternatives

1 approved in writing by the Engineer, will be rejected by the CQC Consultant and shall  
2 be repaired or replaced at the OSDF Construction Subcontractor's expense.

- 3  
4 B. The OSDF Construction Subcontractor shall be aware of all monitoring and  
5 conformance testing required by the CQA Plan. This monitoring and testing, including  
6 random conformance testing of construction materials and completed work, will be  
7 performed by the CQC Consultant. If nonconformances or other deficiencies are  
8 found in the OSDF Construction Subcontractor's materials or completed work, the  
9 OSDF Construction Subcontractor will be required to repair or replace the deficiency  
10 at his expense.

11  
12  
13 **PART 2 PRODUCTS**

14  
15 **2.01 GEOTEXTILE PROPERTIES**

- 16  
17 A. Unless otherwise noted on the Construction Drawings, geotextiles suppliers shall  
18 furnish materials whose "Minimum Average Roll Values", as defined by the Federal  
19 Highway Administration (FHWA), meet or exceed the criteria specified in Tables  
20 02714-1 (for geotextile filters), 02714-2 to 02714-4 (for geotextile cushions), and  
21 02714-5 (for geotextile separators).  
22  
23 B. The geotextiles shall be nonwoven materials, suitable for use in filter, cushion, and  
24 separation applications.  
25  
26 C. The geotextiles provided by the supplier shall be stock products. The supplier shall  
27 not furnish products specifically manufactured to meet the specifications of this project  
28 unless approved in writing by the Engineer.  
29  
30 D. The geotextile shall be manufactured from first quality polymers, with not more than  
31 20% reclaimed polymer used in production.

32  
33 **2.02 MANUFACTURING QUALITY CONTROL**

- 34  
35 A. The geotextile shall be manufactured with quality control procedures that meet or  
36 exceed generally accepted industry standards.  
37  
38 B. The OSDF Construction Subcontractor shall require that the Geotextile Manufacturer  
39 sample and test the geotextile to demonstrate that the material conforms to the  
40 requirements of this Construction Specification.  
41

- C. Any geotextile sample that does not comply with this Section shall result in rejection of the roll from which the sample was obtained. The OSDF Construction Subcontractor shall replace any rejected rolls at his expense.
- D. If a geotextile sample fails to meet the quality control requirements of this Section, the OSDF Construction Subcontractor shall require that Geotextile Manufacturer sample and test rolls manufactured in the same lot, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.
- E. Additional sample testing may be performed, at the Geotextile Manufacturer's discretion and expense, to more closely identify any non-complying rolls and/or to qualify individual rolls.
- F. Sampling shall, in general, be performed on sacrificial portions of the geotextile material such that repair is not required. The OSDF Construction Subcontractor shall require that the Geotextile Manufacturer sample and test the geotextile, at a minimum once every 100,000 ft<sup>2</sup> to demonstrate that its properties conform to the values specified in Tables 02714-1 to 02714-5. As a minimum, the following manufacturing quality control tests shall be performed:

<u>Test</u>	<u>Procedure</u>
Mass per unit area	ASTM D 5261
Grab strength	ASTM D 4632
Tear strength	ASTM D 4533
Puncture strength	ASTM D 4833

- G. The OSDF Construction Subcontractor shall require that the Geotextile Manufacturer comply with the certification and submittal requirements of this Section.

**2.03 PACKING AND LABELING**

- A. Geotextiles shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.
- B. Geotextiles rolls shall be marked or tagged with the following information:
  1. manufacturer's name;
  2. product identification;
  3. lot or batch number;

- 1 4. roll number; and  
2 5. roll dimensions.

- 3  
4 C. If any special handling is required, it shall be so marked on the geotextiles itself; e.g.,  
5 "This Side Up" or "This Side Against Soil to be Retained".  
6

7 **2.04 TRANSPORTATION**

- 8  
9 A. Transportation of the geotextiles is the responsibility of the OSDF Construction  
10 Subcontractor. The OSDF Construction Subcontractor shall be liable for any damage  
11 to the materials incurred prior to and during transportation to the site.  
12  
13 B. The geotextiles shall be delivered to the site at least 14 days prior to the planned  
14 deployment date to allow the CQC Consultant adequate time to perform conformance  
15 testing on the geotextile samples as described in Part 2.06 of this Section.  
16

17 **2.05 HANDLING AND STORAGE**

- 18  
19 A. Handling, unloading, storage, and care of the geotextiles prior to and following  
20 installation at the site, is the responsibility of the OSDF Construction Subcontractor.  
21 The OSDF Construction Subcontractor shall be liable for any damage to the materials  
22 incurred prior to final acceptance by the Construction Contract Manager.  
23  
24 B. The OSDF Construction Subcontractor shall be responsible for storage of the  
25 geotextiles material at the site.  
26  
27 C. The geotextiles shall be protected from sunlight, moisture, excessive heat or cold,  
28 puncture, or other damaging or deleterious conditions. The geotextiles shall be  
29 protected from mud, dirt, and dust. Any additional storage procedures required by the  
30 geotextile manufacturer shall be the OSDF Construction Subcontractor's responsibility.  
31

32  
33 **PART 3 EXECUTION**

34  
35 **3.01 FAMILIARIZATION**

- 36  
37 A. Prior to implementing any of the work described in this Section, the OSDF  
38 Construction Subcontractor shall become thoroughly familiar with the site, the site  
39 conditions, and all portions of the work falling within this Section.  
40  
41

1 B. Inspection:

- 2 1. Prior to implementing any work of this Section, the OSDF Construction  
3 Subcontractor shall carefully inspect the installed work of all other Sections and  
4 verify that all such work is complete to the point where the installation of this  
5 Section may properly commence without adverse impact.  
6 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
7 work of other Sections or the site, he shall notify the Construction Contract  
8 Manager prior to commencing the work. Failure to notify the Construction  
9 Contract Manager of installation of the geotextiles will be construed as OSDF  
10 Construction Subcontractor's acceptance of the related work of all other Sections.  
11

12 **3.02 PLACEMENT**

- 13  
14 A. Geotextile installation shall not commence until CQC conformance evaluations by the  
15 CQC Consultant of previous work are complete, including evaluations of the OSDF  
16 Construction Subcontractor's survey results to confirm that the previous work was  
17 constructed to the required grades, elevations, and thicknesses. Should the OSDF  
18 Construction Subcontractor begin the work of this Section prior to the completion of  
19 CQC evaluations, he does so at his own risk. The OSDF Construction Subcontractor  
20 shall account for the CQC conformance evaluations in his schedule.  
21  
22 B. The OSDF Construction Subcontractor shall handle all geotextiles in such a manner  
23 as to ensure they are not damaged in any way.  
24  
25 C. The OSDF Construction Subcontractor shall take any necessary precautions to prevent  
26 damage to underlying layers during placement of the geotextiles.  
27  
28 D. After unwrapping the geotextiles from its opaque cover, the geotextiles shall not be left  
29 exposed for a period in excess of 10 days unless a longer exposure period is approved  
30 in writing by the geotextile manufacturer.  
31 E. If white colored geotextiles are used, precautions shall be taken against  
32 "snowblindness" of personnel.  
33  
34 F. The OSDF Construction Subcontractor shall take care not to entrap stones, excessive  
35 dust, or moisture in the geotextiles during placement.  
36  
37 G. The OSDF Construction Subcontractor shall anchor or weight all geotextile with  
38 sandbags, or the equivalent, to prevent damage from wind. Such sandbags shall be  
39 installed during placement and shall remain until replaced overlying material shown  
40 on the Construction Drawings.  
41

- 1 H. The OSDF Construction Subcontractor shall examine the entire geotextiles surface after  
2 installation to ensure that no potentially harmful foreign objects are present. The  
3 OSDF Construction Subcontractor shall remove any such foreign objects and shall  
4 replace any damaged geotextiles.  
5

### 6 3.03 SEAMS AND OVERLAPS

7

- 8 A. Filter and cushion geotextiles shall be continuously sewn (i.e., spot sewing is not  
9 allowed) using a "single prayer" seam and overlapped a minimum 6 inches prior to  
10 seaming. No horizontal seams shall be allowed on slopes that are steeper than 10  
11 horizontal to 1 vertical (i.e., seams shall be along, not across, the slopes).  
12  
13 B. Filter and cushion geotextiles shall be sewn with polymeric thread, having chemical  
14 resistance properties equal to or exceeding those of the geotextiles. The seams shall  
15 be sewn using Stitch Type 401.  
16  
17 C. Separator geotextiles shall be overlapped a minimum of 12 inches and spot sewn at  
18 intervals as necessary to ensure that the overlap is maintained.  
19

### 20 3.04 REPAIR

21

- 22 A. Any holes or tears in the geotextiles shall be repaired using a patch made from the  
23 same geotextiles. Geotextiles patches shall extend a minimum of 1 foot beyond the  
24 damaged area. Geotextiles patches will be sewn into place no closer than 1 inch from  
25 any panel edge. Should any tear exceed 50% of the width of the roll, that roll shall  
26 be removed and replaced.  
27  
28 B. Care shall be taken to remove any soil or other material that may have penetrated the  
29 torn geotextiles.  
30  
31 C. The CQC Consultant will observe any repair and note any non-compliance with the  
32 above requirements.  
33

### 34 3.05 CREST ANCHORAGE SYSTEM

35

- 36 A. The geotextile shall be temporarily anchored along with the other geosynthetic layers  
37 in the anchor trench at the crest of the slope.  
38  
39 B. Care shall be taken that soil, sand bags or other materials are not trapped between the  
40 geosynthetic layers.  
41

- C. The anchor trench shall be backfilled with compacted clay once all the geosynthetic layers are installed in the anchor trench as shown on the drawings. Compaction shall be in accordance with the requirement of Section 02215.
- D. Care shall be taken when backfilling the trenches to prevent damage to any of the geosynthetic layers.
- E. The LCS or LDS drainage material shall not be placed on the side slopes until after the anchor trenches are completely backfilled with compacted clay.

**3.06 PLACEMENT OF SOIL MATERIALS**

- A. The OSDF Construction Subcontractor shall place soil materials on top of geotextiles in such a manner as to ensure that:
  - 1. the geotextiles and the underlying materials are not damaged;
  - 2. minimum slippage occurs between the geotextile and the underlying layers during placement; and
  - 3. excess stresses are not produced in the geotextiles.
- B. Equipment shall not be driven directly on the geotextiles. Unless otherwise approved in writing by the Engineer, all equipment operating on materials overlying the geotextiles shall comply with the following:

<u>Maximum Allowable Equipment Ground Pressure (pounds per square inch)</u>	<u>Thickness of Overlying Fill (inches)</u>
< 5	12
< 10	18
< 20	24
> 20	36

**3.07 CONFORMANCE TESTING**

- A. Samples of the geotextile will be removed by the CQC Consultant after the material has been received at the site and sent to a geosynthetics laboratory for testing to ensure conformance with the requirements of this Section. This testing will be carried out prior to the start of the work of this Section.
- B. Samples and tests will be selected by the CQC Consultant in accordance with the CQA Plan.

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- C. Samples will be taken at a minimum frequency of one sample per 100,000 square feet with a minimum of one sample per lot.
- D. The CQC Consultant will increase the frequency of sampling in the event that test results do not comply with requirements of Part 2.01 of this Section until passing conformance test results are obtained for all material that is received at the site. This additional testing shall be performed at the expense of the OSDF Construction Subcontractor.
- E. As a minimum, the following conformance tests will be performed for geotextile filters, cushions, and separators: mass per unit area; grab strength; tear strength; and puncture strength. In addition, the apparent opening size and permittivity tests will be performed for the geotextile filter.
- F. Any geotextiles that are not certified in accordance with Part 1.05 of this Section, or that conformance testing indicates do not comply with Part 2.01 of this Section, will be rejected by the CQC Consultant. The OSDF Construction Subcontractor shall replace the rejected material with new material at his expense.

**3.08 PROTECTION OF WORK**

- A. The OSDF Construction Subcontractor shall use all means necessary to protect all work of this Section.
- B. In the event of damage, the OSDF Construction Subcontractor shall make repairs and replacements to the satisfaction of the Construction Contract Manager and at no additional cost to the Owner.

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**TABLE 02714-1**

**REQUIRED PROPERTY VALUES FOR GEOTEXTILE FILTER**

PROPERTIES	QUALIFIER	UNITS	SPECIFIED <sup>(4)</sup> VALUES	TEST METHOD
<u>Type</u>				
nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd <sup>2</sup>	7	ASTM D 5261
<u>Filter Requirements</u>				
Apparent opening size (O <sub>95</sub> )	maximum	mm	0.21	ASTM D 4751
Permittivity	minimum	sec <sup>-1</sup>	0.5	ASTM D 4491
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	180	ASTM D 4632 <sup>(1)</sup>
Tear strength	minimum	lb	75	ASTM D 4533 <sup>(2)</sup>
Puncture strength	minimum	lb	75	ASTM D 4833 <sup>(3)</sup>
Burst strength	minimum	psi	350	ASTM D 3786
<u>Durability</u>				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

## Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
- (4) All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).

TABLE 02714-2  
REQUIRED PROPERTY VALUES FOR GEOTEXTILE CUSHION  
IN FINAL COVER SYSTEM

PROPERTIES	QUALIFIER	UNITS	SPECIFIED <sup>(4)</sup> VALUES	TEST METHOD
<u>Type</u>				
nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd <sup>2</sup>	8	ASTM D 5261
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	200	ASTM D 4632 <sup>(1)</sup>
Tear strength	minimum	lb	75	ASTM D 4533 <sup>(2)</sup>
Puncture strength	minimum	lb	90	ASTM D 4833 <sup>(3)</sup>
Burst strength	minimum	psi	350	ASTM D 3786
<u>Durability</u>				
Ultraviolet Resistance @ 500 hours	minimum	%	70	ASTM D 4355

Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
- (4) All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).

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**TABLE 02714-3**  
**REQUIRED PROPERTY VALUES FOR GEOTEXTILE CUSHION**  
**IN LINER SYSTEM**

PROPERTIES	QUALIFIER	UNITS	SPECIFIED <sup>(4)</sup> VALUES	TEST METHOD
<u>Type</u>				
nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd <sup>2</sup>	10	ASTM D 5261
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	225	ASTM D 4632 <sup>(1)</sup>
Tear strength	minimum	lb	90	ASTM D 4533 <sup>(2)</sup>
Puncture strength	minimum	lb	120	ASTM D 4833 <sup>(3)</sup>
Burst strength	minimum	psi	450	ASTM D 3786
<u>Durability</u>				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

## Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
- (4) All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).

TABLE 02714-4

**REQUIRED PROPERTY VALUES FOR SUPPLEMENTAL  
GEOTEXTILE CUSHION IN LINER SYSTEM<sup>(5)</sup>**

PROPERTIES	QUALIFIER	UNITS	SPECIFIED <sup>(4)</sup> VALUES	TEST METHOD
<u>Type</u>				
nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd <sup>2</sup>	16	ASTM D 5261
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	350	ASTM D 4632 <sup>(1)</sup>
Tear strength	minimum	lb	120	ASTM D 4533 <sup>(2)</sup>
Puncture strength	minimum	lb	180	ASTM D 4833 <sup>(3)</sup>
Burst strength	minimum	psi	700	ASTM D 3786
<u>Durability</u>				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

## Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
- (4) All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).
- (5) Supplemental geotextile cushion to be used in leachate collection and leak detection corridor.

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**TABLE 02714-5**

**REQUIRED PROPERTY VALUES FOR GEOTEXTILE SEPARATOR**

PROPERTIES	QUALIFIER	UNITS	SPECIFIED <sup>(4)</sup> VALUES	TEST METHOD
<u>Type</u>				
nonwoven				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd <sup>2</sup>	6	ASTM D 5261
<u>Mechanical Requirements</u>				
Grab strength	minimum	lb	180	ASTM D 4632 <sup>(1)</sup>
Tear strength	minimum	lb	75	ASTM D 4533 <sup>(2)</sup>
Puncture strength	minimum	lb	75	ASTM D 4833 <sup>(3)</sup>
Burst strength	minimum	psi	350	ASTM D 3786
<u>Durability</u>				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

## Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
- (4) All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).

[END OF SECTION]

SPECIFICATION COVER SHEET

SPECIFICATION SECTION: 02770 TITLE: GEOMEMBRANE LINER AND COVER

Specifications By: Signature J.F. Beech 23 OCT 95  
 (Cognizant Engineer) Date

Printed Name J.F. BEECH, PRINCIPAL  
 and Title

Scope and Format  
 Checked By: Signature R. Neil Davies 10/23/95  
 (Checker) Date

Printed Name R. Neil Davies Senior Project Eng.  
 and Title

Detailed Requirements

Checked by: Signature Not Used for 30% Submittal B.B. Mazanti 20 Feb 96  
 (Checker) Date

Printed Name B. B. MAZANTI  
 and Title CONSULTANT

Overall Review By: Signature Not Used for 30% Submittal Mark H. Gleason 20 Feb 96  
 (PDP) Date

Printed Name MARK H. GLEASON  
 and Title Assistant Project Engineer

Approved by: Signature Not Used for 30% Submittal J.F. Beech 23 Feb 96 8 Apr 96  
 (DTL) Date

Printed Name ~~BEECH~~ PRINCIPAL  
 and Title Associate

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
<u>PA</u>	<u>30% Submittal</u>				
<u>B</u>	<u>Report for EPA Submittal</u>	<u>14 Dec 95</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>C</u>	<u>Intermediate Design</u>	<u>23 Feb 96</u>	<u>-</u>	<u>-</u>	<u>JFB</u>
<u>D</u>	<u>Intermediate Design, EPA Submittal</u>	<u>8 Apr 96</u>	<u>K</u>	<u>-</u>	<u>-</u>

## SECTION 02770

## GEOMEMBRANE LINER AND CAP

## PART 1 GENERAL

## 1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary for the installation of geomembrane in the liner and final cover systems. The work shall be carried out as specified herein and in accordance with Construction Drawings.
- B. The work shall include, but not be limited to, delivery, storage, placement, anchorage, and seaming of the geomembrane liner and cap.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 02215 - Trenching
- D. Section 02772 - Geosynthetic Clay Liner and Cap

## 1.03 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*", dated [REDACTED].
- B. Site Health and Safety Plan.
- C. Site Construction Quality Assurance (CQA) Plan.
- D. Latest version of the American Society for Testing and Materials (ASTM) standards:
  1. ASTM D 638. Standard Test Method for Tensile Properties of Plastics.
  2. ASTM D 746. Standard Test Method for Brittleness, Temperature of Plastics and Elastomers by Impact.
  3. ASTM D 792. Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
  4. ASTM D 1004. Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting.

- 1 5. ASTM D 1204. Standard Plastics Test Method for Linear Dimensional
- 2 Changes of Nonrigid Thermoplastic Sheeting or Film at
- 3 Elevated Temperature.
- 4 6. ASTM D 1238. Standard Test Method for Flow Rates of Thermoplastics by
- 5 Extrusion Plastometer.
- 6 7. ASTM D 1505. Standard Test Methods for Density of Plastics by Density-
- 7 Gradient Technique.
- 8 8. ASTM D 1603. Standard Test Method for Carbon Black in Olefin Plastics.
- 9 9. ASTM D 3083. Standard Specifications for Flexible Poly (Vinyl Chloride)
- 10 Plastic Sheeting for Pond Canal, and Reservoir Lining.
- 11 10. ASTM D 4437. Standard Test Methods for Determining the Integrity of Field
- 12 Seams Used in Joining Flexible Polymeric Geomembranes.
- 13 11. ASTM D 4833. Test Method for Index Puncture Resistance of Geotextiles,
- 14 Geomembranes, and Related Products.
- 15 12. ASTM D 5199. Standard Test Method for Measuring Nominal Thickness of
- 16 Geotextile and Geomembranes.
- 17 13. ASTM D 5397. Standard Test Method for Evaluation of Stress Crack
- 18 Resistance of Polyolefin Geomembranes Using Notched
- 19 Constant Tensile Load Test.
- 20 14. ASTM D 5596. Recommended Practice for Microscopical Examination of
- 21 Pigment Dispersion in Plastic Compounds.
- 22

23 E. Latest version of the Geosynthetic Research Institute (GRI) test procedures:

- 24 1. GM8 Standard Test Method for Measurement of the Core Thickness of
- 25 Textured Geomembrane.
- 26

#### 27 1.04 QUALIFICATIONS

28  
29 A. OSDF Construction Subcontractor:

- 30 1. The OSDF Construction Subcontractor shall provide the services of a
- 31 Geomembrane Manufacturer and Installer who meets the qualification
- 32 requirements of Part 1.06 of this Section.
- 33 2. The OSDF Construction Subcontractor shall accept and retain full responsibility
- 34 for installation and shall be responsible for any defects in the completed
- 35 geomembranes.
- 36

37 B. Geomembrane Manufacturer:

- 38 1. The Geomembrane Manufacturer shall be responsible for the production of
- 39 geomembrane rolls from resin and shall have sufficient production capacity and
- 40 qualified personnel to provide material meeting the requirements of this section
- 41 and the construction schedule for this project.
- 42

## 1 C. Geosynthetics Installer:

- 2 1. The Geosynthetics Installer shall be responsible and shall provide sufficient  
3 resources for field handling, deploying, seaming, temporarily restraining (against  
4 wind), and other aspects of the deployment and installation of the geomembrane  
5 and other geosynthetic components of the project. The Installer may also be  
6 responsible for anchoring systems and dewatering the area of installation including  
7 anchor trenches.  
8

9 **1.05 WARRANTY**

- 10  
11 A. The OSDF Construction Subcontractor shall furnish the Construction Contract  
12 Manager a 20-year written warranty against defects in materials. Warranty conditions  
13 concerning limits of liability will be evaluated by, and must be acceptable to, the  
14 Construction Contract Manager.  
15  
16 B. The OSDF Construction Subcontractor shall furnish the Construction Contract  
17 Manager with a 1-year written warranty provided by the Geosynthetics Installer against  
18 defects in workmanship. Warranty conditions concerning limits of liability will be  
19 evaluated by, and must be acceptable to, the Construction Contract Manager.  
20

21 **1.06 SUBMITTALS**

- 22  
23 A. The OSDF Construction Subcontractor shall submit the following information on the  
24 Geomembrane Manufacturer for approval:  
25 1. Manufacturing capabilities, including:  
26 a. daily production capacity available for this Contract;  
27 b. manufacturing quality control procedures; and  
28 c. list of material properties, including test method, to which are attached liner  
29 samples.  
30 2. A list of 10 completed facilities for which the Geomembrane Manufacturer has  
31 manufactured a minimum of 10,000,000 ft<sup>2</sup> of polyethylene geomembrane. The  
32 following information shall be provided for each facility:  
33 a. name, location, purpose of facility, and date of installation;  
34 b. names of owner, project manager, design engineer, and installer; and  
35 c. thickness and surface area of geomembrane provided.  
36 3. Origin (resin supplier's name, resin production plant) and identification (brand  
37 name, number) of the polyethylene resin used.  
38  
39 B. The OSDF Construction Subcontractor shall submit the following documentation on  
40 the resin used to manufacture the geomembranes to the Construction Contract Manager  
41 for approval 14 days prior to transporting any geomembrane to the site.

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- 1. Copies of quality control certificates issued by the resin supplier including the production dates and origin of the resin used to manufacture the geomembrane for the project.
  - 2. Results of tests conducted by the Geomembrane Manufacturer to verify the quality of the resin used to manufacture the geomembrane rolls assigned to the project.
  - 3. Certification that no reclaimed polymer is added to the resin during the manufacturing of the geomembrane to be used for this project, or, if recycled polymer is used, the Manufacturer shall submit a notarized certificate signed by the production manager documenting the quantity of recycled material, including a description of the procedure used to measure the quantity of recycled polymer.
- C. The OSDF Construction Subcontractor shall submit the following documentation on geomembrane roll production to the Construction Contract Manager for approval 14 days prior to transporting any geomembrane to the site.
- 1. Manufacturing certificates for each shift's production of geomembrane, signed by responsible parties employed by the Geomembrane Manufacturer (such as the production manager), and notarized.
  - 2. The quality control certificate shall include:
    - a. roll numbers and identification;
    - b. sampling procedures; and
    - c. results of quality control tests, including descriptions of the test methods used (the Geomembrane Manufacturer quality control tests to be performed are outlined in Part 2.03 of this Section).
  - 3. The manufacturer warranty specified in Part 1.05.A of this Section.
- D. The OSDF Construction Subcontractor shall submit the following information from the Geosynthetic Installer to the Construction Contract Manager for approval 14 days prior to mobilization of the Installer to the site.
- 1. A drawing showing the installation layout identifying geomembrane panel configurations, dimensions, details, locations of seams, as well as any variance or additional details which deviate from the Construction Drawings. The layout shall be adequate for use as a construction plan and shall include dimensions, details, etc. The layout drawings, as modified and/or approved by the CQC Consultant, shall become part of these specifications.
  - 2. Installation schedule.
  - 3. Copy of Geosynthetic Installer's letter of approval or license by the Geomembrane Manufacturer.
  - 4. Installation capabilities, including:
    - a. information on equipment proposed for this project;
    - b. average daily production anticipated for this project; and
    - c. quality control procedures.

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5. A list of 10 completed facilities for which the installer has installed a minimum of 10,000,000 ft<sup>2</sup> of polyethylene geomembrane. The following information shall be provided for each facility:
    - a. the name and purpose of the facility, its location, and dates of installation;
    - b. the names of the owner, project manager, and geomembrane manufacturer;
    - c. name and qualifications of the supervisor of the installation crew;
    - d. thickness and surface area of installed geomembrane;
    - e. type of seaming and type of seaming apparatus used; and
    - f. duration of installation.
  6. Resume of the Superintendent to be assigned to this project, including dates and duration of employment.
  7. Resumes of all personnel who will perform seaming operations on this project, including dates and duration of employment.
  8. The installation crew shall have the following experience.
    - a. The Superintendent shall have supervised the installation of a minimum of 5,000,000 ft<sup>2</sup> of polyethylene geomembrane.
    - b. At least one seamer shall have experience seaming a minimum of 100,000 lineal ft of polyethylene geomembrane seams using the same type of seaming apparatus to be used at this site. Seamers with such experience will be designated "master seamers" and shall provide direct supervision over less experienced seamers.
    - c. All other seaming personnel shall have seamed at least 10,000 lineal ft of polyethylene geomembrane seams using the same type of seaming apparatus to be used at this site. Personnel who have seamed less than 10,000 lineal ft of seams shall be allowed to seam only under the direct supervision of the master seamer or Superintendent.
  - E. A Certificate of Calibration less than 12 months old shall be submitted for the field tensiometer prior to installation of any geomembrane.
  - F. During installation, the Installer shall be responsible for the timely submission to the CQC Consultant of:
    1. Quality control documentation.
    2. Subgrade acceptance certificates, signed by the Installer, for each area to be covered by the geomembrane.
  - G. Upon completion of the installation, the OSDF Construction Subcontractor shall be responsible for the submission to the Construction Contract Manager of a warranty from the installer as specified in Part 1.05.B of this Section.

1 **1.07 QUALITY ASSURANCE**

- 2
- 3 A. The OSDF Construction Subcontractor shall ensure that the materials and methods
- 4 used for installation of the geomembrane meet the requirements of the Construction
- 5 Drawings and this Section. Any material or method that does not conform to these
- 6 documents, or to alternatives approved in writing by the Engineer, will be rejected by
- 7 the CQC Consultant and shall be repaired or replaced by the OSDF Construction
- 8 Subcontractor at his own expense.
- 9
- 10 B. The OSDF Construction Subcontractor shall be aware of all monitoring and
- 11 conformance testing required by the CQA Plan. This monitoring and testing, including
- 12 random conformance testing of construction materials and completed work, will be
- 13 performed by the CQC Consultant. If nonconformances or other deficiencies are
- 14 found in the OSDF Construction Subcontractor's materials or completed work, the
- 15 OSDF Construction Subcontractor will be required to repair or replace the deficiency
- 16 at his expense.
- 17

18  
19 **PART 2 PRODUCTS**

20  
21 **2.01 RESIN**

- 22
- 23 A. The geomembrane shall be manufactured from new, first-quality polyethylene resin.
- 24 Reclaimed polymer shall not be added to the resin; however, the use of polymer
- 25 recycled during the manufacturing process shall be permitted if performed with
- 26 appropriate cleanliness and if the recycled polymer does not exceed 2 percent by
- 27 weight of the total polymer weight.
- 28
- 29 B. The resin shall comply with the following high density polyethylene (HDPE) specified
- 30 properties:
- 31 1. Specific Gravity: 0.94 minimum (ASTM D 792 Method A, or ASTM D 1505)
- 32 2. Melt Index: 1.0 g/10 min., maximum (ASTM D 1238 Condition E,
- 33 190°C, 2.16 kg)
- 34

35 **2.02 GEOMEMBRANE PROPERTIES**

- 36
- 37 A. The Geomembrane Manufacturer shall furnish geomembrane having properties that
- 38 comply with the required property values shown in Table 02770-1.
- 39
- 40 B. In addition to the property values listed in Table 02770-1, the geomembranes shall:
- 41 1. Contain a maximum of 1 percent by weight of additives, fillers, or extenders (not
- 42 including carbon black).

- 1           2. Not have striations, pinholes (holes), bubbles, blisters, nodules, undispersed raw  
2           materials, or any sign of contamination by foreign matter on the surface or in the  
3           interior.  
4

5   **2.03    MANUFACTURING QUALITY CONTROL**  
6

7    **A. Resin:**

- 8           1. The Geomembrane Manufacturer shall sample and test the resin to demonstrate  
9           that the resin complies with the requirements of this Section. The Geomembrane  
10          Manufacturer shall certify in writing that the resin meets the requirements of this  
11          Section.  
12          2. Any geomembrane manufactured from noncomplying resin shall be rejected.  
13          3. The OSDF Construction Subcontractor shall be responsible for ensuring the  
14          Geomembrane Manufacturer complies with the submittal requirements of Part  
15          1.06 of this Section.  
16

17   **B. Rolls:**

- 18          1. The Geomembrane Manufacturer shall continuously monitor geomembranes  
19          during the manufacturing process for defects.  
20          2. No geomembrane shall be accepted that exhibits any defects.  
21          3. The Geomembrane Manufacturer shall measure and report the geomembrane  
22          thickness at regular intervals along the roll length.  
23          4. No geomembrane shall be accepted that fails to meet the specified thickness.  
24          5. The Geomembrane Manufacturer shall sample and test the geomembrane, at a  
25          minimum, once every 40,000 ft<sup>2</sup> to demonstrate that its properties conform to the  
26          values specified in Table 02770-1. As a minimum, the following tests shall be  
27          performed:  
28

<u>Test</u>	<u>Procedure</u>	
specific gravity	ASTM D 792	Method A or ASTM D 1505
thickness	ASTM D 5199	
yield strength	ASTM D 638	Modified by NSF 54 Annex A
yield elongation	ASTM D 638	Modified by NSF 54 Annex A
tensile strength	ASTM D 638	Modified by NSF 54 Annex A
tensile elongation	ASTM D 638	Modified by NSF 54 Annex A
carbon black	ASTM D 1603	Modified by NSF 54 Annex A
carbon black dispersion	ASTM D 5596	

- 39  
40          6. Any geomembrane sample that does not comply with the requirements of this  
41          Section will result in rejection of the roll from which the sample was obtained and  
42          will not be used for this project.

- 1 7. If a geomembrane sample fails to meet the quality control requirements of this  
2 Section, the Geomembrane Manufacturer shall sample and test rolls manufactured,  
3 in the same resin batch, or at the same time, as the failing roll. Sampling and  
4 testing of rolls shall continue until a pattern of acceptable test results is  
5 established.  
6 8. Additional testing may be performed at the Geomembrane Manufacturer's  
7 discretion and expense, to isolate and more closely identify the non-complying  
8 rolls and/or to qualify individual rolls.  
9 9. The following tests need not be run at the 1 per 40,000 ft<sup>2</sup> frequency; however,  
10 the Geomembrane Manufacturer shall certify that these tests have been performed  
11 on a sample geomembrane that is identical to the geomembrane to be used on this  
12 project. The OSDF Construction Subcontractor shall provide the test result  
13 documentation to the Construction Contract Manager.  
14

<u>Test</u>	<u>Procedure</u>
soil burial	ASTM D 3083
environmental stress crack	GRI-GM5B
low temperature brittleness	ASTM D 746, Procedure B

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21 C. The Geomembrane Manufacturer shall permit the CQC Consultant, Construction  
22 Contract Manager and/or Engineer to visit the manufacturing plant for project specific  
23 visits. If possible, such visits will be prior to or during the manufacturing of the  
24 geomembrane rolls for the specific project.  
25

## 26 2.04 LABELING

- 27  
28 A. Geomembrane rolls shall be labelled with the following information.  
29 1. thickness of the material;  
30 2. length and width of the roll;  
31 3. name of Geomembrane Manufacturer;  
32 4. product identification;  
33 5. lot number; and  
34 6. roll number.  
35

## 36 2.05 TRANSPORTATION, HANDLING AND STORAGE

- 37  
38 A. Transportation of the geomembrane shall be the responsibility of the OSDF  
39 Construction Subcontractor.  
40  
41 B. Handling and care of the geomembranes prior to and following installation at the site  
42 shall be the responsibility of the OSDF Construction Subcontractor. The OSDF

1 Construction Subcontractor shall be liable for all damage to the materials incurred  
2 prior to final acceptance of the liner system by the Construction Contract Manager.  
3

- 4 C. The OSDF Construction Subcontractor shall be responsible for storage of the  
5 geomembrane at the site. The geomembrane shall be protected from excessive heat  
6 or cold, dirt, puncture, cutting, or other damaging or deleterious conditions. Any  
7 additional storage procedures required by the Geomembrane Manufacturer shall be the  
8 OSDF Construction Subcontractor's responsibility.  
9

### 10 PART 3 INSTALLATION OF GEOMEMBRANES

#### 11 3.01 FAMILIARIZATION

- 12  
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14  
15 A. Prior to implementing any of the work described in this Section, the OSDF  
16 Construction Subcontractor and Geosynthetics Installer shall become thoroughly  
17 familiar with all portions of the work falling within this Section.  
18  
19 B. Inspection:  
20 1. Prior to implementing any of the work in this Section, the OSDF Construction  
21 Subcontractor shall carefully inspect the installed work of all other Sections and  
22 verify that all work is complete to the point where the work of this Section may  
23 properly commence without adverse impact.  
24 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
25 work of other Sections, he shall notify the Construction Contract Manager in  
26 writing prior to the start of the work of this Section. Failure to inform the  
27 Construction Contract Manager in writing will be construed as OSDF  
28 Construction Subcontractor's acceptance of the related work of all other Sections.  
29  
30 C. A pre-installation meeting shall be held to coordinate the installation of the  
31 geosynthetic clay liner and cap with the installation of other components of the liner  
32 system or final cover system.  
33

#### 34 3.02 GEOMEMBRANE DEPLOYMENT

- 35  
36 A. Layout Drawings:  
37 1. The Geosynthetics Installer shall deploy the geomembrane panel in accordance  
38 with layout drawing specified. The layout drawings must be approved by the  
39 Engineer prior to installation of any geomembrane.  
40  
41 B. Field Panel Identification:  
42 1. A geomembrane field panel is a roll or a portion of roll cut in the field.

- 1           2. Each field panel shall be given an identification code (number of letter-number).  
2           This identification code shall be agreed upon by the CQC Consultant and  
3           Geosynthetics Installer.  
4

5           C. Field Panel Placement:

- 6           1. Field panels shall be installed as approved or modified at the location and  
7           positions indicated in the layout drawings.  
8           2. Field panels shall be placed one at a time, and each field panel shall be seamed  
9           immediately after its placement.  
10          3. Geomembranes shall not be placed when the ambient temperature is below 40°F,  
11          unless otherwise authorized in writing by the Engineer.  
12          4. Geomembranes shall not be placed during any precipitation, in the presence of  
13          excessive moisture (e.g., fog, dew), in an area of ponded water, or in the  
14          presence of excessive winds.  
15          5. The OSDF Construction Subcontractor shall ensure that:  
16           a. No vehicular traffic is allowed on the geomembrane.  
17           b. Equipment used does not damage the geomembrane by handling, trafficking,  
18           or leakage of hydrocarbons (i.e., fuels).  
19           c. Personnel working on the geomembrane do not smoke, wear damaging  
20           shoes, bring glass onto the geomembrane, or engage in other activities that  
21           could damage the geomembrane.  
22           d. The method used to unroll the panels does not scratch or crimp the  
23           geomembrane and does not damage the supporting soil.  
24           e. The method used to place the panels minimizes wrinkles (especially  
25           differential wrinkles between adjacent panels). The method used to place the  
26           panels results in intimate contact with geosynthetic clay liner and cap. In  
27           this regard, field panel placement shall be coordinated with geosynthetic clay  
28           liner and cap placement as specified in Section 02772.  
29           f. Temporary ballast and/or anchors (e.g., sand bags), not likely to damage the  
30           geomembrane, are placed on the geomembrane to prevent uplift by wind.  
31           g. The geomembrane is especially protected from damage in heavily trafficked  
32           areas.  
33           h. Any rub sheets to facilitate seaming are removed prior to installation of  
34           subsequent panels.  
35          6. Any field panel or portion thereof that becomes seriously damaged (torn, twisted,  
36          or crimped) shall be replaced with new material at no cost to the Construction  
37          Contract Manager. Less serious damage to the geomembrane may be repaired at  
38          the CQC Consultant's option and at no cost to the Construction Contract  
39          Manager. Damaged panels or portions of damaged panels that have been rejected  
40          shall be removed from the work area.  
41

- 1 D. If the OSDF Construction Subcontractor intends to install geomembrane between one  
2 hour before sunset and one hour after sunrise, he shall notify the Construction Contract  
3 Manager in writing prior to the start of the work. The OSDF Construction  
4 Subcontractor shall indicate additional precautions which shall be taken during these  
5 installation hours. The OSDF Construction Subcontractor shall provide proper  
6 illumination for work during this time period.  
7

### 8 3.03 FIELD SEAMING

9

#### 10 A. Seam Layout:

11 In general, seams shall be oriented parallel to the line of maximum slope, i.e.,  
12 oriented down, not across, the slope. In corners and at odd-shaped geometric  
13 locations, the number of field seams shall be minimized. No horizontal seam shall be  
14 less than 10 feet from the toe of the slope, except where approved by the Engineer.  
15 No seams shall be located in an area of potential stress concentration.  
16

#### 17 B. Personnel:

18 All personnel performing seaming operations shall be qualified as indicated in Part  
19 1.06D.8 of this Section. No seaming shall be performed unless a "master seamer" is  
20 on-site.  
21

#### 22 C. Weather Conditions for Seaming:

- 23 1. Unless authorized in writing by the Engineer, seaming shall not be attempted at  
24 ambient temperatures below 40°F or above 104°F. A meeting will be held with  
25 the Construction Contract Manager, OSDF Construction Subcontractor, Engineer  
26 and CQC Consultant to establish acceptable installation procedures. In all cases,  
27 the geomembrane shall be dry and protected from wind damage.  
28 2. If the Geosynthetics Installer wishes to use methods that may allow seaming at  
29 ambient temperatures below 40°F or above 104°F, he shall use a procedure  
30 recommended by the Engineer.  
31 3. Ambient temperatures shall be measured between 0 to 6 inches above the  
32 geomembrane surface.  
33

#### 34 D. Overlapping and Temporary Bonding:

- 35 1. Geomembrane panels shall be sufficiently overlapped for welding and to allow  
36 peel tests to be performed on the seam. Any seams that cannot be destructively  
37 tested because of insufficient overlap shall be treated as failing seams.  
38 2. The procedure used to temporarily heat bond adjacent panels together shall not  
39 damage the geomembrane. The temperature of the air at the nozzle of heat  
40 bonding apparatus shall be controlled such that the geomembrane is not damaged.  
41  
42

## 1 E. Seam Preparation:

- 2 1. Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt,  
3 debris of any kind, and foreign material.  
4 2. If seam overlap grinding is required, the process shall be completed according to  
5 the Geomembrane Manufacturer's instructions within 20 minutes of the seaming  
6 operation and in a manner that does not damage the geomembrane. The grind  
7 depth shall not exceed ten percent of the geomembrane thickness. Grinding  
8 marks shall not appear beyond 0.25 inch of the extrudate after it is placed.  
9 3. Seams shall be aligned with the fewest possible number of wrinkles and  
10 "fishmouths".  
11

## 12 F. General Seaming Requirements:

- 13 1. Seaming shall extend to the outside edge of panels to be placed in the anchor  
14 trench.  
15 2. If required, a firm substrate such as a flat board or similar hard surface may be  
16 placed directly under the seam overlap to achieve proper support.  
17 3. Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the  
18 wrinkle to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed  
19 and any portion where the overlap is insufficient shall be patched with an oval or  
20 round patch of geomembrane that extends a minimum of 6 inches beyond the cut  
21 in all directions.  
22 4. Any electric generator shall be placed outside the area to be lined or mounted in  
23 a manner that protects the geomembrane from damage. The electric generator  
24 shall be properly grounded.  
25

## 26 G. Seaming Process:

- 27 1. Approved processes for field seaming are extrusion welding and fusion welding.  
28 Seaming equipment shall not damage the geomembrane. Only equipment  
29 identified as part of the approved submittal specified in Part 1.06D.4 shall be  
30 used. Proposed alternate processes shall be documented and submitted to the  
31 Engineer for approval.  
32 2. Extrusion Equipment and Procedures:  
33 a. The Geosynthetics Installer shall maintain at least one spare operable  
34 seaming apparatus on site.  
35 b. Extrusion welding apparatus shall be equipped with gauges giving the  
36 temperature in the apparatus and at the nozzle.  
37 c. Prior to beginning a seam, the extruder shall be purged until all heat-  
38 degraded extrudate has been removed from the barrel. Whenever the  
39 extruder is stopped, the barrel shall be purged of all heat-degraded extrudate.  
40 d. The Geosynthetics Installer shall provide documentation regarding the  
41 welding rod or resin to the Construction Contract Manager and shall certify

1 that the welding rod or resin is compatible with the specifications, and  
2 consists of the same resin as the geomembrane.

- 3 e. The electric generator used for power supply to the welding machines shall  
4 be placed outside the area to be lined or mounted on soft tires such that no  
5 damage occurs to the geomembrane. The electric generator shall be  
6 grounded to the satisfaction of the Construction Contract Manager. A  
7 smooth insulating plate or fabric shall be placed beneath the hot welding  
8 apparatus after use.

9 3. Fusion Equipment and Procedures:

- 10 a. The Geosynthetics Installer shall maintain at least one spare operable  
11 seaming apparatus on site.  
12 b. Fusion-welding apparatus shall be automated vehicular-mounted devices  
13 equipped with gauges giving the applicable temperatures and pressures.  
14 c. The edges of cross seams shall be abraded to a smooth incline (top and  
15 bottom) prior to extrusion welding.  
16 d. A movable protective layer may be used directly below each geomembrane  
17 overlap to be seamed to prevent the buildup of moisture between the sheets  
18 panel.  
19 e. The electric generator used for power supply to the welding machines shall  
20 be placed outside the area to be lined or mounted on soft tires such that no  
21 damage occurs to the geomembrane. The electric generator shall be  
22 grounded to the satisfaction of the Construction Contract Manager. A  
23 smooth insulating plate or fabric shall be placed beneath the hot welding  
24 apparatus after use.

25  
26 H. Trial Seams:

- 27 1. Trial seams shall be made on fragment pieces of geomembrane to verify that  
28 seaming conditions are adequate. Trial seams must be conducted on the same  
29 material to be installed and under similar field conditions as production seams.  
30 Such trial seams shall be made at the beginning of each seaming period, and at  
31 least once each four hours, for each seaming apparatus used that day. Also, each  
32 seamer shall make at least one trial seam each day. Trial seams shall be made  
33 under the same conditions as actual seams. The trial seam sample shall be a  
34 minimum of 15 feet long by 1 foot wide (after seaming) with the seam centered  
35 lengthwise for fusion equipment and at least 3 feet long by 1 foot wide for  
36 extrusion equipment. Seam overlap shall be as indicated in Part 3.04D of this  
37 Section.  
38 2. Four specimens, each 1.0 inch wide, shall be cut from the trial seam sample by  
39 the Geosynthetics Installer. Two specimens shall be tested in shear and two in  
40 peel, using a field tensiometer. The test specimens shall not fail in the seam. If  
41 a specimen fails, the entire operation shall be repeated. If the additional specimen  
42 fails, the seaming apparatus or seamer shall not be accepted and shall not be used

1 for seaming until the deficiencies are corrected and two consecutive successful  
2 trial seams are achieved. A seamer may start production seaming prior to testing  
3 of the trial seams. In the event the trial seam fails, all production seams will be  
4 treated as failed seams and repaired in accordance with Part 3.04K this Section.  
5

6 I. Nondestructive Seam Continuity Testing:

7 1. The Installer shall nondestructively test for continuity on all field seams over their  
8 full length. Continuity testing shall be carried out as the seaming work  
9 progresses, not at the completion of all field seaming. The Installer shall  
10 complete any required repairs in accordance with Part 3.04K of this Section. The  
11 following procedures shall apply:

- 12 a. Vacuum testing shall be used for extrusion welds.  
13 b. Air pressure testing shall be used for double fusion seams.  
14 c. Spark testing shall be performed if the seam cannot be tested using other  
15 nondestructive methods.

16 2. Vacuum Testing:

- 17 a. The equipment shall comprise the following:  
18 i. A vacuum box assembly consisting of a stiff housing, a transparent  
19 viewing window, a soft neoprene gasket attached to the bottom, port  
20 hole or valve assembly, and a vacuum gauge.  
21 ii. A system for applying 5 psi gauge suction to the box.  
22 iii. A bucket of soapy solution and applicator.  
23 b. The following procedures shall be followed:  
24 i. Energize the vacuum pump and reduce the tank pressure to  
25 approximately 5 psi gauge.  
26 ii. Wet an area of the geomembrane seam larger than the vacuum box  
27 with the soapy solution.  
28 iii. Place the box over the wetted area.  
29 iv. Close the bleed valve and open the vacuum valve.  
30 v. Ensure that a leak tight seal is created.  
31 vi. Examine the geomembrane through the viewing window for the  
32 presence of soap bubbles for not less than 20 seconds.  
33 vii. If no bubbles appear after 20 seconds, close the vacuum valve and  
34 open the bleed valve, move the box over the next adjoining area with  
35 a minimum 3 inch overlap, and repeat the process.  
36 viii. All areas where soap bubbles appear shall be marked with a marker  
37 that will not damage the geomembrane and repaired in accordance with  
38 Part 3.04K of this Section.

39 3. Air Pressure Testing (For Double Fusion Seams Only):

- 40 a. The following procedures are applicable to those processes which produce  
41 a double seam with an enclosed space.  
42

- 1           b. The equipment shall comprise the following:
- 2               i. An air pump (manual or motor driven) or air reservoir, equipped with
- 3               a pressure gauge, capable of generating and sustaining a pressure
- 4               between 25 and 30 pounds per square inches, mounted on a cushion
- 5               to protect the geomembrane.
- 6               ii. A rubber hose with fittings and connections.
- 7               iii. A hollow needle, or other approved pressure feed device.
- 8           c. The following procedures shall be followed:
- 9               i. Seal both ends of the seam to be tested.
- 10              ii. Insert needle, or other approved pressure feed device, into the tunnel
- 11              created by the fusion weld.
- 12              iii. Insert a protective cushion between the air pump and the
- 13              geomembrane.
- 14              iv. Energize the air pump to a pressure between 25 and 30 pounds per
- 15              square inches, close valve, and sustain the pressure for not less than
- 16              5 minutes.
- 17              v. If loss of pressure exceeds 3 pounds per square inches, or does not
- 18              stabilize, locate faulty area and repair in accordance with Part 3.04K
- 19              of this Section.
- 20              vi. Cut opposite end of air channel from pressure gauge and observe
- 21              release of pressure to ensure air channel is not blocked.
- 22              vii. Remove needle, or other approved pressure feed device, and seal
- 23              repair in accordance with Part 3.04K of this Section.
- 24

25           J. Destructive Testing:

- 26           1. Destructive seam tests shall be performed on samples collected from selected
- 27           locations to evaluate seam strength and integrity. Destructive tests shall be
- 28           carried out as the seaming work progresses, not at the completion of all field
- 29           seaming.
- 30           2. Sampling:
- 31               a. Destructive test samples shall be collected at a minimum average frequency
- 32               of one test location per 500 feet of seam length. Test locations shall be
- 33               determined during seaming, and may be prompted by suspicion of excess
- 34               crystallinity, contamination, offset seams, or any other potential cause of
- 35               imperfect seaming. The CQC Consultant will be responsible for choosing
- 36               the locations. The OSDF Construction Subcontractor shall not be informed
- 37               in advance of the locations where the seam samples will be taken. The
- 38               Construction Contract Manager or CQC Consultant reserves the right to
- 39               increase the sampling frequency.
- 40               b. Samples shall be cut by the Installer at the locations designated by the CQC
- 41               Consultant as the seaming progresses in order to obtain laboratory test results
- 42               before the geomembrane is covered by another material. Each sample shall

1 be numbered and the sample number and location identified on the panel  
2 layout drawing. All holes in the geomembrane resulting from the destructive  
3 seam sampling shall be immediately repaired in accordance with the repair  
4 procedures described in Part 3.04K of this Section. The continuity of the  
5 new seams in the repaired areas shall be tested according to Part 3.04I of  
6 this Section.

- 7 c. Two strips 1 inch wide and 12 inch long with the seam centered parallel to  
8 the width shall be taken from either side of the sample location. These  
9 samples shall be tested in the field in accordance with Part 3.04J.3 of this  
10 Section. If these samples pass the field test, a laboratory sample shall be  
11 taken. The laboratory sample shall be at least 1 foot wide by 3.5 feet long  
12 with the seam centered lengthwise. The sample shall be cut into three parts  
13 and distributed as follows:

- 14 i. One portion 1 foot long to the Geosynthetics Installer.  
15 ii. One portion 1.5 foot long to the Geosynthetic CQA Laboratory for  
16 testing.  
17 iii. One portion 1 foot long to the Construction Contract Manager for  
18 archival storage.

19 3. Field Testing:

20 The two 1 inch wide strips shall be tested in the tensiometer in the peel mode.  
21 The CQC Consultant has the option to request an additional test in the shear  
22 mode. If any field test sample fails to meet the requirements in Table 02770-2,  
23 then the procedures outlined in Part 3.04J.5 of this Section shall be followed.

24 4. Laboratory Testing:

25 Testing by the Geosynthetics CQA Laboratory will include "Seam Strength" and  
26 "Peel Adhesion" (ASTM D 4437 with 1 inch wide strip, tested at 2 inches per  
27 minute. The minimum acceptable values to be obtained in these tests are those  
28 indicated in Table 02770-2. At least 5 specimens will be tested for each test  
29 method. Specimens will be selected alternately by test from the samples (i.e.,  
30 peel, shear, peel, shear...). Both inside and outside tracks of the dual wedge  
31 fusion seams shall be tested in peel.

32 5. Destructive Test Failure:

- 33 a. The following procedures shall apply whenever a sample fails a destructive  
34 test, whether the test is conducted by the CQC Consultant's laboratory, the  
35 Geosynthetics Installer laboratory, or by a field tensiometer. The  
36 Geosynthetics Installer shall have two options:  
37 i. The Geosynthetics Installer can reconstruct the seam (e.g., remove the  
38 old seam and reseam) between any two passed destructive test  
39 locations.  
40 ii. The Geosynthetics Installer can trace the welding path to an  
41 intermediate location, a minimum of 10 feet from the location of the  
42 failed test (in each direction) and take a small sample for an additional

1 field test at each location. If these additional samples pass the tests,  
2 then full laboratory samples shall be taken. These full laboratory  
3 samples shall be tested in accordance with Part 3.04J.4 of this Section.  
4 If these laboratory samples pass the tests, then the seam shall be  
5 reconstructed between these locations. If either sample fails, then the  
6 process shall be repeated to establish the zone in which the seam  
7 should be reconstructed. In any case, all acceptable seams must be  
8 bounded by two locations from which samples passing laboratory  
9 destructive tests have been taken. In cases exceeding 150 feet of  
10 reconstructed seam, a sample taken from within the reconstructed zone  
11 must pass destructive testing.

- 12 b. Whenever a sample fails, the CQC Consultant may require additional tests  
13 for seams that were formed by the same seamer and/or seaming apparatus  
14 or seamed during the same time shift.  
15

16 **K. Defects and Repairs:**

- 17 1. The geomembrane will be inspected before and after seaming for evidence of  
18 defects, holes, blisters, undispersed raw materials, and any sign of contamination  
19 by foreign matter. The surface of the geomembrane shall be clean at the time of  
20 inspection. The geomembrane surface shall be swept or washed by the Installer  
21 if surface contamination inhibits inspection. The Installer shall ensure that an  
22 inspection of the geomembrane precedes any seaming of that section.  
23 2. Each suspected location, both in seam and non-seam areas, shall be  
24 nondestructively tested using the methods described Part 3.04I of this Section, as  
25 appropriate. Each location that fails nondestructive testing shall be marked by the  
26 CQC Consultant and repaired by the Installer.  
27 3. When seaming of a geomembrane is completed (or when seaming of a large area  
28 of a geomembrane is completed) and prior to placing overlying materials, the  
29 CQC Consultant shall identify all excessive geomembrane wrinkles. The Installer  
30 shall cut and reseam all wrinkles so identified. The seams thus produced shall be  
31 tested like any other seams.  
32 4. Repair Procedures:  
33 a. Any portion of the geomembrane exhibiting a flaw, or failing a destructive  
34 or nondestructive test, shall be repaired by the Geosynthetics Installer.  
35 Several repair procedures exist. The final decision as to the appropriate  
36 repair procedure shall be agreed upon between the CQC Consultant and the  
37 Geosynthetics Installer. The procedures available include:  
38 i. patching, used to repair large holes, tears, undispersed raw materials,  
39 and contamination by foreign matter;  
40 ii. abrading and reseaming, used to repair small sections of extruded  
41 seams;  
42 iii. spot seaming, used to repair minor, localized flaws;

- 1 iv. capping, used to repair long lengths of failed seams;  
2 v. topping, used to repair areas of inadequate seams, which have an  
3 exposed edge less than 4 inches in length; and  
4 vi. removing bad seam and replacing with a strip of new material seamed  
5 into place (used with long lengths of fusion seams).  
6 b. In addition, the following shall be satisfied:  
7 i. surfaces of the geomembrane that are to be repaired shall be abraded  
8 no more than 20 minutes prior to the repair;  
9 ii. all surfaces must be clean and dry at the time of repair;  
10 iii. all seaming equipment used in repair procedures must be approved;  
11 iv. the repair procedures, materials, and techniques shall be approved in  
12 advance, for the specific repair, by the CQC Consultant;  
13 v. patches or caps shall extend at least 6 inches beyond the edge of the  
14 defect, and all corners of patches shall be rounded with a radius of at  
15 least 3 inches; and  
16 vi. the geomembrane below large caps shall be appropriately cut to avoid  
17 water or gas collection between the two sheets.  
18 5. Repair Verification:  
19 a. Each repair shall be nondestructively tested using the methods described in  
20 Part 3.04I of this Section, as appropriate. Repairs that pass the  
21 nondestructive test shall be taken as an indication of an adequate repair.  
22 Failed tests will require the repair to be redone and retested until a passing  
23 test results. At the discretion of the CQC Consultant, destructive testing  
24 may be required on large caps.  
25

### 26 3.04 CREST ANCHORAGE SYSTEM

- 27  
28 A. The geomembrane shall be temporarily anchored along with the geosynthetic clay liner  
29 in the anchor trench at the crest of the slope.  
30  
31 B. Care shall be taken that soil, sand bags or other materials are not trapped between the  
32 geosynthetic layers.  
33  
34 C. The anchor trench shall not be backfilled until all geosynthetic layers are installed in  
35 the anchor trench as shown on the drawings.  
36

### 37 3.05 MATERIALS IN CONTACT WITH THE GEOMEMBRANE

- 38  
39 A. The OSDF Construction Subcontractor shall take all necessary precautions to ensure  
40 that the geomembrane is not damaged during its installation or during the installation  
41 of other components of the liner or final cover system or by other construction  
42 activities.  
43

- 1 B. Granular drainage material shall not be placed over the geomembranes at ambient
- 2 temperatures below 40°F or above 104°F, unless otherwise specified.
- 3
- 4 C. All attempts shall be made to minimize wrinkles in the geomembrane.
- 5
- 6 D. Equipment shall not be driven directly on the geomembrane. Unless otherwise
- 7 specified by the Engineer, all equipment used to spread and compact overlying fill
- 8 shall comply with the following requirement:
- 9

Maximum Allowable Equipment Ground Pressure (pounds per square inches)	Initial Lift Thickness of Overlying Compacted Fill (inches)
< 5	12
< 10	18
< 20	24
> 20	36

- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18 E. In heavily trafficked areas such as access ramps, and in areas trafficked by rubber tire
- 19 vehicles, the thickness of overlying compacted fill should be a least 3 feet. Roads shall
- 20 be at least twice the width of the largest piece of equipment.
- 21
- 22 F. Appurtenances:
- 23 1. Installation of the geomembrane in appurtenant areas, and connection of the
- 24 geomembrane to appurtenances shall be made according to the Construction
- 25 Drawings and Specifications. Extreme care shall be taken while seaming around
- 26 appurtenances since neither nondestructive nor destructive testing may be feasible
- 27 in these areas. The Geosynthetics Installer shall ensure that the geomembrane has
- 28 not been visibly damaged while making connections to sumps and appurtenances.
- 29 2. All clamps, slips, bolts, nuts, or other fasteners used to secure the geomembrane
- 30 to each appurtenance shall be at least as durable as the geomembrane.
- 31

3.06 CONFORMANCE TESTING

- 32
- 33
- 34 A. Samples of the geomembrane will be removed by the CQC Consultant and sent to a
- 35 geosynthetics CQC laboratory for testing to ensure conformance with the requirements
- 36 of this Section. The OSDF Construction Subcontractor shall assist the CQC Consultant
- 37 in obtaining conformance samples. The OSDF Construction Subcontractor shall account
- 38 for this testing in the installation schedule. Only material that meets the requirements
- 39 of Part 2.02 this Section shall be installed.
- 40
- 41 B. Samples will be selected by the CQC Consultant in accordance with this Section and
- 42 with the procedures outlined in the CQA Plan.

- 1 C. Samples will be taken at a minimum frequency of one sample per 100,000 square feet  
2 with a minimum of one sample per lot.  
3
- 4 D. The CQC Consultant may increase the frequency of sampling in the event that test  
5 results do not comply with the requirements of Part 2.02 of this Section. The additional  
6 testing shall be performed at the expense of the OSDF Construction Subcontractor.  
7
- 8 E. As a minimum, tests will be performed by the CQC Consultant to establish the  
9 thickness, specific gravity, tensile properties yield strength and elongation, tensile  
10 strength and elongation, carbon black content and carbon black dispersion of the  
11 geomembrane. The appropriate test methods are summarized in Table 02770-1.  
12
- 13 F. Any geomembranes that are not certified in accordance with Part 1.06.C of this Section,  
14 or that conformance testing indicates do not comply with Part 2.02 of this Section, will  
15 be rejected by the CQC Consultant. The OSDF Construction Subcontractor shall  
16 replace the rejected material with new material, at his expense.  
17

### 18 3.07 GEOMEMBRANE ACCEPTANCE

- 19
- 20 A. The OSDF Construction Subcontractor shall retain all ownership and responsibility for  
21 the geomembrane until accepted by the Construction Contract Manager.  
22
- 23 B. The geomembrane shall be accepted by the Construction Contract Manager when:  
24 1. the installation is completed;  
25 2. all documentation is submitted;  
26 3. verification of the adequacy of all field seams and repairs, including associated  
27 testing, is complete; and  
28 4. all warranties are submitted.  
29

### 30 3.08 PROTECTION OF WORK

- 31
- 32 A. The OSDF Construction Subcontractor shall use all means necessary to protect all work  
33 of this Section.  
34
- 35 B. In the event of damage, the OSDF Construction Subcontractor shall make all repairs  
36 and replacements necessary, to the satisfaction of the Construction Contract Manager  
37 and at no additional cost to the Construction Contract Manager.  
38

TABLE 02770-1

## REQUIRED TEXTURED HDPE GEOMEMBRANE PROPERTIES

Properties	Qualifiers	Units	Specified Values		Test Method
			60 mil	80 mil	
<b>8 Physical Properties</b>					
9 Thickness	average	mils	60	80	GRI-GM8
	minimum	mils	54	76	GRI-GM8
10 Specific Gravity	minimum	N/A	0.940	0.940	ASTM D 792 Method A or ASTM D 1505
11 Melt Flow Index	maximum	g/10 min	1.0	1.0	ASTM D 1238 (Condition E)
<b>12 Mechanical Properties</b>					
13 Tensile Properties (each direction)					
14 1. Force Per Unit Width at Yield	minimum	lb/in	126	168	ASTM D 638
15 2. Tensile Strength (force per unit width at 16 break)	minimum	lb/in	225	300	ASTM D 638
17 3. Elongation at Yield	minimum	%	12	12	ASTM D 638
18 4. Elongation at Break	minimum	%	200	200	ASTM D 638
19 Tear Resistance	minimum	lb	39	52	ASTM D 1004 Die C Puncture
<b>20 Environmental Properties</b>					
21 Low Temperature Impact	minimum	°C	-60	-60	ASTM D 746 Procedure B
22 Carbon Black Content	range	%	2-3	2-3	ASTM D 1603
23 Carbon Black Dispersion	N/A	none	Category 1 or 2		ASTM D 5596
24 Dimensional Stability (each direction)	maximum change	%	±2	±2	ASTM D 1204 212°F, 15 min.
25 Environmental Stress Crack 26	minimum	hrs	200	200	GRI-GM5B

TABLE 02770-2

## REQUIRED HDPE TEXTURED GEOMEMBRANE SEAM PROPERTIES

Properties	Qualifiers	Units	Specified Values		Test Method
			60 mil	80 mil	
Thickness	minimum average	mils	60	80	GRI-GM8
Shear Strength <sup>(1)</sup>					
at yield point	minimum	lb/in	108	144	ASTM D 4437
fusion					
extrusion	minimum	lb/in	108	144	ASTM D 4437
Peel Adhesion					
FTB <sup>(2)</sup>					
fusion	minimum	lb/in	85	108	ASTM D 4437
extrusion	minimum	lb/in	70	90	ASTM D 4437

Notes: 1. Also called "Bonded Seam Strength".

2. FTB = Film Tear Bond. (Maximum 10 percent seam separation)

[END OF SECTION]

**SPECIFICATION COVER SHEET**

**SPECIFICATION SECTION:** 02772 **TITLE:** GEOSYNTHETIC CLAY LINER

**Specifications By:** Signature J.F. Beech 2300590-  
 (Cognizant Engineer) Date  
 Printed Name J.F. BEECH, PRINCIPAL  
 and Title

**Scope and Format**  
**Checked By:** Signature R Neil Davies 10/23/95  
 (Checker) Date  
 Printed Name R NEIL DAVIES.  
 and Title

**Detailed Requirements**  
**Checked by:** Signature Not Used for 30% Submittal 20 Feb 96  
 (Checker) Date  
 Printed Name Kenneth W Cargill  
 and Title Associate

**Overall Review By:** Signature Not Used for 30% Submittal Mark H. Gleason 20 Feb 96  
 (PDP) Date  
 Printed Name MARK H. GLEASON  
 and Title Assistant Project Engineer

**Approved by:** Signature Not Used for 30% Submittal J.F. Beech 8 Apr 96  
 (DTL) 27 Feb 96 Date  
 Printed Name BEECH, PRINCIPAL Kenneth W Cargill  
 and Title Associate

**Record of Revision (Number and initial all revisions)**

Rev. No.	Reason	Date	By	Checked	Approval
<u>0A</u>	<u>30% Submittal</u>				
<u>B</u>	<u>Reprint for EPA Submittal</u>	<u>14 Dec 95</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>C</u>	<u>Intermediate Design</u>	<u>24 Feb 96</u>	<u>-</u>	<u>-</u>	<u>JFB</u>
<u>D</u>	<u>Intermediate Design, EPA Submittal</u>	<u>8 Apr 96</u>	<u>ke</u>	<u>-</u>	<u>-</u>

## SECTION 02772

## GEOSYNTHETIC CLAY LINER AND CAP

## PART 1 GENERAL

## 1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, and equipment and incidentals necessary for installation of the geosynthetic clay liner and cap. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. The work shall include, but not be limited to, delivery, storage, placement, anchorage, and seaming of the geosynthetic clay liner and cap.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements
- B. Section 01025 - Measurement and Payment
- C. Section 02225 - Compacted Clay Liner and Cap
- D. Section 02770 - Geomembrane Liner and Cap

## 1.03 MEASUREMENT AND PAYMENT

Measurement and payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].
- B. Site Health and Safety Plan.
- C. Site Construction Quality Assurance (CQA) Plan.
- D. Latest Version American Society of Testing and Materials (ASTM) Standards:
  1. ASTM D 638. Standard Test Method for Tensile Properties of Plastics.
  2. ASTM D 792. Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement.

3. ASTM D 1004. Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting.
4. ASTM D 1238. Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
5. ASTM D 1505. Standard Test Method for Density of Plastics by the Density Gradient Technique.
6. ASTM D 1603. Standard Test Method for Carbon Black in Olefin Plastics.
7. ASTM D 2216. Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
8. ASTM D 3786. Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.
9. ASTM D 4533. Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
10. ASTM D 4595. Standard Test Method for Tensile Properties of Geotextiles by Wide-Width Strip Method.
11. ASTM D 4632. Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
12. ASTM D 4833. Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
13. ASTM D 5084. Standard Test Method for Measurement of a Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
14. ASTM D 5199. Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
15. ASTM D 5261. Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.
16. ASTM D 5596. Standard Test Method for Microscopical Examination of Pigment Dispersion in Plastic Compounds.

E. Latest version of Geosynthetic Research Institute:

1. GM8 Standard Test Method for Measurement of the Core Thickness of Textured Geomembrane.

## 1.05 QUALIFICATIONS

- A. The OSDF Construction Subcontractor will contract a Manufacturer to supply geosynthetic clay liner and cap. The Manufacturer shall meet the following qualification requirements.

- 1           1. The Manufacturer shall be responsible for the production and delivery of rolls of  
2           geosynthetic clay liner and cap.  
3           2. The Manufacturer shall be a well-established firm with more than one year of  
4           experience in the manufacturing of geosynthetic clay liner and cap.  
5           3. The geosynthetic clay liner and cap Manufacturer shall submit a statement to the  
6           Construction Contract Manager listing:  
7           a. Certified minimum average roll property values of the proposed geosynthetic  
8           clay liner and cap and the tests used to determine those properties.  
9           b. Production capacity available and projected delivery dates for this project.  
10  
11          B. The OSDF Construction Subcontractor shall provide the services of a Geosynthetics  
12          Installer who shall install the geosynthetic clay liner and cap and who shall meet the  
13          requirements of Section 02770 and this Section.  
14  
15          C. The Geosynthetics Installer shall be responsible for field handling, storing, deploying,  
16          overlapping, temporary restraining (against wind), anchoring systems, maintaining the  
17          geosynthetic clay liner and cap in an unhydrated state, and other aspects of  
18          geosynthetic clay liner and cap installation.  
19  
20          D. The OSDF Construction Subcontractor shall accept and retain full responsibility for  
21          all materials and installation and shall be held responsible for any defects in the  
22          completed system.

#### 23 24 **1.06 CONSTRUCTION QUALITY ASSURANCE MONITORING**

- 25  
26          A. The OSDF Construction Subcontractor shall ensure that the materials and methods  
27          used for the geosynthetic clay liner and cap meet the requirements of the Construction  
28          Drawings and this Section. Any material or method that does not conform to these  
29          documents, or to alternatives approved in writing by the Engineer, will be rejected and  
30          shall be repaired or replaced by the OSDF Construction Subcontractor at his expense.  
31  
32          B. The OSDF Construction Subcontractor shall be aware of all monitoring and  
33          conformance testing required by the CQA Plan. This monitoring and testing, including  
34          random conformance testing of construction materials and completed work, will be  
35          performed by the CQC Consultant. If nonconformances or other deficiencies are  
36          found in the OSDF Construction Subcontractor's materials or completed work, the  
37          OSDF Construction Subcontractor will be required to repair or replace the deficiency  
38          at his expense.  
39

1     **1.07     SUBMITTALS**

- 2
- 3     A. The OSDF Construction Subcontractor shall submit the following information on the
- 4     Manufacturer of the geosynthetic clay liner and cap to the Construction Contract
- 5     Manager for approval:
- 6     1. Manufacturing capabilities, including:
- 7         a. daily production capacity available for this project;
- 8         b. manufacturing quality control procedures; and
- 9         c. list of material properties, including test method, to which are attached
- 10         geosynthetic clay liner and cap samples.
- 11
- 12     B. Prior to transporting any geosynthetic clay liner and cap to the site, the OSDF
- 13     Construction Subcontractor shall provide the following documentation to the
- 14     Construction Contractor for approval.
- 15     1. Manufacturing quality control certificates for each shift's production, signed by
- 16     responsible parties employed by the Manufacturer (such as the production
- 17     manager).
- 18     2. The quality control certificates shall include:
- 19         a. roll numbers and identification;
- 20         b. sampling procedures; and
- 21         c. results of quality control tests, including description of test methods used,
- 22         outlined in Part 2.02 of this Section.
- 23     3. The Manufacturer shall certify that the geosynthetic clay liner and cap meets all
- 24     the properties outlined in 2.01 of this Section.
- 25

26     **1.08     PACKING AND SHIPPING**

- 27
- 28     A. Geosynthetic clay liners and caps shall be supplied in rolls wrapped in impermeable
- 29     and opaque protective covers.
- 30
- 31     B. Geosynthetic clay liners and caps shall be marked or tagged with the following
- 32     information:
- 33         1. manufacturer's name;
- 34         2. product identification;
- 35         3. lot number;
- 36         4. roll number; and
- 37         5. roll dimensions.
- 38
- 39     C. Transportation of the geosynthetic clay liner and cap is the responsibility of the OSDF
- 40     Construction Subcontractor. The OSDF Construction Subcontractor shall be liable for
- 41     all damages to the materials incurred prior to and during transportation to the site.

- 1 D. The geosynthetic clay liner and cap shall be on-site at least 14 days prior to the  
2 scheduled installation date to allow for completion of conformance testing described  
3 in Part 3 of this Section.  
4

5 **1.09 STORAGE AND PROTECTION**  
6

- 7 A. Handling, storage, and care of the geosynthetic clay liner and cap, prior to and  
8 following installation, is the responsibility of the OSDF Construction Subcontractor,  
9 until final acceptance by the Construction Contract Manager.  
10  
11 B. The geosynthetic clay liner and cap shall be protected from moisture, excessive heat  
12 or cold, puncture, or other damaging or deleterious conditions. The geosynthetic clay  
13 liner and cap shall be stored off the ground and out of direct sunlight. Any additional  
14 storage procedures required by the Manufacturer shall be the OSDF Construction  
15 Subcontractor's responsibility.  
16  
17

18 **PART 2 PRODUCTS**  
19

20 **2.01 MATERIAL PROPERTIES**  
21

- 22 A. The geosynthetic clay liner and cap shall consist of a sodium montmorillonite core with  
23 textured 40-mil HDPE geomembrane backing, or shall consist of an internally-  
24 reinforced sodium montmorillonite core with a nonwoven geotextile and a woven  
25 geotextile component, as specified on the Construction Drawings. The geosynthetic  
26 clay liner and cap components shall meet the material properties stated in Part 2.01B  
27 or 2.01C of this Section.  
28  
29 B. The geosynthetic clay liner or cap consisting of a sodium montmorillonite core with  
30 textured 40-mil HDPE geomembrane backing shall meet the following requirements.  
31 1. The geosynthetic clay liner and cap shall consist of a sodium montmorillonite core  
32 with a textured 40-mil HDPE geomembrane backing.  
33 2. The hydraulic conductivity of the sodium bentonite component of the geosynthetic  
34 clay liner and cap shall be no greater than  $5 \times 10^{-9}$  centimeters per second, when  
35 measured in a flexible wall permeameter in general accordance with ASTM D  
36 5084 under an effective confining stress of 5 pounds per square inch.  
37 3. The geosynthetic clay liner and cap shall have the following minimum  
38 dimensions:  
39 a. the sodium bentonite component shall be glued to the HDPE geomembrane  
40 component and shall be applied at a minimum concentration of 1 pound per  
41 square foot, measured at a water content of less than or equal to 25 percent;

- 1           b. the minimum geosynthetic clay liner and cap roll width shall be 15 feet; and  
2           c. the geosynthetic clay liner and cap roll length shall be long enough to  
3           conform with the requirements specified in this Section.
- 4           4. The bentonite used to fabricate the geosynthetic clay liner and cap shall be at least  
5           90 percent sodium montmorillonite.
- 6           5. The geomembrane component of the geosynthetic clay liner and cap shall have the  
7           following characteristics:
- 8           a. Reclaimed polymer shall not be added to the resin for the HDPE backing;  
9           however, the use of polymer recycled during the manufacturing process shall  
10           be permitted if performed with appropriate cleanliness and if the recycled  
11           polymer does not exceed 2 percent by weight of the total polymer weight.  
12           The geomembrane shall be manufactured from new, first-quality polyethylene  
13           resin, manufactured for use in geomembranes.
- 14           b. Geomembrane Properties
- 15           i. The manufacturer shall furnish geomembranes having properties that  
16           comply with the required property values shown in Table 02772-1.
- 17           ii. In addition to the property values listed in Table 02772-1, the  
18           geomembranes shall:
- 19           • contain a maximum of 1 percent by weight of additives, fillers, or  
20           extenders (not including carbon black);
  - 21           • not have striations, pinholes, or bubbles on the surface or in the  
22           interior;
  - 23           • be produced so as to be free of holes, blisters, undispersed raw  
24           materials, or any sign of contamination by foreign matter; and
  - 25           • be manufactured in a single layer (thinner layers shall not be  
26           welded together to produce the final required thickness).
- 27           6. The bentonite shall be adhered to the backing material in a manner that prevents  
28           it from being dislodged when transported, handled, and installed in a manner  
29           prescribed by the Manufacturer of the geosynthetic clay liner and cap. The  
30           bentonite shall be held in place by using adhesives. The method used to hold the  
31           bentonite in place shall not be detrimental to other components of the lining  
32           system.
- 33
- 34           C. The geosynthetic clay liner and cap consisting of an internally-reinforced sodium  
35           montmorillonite core with woven and nonwoven geotextile components shall meet the  
36           following requirements.
- 37           1. The geosynthetic clay liner and cap shall consist of an internally-reinforced  
38           sodium montmorillonite core with a nonwoven geotextile backing on one side and  
39           a woven geotextile backing on the other side.
- 40           2. The hydraulic conductivity of the geosynthetic clay liner and cap shall be no  
41           greater than  $5 \times 10^{-9}$  centimeters per second, when measured in a flexible wall

- 1 permeameter in general accordance with ASTM D 5084 under an effective  
2 confining stress of 5 pounds per square inch.
- 3 3. The geosynthetic clay liner and cap shall have the following minimum  
4 dimensions:
- 5 a. the minimum roll width shall be 15 feet; and  
6 b. the liner length shall be long enough to conform with the requirements  
7 specified in this Section.
- 8 4. The bentonite used to fabricate the geosynthetic clay liner and cap shall have at  
9 least 90 percent sodium montmorillonite.
- 10 5. The bentonite component of the geosynthetic clay liner and cap shall be applied  
11 at a minimum concentration of 1 pound per square foot, when measured at a  
12 water content of less than or equal to 25 percent.
- 13 6. The geotextile used to fabricate the geosynthetic clay liner and cap shall be a  
14 woven geotextile and a nonwoven geotextile manufactured with polypropylene or  
15 polyester material and shall conform to the minimum property values shown in  
16 Table 02772-1.
- 17 7. The puncture strength of the unhydrated (dry) geosynthetic clay liner and cap  
18 shall be greater than or equal to 100 pounds when measured in accordance with  
19 ASTM D 4833.
- 20 8. The geosynthetic clay liner and cap shall develop a wide-width tensile resistance  
21 of at least 35 pound per inch at 10 percent strain when tested in accordance with  
22 ASTM D 4595.
- 23 9. The bentonite will be adhered to the backing material in a manner that prevents  
24 it from being dislodged when transported, handled, and installed in a manner  
25 prescribed by the geosynthetic clay liner and cap manufacturer. The method used  
26 to hold the bentonite in place shall not be detrimental to other components of the  
27 lining system.
- 28
- 29 C. The geosynthetic clay liners and caps shall have the following shear strength properties  
30 based on the results of the soil-geosynthetic interface testing program.

## 31 2.02 MANUFACTURING QUALITY CONTROL

- 32
- 33
- 34 A. The geosynthetic clay liner and cap shall be manufactured with quality control  
35 procedures that meet or exceed generally accepted industry standards.
- 36
- 37 B. The geosynthetic clay liner and cap Manufacturer shall sample and test the  
38 geosynthetic clay liner and cap to demonstrate that the material complies with the  
39 requirements of this Section.
- 40

- 1 C. Any geosynthetic clay liner and cap sample that does not comply with this Section will  
2 result in rejection of the roll from which the sample was obtained. The Manufacturer  
3 shall replace any rejected rolls at no additional cost to the Owner.  
4
- 5 D. If a geosynthetic clay liner and cap sample fails to meet the quality control  
6 requirements of this Section, the Construction Contract Manager will require that the  
7 geosynthetic clay liner and cap Manufacturer sample and test rolls manufactured in the  
8 same lot, or at the same time, as the failing roll. Sampling and testing of rolls shall  
9 continue until a pattern of acceptable test results is established.  
10
- 11 E. Additional sample testing may be performed, at the geosynthetic clay liner and cap  
12 Manufacturer's discretion and expense, to more closely identify any non-complying  
13 rolls and/or to qualify individual rolls.  
14
- 15 F. Sampling shall, in general, be performed on sacrificial portions of the geosynthetic  
16 clay liner and cap material such that repair is not required. The geosynthetic clay liner  
17 and cap Manufacturer shall sample and test the geosynthetic clay liner and cap, at a  
18 minimum, once every 40,000 ft<sup>2</sup> to demonstrate that its properties conform to the  
19 stated requirements. The following tests shall be performed at this frequency:  
20

21 Test

22 **TO BE ADDED**

- 23
- 24
- 25 G. The geosynthetic clay liner and cap Manufacturer shall comply with the certification  
26 and submittal requirements of this Section.  
27  
28

## 29 PART 3 EXECUTION

### 30 3.01 FAMILIARIZATION

- 31
- 32
- 33 A. Prior to implementing any of the work described in this Section, the OSDF  
34 Construction Subcontractor shall carefully inspect the installed work of all other  
35 Sections and verify that all work is complete to the point where the installation of this  
36 Section may properly commence without adverse impact.  
37
- 38 B. Inspection:
- 39 1. Prior to implementing any of the work in this Section, the OSDF Construction  
40 Subcontractor shall carefully inspect the installed work of all other Sections and

1 verify that all work is complete to the point where the installation of this Section  
2 may properly commence without adverse impact.  
3  
4

- 5 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
6 work of other Sections, he should notify the Construction Contract Manager in  
7 writing prior to commencing the work. Failure to notify the Construction  
8 Contract Manager or installation of the geosynthetic clay liner and cap will be  
9 construed as OSDF Construction Subcontractor's acceptance of the related work  
10 of all other Sections.  
11

12 C. A pre-installation meeting shall be held to coordinate the installation of the  
13 geosynthetic clay liner and cap with the installation of other components of the lining  
14 system or final cover system.  
15

16 D. Prior to implementing any of the work in this Section, the OSDF Construction  
17 Subcontractor shall carefully inspect the installed work of all other Sections and verify  
18 that all work is complete to the point where the installation of this Section may  
19 properly commence without adverse impact.  
20

21 E. If the OSDF Construction Subcontractor has any concern regarding the installed work  
22 of other Sections, he should notify the Construction Contract Manager immediately.  
23 Installation of the geosynthetic clay liner and cap will be construed as OSDF  
24 Construction Subcontractor's acceptance of the related work of all other Sections.  
25

### 26 3.02 SURFACE PREPARATION 27

28 A. The Geosynthetics Installer shall provide certification in writing that the surface on  
29 which the geosynthetic clay liner or cap will be installed is acceptable. This  
30 certification of acceptance shall be given to the CQC Consultant prior to  
31 commencement of geomembrane installation in the area under consideration.  
32

33 B. Special care shall be taken to maintain the prepared soil surface.  
34

35 C. No geosynthetic clay liner or cap shall be placed onto an area that has been softened  
36 by precipitation or that has cracked due to desiccation. The soil surface shall be  
37 observed daily to evaluate the effects of desiccation cracking and/or softening on the  
38 integrity of the compacted clay liner and cap.  
39

40 D. Any damage to the compacted clay liner and cap surface caused by installation  
41 activities shall be repaired at the OSDF Construction Subcontractor's expense.

1     **3.03     CREST ANCHORAGE SYSTEM**

- 2
- 3     A.   The anchor trench shall be excavated by the OSDF Construction Subcontractor prior
- 4       to geosynthetic clay liner and cap placement, to the lines and grades shown on the
- 5       drawings.
- 6
- 7     B.   No loose soil shall be allowed in the anchor trench beneath the geosynthetic clay liner
- 8       and cap.
- 9
- 10    C.   The geosynthetic clay liner shall be temporarily anchored to the anchor trench until all
- 11       geosynthetic layers are installed in the anchor trench as shown on the Construction
- 12       Drawings.
- 13

14     **3.04     HANDLING AND PLACEMENT**

- 15
- 16    A.   The OSDF Construction Subcontractor shall handle all geosynthetic clay liner and caps
- 17       in such a manner that they are not damaged in any way and so that they do not become
- 18       hydrated prior to, or during, installation.
- 19
- 20    B.   In the presence of wind, all geosynthetic clay liner and caps shall be sufficiently
- 21       weighted with sandbags to prevent their movement.
- 22
- 23    C.   Geosynthetic clay liner and cap shall be cut using a utility blade in a manner approved
- 24       by the CQC Consultant. Any damage to any underlying materials during cutting will
- 25       be repaired at no cost to the OSDF Construction Subcontractor's expense.
- 26
- 27    D.   During placement, care shall be taken not to entrap stones or moisture under the
- 28       geosynthetic clay liner and cap. Care shall be taken not to walk on or drag equipment
- 29       across the exposed geosynthetic clay liner and cap.
- 30
- 31    E.   Any geosynthetic clay liner and cap damaged by stones or other foreign objects, or by
- 32       installation activities, shall be replaced at the OSDF Construction Subcontractor's
- 33       expense.
- 34
- 35    F.   Geosynthetic clay liner and caps that have a sodium montmorillonite core and a
- 36       textured 40-mil HDPE geomembrane backing shall be installed with the HDPE
- 37       geomembrane backing against the underlying compacted clay liner or cap.
- 38       Geosynthetic clay liner and cap that is internally-reinforced shall be installed with the
- 39       nonwoven backing component against the underlying compacted clay liner or cap.
- 40

- 1 G. If white colored geosynthetic clay liner and cap is used, precautions shall be taken  
2 against "snowblindness" of personnel.  
3
- 4 H. The geosynthetic clay liner and cap shall not be installed on an excessively moist  
5 subgrade or on standing water. The geosynthetic clay liner and cap shall be installed  
6 in a way that prevents hydration of the mat prior to completion of construction of the  
7 liner and final cover system, as appropriate.  
8
- 9 I. The geosynthetic clay liner and cap shall not be installed during precipitation or other  
10 conditions that may cause hydration of the geosynthetic clay liner and cap.  
11
- 12 J. Geomembrane installation shall immediately follow the geosynthetic clay liner and cap  
13 installation. All geosynthetic clay liner and cap that is placed during a day's work  
14 shall be covered with geomembrane before the OSDF Construction Subcontractor  
15 leaves the site at the end of the day. The edges of geosynthetic clay liner placement  
16 should be covered each day and protected from foundation due to stormwater runoff.  
17
- 18 K. Material shall not be placed on a geosynthetic clay liner and cap that is hydrated.  
19
- 20 L. All geomembrane seams shall be welded after each geomembrane panel is placed.  
21 Heat sealing of seams for geomembrane placed over geosynthetic clay liner and cap  
22 is not acceptable.  
23
- 24 M. All geomembrane defects and destructive sample locations shall be immediately  
25 repaired so as to prevent the ingress of moisture to the geosynthetic clay liner and cap  
26 at these locations.  
27
- 28 N. Earthen material within the liner and final cover systems shall be placed on top of the  
29 geomembrane and other geosynthetics overlying the geosynthetic clay liner and cap as  
30 soon after installation of the geosynthetic clay liner and cap as possible. The  
31 geosynthetic clay liner and cap shall be removed and replaced if it becomes hydrated  
32 before the earthen material is placed.  
33
- 34 O. All hydrated geosynthetic clay liner and cap shall be removed and replaced by the  
35 OSDF Construction Subcontractor at his expense.  
36

### 37 3.05 OVERLAPS

- 38
- 39 A. On slopes steeper than 10 horizontal to 1 vertical, all geosynthetic clay liner and caps  
40 shall be continuous down the slope; that is, no horizontal seams shall be allowed on  
41 the slope.

- 1  
2 B. No horizontal seams shall be allowed on the base of the landfill within 5 ft of the toe  
3 of the slope.  
4  
5 C. All geosynthetic clay liner and cap shall be overlapped in accordance with the  
6 Manufacturer's recommended procedures. As a minimum, along the length (i.e., the  
7 sides) of the mat the overlap shall be 6 inches, and along the width (i.e., the ends) the  
8 overlap shall be 12 inches.  
9

10 **3.06 MATERIALS IN CONTACT WITH THE GEOSYNTHETIC CLAY LINER AND**  
11 **CAP**

- 12  
13 A. Installation of other components of the liner system and final cover system shall be  
14 carefully performed to minimize damage to the geosynthetic clay liner and cap.  
15  
16 B. Equipment shall not be driven directly on the geosynthetic clay liner and cap.  
17  
18 C. Installation of the geosynthetic clay liner and cap in appurtenant areas, and connection  
19 of the geosynthetic clay liner and cap to appurtenances shall be made according to the  
20 Construction Drawings. The OSDF Construction Subcontractor shall ensure that the  
21 geosynthetic clay liner and cap is not damaged while working around the  
22 appurtenances.  
23

24 **3.07 REPAIR**

- 25  
26 A. Any holes or tears in the geosynthetic clay liner and cap shall be repaired by placing  
27 a geosynthetic clay liner and cap patch over the hole. On slopes greater than 5  
28 percent, the patch shall overlap the edges of the hole or tear by a minimum of 2 feet  
29 in all directions. On slopes 5 percent or flatter, the patch shall overlap the edges of  
30 the hole or tear by a minimum of 1 foot in all directions. The patch shall be secured  
31 with a water-based adhesive approved by the Manufacturer.  
32  
33 B. Care shall be taken to remove any soil or other material which may have penetrated  
34 the torn geosynthetic clay liner and cap.  
35  
36 C. All repairs shall be made at the OSDF Construction Subcontractor's expense.  
37  
38 D. The patch shall not be nailed or stapled.  
39  
40  
41

1     **3.08     CONFORMANCE TESTING**

- 2
- 3     A.   Samples of the geomembrane will be removed by the CQC Consultant and sent to a
- 4        geosynthetics CQC laboratory for testing to ensure conformance with the requirements
- 5        of this Section. The OSDF Construction Subcontractor shall assist the CQC
- 6        Consultant in obtaining conformance samples. The OSDF Construction Subcontractor
- 7        shall account for this testing in the installation schedule. Only material that meets the
- 8        requirements of Part 2.01 of this Section shall be installed
- 9
- 10    B.   Samples and tests shall be selected by the CQC Consultant in accordance with this
- 11        Section.
- 12
- 13    C.   Samples shall be taken at a minimum frequency rate of one sample per 100,000 square
- 14        feet with a minimum of one sample per lot. If the OSDF Construction Subcontractor's
- 15        supplier provides material that requires sampling at a frequency (due to lot size,
- 16        shipment size, etc.) resulting in one sample per less than 90 percent of this value, then
- 17        OSDF Construction Subcontractor shall pay the cost for all additional testing beyond
- 18        one per less than 90 percent of this amount.
- 19
- 20    D.   The CQC Consultant may increase the frequency of sampling in the event that test
- 21        results do not comply with the requirements of Part 2.01 of this Section until passing
- 22        conformance test results are obtained for all material that is received at the site. This
- 23        additional testing shall be performed at the expense of the OSDF Construction
- 24        Subcontractor.
- 25
- 26    E.   As a minimum, the following conformance tests will be performed: mass per unit area,
- 27        hydraulic conductivity, and internal shear strength.
- 28
- 29    F.   Any geosynthetic clay liner and cap that are not certified by the geosynthetic clay liner
- 30        and cap Manufacturer in accordance with Part 1.05 of this section, or that has a
- 31        hydraulic conductivity greater than that specified in Part 2.01 shall be rejected and
- 32        replaced by the OSDF Construction Subcontractor at his own expense.
- 33

34     **3.09     PROTECTION OF WORK**

- 35
- 36    A.   The OSDF Construction Subcontractor shall use all means necessary to protect all
- 37        work of this Section.
- 38
- 39    B.   In the event of damage, the OSDF Construction Subcontractor shall immediately make
- 40        all repairs and replacements necessary to the approval of the Construction Contract
- 41        Manager and at the OSDF Construction Subcontractor's expense.

TABLE 02772-1

## REQUIRED GEOSYNTHETIC CLAY LINER PROPERTY VALUES

PROPERTIES	QUALIFIERS	UNITS	SPECIFIED <sup>(1)</sup> VALUES	TEST METHOD
<u>GCL Properties</u>				
Bentonite Content	minimum	lb/ft <sup>2</sup>	1.0	ASTM D 5261
Hydraulic Conductivity (Bentonite)	minimum	cm/s	5 x 10 <sup>-9</sup>	GRI GCL-2
Moisture Content (Bentonite)	maximum	percent	75	ASTM D 2216
<u>Textured HDPE Geomembrane Properties</u>				
Thickness	average	mils	40	CRI GM 8
	minimum	mils	36	GRI GM 8
Specific Gravity		N/A	0.940 to .960	ASTM D 792 or ASTM 1505
Melt Flow Index	maximum	g/10 min	1.0	ASTM D 1238
Elongation at Yield	minimum	percent	13	ASTM D 638
Elongation at Break	minimum	percent	100	ASTM D 638
Strength at Yield	minimum	lb/in	95	ASTM D 638
Strength at Break	minimum	lb/in	50	ASTM D 638
Tear Resistance	minimum	lbs	12	ASTM D 1004 Die C puncture
Puncture Resistance	minimum	lb	25	ASTM D 4833
Carbon Black Content	range	%	2-3	ASTM D 1603
Carbon Black Dispersion	N/A	none	Category 1 or 2	ASTM D 5596

TABLE 02772-1  
(continued)

PROPERTIES	QUALIFIERS	UNITS	SPECIFIED <sup>(1)</sup> VALUES	TEST METHOD
<u>Geotextile Properties</u>				
Polymer Composition	minimum	%	95 polyester or polypropylene	
<u>Woven Geotextile</u>				
Mass Per Unit Area	minimum	oz/yd <sup>2</sup>	3.0	ASTM D 5261
Grab Strength	minimum	lb	108	ASTM D 4632 <sup>(2)</sup>
Tear Strength	minimum	lb	54	ASTM D 4533 <sup>(2)</sup>
Puncture Strength	minimum	lb	54	ASTM D 4833
Mullen Burst Strength	minimum	psi	270	ASTM D 3786
<u>Nonwoven Geotextile</u>				
Mass Per Unit Area	minimum	oz/yd <sup>2</sup>	5.4	ASTM D 5261
Grab Strength	minimum	lb	135	ASTM D 4632 <sup>(2)</sup>
Tear Strength	minimum	lb	54	ASTM D 4533 <sup>(2)</sup>
Puncture Strength	minimum	lb	72	ASTM D 4833
Mullen Burst Strength	minimum	psi	250	ASTM D 3786

Notes: 1. All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).

2. Minimum value measured in machine and cross machine direction.

[END OF SECTION]

SPECIFICATION COVER SHEET

SPECIFICATION SECTION: 02920 TITLE: TOPSOIL  
 Specifications By: Signature J.F. Beek 23 OCT 95  
 (Cognizant Engineer) Date  
 Printed Name J.F. BEEK, PRINCIPAL  
 and Title

Scope and Format  
 Checked By: Signature R Neal Davies 10/23/95  
 (Checker) Date  
 Printed Name R NEAL DAVIES Senior Project. Eng  
 and Title

Detailed Requirements  
 Checked by: Signature Not Used for 30% Submittal B.B. Mazanti 2/23/96  
 (Checker) Date  
 Printed Name B. B. MAZANTI  
 and Title Consultant

Overall Review By: Signature Not Used for 30% Submittal Mark H. Gleason 20 Feb 96  
 (PDP) Date  
 Printed Name Mark H. Gleason  
 and Title Assistant Project Engineer

Approved by: Signature Not Used for 30% Submittal J.F. Beek 23 Feb 96 BAp 96  
 (DTL) Date  
 Printed Name Beek, Principal Kenneth W Cargill  
 and Title Associate

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
<u>0A</u>	<u>30% Submittal</u>				
<u>B</u>	<u>Report for EPA submitted</u>	<u>14 Dec 95</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>C</u>	<u>Intermediate Design</u>	<u>23 Feb 96</u>	<u>-</u>	<u>-</u>	<u>JFB</u>
<u>D</u>	<u>Intermediate Design, EPA Submitted</u>	<u>8 Apr 96</u>	<u>K</u>	<u>-</u>	<u>-</u>

## SECTION 02920

## TOPSOIL

## PART 1 GENERAL

## 1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment and incidentals necessary to perform the work. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. The work specified in this Section shall include, but not necessarily be limited to: mixing, loading, and hauling of topsoil from either an on-site or off-site source; placing the topsoil; and grading the topsoil. Topsoil shall conform to the dimensions, lines, grades, and sections shown on the Construction Drawings or as directed by the Construction Contracts Manager.

## 1.02 RELATED SECTIONS

- A. Section 01010 - Summary of Work
- B. Section 01025 - Measurement and Payment
- C. Section 02200 - Earthwork
- D. Section 02250 - Vegetative Soil Layer
- E. Section 02270 - Erosion and Sediment Control
- F. Section 02930 - Vegetation

## 1.03 MEASUREMENT AND PAYMENT

Measurement and payment shall be in accordance with Section 01025.

## 1.04 REFERENCES

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility*," dated [REDACTED].
- B. Site Health and Safety Plan.

- 1 C. Site Construction Quality Assurance (CQA) Plan.  
2  
3 D. U.S. Department of Agriculture (USDA) Triangular Textural Classification.  
4  
5 E. Latest version of American Society for Testing and Materials (ASTM) Standards:  
6 1. ASTM D 422. Standard Method for Particle-Size Analysis of Soils.  
7 2. ASTM D 2487. Standard Test Method for Classification of Soils for  
8 Engineering Purposes.  
9 3. ASTM D 2974. Standard Test Methods for Moisture, Ash, and Organic Matter  
10 of Peat and Other Organic Soil.  
11 4. ASTM D 4318. Standard Test Method for Liquid Limit, Plastic Limit, and  
12 Plasticity Index of Soils.

### 14 1.05 SUBMITTALS

- 15  
16 A. If the OSDF Construction Subcontractor is directed to use off-site sources, he shall  
17 submit the following information to the Construction Contract Manager at least ten  
18 working days prior to the start of topsoil delivery:  
19 1. written information on the source of the topsoil; and  
20 2. written certification that the topsoil meets the requirements of this Section.  
21  
22 B. If topsoil is to be imported to the site, the OSDF Construction Subcontractor shall  
23 provide evidence to the Construction Contract Manager prior to importing topsoil that  
24 the material has been tested, using USEPA SW846 test standards, for constituents  
25 contained in the USEPA target analyte list (TAL) and target compound list (TCL).  
26 The Construction Contract Manager will evaluate these results to establish that the fill  
27 material is clean.  
28  
29 C. If the work of this Section is interrupted for reasons other than inclement weather, the  
30 OSDF Construction Subcontractor shall notify the Construction Contract Manager a  
31 minimum of 24 hours prior to the resumption of the work.  
32

### 33 1.06 QUALITY ASSURANCE

- 34  
35 A. The OSDF Construction Subcontractor shall ensure that the materials and methods  
36 used for construction of the topsoil meet the requirements of the Construction  
37 Drawings and this Section. Any material or method that does not conform to these  
38 documents, or to alternatives approved in writing by the Engineer will be rejected and  
39 shall be repaired or replaced by the OSDF Construction Subcontractor.  
40  
41

- B. The OSDF Construction Subcontractor shall be aware of the monitoring and field/laboratory conformance testing required by the CQA Plan. This monitoring and testing, including random conformance testing of construction materials and completed work, will be performed by the CQC Consultant. If nonconformances or other deficiencies are found in the OSDF Construction Subcontractors materials or completed work, the OSDF Construction Subcontractor will be required to repair or replace the deficiency at his expense.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Material used for topsoil shall be a clay loam, which is loose and friable.
- B. Topsoil shall be obtained from on-site borrow areas or other sources approved by the Construction Contract Manager. Acceptable topsoil shall contain not less than 3 percent organic matter as determined by loss on ignition of samples oven dried to constant weight at 824°F (440°C) is determined by ASTM D 2974, Method C. The topsoil may be amended as approved in writing by the Engineer if the organic content is less than three percent.
- C. Off-site sources shall not be used unless approved in writing by the Construction Contract Manager.

**PART 3 EXECUTION**

**3.01 FAMILIARIZATION**

- A. Prior to implementing any of the work described in this Section, the OSDF Construction Subcontractor shall become thoroughly familiar with all portions of the work falling within this Section.
- B. Inspection:
  - 1. Prior to implementing any of the work in this Section, the OSDF Construction Subcontractor shall carefully inspect the installed work of all other Sections and verify that all work is complete to the point where the installation of this section may properly commence without adverse impact.
  - 2. If the OSDF Construction Subcontractor has any concerns regarding the installed work of other Sections, he shall notify the Construction Contract Manager in

1 writing prior to commencing the work. Failure to notify the Construction  
2 Contract Manager or continuance with topsoil placement will be construed as the  
3 OSDF Construction Subcontractor's acceptance of the related work of all other  
4 Sections.  
5

### 6 3.02 PLACEMENT

7

- 8 A. Placement of topsoil shall not commence until CQC conformance evaluations by of  
9 previous work are completed the CQC Consultant, including evaluations of the OSDF  
10 Construction Subcontractor's survey results to confirm that the previous work was  
11 constructed to the required grades, elevations, and thicknesses. Should the OSDF  
12 Construction Subcontractor begin the work of this Section prior to the completion of  
13 quality control and CQA evaluations, he does so at his work risk. The OSDF  
14 Construction Subcontractor shall account for the CQC conformance evaluations in his  
15 schedule.  
16
- 17 B. Prior to spreading the topsoil, the top surface of the existing soil layer shall be  
18 scarified or otherwise loosened to a minimum depth of 1 inch.  
19
- 20 C. Topsoil shall be placed to the thickness, grades, and limits shown on the Construction  
21 Drawings. The break between slopes on the final cover system shall be rounded.  
22
- 23 D. Topsoil shall be placed over approved areas to a depth sufficiently greater than  
24 required so that after natural settlement and light rolling, the completed work will  
25 conform to the thickness requirement on the Construction Drawings.  
26
- 27 E. No topsoil shall be spread in water or while frozen or muddy. If soil or weather  
28 conditions are unsuitable, as determined by the CQC Consultant, the OSDF  
29 Construction Subcontractor shall cease placing topsoil until permission to resume  
30 topsoil operations is obtained from the CQC Consultant.  
31
- 32 F. After topsoil has been spread, it shall be prepared by scarifying or harrowing and hand  
33 raking. Stiff clods, lumps, roots, litter, and other foreign material shall be removed  
34 by the OSDF Construction Subcontractor to the satisfaction of the CQC Consultant.  
35
- 36 G. The OSDF Construction Subcontractor shall be prepared to immediately vegetate areas  
37 receiving placement of the topsoil. Vegetation shall be carried out in accordance with  
38 Section 02930 of these Specifications.  
39  
40  
41

1 **3.03 PROTECTION OF WORK**

- 2
- 3 A. The OSDF Construction Subcontractor shall use all means necessary to protect all
- 4 work of this Section.
- 5
- 6 B. In the event of damage to prior work or work completed as specified in this Section,
- 7 the OSDF Construction Subcontractor shall immediately make all repairs and
- 8 replacements necessary, to the approval of the Construction Contract Manager and at
- 9 no additional cost to the Owner.
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[END OF SECTION]

**SPECIFICATION COVER SHEET**

**SPECIFICATION SECTION:** 02930 **TITLE:** VEGETATION  
**Specifications By:** Signature J.F. Beeth 23 OCT 1995  
 (Cognizant Engineer) Date  
 Printed Name J. F. BEETH, PRINCIPAL  
 and Title

**Scope and Format**  
**Checked By:** Signature R Neal Davies 10/23/95  
 (Checker) Date  
 Printed Name R Neal Davies, Senior Project Eng.  
 and Title

**Detailed Requirements**  
**Checked by:** Signature Not Used for 30% Submittal B.B. Mazanti 2/23/96  
 (Checker) Date  
 Printed Name B. B. MAZANTI  
 and Title Consultant

**Overall Review By:** Signature Not Used for 30% Submittal Mark H. Gleason 20 Feb 96  
 (PDP) Date  
 Printed Name Mark H. Gleason  
 and Title Assistant Project Engineer

**Approved by:** Signature Not Used for 30% Submittal J.F. Beeth 23 Feb 96  
 (DTL) Date  
 Printed Name BEETH, PRINCIPAL Kenneth W Cargill  
 and Title Associate

**Record of Revision (Number and initial all revisions)**

Rev. No.	Reason	Date	By	Checked	Approval
<u>NA</u>	<u>30% Submittal</u>				
<u>B</u>	<u>Report for EPA Submittal</u>	<u>14 Dec 95</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>C</u>	<u>Intermediate Design</u>	<u>23 Feb 96</u>	<u>—</u>	<u>—</u>	<u>JFB</u>
<u>D</u>	<u>Intermediate Design, EPA Submittal</u>	<u>8 Apr 96</u>	<u>—</u>	<u>—</u>	<u>—</u>

SECTION 02930

VEGETATION

PART 1 GENERAL

1.01 SCOPE

- A. The OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals required to establish vegetation as specified herein and shown on the Construction Drawings.
- B. The work shall include, but not be limited to, hydroseeding mulching, fertilizing, and maintaining seeded areas until vegetation is established for those areas shown on the Construction Drawings and other areas disturbed by the OSDF Construction Subcontractor.

1.02 RELATED SECTIONS

- A. Section 01012 - General
- B. Section 01025 - Measurement and Payment
- C. Section 02110 - Clearing, Grubbing, and Stripping
- D. Section 02200 - Earthwork
- E. Section 02270 - Erosion and Sediment Control

1.03 MEASUREMENT AND PAYMENT

Measurement and payment shall be in accordance with Section 01025.

1.04 REFERENCES

- A. Construction Drawings, entitled, "*Fernald Environmental Management Project, On-Site Disposal Facility*", dated [REDACTED].
- B. Site Health and Safety Plan.
- C. Construction Quality Assurance (CQA) Plan.
- D. Stormwater Management and Erosion Control Plan.

1  
2 **1.05 SUBMITTALS**  
3

- 4 A. The OSDF Construction Subcontractor shall submit the following to the Construction  
5 Contracts Manager for approval acceptance at least 28 days prior to starting the work  
6 of this Section:  
7 1. Samples of proposed seed mixes, mulches, and fertilizers.  
8 2. Manufacturers product data and recommended methods of application.  
9
- 10 B. Once proposed seed mixes are approved by the Construction Contracts Manager, the  
11 OSDF Construction Subcontractor shall submit a manufacturer's certificate of  
12 compliance for each seed type. These certificates shall include the guaranteed  
13 percentages of purity, weed content, and germination of the seed, and also the net  
14 weight and date of shipment. No seed may be sown until the Construction Contracts  
15 Manager has approved certificates.  
16
- 17 C. For wood cellulose mulch, the OSDF Subcontractor shall submit a manufacturer's  
18 certificate that the mulch meets the requirements of Part 2.01F of this Section.  
19
- 20 D. The OSDF Construction Subcontractor shall supply a manufacturer certificate from the  
21 manufacturer or a testing laboratory as to the available nutrients contained in the  
22 proposed fertilizer.  
23

24 **1.06 CONSTRUCTION QUALITY ASSURANCE**  
25

26 The OSDF Construction Subcontractor shall ensure that the material and methods used  
27 for site revegetation meet the requirements of the Construction Drawings and  
28 Specifications. Any material or method that does not conform to these documents, or  
29 to alternatives approved in writing by the Engineer, will be rejected by the CQC  
30 Consultant and shall be repaired or replaced by the OSDF Construction Subcontractor  
31 at no additional cost to the Owner.  
32

33  
34 **PART 2 PRODUCTS**  
35

36 **2.01 MATERIALS**  
37

- 38 A. Seed shall be labeled in accordance with USDA Rules and Regulations under the  
39 Federal Seed Act and applicable State seed laws. Seed shall also comply with  
40 applicable State seed laws. Seed shall be furnished in sealed bags or containers  
41 bearing the date of the last germination, which date shall be within a period of 6

1 months prior to commencement of planting operations. No seed shall be used after its  
2 date of expiration. Seed shall be from same or previous year's crop. Each variety of  
3 seed shall have a purity of not less than 90%, a percentage of germination not less  
4 than 80%, shall have a weedseed content of not more than 0.75% and contain no  
5 noxious weeds. The above percentages are by weight. The seed mixtures shall consist  
6 of seed proportioned by weight in accordance with Tables 02930-1 and 02930-2. The  
7 seed mix for permanent seeding and temporary seeding shall be that identified in the  
8 Short Term and Climax Vegetation Evaluation.

- 9
- 10 B. Mulch may consist of straw or wood cellulose fiber unless otherwise noted. Mulch  
11 shall be free of clay, stones, foreign substances, plant parts of Canada Thistle and  
12 Johnson grass, and reasonably free of other weed seeds.
- 13
- 14 C. Straw shall not contain sticks larger than 1/4-inch diameter or other materials that may  
15 prevent matting down during application. No straw shall be used within 48 hours after  
16 cutting. Straw shall be free from mold and other objectionable material and shall be  
17 in an air-dry condition suitable for placing with mulch blower equipment.
- 18
- 19 D. Mulch applied by spraying shall be a specially processed wood cellulose processed into  
20 a uniform fibrous physical state. Wood cellulose fiber shall contain a green dye that  
21 will provide easy visual inspection for uniformity of the slurry spread. The wood  
22 cellulose fiber including dye, shall contain no growth or germination-inhibiting  
23 properties. It shall be manufactured in such a manner that, after addition and agitation  
24 in slurry tanks with water, the fibers in the material become uniformly suspended to  
25 form a homogeneous material. When sprayed on the ground, the material shall allow  
26 absorption and percolation of moisture. The manufacturer shall submit a certificate  
27 that the wood cellulose fiber meets the following requirements:

<u>Quantity</u>	<u>Specification Limit</u>
Particle Length	0.375 inch
Particle Thickness	0.047 inch
Net Dry Weight Content	minimum stated on bag
pH	4.0 to 8.5
Ash Content	1.6% maximum
Water Holding Capacity	90% minimum

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38 The material shall be delivered in packages of uniform weight not exceeding 75 pounds  
39 net weight and bear the name of the manufacturer, the net weight, and a supplemental  
40 statement of net weight content.

41

1 E. Fertilizer shall be standard commercial grade fertilizer meeting the requirements of all  
 2 State and Federal regulations and standards of the Association of Office Agricultural  
 3 Chemists. Fertilizer shall be delivered to the site in original, properly labeled,  
 4 unopened, clean, containers each showing the manufacturer's guaranteed analysis  
 5 conforming to applicable fertilizer regulations and standards. Fertilizer failing to meet  
 6 the specified analysis may be used as determined by the Engineer providing sufficient  
 7 materials are applied to comply with the specified nutrients per unit of measure without  
 8 additional cost to the Owner. Fertilizer shall be 10-10-10 or as modified by the  
 9 Construction Contract Manager based on testing of the topsoil. Fertilizer shall be  
 10 applied to all areas receiving seed.

11  
12  
13 **PART 3 EXECUTION**

14  
15 **3.01 FAMILIARIZATION**

- 16  
17 A. Prior to implementing any of the work described in this Section, the OSDF  
 18 Construction Subcontractor shall become thoroughly familiar with all portions of the  
 19 work falling within this Section.  
 20  
 21 B. Inspection:  
 22 1. Prior to implementing any of the work in this Section, the OSDF Construction  
 23 Subcontractor shall carefully inspect the installed work of all other Sections and  
 24 verify that all work is complete to the point where the installation of this section  
 25 may properly commence without adverse impact.  
 26 2. If the OSDF Construction Subcontractor has any concerns regarding the installed  
 27 work of other Sections, he shall notify the Construction Contracts Manager in  
 28 writing within 48 hours of his site inspection. Failure to inform the Construction  
 29 Contracts Manager in writing of performance of work in this Section will be  
 30 construed as OSDF Construction Subcontractor's acceptance of the related work  
 31 of all other Sections.

32  
33 **3.02 APPLICATION**

- 34  
35 A. Fertilizer, seed, and mulch shall be applied to topsoil areas on the OSDF final cover  
 36 system, to the OSDF seasonal cover, and to any disturbed areas adjacent to the OSDF  
 37 requiring vegetative cover.  
 38  
 39 B. For all areas to be seeded:  
 40 1. Fertilizer (10-10-10) shall be applied at a uniform rate of 1,000 pounds per acre  
 41 or as determined by the Engineer/Construction Contracts Manager.

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- 2. The specified seed mix shall be applied at the rates indicated on Tables 2930-01 and 2930-02.
  - 3. Mulch applied either by hand or by the blowing method shall be spread at the rate of 2.5 air-dried tons per acre or 70 to 90 pounds (two bales) per 1,000 square feet within 24 hours of seeding.
  - 4. Wood cellulose fiber used as mulch shall be applied at a dry net weight of 750 pounds per acre. The wood cellulose fiber shall be mixed with water at a maximum rate of 50 pounds of wood cellulose fiber per 100 gallons.
- C. The application of fertilizer may be performed hydraulically in one operation with hydroseeding. The OSDF Construction Subcontractor is responsible for cleaning all structures and paved areas of unwanted deposits of the hydroseed mixture.

**3.03 INSTALLATION**

- A. Previously established grades, as shown on the Drawings, shall be maintained in a true and even condition.
- B. Seeding, conditioning, and mulching shall only be performed during those periods within the seasons that are normal for such work as determined by the weather and locally accepted practice and as approved by the Engineer. The OSDF Construction Subcontractor shall hydroseed only on a calm day with winds below twenty miles per hour. No seeding shall be done on frozen ground or when the temperature is 32°F or lower.
- C. The OSDF Construction Subcontractor shall notify the Construction Contracts Manager 24 hours prior to seeding or fertilizing.
- D. Permanent seeding or the closure cap shall be accomplished between the period of 15 March through 31 May and 1 August through 30 September. Seeding outside of this period shall only be undertaken upon approval of the Engineer. A crusting agent shall be applied to areas requiring vegetation between 1 November and 14 March.
- E. Before seeding, all gullies, washes, or disturbed areas that develop subsequent to final dressing of topsoil shall be repaired. Areas to be hydroseeded shall be scarified. All other areas shall be loosened to a depth of 4 to 6 inches by discing, harrowing, or other approved methods immediately prior to seeding.
- F. Fertilizer shall be applied dry at the specified rate or hydraulically with seed. Fertilizer applied dry shall be raked into the prepared topsoil to a depth of 4 to 6 inches.

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- G. Seeding shall be done within three days following topsoil placement. Seed shall be applied by drilling, broadcasting, or hydroseeding. Seeding by drilling shall be done to a depth of 0.25 in. followed by cultipacking. Broadcasted seed shall be covered with 0.25 in. of topsoil using a light harrow or similar equipment. The fertilizer and seed shall be applied at the rates and percentages indicated in Tables 02930-01 and 02930-02. The spraying equipment and mixture shall be so designed that when the mixture is sprayed over an area, the fertilizer, grass seed, and/or mulch shall be equal in quantity to the specified rates. Prior to the start of work, the OSDF Construction Subcontractor shall furnish the Construction Contracts Manager with a certified statement as to the number of pounds of materials to be used per 100 gallons of water. Seed and/or fertilizer shall be mixed together with water in the relative proportions specified so that these combined solids do not exceed 300 pounds per 100 gallons. Mixing shall be done within one hour of application. The water-seed-fertilizer mixture shall be applied at a minimum rate of 1,000 gallons/acre. This statement shall also specify the number of square feet of seeding that can be covered with the quantity of solution in the OSDF Construction Subcontractor's hydroseeder. Upon completion of seeding operations, the OSDF Construction Subcontractor shall furnish the Engineer with a certified statement on the actual quantity of solution applied. After hydroseeding on flat areas, the seedbed shall be immediately rolled with a hand roller weighing 40 to 65 pounds per foot of width unless an intervening precipitation causes such rolling to be detrimental to the seeded area.
- H. Mulch materials shall be applied on seeded areas within 24 hours after seeding. Mulch applied by hand shall provide a loose depth of not less than 1.5 inches nor more than 3 inches. Mulch applied by the blowing method shall provide a loose depth of not less than 1 inch nor more than 2 inches, and 95% of the mulch shall be 6 inches or more in length. Mulch applied by the above methods shall achieve a uniform distribution and depth so that no more than 10% of the soil surface is exposed.
- I. In order to prevent unnecessary erosion of newly topsoiled and graded slopes and unnecessary siltation of drainage ways, the OSDF Construction Subcontractor shall carry out seeding and mulching as soon as he has satisfactorily completed a unit or portion of the project and/or as directed by the Engineer. For the purpose of this project a unit is defined as 10,000 square feet. When protection of newly topsoiled and graded areas is necessary at a time which is outside of the normal seeding seasons, the OSDF Construction Subcontractor shall protect those areas by whatever means necessary, as approved by the Engineer, and shall be responsible for prevention of siltation in the areas beyond the limit of work.

1     **3.04     MAINTENANCE, AND PROVISIONAL ACCEPTANCE**

- 2
- 3     A.   The OSDF Construction Subcontractor shall keep all seeded areas watered, lawn areas
- 4       moved and in good condition, reseeding all seeded areas if and when necessary until
- 5       a good, healthy, uniform growth is established over the entire area seeded, and shall
- 6       maintain all seeded areas in an approved condition until provisional acceptance.
- 7       Irrigation water shall be applied at a maximum of 0.15 in./hour.
- 8
- 9     B.   The CQC Consultant will inspect all work for provisional acceptance at the end of the
- 10      ten week maintenance period, upon the OSDF Construction Subcontractor's written
- 11      request received at least ten days before the anticipated date of inspection. The
- 12      maintenance period must occur during the growing season of 15 March to
- 13      1 November.
- 14
- 15    C.   A satisfactory stand will be defined as a section of turf of 10,000 square feet or larger
- 16      that has:
- 17      1.   No bare spots larger than three square feet.
- 18      2.   No more than ten percent of total area with bare spots larger than one square
- 19      foot.
- 20      3.   Not more than fifteen percent of total area with bare spots larger than 6-in.
- 21      square.
- 22
- 23    D.   The OSDF Construction Subcontractor shall furnish full and complete written
- 24      instructions for maintenance of the seeded areas to the Construction Contracts Manager
- 25      at the time of provisional acceptance.
- 26
- 27    E.   The inspection by the CQC Consultant will determine whether maintenance shall
- 28      continue in any area or manner.
- 29
- 30    F.   After all necessary corrective work and clean-up has been completed, and maintenance
- 31      instructions have been received by the Construction Contracts Manager, the CQC
- 32      Consultant will certify in writing the provisional acceptance of the lawn areas. The
- 33      OSDF Construction Subcontractor's responsibility for maintenance of lawns, or parts
- 34      of lawns shall cease on receipt of provisional acceptance.
- 35

36     **3.05     GUARANTEE PERIOD AND FINAL ACCEPTANCE**

- 37
- 38    A.   All seeded areas shall be guaranteed by the OSDF Construction Subcontractor for not
- 39      less than one full year from the time of provisional acceptance.
- 40

- 1 B. At the end of the guarantee period, inspection will be made by the Construction  
2 Contracts Manager upon written request submitted by the OSDF Construction  
3 Subcontractor at least ten days before the anticipated date. Seeded areas not  
4 demonstrating satisfactory stands of vegetation as outlined above, or as determined by  
5 the CQC Consultant, shall be renovated, reseeded, and maintained to meet all  
6 requirements as specified herein at the OSDF Construction Subcontractor's expense.  
7
- 8 C. After all necessary corrective work has been completed, the CQC Consultant shall  
9 certify in writing the final acceptance of the seeded areas.

10  
11 **3.06 PRODUCT PROTECTION**

- 12
- 13 A. The OSDF Construction Subcontractor shall use all means necessary to protect all  
14 prior work and materials and completed work of other Sections.  
15
- 16 B. In the event of damage, the OSDF Construction Subcontractor shall immediately make  
17 all repairs and replacements necessary, to the approval of the Construction Contract  
18 Manager and at no additional cost to the Owner.  
19  
20

TABLE 02930-01

## SEED MIXES FOR PERMANENT COVER ON AND OFF CAP

Slope - Moisture Class	Species/Planting Period Class			
	Native Species/Apr - May <sup>1</sup>		Pasture Species/Mar 15 - May or Aug - Sep	
	Species <sup>2</sup>	lb/ac	Species	lb/ac
Wet (Swales - Waterways)	Big Bluestem	10	Reed Canarygrass	8
	Switchgrass	5	Kentucky Bluegrass <sup>3</sup>	10
			Alsike Clover	5
Moist (Slopes or 1-9 percent)	Big Bluestem	5	Creeping Red Fescue	20
	Indiangrass	5	Annual Ryegrass	10
	Canada Wildrye	1	Kentucky Bluegrass <sup>3</sup>	15
	Switchgrass	3	Alsike Clover	5
Dry (Slopes of 10-17 percent)	Big Bluestem	5	Creeping Red Fescue	20
	Indiangrass	5	Annual Ryegrass	10
	Canada Wildrye	3	Kentucky Bluegrass <sup>3</sup>	10
	Switchgrass	5	Flatpea	5

- Notes:
1. Switchgrass should be frost seeded (Jan - Feb) by broadcasting into winter cover.
  2. "Cave-in-rock" switchgrass variety recommended. Species other than switchgrass planted by drilling during April - May.
  3. Substitute Red Top on strongly acid sites.

**TABLE 02930-02**  
**SEED MIXES FOR SEASONAL COVER**

Slope - Moisture Class	Planting Period			
	Warm Season (Jun - Aug)		Cool Season (Aug - Nov)	
	Species	lb/ac	Species	lb/ac
Wet (Swales - Waterways)	Annual Ryegrass	40	Annual Ryegrass	40
Moist (Slopes or 1-9 percent)	Oats Sudangrass	64 80 3	Rye Perennial Ryegrass	80 20
Dry (Slopes of 10-33 percent)	Oats Sudangrass	64 80	Rye Perennial Ryegrass	80 20
Dry (Slopes > 33 percent)	Korean Iespedeza Sudangrass	8 80	No Slopes <33 Percent planned for this period	

[END OF SECTION]

SPECIFICATION COVER SHEET

SPECIFICATION SECTION: 15000 TITLE: MECHANICAL

Specifications By: Signature Laurence W Fly 2-26-96  
(Cognizant Engineer) Date

Printed Name LAURENCE W. FLY  
and Title PROJECT MANAGER

Scope and Format Checked By: Signature Brian D. Jacobson 26 Feb 96  
(Checker) Date

Printed Name BRIAN D. JACOBSON  
and Title STAFF ENGINEER

Detailed Requirement: Checked by: Signature Brian D. Jacobson \_\_\_\_\_  
(Checker) Date

Printed Name BRIAN D. JACOBSON  
and Title STAFF ENGINEER

Overall Review By: Signature Kenneth W Cargill 26 Feb 96  
(PDP) Date

Printed Name Kenneth W Cargill  
and Title

Approved by: Signature J.F. Becht 26 Feb 96  
(DTL) Date

Printed Name BECHT PRINCIPAL  
and Title

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
A	Intermediate Design	26 Feb 96	-	-	JFB
D	Intermediate Design, EPA submitted	8 Apr 96	<u>[Signature]</u>	-	-

SECTION 15000

MECHANICAL

PART 1: GENERAL

1.01 SCOPE

- A. This OSDF Construction Subcontractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary for the following mechanical systems:
  - 1. Temporary lift station pumps, check valve, manual valves, flowmeter, pump enclosure piping, pump control panel, associated instrumentation, radio receiver, radio antenna, alarm lights, electrically actuated isolation valve, and all other work indicated on Construction Drawings or as specified herein.
  - 2. Permanent lift station electrically actuated isolation valve, lift station control panel, associated instrumentation, radio transmitter, radio antenna, alarm light, and all other work indicated on Construction Drawings or as specified herein.
  - 3. Leak detection manholes control panels and associated instrumentation, alarm lights, and all other work indicated on Construction Drawings or as specified herein and all other work indicated on Construction Drawings or as specified herein.
  - 4. Leachate collection manholes manual valves and instrumentation, and all other work indicated on Construction Drawings or as specified herein.
- B. All material and equipment for proper installation and operation of the work included under this section shall be purchased, procured, installed and tested as required by this Section.
- C. The temporary lift station pump control panel, associated instrumentation, radio receiver, radio antenna and alarm light shall be furnished complete and turned over to the electrical contractor for installation. Coordination with all trades shall be included in the work.
- D. Permanent lift station control panel, associated instrumentation, electric valve actuator, radio transmitter, radio antenna, and alarm light shall be furnished complete and turned over to the electrical contractor for installation. Coordination with all trades shall be included in the work.
- E. Leak detection manholes control panels and associated instrumentation, and alarm light shall be furnished complete and turned over to the electrical contractor for installation. Coordination with all trades shall be included in the work.

- 1 F. Leachate collection manholes control panels and associated instrumentation, and alarm
- 2 light shall be furnished complete and turned over to the electrical contractor for
- 3 installation. Coordination with all trades shall be included in the work.
- 4
- 5 G. Additional work included in this section is the testing/startup and the coordination with
- 6 other Contractors to support testing/startup activities of the following:
- 7 1. Temporary lift station pumps, check valve, manual valves, flowmeter, pump
- 8 enclosure piping, pump control panel, associated instrumentation, radio receiver,
- 9 radio antenna, and alarm lights.
- 10 2. Permanent lift station electrically actuated isolation valve, lift station alarm and
- 11 level control panel, associated instrumentation, radio transmitter, radio antenna,
- 12 and alarm light.
- 13 3. Leak detection manholes control panels and associated instrumentation, and alarm
- 14 lights.
- 15 4. Leachate collection manholes control panels and associated instrumentation, and
- 16 alarm lights.
- 17
- 18 H. Work not included or items of labor and material provided and/or installed under other
- 19 divisions of these Specifications are as follows:
- 20 1. The temporary lift station pump control panel, associated instrumentation, radio
- 21 receiver, radio antenna and alarm light shall be furnished complete and turned
- 22 over to the electrical contractor for installation. Coordination with all trades shall
- 23 be included in the work.
- 24 2. Permanent lift station control panel, associated instrumentation, electric valve
- 25 actuator, radio transmitters, radio antenna, and alarm light shall be furnished
- 26 complete and turned over to the electrical contractor for installation.
- 27 Coordination with all trades shall be included in the work.
- 28 3. Leak detection manholes control panels and associated instrumentation, and alarm
- 29 light shall be furnished complete and turned over to the electrical contractor for
- 30 installation. Coordination with all trades shall be included in the work.
- 31 4. HDPE pipe, fittings, manholes, appurtenances, HDPE leak detection piping,
- 32 HDPE leachate collection piping, HDPE leachate transmission piping, and force
- 33 main piping.
- 34

**1.02 RELATED SECTION**

- 35
- 36
- 37 A. Section 01012 - General Requirements
- 38
- 39 B. Section 01025 - Measurement and Payment
- 40
- 41

1 C. Section 02610 - HDPE Pipe, Fittings, and Valves

2  
3 D. Section 16000 - Electrical

4  
5 **1.03 MEASUREMENT AND PAYMENT**

6  
7 Measurement and payment shall be in accordance with Section 01025.

8  
9 **1.04 REFERENCES**

10  
11 A. All materials and methods shall conform to applicable requirements of documents listed  
12 below. In case of conflict between this Section and the listed documents, the  
13 requirements of this Section shall prevail:

- 14 1. ANSI A13.1 Piping and piping systems
- 15 2. ANSI A74 Cast Iron Soil Pipe and Fittings
- 16 3. API 1104 Welding of Pipeline and Related Facilities
- 17 4. ASME Boiler Code (Class I)
- 18 5. ASME B2.1 Pipe Threads (except Dryseal)
- 19 6. ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings
- 20 7. ASME B31.1 Power Piping
- 21 8. ASME B31.3 Chemical Plant and Petroleum Refinery Piping
- 22 9. ASTM A53 Specification for Pipe, Steel, Bland & Hot-Dipped Zinc Coated  
23 Welded and Seamless
- 24 10. ASTM A312 Seamless and Welded Austenitic Stainless Steel Pipe
- 25 11. ASTM A403 Wrought Austenitic Stainless Steel Piping Fittings
- 26 12. ASTM D2683 Specification for Socket-Type Polyethylene Fittings for Outside  
27 Diameter-Controlled Polyethylene Pipe Tubing
- 28 13. ASTM D3261 Specification for Butt Heat Fusion Polyethylene (PE) Plastic  
29 Fittings for Polyethylene (PE) Plastic Pipe Tubing
- 30 14. ASTM F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- 31 15. AWWA C101 Standard for Thickness Design of Cast Iron Pipe
- 32 16. AWWA C111 Standard for Rubber Gasket Joints for Ductile Iron and Gray  
33 Iron Pressure Pipe and Fittings
- 34 17. AWWA C115 Standard for Flanged Cast Iron and ductile Iron Pipe with  
35 Threaded Flanges
- 36 18. AWWA C151 Standard for Ductile Iron Pipe, Centrifugally Cast, in Metal  
37 Molds or Sand Lined Molds for Water and Other Liquids
- 38 19. AWWA C200 Standard for Steel Water Pipe, Six Inches and Larger
- 39 20. AWWA C203 Standard for Coal-Tar Protective Coatings and Linings for Steel  
40 Water Pipelines - Enamel and Tape-Applied.
- 41 21. AWWA C206 Standard for Field Welding of Steel Water Pipe



- 3. Leak detection manholes control panels and associated instrumentation, solar collector panels, solar system control panel and rotating beacon alarm light.
- 4. The decon facility sump pump control panel, associated instrumentation, motor operated valve and rotating beacon alarm light.

B. Relocation of equipment indicated on Construction Drawings shall be approved by the Engineer.

C. Any work installed contrary to Contract Drawings shall be subject to correction as directed by the Engineer, and no extra compensation will be allowed for making these changes.

**1.08 COORDINATION OF THE WORK**

A. The OSDF Construction Subcontractor shall check the drawings of the various trades before submitting his bid and shall be responsible, under this Section of the Specifications, for the proper coordination of the work, with the installation clearances under other Sections. Any changes required to avoid interferences shall be submitted to the Construction Contract Manager for review and shall be made as directed, without additional cost to the Owner.

B. Examine all drawings for location of equipment to be installed under this Section.

**1.09 SHOP DRAWING REVIEW**

A. At least ten working days prior to the start of installation of mechanical equipment, the OSDF Construction Subcontractor shall submit for review, details of all materials, equipment and systems to be furnished under this Section in accordance with requirements of Section 01350.

B. The OSDF Construction Subcontractor shall submit a listing of all the materials indicated below, with the type of construction materials, manufacturer and catalog or model number, pump curves, electrical characteristics, etc. This will include: temporary lift station pumps and temporary lift station pump control panels.

C. Shop drawings shall include dimensions, ratings, mounting requirements, clearances, components interface, wiring diagrams and other information required for proper evaluation and complete installation.

D. The approval of systems, equipment and shop drawings is a general approval subject to the contract drawings, specifications and verification of all measurements at the job

1 site. Approval does not relieve the OSDF Construction Subcontractor from the  
2 responsibility of shop drawing errors. The OSDF Construction Subcontractor shall  
3 carefully check and correct all shop drawings prior to submission for approval.  
4

- 5 E. "Record" copies of all shop drawings shall be submitted to the Engineer before final  
6 inspection and acceptance.  
7
- 8 F. No material shall be ordered or shop work started until the Engineer's review of shop  
9 drawings has been completed.  
10

### 11 1.10 SUBSTITUTIONS

- 12
- 13 A. Where equipment is identified by manufacturer and catalog number, it shall be  
14 construed as the base of requirements for quality and performance. Where  
15 manufacturers for equipment are identified by name, the OSDF Construction  
16 Subcontractor may submit for approval, similar equipment of other manufacturers as  
17 substitution. It is the OSDF Construction Subcontractor's responsibility to prove that  
18 proposed equipment is equal to that specified. The decision of the Construction  
19 Contract Manager as to whether the submitted equipment is acceptable shall be final  
20 and binding.  
21
- 22 B. All changes necessary to accommodate the substituted equipment shall be made at the  
23 OSDF Construction Subcontractor's expense, and shall be as approved by the  
24 Construction Contract Manager. Detailed drawings indicating the required changes  
25 shall be submitted for approval at the time the substitution is requested.  
26

### 27 1.11 GUARANTEE

28

29 The OSDF Construction Subcontractor shall guarantee to correct all defects in material,  
30 equipment, or workmanship disclosed within a period of one (1) year from date of project  
31 acceptance by the Owner.  
32

### 33 1.12 OPERATING AND MAINTENANCE MANUAL

34

35 After completion of the work, the OSDF Construction Subcontractor shall furnish and  
36 deliver to the Construction Contract Manager four (4) copies of a complete equipment  
37 operations and maintenance manual. Each manual shall include one (1) copy each of all  
38 approved shop drawings, catalog pages, instruction sheets, operating instructions,  
39 installation and maintenance instructions, spare parts bulletin, and a wiring diagram for the  
40 submersible cell pumps systems.  
41

1 **1.13 STANDARDS**

- 2
- 3 A. All materials and equipment furnished under this section shall be new and comply with
- 4 the applicable standards of the entities listed below:
- 5 1. American National Standards Institute - ANSI
- 6 2. American Society for Testing Materials - ASTM
- 7 3. American Standard Association - ASA
- 8 4. National Electric Code - NEC
- 9 5. National Electrical Manufacturers' Association - NEMA
- 10 6. Occupational Safety & Health Act - OSHA
- 11 7. Underwriters' Laboratories, Inc. - UL
- 12 8. Factory Mutual - FM
- 13 9. Electrical Testing Laboratories, Inc. - ETL

14  
15 **1.14 CODE RULES, INSPECTION FEES AND WORKMANSHIP**

- 16
- 17 A. The installation shall comply with the regulations of the Standard Mechanical and
- 18 Plumbing Codes (1991 Edition), and all authorities having jurisdiction. Where the
- 19 drawings and/or Specifications exceed these requirements then the drawings and/or
- 20 Specifications shall take precedence.
- 21
- 22 B. The certificates of final inspection and certificates of approval of all authorities shall
- 23 be delivered to the Engineer.
- 24
- 25

26 **PART 2: PRODUCTS**

27  
28 **2.01 TEMPORARY LIFT STATION PUMP**

- 29
- 30 A. The temporary lift station pumps shall be Type C, horizontally mounted, single stage
- 31 centrifugal pumps, close-coupled to electric 120/240 VAC, 1 phase motors.
- 32
- 33 B. The temporary lift station pumps shall be capable of drawing water a minimum of
- 34 15 ft above the temporary lift station manhole floor with a discharge flow rate of
- 35 100 GPM, and a total dynamic head of 120 feet.
- 36
- 37 C. The temporary lift station pump casing, suction flange and discharge flange shall be
- 38 316SS with bronze impeller.
- 39
- 40 D. The temporary lift station pumps shall function with the following environmental
- 41 conditions:

- 1 1. Compensated temperature range of 0°C to 50°C.
- 2 2. Operating temperature range of -20°C to 70°C.

3  
4 E. The pumps shall be Burk Pumps, Burk Pumps Division, Model 30G6-1-1/2.

5  
6 F. The OSDF Construction Subcontractor shall install the temporary lift station pumps,  
7 motors, discharge valve, flowmeter, piping, and wiring in the pump enclosure in  
8 accordance with manufacturer's instructions and as detailed on Construction Drawings.

## 9 10 **2.02 TEMPORARY LIFT STATION PUMP CONTROL PANEL**

11  
12 A. The pump control panel shall operate the pump motor and auxiliary equipment in  
13 manual or automatic mode. The panel enclosure shall be NEMA Type 3R.

14  
15 B. Pump control panel enclosure shall be NEMA Type 3R, 14 gauge, G-90 galvanized  
16 steel, with all surfaces phosphatized, finished inside and outside with ANSI 61 gray  
17 polyester power finish, with an outer door and inner panel face door.

- 18 1. The panel shall have a full width drip shield formed into the top cap to prevent  
19 standing water from dripping into the interior when door is opened.
- 20 2. The panel drip shield and formed edges of the enclosure shall provide a seating  
21 surface for the full door gasket.
- 22 3. The outer door and inner panel face door shall be equipped with two galvanized  
23 hinges with stainless steel hinge pins.
- 24 4. The panel outer door shall be equipped with two padlock-capable draw-pull  
25 latches.
- 26 5. The panel shall have removable steel component mounting panel plate finished in  
27 white enamel and shall be drilled and tapped for component mounting.

28  
29 C. The control system shall operate from a 120 volt, 60 hertz, 1 phase power feed. The  
30 pump control components shall be sized to operate pump motor of specified  
31 horsepower.

32  
33 D. The control panel shall include the following as standard features:

- 34 1. "Hand-Off-Auto" Selector Switches, one (1) for each pump, which allows manual  
35 or automatic operation. The selector switch shall be a heavy duty, oil tight,  
36 NEMA 3R rated switch mounted on the inner panel face door.
- 37 2. Pump run lights, one (1) for each pump, indicating motor circuit energized,  
38 mounted on the inner panel face door. Lights shall be heavy duty, oil tight,  
39 NEMA 3R rated with voltage surge suppressor built-in to prolong lamp life.

- 1 3. Pump stop lights, one (1) for each pump, indicating circuit de-energized, mounted  
2 on the inner panel face door. Lights shall be heavy duty, oil tight, NEMA 3R  
3 rated with voltage surge suppressor built-in to prolong lamp life.
- 4 4. Heater with adjustable thermostat: to promote even distribution of heat and  
5 elimination of hot spots and condensation. Heater element shall be mounted in  
6 space between the subpanel and the back of the enclosure and provide a minimum  
7 of 50 watt of heating capacity.
- 8 5. Terminal Strip: this provides easy connection of external components.
- 9 6. 2-Honeywell UDC 3000 Versa-Pro Universal Digital Programmable Level  
10 Controller/Level Indicators mounted in a cutout on the inner panel face door, with  
11 the following:
  - 12 a. Digital level indication readout accurate to  $\pm 0.1$  inch water.
  - 13 b. Minimum of 4 alarm relay contacts rated at 5 amps at 120 VAC.
  - 14 c. Minimum of 4 alarm signal inputs rated at 4-20mA/250 Ohms, 0-10 V.
- 15 7. Honeywell UDC 3000 Versa-Pro Universal Digital Programmable Flow  
16 Controller/Flow Indicator mounted in a cutout on the inner panel face door, with  
17 the following:
  - 18 a. Digital flow indication readout accurate to  $\pm 3$  gallons per minute.
  - 19 b. Minimum of 4 alarm relay contacts rated at 5 amps at 120 VAC.
  - 20 c. Minimum of 4 alarm signal inputs rated at 4-20mA/250 Ohms, 0-10 Volts.
- 21 8. Square D Automatic Electric Alternator Class 9039 machine relay type NEMA  
22 4X, mounted to the component panel plate.
- 23 9. On-Off key operated single pole, single throw switch, NEMA Type 3R-13, rated  
24 at 15 Amps, 120 VAC, mounted on inner panel door face for operating both  
25 pumps at the same time.
- 26 10. On-Off spring return to Off, single pole, single throw switch, NEMA Type 3R,  
27 rated at 15 Amps, 120 VAC, mounted on inner panel door face for alarm light.
- 28 11. The following Class 8501 industrial control relays NEMA Type A600, rated 600  
29 Volt, 10 Amp, with 120 VAC coil with a minimum number of poles:
  - 30 a. 4-single pole with normally open contacts.
  - 31 b. 1-two pole with normally open contacts.
  - 32 c. 2-four pole with 3 normally open contacts, 1 normally closed contact.
  - 33 d. 1-four pole with normally open contacts.
  - 34 e. 1-four pole with normally closed contacts.
  - 35 f. 4-six pole with 6 normally closed contacts, 2 normally open contacts.
- 36 12. Two (2), 115 VAC to 10 VDC, 30 mA rectifiers for level sensor transducer,  
37 liquid level detector probe excitation.
- 38 13. One (1), 115 VAC to 60 VDC, 30 mA rectifier for flow transmitter excitation.
- 39
- 40 E. Control System level signal to control panel programmable level controller/level  
41 indicator from AMETEK 575, submersible level transmitter with the following:

1. Solid state semiconductor sensor.
2. 316 Stainless Steel housing.
3. Range of 0-14 Feet of Water, 0-6 PSI with 4-20 mA output

F. Pump Enclosure Water Detection Sensor from RS Products as follows:

1. solid state electronic water sensor, Model S-13.
2. 15 feet 2 conductor sensing wire, Model S-14.

G. Temporary Lift Station Control Panel Radio Receiver as follows:

The OSDF Construction Subcontractor shall provide a Remote Control Radio Receiver Remtron RCR804, primary operating voltage 115 VAC, 1 phase, 60 Hz, with 4 output relays receiving at 150 MHz, operating environment temperature range of -7°C to 70°C with NEMA Type 12 cabinet, including pole mounted 7" tuned receiver antenna and cable.

## 2.03 TEMPORARY LIFT STATION PUMP CONTROL PANEL FUNCTIONAL OPERATION

A. The temporary lift station pumps will normally operate as follows:

1. The pumps will alternate operation each time the pump controls receive either a manual start signal or a Hi level automatic start signal from the programmable level controller/level indicator, LIC 301.
2. Each pump has a manual/off/auto control switch which will "normally" be positioned in the "AUTO" position.
3. The temporary lift station pumps (either Pump "301" or Pump "302", depending on the alternator relay contact configuration) will auto start when the level sensor transducer transmits a high level signal to the LIC 302. The Hi Level Contact at LIC 301 will then close, energizing 3Y5, Hi Level Relay, which energizes Pump Run Relay 3Y1 or 3Y2 (depending on the alternator relay contact configuration). At the same time, 3Y5 Relay energizes the 3LY1 (Latching Relay). When 3Y1 or 3Y2 energizes, the "Pump Run" light will energize and the "Pump Stop" light will de-energize. While the pump is running, and the manhole water drops below the hi-level setpoint, the 3Y5 Hi-Level relay de-energizes. The 3LY1 Latching Relay allows the pump to continue running.
4. The operating pump will normally run until the level sensor transducer transmits a low level signal to the LIC 301. The LIC 301 low level contact closes, energizing 3Y6 (Low Level Relay) which de-energizes the Pump Run Relay (3Y1 or 3Y2) and 3LY1 (Latching Relay). This will stop the pump. When the Pump Run Relay (3Y1 or 3Y2) de-energizes, the pump run light will go OFF and the pump stop light will come ON.

- 1 5. When either pump is running at a throttled discharge of approximately 80 GPM,  
2 the flow transmitter receives a signal and sends the flow signal to the  
3 programmable flow controller/flow indicator, PFC 2.
- 4 6. When either pump starts the pump run relay (3Y1 or 3Y2) energizes and the  
5 normally open contacts close energizing the motor operated pumps discharge  
6 valve (MOV-306) relay 3Y12 which opens the valve.
- 7 7. When either pump stops the pump run relay (3Y1 or 3Y2) de-energizes and the  
8 motor operated pumps discharge valve (MOV-306) relay 3Y12 de-energizes which  
9 closes the valve.

10  
11 B. The temporary lift station pumps OFF-NORMAL operation is as follows:

- 12 1. When either pump starts, if the flow rate is  $\geq 90$  GPM, the flow transmitter will  
13 send a signal to FIC 300, closing the hi flow contact in FIC 300. This energizes  
14 3Y9, Pump High Flow Relay, and de-energizes the Pump Run Relay (3Y1 or  
15 3Y2) and 3LY1, Latching Relay. This stops the pump.
- 16 2. When either pump starts, if the flow rate is  $\leq 50$  GPM, the flow transmitter will  
17 send a signal to FIC 300, closing the low flow contact in FIC 300. This  
18 energizes 3Y8, Pump Low Flow Relay, and de-energizes the Pump Run Relay  
19 (3Y1 or 3Y2) and 3LY1, Latching Relay. This stops the pump.
- 20 3. When either pump is running, if the pump enclosure piping flanges start leaking,  
21 the pump enclosure water detection sensor will sense the liquid. The probe  
22 contact will close energizing 3Y7 (pumps enclosure liquid level relay), which de-  
23 energizes the pump run relay and 3LY1 latching relay.
- 24 4. If both pumps are required to be operating, the key operated switch, 3KS, is  
25 placed in the ON position. The 3KY3 relay energizes. The pumps' control  
26 switches are then placed in MANUAL, which starts both pumps. When the  
27 3KY3 relay energizes, it disables both pumps from auto-starting and disables the  
28 pump high flow interlock.
- 29 5. When either pump is operating, the permanent lift station hi-hi level alarm will  
30 energize 3Y10 (permanent lift station hi-hi level relay) and de-energize the pump  
31 run relay and latching relay. This stops the operating pump. Additionally, decon  
32 facility sump pump disable relay 3Y13 is energized which disables the decon  
33 facility sump pump from starting.

34  
35 C. The Lift Station Rotating Beacon Alarm Light operation is as follows:

- 36 1. When the 3Y4 (hi-hi level) energizes, the 3TY1 (alarm timed seal-in relay)  
37 energizes which energizes 3Y11 relay (Rotating Beacon Alarm Light) and the  
38 Rotating Beacon Alarm Light starts flashing.
- 39 2. When the 3Y7 relay (pumps enclosure water detection) energizes, the 3TY1  
40 (alarm timed seal-in relay) energizes which energizes 3Y11 relay (Rotating  
41 Beacon Alarm Light) and the Rotating Beacon Alarm Light starts flashing.

3. When the 3Y8 relay (pumps low flow energizes, the 3TY1 (alarm timed seal-in relay) energizes which energizes 3Y11 relay (Rotating Beacon Alarm Light) and the Rotating Beacon Alarm Light starts flashing.
4. When the 3Y9 relay (pumps high flow energizes, the 3TY1 (alarm timed seal-in relay) energizes which energizes 3Y11 relay (Rotating Beacon Alarm Light) and the Rotating Beacon Alarm Light starts flashing.
5. When the 3Y10 relay (permanent lift station hi-hi level) energizes, the 3TY1 (alarm timed seal-in relay) energizes which energizes 3Y11 relay (Rotating Beacon Alarm Light) and the Rotating Beacon Alarm Light starts flashing.

D. Temporary Lift Station Radio Receiver (150 MHz) operation is as follows:

1. When the permanent lift hi-hi level signal is transmitted to the temporary lift station radio receiver the 3Y10 relay (permanent lift station hi-hi level) energizes, which disables the temporary lift station pumps operation and energizes the decon facility sump pump disable relay 3Y13.

#### 2.04 TEMPORARY LIFT STATION PUMPS SUCTION PIPING

- A. The OSDF Construction Subcontractor shall provide 2" schedule 80 PVC pipe with glue-type slip-on fittings and glue-type slip-on fitting by full face flange to mate with flanged equipment as shown on the Drawings.

#### 2.05 TEMPORARY LIFT STATION PUMPS SUCTION PIPING CHECK VALVE

- A. Temporary Lift Station Pumps Suction Piping Check Valve.

The OSDF Construction Subcontractor shall provide 2 inch flanged, PVC, swing check valve with EPDM Teflon seats rated a 30 °F to 120 °F, 150 PSIG mounted in the pumps suction piping in the leachate collection manhole.

- B. Temporary Lift Station Pumps Suction Piping (in manhole) Manual Valve.

The OSDF Construction Subcontractor shall provide 2" flanged, PVC, sliding plug gate valve with Polypropylene plug, EPDM seals rated a 30 °F to 120 °F, 150 PSIG mounted in the pumps suction piping in the leachate collection manhole.

- C. Temporary Lift Station Pumps Suction Piping (in pumps enclosure) Manual Valves.

The OSDF Construction Subcontractor shall provide 2" flanged, PVC, sliding plug gate valve with Polypropylene plug, EPDM seals rated a 30 °F to 120 °F, 150 PSIG

1 mounted in the pumps suction piping in the pumps enclosure down stream of the tee  
2 for each pump.  
3

4 **2.06 TEMPORARY LIFT STATION PUMPS DISCHARGE MANUAL ISOLATION**  
5 **VALVES**  
6

7 The OSDF Construction Subcontractor shall provide 1-1/2" flanged PVC globe valves with  
8 EPDM seats, manual handwheel, rated at 30 " F to 120 0 F, 150 PSIG mounted in the  
9 pumps discharge piping upstream of the tee for each pump.  
10

11 A. Manual Discharge Isolation Valve:  
12

13 The Contractor shall provide 1-1/2 inch flanged, PVC globe valves with EPDM seats  
14 rated at 30°F to 120°F, 150 PSIG, mounted downstream of the pump's discharge  
15 flange with manual handwheel.  
16

17 B. Motor Operated Discharge Valve:  
18

19 The Contractor shall provide 2" flanged, safe block PVC ball valve with Viton valve  
20 seals, Teflon seats rated at 225 PSI at 70°F with a BV Series electric actuator rated  
21 at 120 VAC.  
22

23 **2.07 TEMPORARY LIFT STATION PUMPS DISCHARGE PIPING CHECK VALVES**  
24

25 The OSDF Construction Subcontractor shall provide 1-1/2 inch flanged PVC swing check  
26 valves with EPDM Teflon seats rated at 30 °F to 120 °F, 150 PSIG mounted in the pumps  
27 discharge piping upstream of the tee for each pump.  
28

29 **2.08 TEMPORARY LIFT STATION PUMPS FLOWMETER**  
30

31 The OSDF Construction Subcontractor shall provide 2" flanged bronze disc type flowmeter  
32 rated at 0-160 GPM,  $\pm 1.5\%$  of range accuracy with analog flow transmitter with a 4-20  
33 mA output signal.  
34

35 **2.09 PUMPS ENCLOSURE INTERIOR SUCTION & DISCHARGE PIPING**  
36

37 A. The OSDF Construction Subcontractor shall provide 1-1/2" and 2" schedule 80 PVC  
38 pipe with glue-type slip-on fittings and glue-type slip-on fitting by full face flange to  
39 mate with flanged equipment as shown on the Drawings.  
40

1 **2.10 LEAK DETECTION AND LEACHATE COLLECTION MANHOLES CONTROL**  
2 **PANELS**  
3

- 4 A. The Control Panels shall operate level detection and level alarm equipment.  
5  
6 B. The Control Panel enclosure shall be NEMA Type 3R, 14 gauge G-90 galvanized  
7 steel, with all surfaces phosphatized, finished inside and outside with ANSI 61 gray  
8 polyester power finish, with an outer door and inner panel face door.  
9 1. The panel shall have a full width drip shield formed into the top cap to prevent  
10 standing water from dripping into the interior when door is opened.  
11 2. The panel drip shield and formed edges of the enclosure shall provide a seating  
12 surface for the full door gasket.  
13 3. The outer door and inner panel face door shall be equipped with two galvanized  
14 hinges with stainless steel hinge pins.  
15 4. The panel outer door shall be equipped with two padlock-capable draw-pull  
16 latches.  
17 5. The panel shall have removable steel component mounting panel plate finished in  
18 white enamel and shall be drilled and tapped for component mounting.  
19  
20 C. The Control system shall operate from a 12 VDC source supplied by a pole mounted  
21 53 Watt solar collector, marine type sealed control module and sealed lead acid  
22 battery.  
23  
24 D. The control panel shall include the following as standard features:  
25 1. Terminal Strip: this provides easy connection of external components.  
26 2. Honeywell UDC 3000 Versa-Pro Universal Digital Programmable Level  
27 Controller/Level Indicator mounted in a cutout on the inner panel face door, with  
28 the following:  
29 a. Digital level indication readout accurate to  $\pm 0.1$  inch water.  
30 b. Minimum of 2 alarm relay contacts rated at 5 amps at 120 VAC.  
31 c. Minimum of 2 alarm signal inputs rated at 4-20mA/250 Ohms, 0-10 Volts.  
32 3. Off-Test spring return to OFF, single pole, single throw, NEMA Type 3R, rated  
33 .5 Amp, 24 VDC, mounted on inner panel door face for rotating beacon alarm  
34 light testing.  
35 4. Three (3) two pole Class 8700 industrial control relays NEMA Type 600 with  
36 normally open contacts, rated 24 VDC, 5 Amp, with 12 VDC coil.  
37  
38 E. Control System level signal to control panel programmable level controller/level  
39 indicator from AMETEK 575, submersible level transmitter with the following:  
40 1. Solid state semiconductor sensor.  
41 2. 316 Stainless Steel housing.

1 3. Range of 0-14 feet of Water, 0-6 PSI with 4-20 mA output.  
2

3 **2.11 LEAK DETECTION AND LEACHATE COLLECTION MANHOLES CONTROL**  
4 **PANEL FUNCTIONAL OPERATION**  
5

- 6 A. When the LCS level sensor transducer transmits a hi level signal to the Programmable  
7 Level Controller/Level Indicator LIC-\*01, the LIC Hi-level contact closes, energizing  
8 \*Y1 (manhole cell designator number), energizing the \*TY4 relay (alarm timed seal-in  
9 relay, which energizes relay \*Y3 (Rotating Beacon Alarm Light) and the Rotating  
10 Beacon Alarm Light starts flashing.  
11
- 12 B. When the level LDS sensor transducer transmits a hi-hi level signal to the  
13 Programmable Level Controller/Level Indicator, the LIC-\*02, the LIC Hi-Hi-level  
14 contact closes, energizes \*Y2 (manhole cell designator number), energizing the \*TY4  
15 relay (alarm timed seal-in relay, which energized relay \*Y3 (Rotating Beacon Alarm  
16 Light) and the Rotating Beacon Alarm Light starts flashing.  
17

18 **2.12 LEAK DETECTION AND LEACHATE COLLECTION MANHOLE**  
19

20 A. Leak Detection Manhole Monitoring Valve  
21

22 The OSDF Construction Subcontractor shall provide 1/2" PVC ball valves with NPT  
23 threaded connectors, Teflon backed EPDM seats and EPDM seals, rated at 30 °F. to  
24 120 °F, 150 PSIG, mounted on a tee fitting in the leak detection manhole inlet piping  
25 for monitoring leakage.  
26

27 B. Leak Detection Manhole Check Valve  
28

29 The OSDF Construction Subcontractor shall provide 3" flanged PVC short form wafer  
30 style swing check valve with EDPM hinge clamp and valve plates rated at -40 °F to  
31 350 °F, 150 PSI mounted in the leak detection manhole outlet piping.  
32

33 C. Leachate Collection Manhole Monitoring Valves  
34

35 The OSDF Construction Subcontractor shall provide 1/2" PVC ball valves with NPT  
36 threaded connectors, Teflon backed EPDM seats and EPDM seals, rated at 30 °F. to  
37 120 °F, 150 PSIG, mounted on a tee fitting in the leachate collection manhole 10"  
38 inlet cell collection containment pipes for monitoring leakage from the carrier pipe.  
39

1 D. Leachate Collection Manhole Sampling Valves

2  
3 The OSDF Construction Subcontractor shall provide 1/2" PVC ball valves with NPT  
4 threaded connectors, Teflon backed EPDM seats and EPDM seals, rated at 30 °F. to  
5 120 °F, 150 PSIG, mounted on a tee fitting in the leachate collection manhole 6" inlet  
6 cell collection carrier pipes for sampling leachate.  
7

8 E. Leachate Collection Manhole Check Valve

9  
10 The OSDF Construction Subcontractor shall provide 6" flanged PVC short form wafer  
11 style swing check valve with EDPM hinge clamp and valve plates rated at -40 °F to  
12 350 °F, 150 PSI mounted in the leachate collection manhole inlet piping.  
13

14 F. Leachate Collection Manhole Manual Butterfly Valves

15  
16 The OSDF Construction Subcontractor shall provide 6" flanged PVC wafer style, lever  
17 action, butterfly valve with PVC disc, EPDM seats, EPDM seals rated at 30 °F to 350  
18 °F, 150 PSI mounted in the leachate collection manhole inlet piping.  
19

20 G. Leachate Collection Manhole (temporary lift station manhole) Motor Operated Valve.

21  
22 The OSDF Construction Subcontractor shall provide 6" flanged PVC wafer style, gear  
23 action, butterfly valve with PVC disc, EPDM seats, EPDM seals rated at 30 °F to 350  
24 °F, 150 PSI with a BV Series electric actuator rated at 120 VDC mounted in the  
25 leachate collection manhole inlet piping.  
26

27 **2.13 PERMANENT LIFT STATION CONTROL PANEL**

28  
29 A. The control panel shall operate level detection, level alarm and isolation equipment.  
30 The panel enclosure shall be NEMA Type 3R.  
31

32 B. Control panel enclosure shall be NEMA type 3R, 14 gauge, G-90 galvanized steel,  
33 with all surfaces phosphatized, finished inside and outside with ANSI 61 gray polyester  
34 power finish, with an outer door and inner panel face door.

- 35 1. The panel shall have a full width drip shield formed into the top cap to prevent  
36 standing water from dripping into the interior when door is opened.  
37 2. The panel drip shield and formed edges of the enclosure shall provide a seating  
38 surface for the full door gasket.  
39 3. The outer door and inner panel face door shall be equipped with two galvanized  
40 hinges with stainless steel hinge pins.

- 1           4. The panel outer door shall be equipped with two padlock-capable draw-pull  
2           latches.
- 3           5. The panel shall have removable steel component mounting panel plate finished in  
4           white enamel and shall be drilled and tapped for component mounting.
- 5
- 6           C. The control system shall operate from a 120 volt, 60 hertz, 1 phase power feed.
- 7
- 8           D. The control panel shall include the following as standard features:
- 9           1. Heater with adjustable thermostat: to promote even distribution of heat and  
10           elimination of hot spots and condensation. Heater element shall be mounted in  
11           space between the subpanel and the back of the enclosure and provide a minimum  
12           of 50 watt of heating capacity.
- 13           2. Terminal Strip: this provides easy connection of external components.
- 14           3. Honeywell UDC 3000 Versa-Pro Universal Digital Programmable Level  
15           Controller/Level Indicator mounted in a cutout on the inner panel face door, with  
16           the following:
- 17           a. Digital level indication readout accurate to  $\pm 0.1$  inch water.
- 18           b. Minimum of 4 alarm relay contacts rated at 5 amps at 120 VAC.
- 19           c. Minimum of 4 alarm signal inputs rated at 4-20mA/250 Ohms, 0-10 Volts.
- 20           4. Off-Test spring return to OFF, single pole, single throw switch, NEMA Type 3R,  
21           rated at 15 Amps, 120 VAC mounted on inner panel door face for alarm light  
22           testing.
- 23           5. The following Class 8501 industrial control relays NEMA Type A600, rated 600  
24           Volt, 10 Amp, with 120 VAC coil with a minimum number of poles:
- 25           a. 4-two pole with normally open contacts.
- 26           b. 2-four pole with 3 normally open contacts, 1 normally closed contact.
- 27           c. 1-four pole with normally open contacts.
- 28           d. 1-four pole with normally closed contacts.
- 29           e. 4-six pole with 6 normally closed contacts, 2 normally open contacts.
- 30           6. One (1), 115 VAC to 10 VDC, 30 mA rectifiers for level sensor transducer,  
31           liquid level detector probe excitation.
- 32
- 33           E. Control System level signal to control panel programmable level controller/level  
34           Indicator from AMETEK 575, submersible level transmitter with the following:
- 35           1. Solid state semiconductor sensor.
- 36           2. 316 Stainless Steel housing.
- 37           3. Range of 0-14 Feet of Water, 0-6 PSI with 4-20 mA output
- 38

1 F. Permanent Lift Station Control Panel Radio Transmitter as follows:

2  
3 The OSDF Construction Subcontractor shall provide a Remote Control Radio  
4 Transmitter Remtron RCR804, primary operating voltage 115 VAC, 1 phase, 60 Hz,  
5 with 4 output relays transmitting at 150 MHz, operating environment temperature  
6 range of -7°C to 70°C with NEMA Type 12 cabinet, including pole mounted 7" tuned  
7 transmitter antenna and cable.  
8

9 **2.14 PERMANENT LIFT STATION CONTROL PANEL FUNCTIONAL OPERATION**

10  
11 A. When the permanent lift station level sensor transducer transmits a hi-hi level signal  
12 to the Programmable Level Indicator/Controller, LIC-110, the Hi-Hi level contact  
13 closes, energizing relay 10Y1 which closes the Permanent Lift Station inlet motor  
14 operated valve (MOV-111), the Radio Transmitter sends a signal to the Temporary Lift  
15 Station which disables the Temporary Lift Pumps and the decontamination facility  
16 pumps and the Permanent Lift Station relay 10TY4 (alarm seal-in relay) energizes  
17 which energizes relay 10Y2 (Rotating Beacon Alarm Light) and the Rotating Beacon  
18 Alarm Light starts flashing.  
19

20 B. The Pumps Start and Stop contacts in the Programmable Level Indicator/Controller  
21 will be wired into the controller. That wiring and the programming of those setpoints  
22 are not part of this specification.  
23

24 C. When the permanent lift station annular space level sensor transducer transmits a hi  
25 level signal to the Programmable Level Indicator/Controller, LIC-111, the Hi level  
26 contact closes, energizing relay 10Y1 and 10TY4 (alarm seal-in relay) energizes which  
27 energizes relay 10Y2 (Rotating Beacon Alarm Light) and the Rotating Beacon Alarm  
28 Light starts flashing.  
29

30 **2.15 PERMANENT LIFT STATION MANHOLE LEACHATE TRANSMISSION**  
31 **SYSTEM HEADER ISOLATION VALVE**

32  
33 The OSDF Construction Subcontractor shall provide 6" flanged safe block PVC ball valve  
34 with Viton valve seals, Teflon seats, rated at 225 PSI at 70°F with a BV Series electric  
35 actuator rated at 120 VAC.  
36

37 **2.16 DECON FACILITY SUMP PUMP**

38  
39 A. The decon facility sump pump shall be Type C, submersible pump, -coupled to electric  
40 120/240 VAC, 1 phase motor.  
41

- 1 B. The decon facility sump pump shall be capable a discharge flow rate of 80 GPM, and  
2 a total dynamic head of 60 feet.  
3  
4 C. The decon facility sump pump casing, suction fitting and discharge fitting shall be  
5 316SS with bronze impeller.  
6  
7 D. The decon facility sump pump shall function with the following environmental  
8 conditions.  
9 1. Compensated temperature range of 0°C to 50°C.  
10 2. Operating temperature range of -20°C to 70°C.  
11  
12 E. The pumps shall be EBARA International Corp. Model 40P707U6.6S.  
13  
14 F. The Contractor shall install the decon facility sump pump discharge valve, piping, and  
15 wiring in the pump enclosure in accordance with manufacturer's instructions and as  
16 detailed on Construction Drawings.  
17

#### 18 2.17 DECON FACILITY SUMP PUMP CONTROL PANEL

- 19  
20 A. The pump control panel shall operate the pump motor and auxiliary equipment in  
21 manual or automatic mode. The panel enclosure shall be NEMA Type 3R.  
22  
23 B. Pump control panel enclosure shall be NEMA Type 3R, 14 gauge, G-90 galvanized  
24 steel, with all surfaces phosphatized, finished inside and outside with ANSI 61 gray  
25 polyester power finish, with an outer door and inner panel face door.  
26 1. The panel shall have a full width drip shield formed into the top cap to prevent  
27 standing water from dripping into the interior when door is opened.  
28 2. The panel drip shield and formed edges of the enclosure shall provide a seating  
29 surface for the full door gasket.  
30 3. The outer door and inner panel face door shall be equipped with two galvanized  
31 hinges with stainless steel hinge pins.  
32 4. The panel outer door shall be equipped with two padlock-capable draw-pull  
33 latches.  
34 5. The panel shall have removable steel component mounting panel plate finished in  
35 white enamel and shall be drilled and tapped for component mounting.  
36  
37 C. The control system shall operate from a 120 volt, 60 hertz, I phase power feed, The  
38 pump control components shall be sized to operate pump motor of specified  
39 horsepower.  
40  
41

- 1 D. The control panel shall include the following as standard features:
- 2 1. "Hand-Off-Auto" Selector Switch allows manual or automatic operation. The
- 3 selector switch shall be a heavy duty, oil tight, NEMA 3R rated switch mounted
- 4 on the inner panel face door.
- 5 2. Pump run light indicating motor circuit energized, mounted on the inner panel
- 6 face door. Lights shall be heavy duty, oil tight, NEMA 3R rated with voltage
- 7 surge suppressor built-in to prolong lamp life.
- 8 3. Pump stop light indicating circuit de-energized, mounted on the inner panel face
- 9 door. Lights shall be heavy duty, oil tight, NEMA 3R rated with voltage surge
- 10 suppressor built-in to prolong lamp life.
- 11 4. Heater with adjustable thermostat: to promote even distribution of heat and
- 12 elimination of hot spots and condensation. Heater element shall be mounted in
- 13 space between the subpanel and the back of the enclosure and provide a minimum
- 14 of 50 watt of heating capacity.
- 15 5. Terminal Strip: this provides easy connection of external components.
- 16 6. Honeywell UDC 3000 Versa-Pro Universal Digital Programmable Level
- 17 Controller/Level Indicator mounted in a cutout on the inner panel face door with
- 18 the following:
- 19 a. Digital level indication readout accurate to  $\pm 0.1$  inch water.
- 20 b. Minimum of 4 alarm relay contacts rated at 5 amps at 120 VAC.
- 21 c. Minimum of 4 alarm signal inputs rated at 4-20 mA/250 Ohms, 0-10 V.
- 22 7. Square D Automatic Electric Alternator Class 9039 machine relay type NEMA
- 23 4X, mounted to the component panel plate.
- 24 8. On-Off spring return to Off, single pole, single throw switch, NEMA Type 3R,
- 25 rated at 15 Amps, 120 VAC, mounted on inner panel door face for rotating
- 26 beacon alarm light.
- 27 9. The following Class 8501 industrial control relays NEMA Type A600, rated 600
- 28 Volt, 10 Amp, with 120 VAC coil with a minimum number of poles:
- 29 a. 3-single pole with normally open contacts.
- 30 10. One (1), 115 VAC to 10 VDC, 30 mA rectifiers for level sensor transducer,
- 31 liquid level detector probe excitation.
- 32
- 33 E. Control System level signal to control panel programmable level controller/level
- 34 indicator from AMETEK 575, submersible level transmitter with the following:
- 35 1. Solid state semiconductor sensor.
- 36 2. 316 Stainless Steel housing.
- 37 3. Range of 0-14 Feet of Water, 0-6 PSI with 4-20 mA output
- 38
- 39
- 40
- 41

1     **2.18     DECON FACILITY PUMP CONTROL PANEL FUNCTIONAL OPERATION**  
2

3     A.   The decon facility sump pump will normally operate as follows:

- 4       1.   The pump operation each time the pump controls receive either a manual start
- 
- 5           signal or a Hi level automatic start signal from the programmable level controller/
- 
- 6           level indicator, LIC-210.
- 
- 7       2.   The pump has a manual/off/auto control switch which will "normally" be
- 
- 8           positioned in the "AUTO" position.
- 
- 9       3.   The sump pump will auto start when the level sensor transducer transmits a high
- 
- 10           level signal to the LIC-210. The Hi Level Contact at LIC-210 will then close,
- 
- 11           energizing DFY3, Hi Level Relay, which energizes Pump Run Relay DFY1. At
- 
- 12           the same time, DFY3 Relay energizes the DFLY1 (Latching Relay). When
- 
- 13           DFY1 energizes, the "Pump Run" light will energize and the "Pump Stop" light
- 
- 14           will de-energize. While the pump is running, and the sump water drops below
- 
- 15           the hi-level setpoint, the DFY3 Hi Level relay de-energizes. The DFLY1
- 
- 16           Latching Relay allows the pump to continue running.
- 
- 17       4.   The SUMP pump will normally run until the level sensor transducer transmits a
- 
- 18           low level signal to the LIC-210. The LIC-210 low level contact closes,
- 
- 19           energizing DFY4 (Low Level Relay) which de-energizes the Pump Run Relay
- 
- 20           DFY1 and DFLY1 (Latching Relay). This will stop the pump. When the Pump
- 
- 21           Run Relay DFY1 de-energizes, the pump run light will go OFF and the pump
- 
- 22           stop light will come ON.
- 
- 23       5.   When the sump pump is running the discharge rate is throttled for a maximum of
- 
- 24           80 GPM.
- 
- 25       6.   When the sump pump starts the pump-run relay DFY1 energizes and the normally
- 
- 26           open contacts close energizing the motor operated discharge valve (MOV-210)
- 
- 27           which opens the valve.
- 
- 28       7.   When the sump pump stops the pump run relay DFY1 de-energizes and the motor
- 
- 29           operated discharge valve (MOV-210) which closes the valve.
- 
- 30       8.   When the sump starts the pump run relay DFY1 energizes and the normally open
- 
- 31           contacts close energizing the temporary lift station pumps disable relay DFY13
- 
- 32           which disables the temporary lift station pumps from starting.
- 
- 33       9.   When the sump starts the pump run relay DFY1 de-energizes and the temporary
- 
- 34           lift station pumps disable relay DFY13 de-energizes the temporary lift station
- 
- 35           pumps can be started.
- 
- 36

37     B.   The decon facility sump pump Rotating Beacon Alarm Light operation is as follows

- 38       1.   When the DFY4 relay (hi-hi level) energizes, the DFTY5 relay (alarm seal-in
- 
- 39           relay) energizes which energizes relay DFY5 (rotating beacon alarm light) and the
- 
- 40           Rotating Beacon Alarm Light starts flashing.
- 
- 41

1     **2.19    DECON FACILITY SUMP PUMPS DISCHARGE VALVES**

2  
3     **A.    Manual Discharge Isolation Valve**

4  
5     The Contractor shall provide 2" flanged, PVC globe valves with EPDM seats rated at  
6     30°F to 120°F, 150 PSIG, mounted downstream of the pump's discharge flange with  
7     valve handwheel.

8  
9     **B.    Motor Operated Discharge Valve:**

10  
11    The Contractor shall provide 2" flanged, safe block PVC ball valve with Viton valve  
12    seals, Teflon seats rated at 225 PSI at 70°F with a BV Series electric actuator rated  
13    at 120VAC.

14  
15  
16    **PART 3:    EXECUTION**

17  
18    **3.01    INSTALLATION**

19  
20    **A.    General:** Comply with the manufacturer's written installation instructions.

21  
22    **B.    Install pumps in locations indicated and arrange to provide access for periodic**  
23    **maintenance, including removal of motors, impellers, couplings, and accessories.**

24  
25    **C.    The OSDF Construction Subcontractor shall fabricate the control system as shown on**  
26    **the approved drawings. The OSDF Construction Subcontractor shall install the**  
27    **controls and perform all necessary field electrical work to connect the local and remote**  
28    **control devices.**

29  
30    **D.    Control Panel signal and control circuit wiring shall conform to the following:**

31    1. All wires shall be run in plastic wireways except field wiring, wiring run between  
32    mating blocks in adjacent sections, wiring from components on a swing-out panel  
33    to components on a part of the fixed structure, and wiring run to panel-mounted  
34    components.

35    2. Wiring run from components on a swing-out panel to other components on a fixed  
36    panel shall be made up in tied bundles. These bundles shall be tied with nylon  
37    wire ties, and shall be secured to panels at both sides of the "hinge loop" so that  
38    conductors are not strained at the terminals.

39    3. Wiring run to control devices on the front panels shall be tied together at short  
40    intervals (6 inches maximum) with nylon wire ties and secured to the inside face  
41    of the panel using adhesive mounts.

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- 4. Wiring to rear terminals on panel-mount instruments shall be run in plastic wireways secured to horizontal brackets run above or below the instruments in approximately the same plane as the rear of the instruments.
- 5. Conformance to the above wiring installation requirements shall be reflected by details shown on the shop drawings.
- 6. Instrument signal circuit conductors shall be tagged with unique multiple digit numbers consistent with Section 16100.
- 7. Black and white wires from the circuit breaker panel board shall be tagged including the 1- or 2-digit number of the branch circuit breaker.

E. Installation, calibration, testing and start-up instructions are as follows:

- 1. General: All systems specified in the applicable Sections of Division 13 shall be installed, connected, calibrated, and tested by the OSDF Construction Subcontractor as described below.
- 2. Installation and Connection: The installation personnel shall be provided with a final reviewed copy of the shop drawings and data. All external wiring shall be installed in conformance with Section 16100, Basic Materials and Methods.
  - a. The instrument process sensing lines and air signal tubing shall, in general, be installed in a similar manner to the installation of conduit specified under Section 16100. Individual tubes shall be run parallel and near the surfaces from which they are supported. Supports shall be used at intervals of not more than 3 feet of rigid tubing.
  - b. Bends shall be formed with the proper tool and to uniform radii and shall be made without deforming or thinning the walls of the tubing. Plastic clips shall be used to hold individual plastic tubes parallel. Ends of tubing shall be square-cut and cleaned before being inserted in the fittings. Bulkhead fittings shall be provided at all panels requiring pipe and/or tubing entries.
  - c. The OSDF Construction Subcontractor shall have a technical field representative instruct these installation personnel on any and all installation requirements. Thereafter, the technical field representative shall be readily available by telephone to answer questions and supply clarification when needed by the installation personnel.
  - d. After all installation and connection work has been completed, the technical field representative shall check it for correctness, verifying polarity of electric power and signal connections, making sure all process connections are free of leaks, and all other similar details. The technical field representative shall certify in writing to the OSDF Construction Subcontractor that for each loop or system checked out, all discrepancies have been corrected by the installation personnel.

- e. The OSDF Construction Subcontractor shall bear all costs and provide all personnel, equipment, and materials necessary to implement all activities specified herein.

### 3.2 CONNECTIONS

Install discharge pipe sizes equal to or greater than the diameter of the pump nozzles.

### 3.3 COMMISSIONING

- A. Final Checks Before Start-up: Perform the following preventative maintenance operations and checks before start-up:
  - 1. Lubricate oil-lubricated bearings.
  - 2. Check motor for proper rotation. Rotation shall match direction of rotation marked on the pump casing.
  - 3. Check that pump is free to rotate by hand. If the pump is bound or even drags slightly, do not operate the pump until the cause of the trouble is determined and corrected.

[END OF SECTION]

**SPECIFICATION COVER SHEET**

**SPECIFICATION SECTION:** 16000      **TITLE:** ELECTRICAL

**Specifications By:** Lawrence W. Fly      2-23-96  
 (Cognizant Engineer)      Signature      Date

Lawrence W. Fly  
 Printed Name      and Title      PROJECT MANAGER

**Scope and Format Checked By:** Brian D. Jacobson      24 Feb 96  
 (Checker)      Signature      Date

Brian D. Jacobson  
 Printed Name      and Title      STAFF ENGINEER

**Detailed Requirements Checked by:** Brian D. Jacobson      24 Feb 96  
 (Checker)      Signature      Date

Brian D. Jacobson  
 Printed Name      and Title      STAFF ENGINEER

**Overall Review By:** Kenneth W. Cargill      25 Feb 96  
 (PDP)      Signature      Date

Kenneth W. Cargill  
 Printed Name      and Title      Associate

**Approved by:** J.H. Beal      26 Feb 96  
 (DTL)      Signature      Date

DEELIT, PRINCIPAL  
 Printed Name      and Title

**Record of Revision (Number and initial all revisions)**

Rev. No.	Reason	Date	By	Checked	Approval
A	Intermediate Design	26 Feb 96	-	-	JFB
D	Intermediate Design, EPA Submitted	28 Apr 96	K	-	-

## SECTION 16000

## ELECTRICAL

## PART 1: GENERAL

## 1.01 SECTION INCLUDES

## 1.02 SCOPE

- A. Work under this Section shall include the furnishing of all labor, material, tools, equipment, and incidentals required for the complete installation of systems for power and signals. The work shall be carried out as specified herein and in accordance with the Construction Drawings.
- B. All materials and appliances, obviously a part of the electrical system and necessary to its proper operation, but not specifically mentioned in this Section or shown on the Construction Drawings, shall be furnished and installed without additional charge.
- C. All materials and equipment necessary for the proper installation and operation of the work included under this Section shall be purchased, procured, installed and wired and tested as required by these Specifications. The scope of the work shall include but not necessarily be limited to 13.8 KV, 1 phase, 2 wire system overhead pole line construction to electrical equipment such as primary cutouts, surge arrestors, oil filled transformers and other components required for a complete system. The scope also includes 120/240VAC, 1 phase, 3 wire system wiring to electrical equipment such as distribution panelboards, dry type transformers, control devices and all other components required for a complete electrical system. The wiring shall include raceways, cables, junction and pull boxes; wireways and all other required components for a complete installation.
- D. The work shall include, but not limited to:
1. Power wiring, including power circuit connections for pump motors.
  2. Radio transmitters, radio receivers and telephone systems raceways and equipment mounting boards as indicated on the contract documents.
  3. Solar collector units and solar control panels.
  4. Leaving the electrical system in proper operation conditions.
  5. Testing and start-up of all electrical equipment of these Specification.

## 1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements.

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- B. Section 01025 - Measurement and Payment.
- C. Section 01350 - Submittals.
- D. Section 15000 - Mechanical.

**1.03 MEASUREMENT AND PAYMENT**

Measurement and payment shall be in accordance with Section 01025.

**1.04 REFERENCES**

- A. Construction Drawings, entitled "*Fernald Environmental Management Project, On-Site Disposal Facility,*" dated [REDACTED].
- B. Site Health and Safety Plan.

**1.05 GENERAL REQUIREMENTS**

- A. Throughout the Specifications, types of material may be specified by manufacturer's name and catalog number in order to establish standards of quality and performance and not for the purpose of limiting competition. Substitutions may be submitted in accordance with these specifications.
- B. The Construction Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawings and Specifications, the higher cost shall be included, and the Engineer shall be notified of the discrepancy.
- C. The OSDF Construction Subcontractor shall be responsible for repairing any equipment or materials damaged by his operations.

**1.06 HANDLING OF MATERIALS**

- A. The OSDF Construction Subcontractor shall receive, unload and be responsible for all materials and equipment furnished under this Section of the Specifications.
- B. All materials and equipment shall be stored in a protected area until ready for installation. If it is necessary to store outdoors or in areas exposed to weather, equipment, and materials shall be stored above grade and enclosed in watertight

1 wrapping. OSDF Construction Subcontractor shall provide adequate heaters or heat  
2 lamps to keep equipment dry while in storage.

- 3  
4 C. Damaged equipment shall be replaced by the OSDF Construction Subcontractor to the  
5 satisfaction of the Construction Contract Manager at the OSDF Construction  
6 Subcontractor's expense.  
7

8 **1.07 ELECTRICAL DRAWINGS**  
9

- 10 A. Construction drawings are generally diagrammatic and show the arrangement and  
11 location of fixtures, equipment and conduit. The OSDF Construction Subcontractor  
12 shall carefully investigate the structural and finish conditions affecting his work and  
13 arrange his work accordingly.  
14  
15 B. The right is reserved to relocate up to 10 feet, equipment indicated on construction  
16 drawings prior to rough-in without increase in contract cost.  
17  
18 C. Any work installed contrary to construction drawings shall be subject to correction as  
19 directed by the Construction Contract Manager and at the OSDF Construction  
20 Subcontractor's expense.  
21  
22 D. All connections to equipment shall be made in accordance with approved shop  
23 drawings.  
24

25 **1.08 COORDINATION OF THE WORK**  
26

- 27 A. The OSDF Construction Subcontractor shall check the drawings of the various trades  
28 before submitting his bid and shall be responsible, under this Section, for the proper  
29 coordination of the electrical work with the installation clearances under other  
30 Sections. Any changes required to avoid interferences shall be submitted to the  
31 Engineer for review and shall be made as directed, without additional cost to the  
32 Owner.  
33  
34 B. Where exact locations are required by equipment for stubbing-up and terminating  
35 conduit, the OSDF Construction Subcontractor shall coordinate with shop Drawings  
36 and any other data required to locate the conduit before the work is started and any  
37 concrete is poured.  
38  
39 C. The OSDF Construction Subcontractor shall examine all drawings for location of  
40 equipment to be installed under this Section.  
41

1 **1.09 SHOP DRAWING REVIEW**  
2

- 3 A. At least ten working days prior to the start of installation of mechanical equipment, the  
4 OSDF Construction Subcontractor shall submit for review, details of all materials,  
5 equipment and systems to be furnished under this section in accordance with  
6 requirements of Section 01350.  
7
- 8 B. The OSDF Construction Subcontractor shall submit a listing of all the materials  
9 indicated below, with the type of material, manufacturer and catalog or model number  
10 for each. This will include: junction boxes, pull boxes, wireways, raceways, wire,  
11 cables, wiring devices, plates, nameplates, and alarm devices.  
12
- 13 C. The OSDF Construction Subcontractor shall submit complete shop drawings of dry  
14 type transformers, panelboards, cabinets, and pump controllers.  
15
- 16 D. Shop drawings shall include dimensions, weight, ratings, mounting requirements,  
17 clearances, components interface, wiring diagrams and other information required for  
18 proper evaluation and complete installation.  
19
- 20 E. The approval of systems, equipment and shop drawings is a general approval subject  
21 to the contract drawings, specifications and verification of all measurements at the job  
22 site. Approval does not relieve the OSDF Construction Subcontractor from the  
23 responsibility of shop drawing errors. The OSDF Construction Subcontractor shall  
24 carefully check and correct all shop drawings prior to submission for approval.  
25
- 26 F. "Record" copies of all shop drawings shall be submitted to the Construction Contract  
27 Manager before final inspection and acceptance.  
28
- 29 G. No material shall be ordered or shop work started until the Construction Contract  
30 Manager's review of shop drawings has been completed.  
31

32 **1.10 RECORD DRAWINGS**  
33

- 34 A. The contractor shall provide and maintain at the site a set of prints on which the actual  
35 installation of all work under this section shall be accurately shown, indicating any  
36 variation from contract drawings. Changes in circuitry shall be clearly and completely  
37 indicated as the work progresses.  
38
- 39 B. These progress prints shall be available for inspection by the Construction Contract  
40 Manager and shall be used to determine the progress of electrical work.  
41

- C. At the completion of the work, the OSDF Construction Subcontractor shall prepare a new set of record drawings, of the work actually noted on the marked-up prints, including the DIMENSIONED location of all underground conduit.
- D. The OSDF Construction Subcontractor shall furnish these record drawings to the Construction Contract Manager for approval and transmission.

**1.11 SUBSTITUTIONS**

- A. Where equipment is identified by manufacturer and catalog number, it shall be construed as the base of requirements for quality and performance. Where manufacturers for equipment are identified by name, the OSDF Construction Subcontractor may submit for approval, similar equipment of other manufacturers as substitution. It is the OSDF Construction Subcontractor's responsibility to prove that proposed equipment is equal to that specified. The decision of the Engineer as to whether the submitted equipment is acceptable shall be final and binding.
- B. All changes necessary to accommodate the substituted equipment shall be made at the OSDF Construction Subcontractor's expense, and shall be as approved by the Construction Contract Manager. Detailed drawings indicating the required changes shall be submitted for approval at the time the substitution is requested.

**1.12 GUARANTEE**

The OSDF Construction Subcontractor shall guarantee to correct all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of project acceptance by the Construction Contract Manager.

**1.13 OPERATING AND MAINTENANCE MANUAL**

After completion of the work, the OSDF Construction Subcontractor shall furnish and deliver to the Construction Contract Manager's Representative four (4) copies of a complete electrical equipment operations and maintenance manual. Each manual shall include one (1) copy each of all approved shop drawings, catalog pages, instruction sheets, operating instructions, installation and maintenance instructions, spare parts bulletin, a wiring diagram shall be furnished for each system.

**1.14 STANDARDS**

- A. All materials and equipment furnished under this section shall be new and comply with the applicable standards of the entities listed below:

- 1 1. American National Standards Institute - ANSI
- 2 2. American Society for Testing Materials - ASTM
- 3 3. American Standard Association - ASA
- 4 4. Institute of Electrical and Electronic Engineers - IEEE
- 5 5. Insulated Cable Engineers Assoc. - ICEA
- 6 6. National Electrical Code - NEC
- 7 7. National Electrical Manufacturers' Association - NEMA
- 8 8. Occupational Safety & Health Act - OSHA
- 9 9. Underwriters' Laboratories, Inc. - UL
- 10 10. Factory Mutual - FM
- 11 11. Electrical Testing Laboratories, Inc. - ETL
- 12 12. National Electric Safety Code - NESC

#### 1.15 ABBREVIATIONS AND DEFINITIONS

When the following abbreviations and definitions are used in relation to the work for Division 16, they shall have the following meanings:

<u>ITEM</u>	<u>MEANING</u>
Accepted	Reviewed with no exceptions taken to submittal material. See "Submittal" below.
ANSI	American National Standards Institute
Approved	Inspected and accepted by the CQC Consultant or Construction Contract Manager's Rep.
ASTM	American Society for Testing and Materials.
Boxes	Outlet, Junction, or Pull Boxes.
Code	All codes currently enforced at project location.
Compression	Compressed using a leverage powered (hydraulic or equivalent) crimping tool.
Connection	All materials and labor required for equipment to be fully operational.
EMT	Electrical Metallic Tubing.
Exterior Location	Outside of or penetrating the outer surfaces of the building weather protective membrane
Fully Operational	Tested and approved and operating to the satisfaction of the CQC Consultant or Construction Contract Manager, manufacturer, and contract documents.
Furnish	Deliver to the jobsite
Install	To enter permanently into the project and make fully operational
Mfr.	Manufacturer

1	NEC	National Electrical Code,
2		National Fire Protection Association
3		Publication #70 (latest adopted edition with amendments)
4	NESC	National Electrical Safety Code
5	NEMA	National Electrical Manufacturers Association
6	NFPA	National Fire Protection Association
7	Noted	Shown or specified in the contract documents
8	PVC	Polyvinyl Chloride
9	Provide	Furnish and install
10	RGS	Rigid Galvanized Steel
11	Required	As required by code, Construction Contract Manager, or contract
12		documents for the particular installation to be fully operational
13	Shop Drawing	Document prepared by OSDF Construction Subcontractor,
14		supplier, fabricator, or similar party which fully illustrates and
15		details the equipment and intended installation relative to this
16		specified project
17	Shown	As indicated on the Drawings or details
18	Submittal	Material for CQC Consultant's or Construction Contract Manager's
19		review which may contain catalog cuts, shop drawings, wiring
20		diagrams, etc., of the actual material being furnished.
21	UL	Underwriters' Laboratories, Inc.
22	Wiring	Raceway, conductors, and connections

[END OF SECTION]

SPECIFICATION COVER SHEET

SPECIFICATION SECTION: 16100 TITLE: BASIC MATERIAL AND METHODS

Specifications By: Signature Laurence W Fly 2-23-96  
 (Cognizant Engineer) Printed Name LAURENCE W. FLY Date  
and Title PROJECT MANAGER

Scope and Format  
 Checked By: Signature Brian D Jacobson 24 Feb 96  
 (Checker) Printed Name BRIAN D JACOBSON Date  
and Title STAFF ENGINEER

Detailed Requirements  
 Checked by: Signature Brian D Jacobson 24 Feb 96  
 (Checker) Printed Name BRIAN D JACOBSON Date  
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Overall Review By: Signature Kenneth W Cargill 25 Feb 96  
 (PDP) Printed Name Kenneth W Cargill Date  
and Title Associate

Approved by: Signature J.F. Beel 26 Feb 96  
 (DTL) Printed Name J.F. Beel BEEL, PHOENIX Date  
and Title

Record of Revision (Number and initial all revisions)

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A	Intermediate Design	26 Feb 96	-	-	JFD
D	Intermediate Design, EPA Submitted	BAp 96	fc	-	-

SECTION 16100

BASIC MATERIALS AND METHODS

PART 1: GENERAL

1.01 SCOPE

- A. This Section contains the general requirements for materials and installation methods which apply to all sections of Division 16. The OSDF Construction Subcontractor shall be responsible for following all requirements, materials, and methods of the Section and those indicated on the Construction Drawings.

1.02 RELATED SECTIONS

- A. Section 01012 - General Requirements.
- B. Section 01025 - Measurement and Payment.
- C. Section 16120 - Conductors and Terminations.

PART 2: PRODUCTS

2.01 GENERAL

- A. All materials shall be new, free from defects, and not less than the quality herein specified. Materials shall be designed to ensure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.
- B. Each type of material furnished shall be of the same make, be the standard product of a manufacturer regularly engaged in production of such materials, and be the manufacturer's latest standard design.
- C. All materials and equipment installed, including lighting fixtures, shall have been tested and listed by Underwriters Laboratories or other approved testing organization and shall be so labeled.

2.02 SUBSTITUTION OF MATERIALS

- A. Where equipment is identified by manufacturer and catalog number, it shall be construed as the base of requirements for quality and performance. Where manufacturers for equipment are identified by name, the OSDF Construction

1 Subcontractor may submit for approval, similar equipment of other manufacturers as  
2 substitution. It is the OSDF Construction Subcontractor's responsibility to prove that  
3 proposed equipment is equal to that specified. The decision of the Construction  
4 Contract Manager as to whether the submitted equipment is acceptable shall be final  
5 and binding.

- 6  
7 B. All changes necessary to accommodate the substituted equipment shall be made at the  
8 OSDF Construction Subcontractor's expense, and shall be approved in writing by the  
9 Construction Contract Manager.
- 10  
11 C. Detailed drawings indicating the required changes shall be submitted for approval at  
12 the time the substitution is requested.

### 13 14 **2.03 COMPLETE SYSTEMS**

- 15  
16 A. All systems specified in Division 16 and shown on the drawings shall be complete in  
17 every detail and fully operational upon completion of the project unless specifically  
18 noted otherwise. Mention of certain materials in these specifications shall not be  
19 construed as releasing the OSDF Construction Subcontractor from furnishing such  
20 additional materials and performing all labor required to provide complete and fully  
21 operational systems.

### 22 23 **2.04 SUBMITTALS AND SHOP DRAWINGS**

- 24  
25 A. The OSDF Construction Subcontractor shall submit product information submittals are  
26 required for the following:
- 27 1. Raceways;
  - 28 2. Wires and Cables;
  - 29 3. Connectors and Terminations;
  - 30 4. Motor Controllers;
  - 31 5. Power Service Equipment;
  - 32 6. Transformers;
  - 33 7. Panelboards;
  - 34 8. Lighting Fixtures and Ballasts;
  - 35 9. Wood Poles;
  - 36 10. Open Fuse Cutouts;
  - 37 11. Surge Arresters;
  - 38 12. Push-button Stations;
  - 39 13. Pullbox; and
  - 40 14. Heat Trace
  - 41 15. Solar Collector Unit and Solar Control Panel.

1 B. Shop Drawings are required for:

2 1. Panelboards

3  
4 C. The OSDF Construction Subcontractor shall submit detailed information on proposed  
5 electrical equipment and electrical requirements.

6  
7 **2.05 NAMEPLATES**

8  
9 Provide permanently attached nameplates constructed of plastic laminated material engraved  
10 through white surface material to black sublayer. Nameplates shall indicate the equipment  
11 designation, voltage, number of phases, and the name of the piece of equipment that  
12 provides the source of power.

13  
14 A. Breaker Nameplates: Refer to Section 16471.

15  
16 B. Motor Starter Nameplates: Refer to Section 16160.

17  
18 C. Manual disconnect switches: Refer to Section 16160.

19  
20 D. Nameplates shall be on the Construction drawings and details.

21  
22  
23 **PART 3: INSTALLATION**

24  
25 **3.01 CUTTING CONSTRUCTION:**

26  
27 A. The OSDF Construction Subcontractor shall obtain permission from the Engineer and  
28 coordinate with other trades prior to cutting. Locate cuttings so they will not weaken  
29 structural components. The OSDF Construction Subcontractor shall cut carefully and  
30 only the minimum amount necessary. The OSDF Construction Subcontractor shall cut  
31 concrete with diamond core drills or concrete saws except where space limitations  
32 prevent the use of such tools.

33  
34 B. All construction materials damaged or cut shall be repaired or replaced with materials  
35 of like kind and quality as original materials by skilled labor experienced in that  
36 particular building trade to the satisfaction of the CQC Consultant and at the OSDF  
37 Construction Subcontractor's expense.

38  
39 **3.02 EXCAVATIONS**

40  
41 A. Excavations shall not disturb or injure walls, footings, or other property.

1 B. Remove all surplus earth not needed for backfilling and dispose of as directed by  
2 Construction Contract Manager.

3  
4 C. Excavation shall be performed in accordance with Section 02200 and Section 022150  
5 of this Specification.

6  
7 **3.03 PAINTING**

8  
9 A. All exterior and interior steel surfaces shall be properly cleaned and finished with gray  
10 ASA-61 paint over a rust-inhibiting phosphatized coating. The finish paint shall be  
11 suitable for field painting. Items furnished under Division 16 that are scratched or  
12 marred in shipment or installation shall be refinished to the satisfaction of the  
13 Construction Contract Manager.

14  
15 **3.04 CLEAN UP**

16  
17 OSDF Construction Subcontractor shall continually remove debris, cuttings, crates, cartons,  
18 etc., created by his work. Such clean up shall be done daily and at sufficient frequency to  
19 eliminate hazard to the public, other workers, the building, employees, or other personnel.  
20 Before acceptance of the installation, OSDF Construction Subcontractor shall carefully clean  
21 cabinets, panels, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus  
22 shall be removed and new finish equal to the original applied.

23  
24 **3.05 WORKMANSHIP AND OBSERVATION**

25  
26 A. Workmanship shall be of the best quality and none but competent and experienced  
27 electricians shall be employed and shall be under the supervision of a competent and  
28 experienced foreman. All completed work shall represent a neat and orderly  
29 appearance.

30  
31 B. All work and materials shall be subject to observation at any and all times by the CQC  
32 Consultant.

33  
34 **3.06 EQUIPMENT CONNECTION**

35  
36 A. The OSDF Construction Subcontractor shall provide complete all electrical connections  
37 necessary to serve such equipment of this Section. Provide required control  
38 connections to all equipment so that the equipment is fully operational upon completion  
39 of the project. Whenever the Drawings show an equipment connection, the OSDF  
40 Construction Subcontractor shall provide the code-required disconnect switch.

- B. All materials and equipment shall be installed in conformance with the manufacturer's installation instructions and UL requirements.

**3.07 INTERFACE WITH OTHER TRADES**

- A. The OSDF Construction Subcontractor shall continually interface and coordinate the electrical work with the work of other trades.

**3.08 WIRE NUMBERING**

- A. All field wiring, external to pre-manufactured panels and equipment, shall be numbered by the OSDF Construction Subcontractor. The numbering shall be sequential beginning with 1 and continuing to 99. If a panel requires more than 99 wire numbers start again at 1 preceded by an alpha character starting with A.
- B. The OSDF Construction Subcontractor shall submit a finished wire number schedule complete with conduit numbers and a functional description of the wires.
- C. Wire markers shall be installed in accordance with Section 16120.

**3.09 EQUIPMENT SUPPORTS**

- A. Hangers and supports for raceways and electrical equipment shall be Unistrut with Unistrut conduit clamps or Construction Contract Manager approved device. Split and hinged rings shall be bolted to or interlocked with suspension rod and shall be installed in accordance with Section in accordance with the design drawings.

**3.10 TESTING DURING INSTALLATION**

- A. The OSDF Construction Subcontractor shall perform continuity tests of every wire from instruments or sensing elements to readout or alarm device.
- B. The OSDF Construction Subcontractor shall measure and record resistance reading between shield and ground for shielded cables in accordance with manufacturer's recommendations and shall transfer the resistance reading to record drawings.

**3.11 PROTECTION OF WORK**

- A. The OSDF Construction Subcontractor shall use all means necessary to protect all work of this Section and all materials and completed work of other Sections.

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9

B. In the event of damage to prior work, the OSDF Construction Subcontractor shall make repairs and replacements to the satisfaction of the Construction Contract Manager at the OSDF Construction Subcontractor's cost.

[END OF SECTION]

**SPECIFICATION COVER SHEET**

**SPECIFICATION SECTION:** 16160 **TITLE:** MOTOR CONTROLLERS, MANUAL DISCONNECT SWITCHES

**Specifications By:** Signature Laurence W Fly 2-23-96  
(Cognizant Engineer) Date

Printed Name LAURENCE W FLY  
and Title PROJECT MANAGER

**Scope and Format**

**Checked by:** Signature Brian D. Jacobson 24 Feb 96  
(Checker) Date

Printed Name BRIAN D JACOBSON  
and Title STAFF ENGINEER

**Detailed Requirements**

**Checked by:** Signature Brian D. Jacobson 24 Feb 96  
(Checker) Date

Printed Name BRIAN D. JACOBSON  
and Title STAFF ENGINEER

**Overall Review By:**

**(PDP)** Signature Kenneth W Cargill 25 Feb 96  
Date

Printed Name Kenneth W Cargill  
and Title Associate

**Approved by:**

**(DTL)** Signature J. Beek 26 Feb 96  
Date

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**Record of Revision (Number and initial all revisions)**

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## SECTION 16160

**MOTOR CONTROLLERS, MANUAL DISCONNECT  
SWITCHES, AND BREAKER PANELS****PART 1: GENERAL****1.01 SCOPE**

- A. Scope of work under this Section includes all requirements for motor controllers (starters), manual disconnect switches, and breaker panels. Motor controls, manual disconnect switches, and breaker panels shall conform to NEMA standards for each specific purpose and be U.L. listed.
- B. The OSDF Construction Subcontractor performing the Division 16 work shall furnish motor controllers for all motors shown unless the controllers are included with the equipment furnished under other Divisions of these Specifications. The OSDF Construction Subcontractor performing the Division 15 work shall install all motor controllers including all controllers not factory assembled into equipment furnished under other Divisions of these Specifications or by others. All motors and motor controllers, manual disconnect switches, and breaker panels shall be complete and fully operational upon completion of the project.

**1.02 SUBMITTALS**

- A. The OSDF Construction Subcontractor shall verify motor sizes and voltages provided under other Divisions. The OSDF Construction Subcontractor shall submit detailed information on proposed motor sizes, currents, voltages, and motor starter sizes, manual disconnect switches, and breaker panels.

**PART 2: PRODUCTS****2.01 MOTOR STARTERS**

- A. Magnetic motor starters: Shall conform to or contain items called for below and unless noted otherwise, shall be full voltage non-reversing. No starters smaller than NEMA size 1 and no half size starters are permitted.
- B. Overload devices: Shall be melting alloy or bimetallic type. One overload shall be provided for each phase. Provisions shall be made for resetting the overload devices from outside the starter enclosure. Provide ambient compensated overload devices

1 only when the motor is at a constant temperature and the controller is subject to a  
2 separate, varying temperature. Automatic reset overload devices are not permitted.  
3

4 C. Enclosures: All motor controllers shall be contained in NEMA 3R enclosures.  
5

6 D. Motor controller shall be manufactured by Allen Bradley, General Electric, Square D,  
7 Westinghouse, Cutler Hammer.  
8

9 E. Engraved phenolic nameplates shall be provided by OSDF Construction Subcontractor  
10 in accordance with Section 16100, and permanently attached to each controller.  
11

## 12 2.02 BREAKER PANELS

13  
14 A. Service panel shall be 600V class construction for 1 phase, 3 wire use.  
15

16 B. Breaker Panels shall be of the dead-front safety type, equipped with thermal-magnetic  
17 molded case circuit breakers with trip rating as shown on schedules.  
18

19 C. Breaker Panels shall be manufactured by General Electric, Square D, Westinghouse  
20 or Siemens.  
21

22 D. All interiors shall be completely factory assembled with circuit breakers, wire  
23 connectors and accessories. All wire connectors shall be of the pressure type and all  
24 shall be suitable for copper wires.  
25

26 E. Interiors shall be so designed that circuit breaker devices can be replaced without  
27 disturbing adjacent units and without removing the main bus connectors.  
28

29 F. Branch circuits shall be arranged using double row construction. Branch circuits shall  
30 be numbered by the manufacturer. The manufacturer shall provide permanent circuit  
31 numbers on the deadfront trim with odd numbers on the left side and even on the  
32 right.  
33

34 G. Buses shall be tin plated copper. Phase bussing shall be full height without reduction.  
35

36 H. Main bus shall be distribution phase sequence type configuration to allow installation  
37 of two or three pole circuit breakers at any locations. Where trip rating of circuit  
38 breaker requires, double row bussing shall be provided to maintain double row circuit  
39 breaker arrangement.  
40

- 1 I. Neutral bussing shall be 100 percent rated, insulation from grounded parts and shall  
2 have suitable lugs and terminals to make all neutral connections.  
3  
4 J. Breaker panel shall be rated for NEMA 3R environment, made from galvanized code  
5 gauge steel having multiple knockouts. Boxes shall be of sufficient size to provide a  
6 minimum gutter space of 4" on all sides. Where feeder cables supplying the mains  
7 of a panel area carried through its box to supply other electrical equipment, the box  
8 shall be so sized as to include this wiring space. This wiring space shall be in addition  
9 to the minimum gutter space specified above and the limiting width may be increased  
10 accordingly.  
11  
12 K. Hinged lockable doors shall be provided covering all switching device handles.  
13  
14 L. All exterior and interior steel surfaces of the breaker panels shall be properly cleaned  
15 and finished with gray ASA-61 paint over a rust-inhibiting phosphatized coating. The  
16 finish paint shall be suitable for field painting.  
17

### 18 2.03 MANUAL DISCONNECT SWITCHES

- 19  
20 A. Disconnect Switches shall be contained in NEMA 3R enclosures.  
21  
22 B. Disconnect Switches shall be manufactured by Allen Bradley, General Electric,  
23 Square D, Westinghouse, Cutler Hammer.  
24  
25 C. Engraved phenolic nameplates shall be provided by Contractor in accordance with  
26 Section 16100, and permanently attached to disconnect.  
27  
28 D. Disconnect switches shall be 600V class construction for 1 phase, 3 wire use.  
29  
30 E. All interiors shall be completely factory assembled with switch mechanism and door  
31 closing mechanism, wire connectors and accessories. All wire connectors shall be of  
32 the pressure type and all shall be suitable for copper wires.  
33  
34 F. Neutral bussing shall be 100 percent rated, insulation from grounded parts and shall  
35 have suitable lugs and terminals to make all neutral connections.  
36  
37 G. Hinged lockable doors shall be provided covering all switching device handles.  
38  
39 H. All exterior and interior steel surfaces of the disconnect switches shall be properly  
40 cleaned and finished with gray ASA-61 paint over a rust-inhibiting phosphatized  
41 coating. The finish paint shall be suitable for field painting,

1  
2 **PART 3: INSTALLATION**

3  
4 **3.01 WIRING**

5  
6 Wiring shall conform to applicable Sections of these Specifications. Provide wiring from  
7 branch circuit overcurrent device to motor controller to motor terminals, including  
8 installation of starter and all connections. provide raceway and conductors as shown for  
9 remote control, or interlock connections. Coordinate other control wiring with other  
10 Divisions of these Specifications. provide overload elements in controllers sized to match  
11 motor nameplate full load amperes. Space within controllers shall not be used as a junction  
12 box.

13  
14 **3.02 MOUNTING**

- 15  
16 A. Securely mount to equipment rack or pole or approved mounting frame suitable to  
17 withstand earthquake forces. Controllers supported only by raceways are not  
18 acceptable.
- 19  
20 B. Securely mount enclosures to mounting rack or pole as shown on the Drawings.  
21 Motor starter enclosure for lift station pumps shall be mounted using Unistrut or other  
22 similar mounting hardware, as shown on the Drawings. Attach with 4 screws or bolts  
23 minimum, each.
- 24  
25 C. Breaker panels shall be installed per Construction Drawing, in accordance with  
26 manufacturer's instructions, and shall be installed at 6'-6" above finished grade to top  
27 of breaker panel.
- 28  
29 D. The OSDF Construction Subcontractor shall provide nameplate with panel designation.  
30 The OSDF Construction Subcontractor shall provide typewritten circuit directories odd  
31 numbers on left and even right side which accurately list the type and location of  
32 outlets served. At the top of the directory, type the breaker panels designation and  
33 voltage.

34  
35 **3.03 TESTING**

- 36  
37 A. As a minimum, the following tests shall be conducted:  
38 1. Continuity of cables and proper insulation.  
39 2. Proper insulation resistance of equipment bussing.  
40 3. Continuity of all ground conductors.  
41 4. Mounting of receptacles and polarity check.

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- 5. Rotation of motors.
- 6. Overload settings.
- 7. Phasing: A-B-C-Clockwise.

**3.04 PROTECTION OF WORK**

- A. The OSDF Construction Subcontractor shall use all means necessary to protect all work of this Section and all materials and completed work of other Sections.
- B. In the event of damage to prior work, the OSDF Construction Subcontractor shall make repairs and replacements to the satisfaction of the Construction Contract Manager at OSDF Construction Subcontractor's expense.

[END OF SECTION]

**SPECIFICATION COVER SHEET**

SPECIFICATION SECTION: 16400 TITLE: OVERHEAD SERVICE

Specifications By: Signature Laurence W Fly 2-23-96  
(Cognizant Engineer) Date

Printed Name LAURENCE W FLY  
and Title PROJECT MANAGER

Scope and Format  
Checked By: Signature Brian D Jacobson 24 Feb 96  
(Checker) Date

Printed Name BRIAN D JACOBSON  
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Detailed Requirements  
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D	Intermediate Design, EPA Submittal	8 Apr 96	KC	-	-

## SECTION 16400

## OVERHEAD SERVICE

## PART 1: GENERAL

## 1.01 SCOPE

This Sections includes the general requirements for overhead electrical distribution service in accordance with National Electrical Safety Code.

## PART 2: PRODUCTS

## 2.01 WOOD POLES

- A. Poles shall be Southern Pine Cut form live stock and shall conform to ANSI Standard 5.1, Specifications and Dimensions for Wood Poles. All poles shall be air seasoned and butt treated in accordance with the American Wood Preservers' Association (AWPA) Standard C7. Each pole shall be branded or marked as described in ANSI 05.1 as follows:
1. The brand or mark shall be placed squarely on the face of the pole and at 10 feet form the butt. The face brand shall designate the supplier's code or trademark; plant location and year of treatment; species and preservative code; and class and length of pole.
  2. The pole roof and gain shall be brush coated with pentachlorophenol-petroleum solution conforming to AWPA Standards p8 and p9. The top of each pole shall have a one-way roof cut sloping 30 degrees (120 degrees with pole axis), and the cut surface shall face at right angles to the pole face.
- B. Poles shall be class 2 or 3.
- C. The minimum setting depth for poles shall be 5 feet, 6 inches for 30 foot pole and 6.0 feet for 35 foot poles.
- D. Holes for wood poles shall be dug using an auger type machine. Hole diameter shall be large enough to allow use of tamping bar or other compaction equipment.
- E. Backfill around poles shall be placed in six-inch lifts and thoroughly compacted by hand tamping. Surplus excavated material shall be placed around the pole in a cone approximately one foot in height.

1     **2.02     POLE LINE HARDWARE**

2  
3         All pole line hardware shall be heavy galvanized steel.

4  
5     **2.03     OPEN FUSE CUTOUTS - POLE MOUNTED**

6  
7         Unit shall be rated 15KV, shall be positive latch type, for hook-stick operation. Provide  
8         with fuses. Sizes as shown on Drawings.

9  
10    **2.04     SPAN OR DOWN GUYS**

11  
12         Span or down guys shall employ high strength stranded galvanized steel guy wore. An eye  
13         bolt shall be used on the pole (angle eye bolt for down guy) and a three bolt clamp. Use  
14         8-foot-long plastic half-round guy guard at lower end of down guy.

15  
16    **2.05     ANCHORS**

17  
18         Anchors shall be concrete cone type with 5/8-inch-diameter x 8-foot-long anchor rod set  
19         in line with the angle of the down guy and with the eye at top projecting not more than 5  
20         inches above finished grade. Anchor shall be rated for 15,000 pounds tension in medium  
21         dense soil conditions.

22  
23    **2.06     INSULATORS, POLE MOUNTED**

24  
25         Pin type insulators shall be in accordance with ANSI C29.5 Class 55-4. Shall be wet  
26         process brown porcelain.

27  
28    **2.07     POLE MOUNTED TRANSFORMERS**

29  
30         Single phase distribution type per ANSI C57.12. Oil filled, non-PCB type. Four taps, (2)  
31         2-1/2% above, (2) 2-1/2% below. 5 KVA, 10 KVA, 15 KVA, 25 KVA, 37.5 KVA, 75  
32         KVA, and 125 KVA. Top-mounted primary bushings and side-mounted secondary  
33         bushings. Provided with lifting lugs and mounting brackets. Transformers shall be  
34         delivered to site for testing at least 2 weeks prior to installation.

35  
36    **2.08     SURGE ARRESTERS**

37  
38         Distribution class designed for outdoor pole mounting. Shall be valve type rated for 15KV.  
39         External air gap type not permitted. Provide with mounting bracket.

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**2.09 SERVICE DROP**

Cable shall be rated for 600 volts, suitable for outdoor aerial installation. Conductors shall be wound symmetrically around messenger cable.

**PART 3: INSTALLATION**

**3.01 GENERAL**

- A. Installation shall be per ANSI C2, National Electrical Safety Code.
- B. Plumb all poles to true vertical.

**3.02 TRANSFORMER INSTALLATION**

The OSDF Construction Subcontractor shall install transformers in accordance with manufacturer's instructions and Construction Drawings.

**3.03 PROTECTION OF WORK**

- A. The OSDF Construction Subcontractor shall use all means necessary to protect all work of this Section and all materials and completed work of other Sections.
- B. In the event of damage to prior work, the OSDF Construction Subcontractor shall make repairs and replacements to the satisfaction of the Construction Contract Manager at the OSDF Construction Subcontractor's expense.

[END OF SECTION]

**SPECIFICATION COVER SHEET**

**SPECIFICATION SECTION:** 16450 **TITLE:** GROUNDING  
**Specifications By:** Signature Lawrence W. Fly 2-23-96  
 (Cognizant Engineer) Date

Printed Name LAWRENCE W. FLY  
and Title PROJECT MANAGER

**Scope and Format**  
**Checked By:** Signature Brian D. Jacobson 24 Feb 96  
 (Checker) Date

Printed Name BRIAN D. JACOBSON  
and Title STAFF ENGINEER

**Detailed Requirements**  
**Checked by:** Signature Brian D. Jacobson 24 Feb 96  
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Printed Name BRIAN D. JACOBSON  
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**Overall Review By:** Signature Kenneth W. Cargill 25 Feb 96  
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Printed Name Kenneth W. Cargill  
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D	Intermediate Design, EPA Submitted	8 Apr 96	KC	-	-

**SECTION 16450****GROUNDING****PART 1: GENERAL****1.01 SCOPE**

Grounding systems shall be provided for service neutral power ground and for equipment grounds and bonding as required by the National Electrical Safety Code.

**PART 2: PRODUCTS****2.01 GROUNDING CONDUCTORS AND CONNECTORS**

- A. Breaker Panel, pump controller, grounding will be copper only, sized per code. Bare or green insulated in sizes #10 AWG or larger. Green insulated for size #12 AWG.
- B. Overhead distribution poles, overhead transformers, surge arrestors, down guy wire will be copper only, sized per code. Bare size #4 AWG or larger.

**2.02 GROUND RODS**

The OSDF Construction Subcontractor shall provide 3/4-inch-diameter x 10.0-foot-long copper clad steel.

**PART 3: INSTALLATION****3.01 GROUNDING, GENERAL**

The OSDF Construction Subcontractor shall provide all grounding for electrical systems and equipment as required by National Electrical Safety Code and per Construction Drawings.

**3.02 GROUND RODS**

The OSDF Construction Subcontractor shall provide as shown and/or required and connect the grounding conductor to each rod.

**3.03 SIZE OF GROUND WIRE**

The OSDF Construction Subcontractor shall provide as required by National Electric Code. Where ground wire is exposed to physical damage, the OSDF Construction Subcontractor

1 shall protect with rigid non-ferrous conduit as permitted by applicable National Electrical  
2 Safety Code.

3  
4 **3.04 GROUND CONDUCTOR**

5  
6 The OSDF Construction Subcontractor shall provide grounding conductor in all conduit  
7 runs.

8  
9 **3.05 CONNECTION TO POWER GROUND BUS**

10  
11 A. The OSDF Construction Subcontractor shall furnish and install connections in  
12 accordance with codes, including but not limited to :

- 13 1. Raceway system  
14 2. Panelboards  
15 3. Service neutral  
16 4. "Separately derived service" (transformer or emergency power supply)  
17 5. Electrically operated equipment and devices  
18 6. Surge arrestors.

19  
20 B. No device or equipment shall be connected for electrical service which has a neutral  
21 conductor connected to a grounding conductor or to the frame within the device or  
22 equipment.

23  
24 **3.06 METHOD OF CONNECTIONS**

25  
26 The OSDF Construction Subcontractor shall make all ground connections and ground cable  
27 splices by thermal welding or copper compression-set type connectors U. L. listed for  
28 grounding purposes. Grounding lugs, where provided as standard manufacturer's items on  
29 equipment furnished, may be used.

30  
31 **3.07 EXPANSION FITTINGS**

32  
33 In conduit runs requiring an expansion fitting, a bonding jumper shall be installed around  
34 the fitting to maintain continuous ground continuity.

35  
36 **3.08 PROTECTION OF WORK**

37  
38 A. The OSDF Construction Subcontractor shall use all means necessary to protect all  
39 work of this Section.  
40  
41

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B. In the event of damage to prior work on this Section, the OSDF Construction Subcontractor shall make repairs and replacements to the satisfaction of the Construction Contract Manager at the OSDF Construction Subcontractor's expense.

[END OF SECTION]