CONSTRUCTION QUALITY ASSURANCE PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-0006
Revision 1
May 2001

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

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Under

Fluor Fernald, Inc.
Contract 95PS005028

CONSTRUCTION QUALITY ASSURANCE PLAN

ON-SITE DISPOSAL FACILITY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

REVISION 1
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Reviewed by:

J.F. Beech, Ph.D., P.E., GeoSyntec, OSDF Principal-In-Charge — Date: 9 May 2001

FOR S. WOLOSKY U. KUMTHEKAR
Uday Kumthekar, P.E., Fluor Fernald, Inc., OSDF Area Project Manager — Date: 5/15/01

J.D. Chiou, Ph.D., P.E., Fluor Fernald, Inc., Soil & Disposal Facility Project Director — Date: 5/15/01

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REVISION SUMMARY

Revision	Dated	Description of Revision
0	5/97	Initial issuance of Revision 0, *Construction Quality Assurance Plan, On-Site Disposal Facility* (20100-PL-0006)
1	5/00	Issuance of Revision 1 to incorporate lessons learned from OSDF Phase I and II; DCNs 1700-063 dated 10 September 1997, 20102-008 dated 22 April 1998, 20102-017 dated 3 June 1998, 20102-027 dated 22 June 1996, 20102-044 dated 5 August 1998, and 20102-057 dated 9 September 1998; RCIs 20103-004R dated 21 February 2001 and 20103-005R dated 5 March 2001.

ACRONYM LIST

ALARA	As Low As Reasonably Achievable
APZ	Acceptable Permeability Zone
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM_	American Society of Testing and Materials
BAMR	Borrow Area Management and Restoration
CFC	Certified-For-Construction
CM	Construction Manager
COE	Corps of Engineers
CQA	Construction Quality Assurance
CQC	Construction Quality Control
CS	Confirmatory Sampling
CSS	Construction Safety and Security
DCP	Design Criteria Package
DOE	Department of Energy
DOT	Department of Transportation
FEMP	Fernald Environmental Management Project
FTMS	Federal Testing Method Standards
GCL	Geosynthetic Clay Liner
GCC	Geosynthetic Clay Cap
HDPE	High Density Polyethylene
IMP	Impacted Materials Placement
NSF	National Sanitation Foundation
O&M	Operations and Maintenance
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	On-Site Disposal Facility
OU1	Operable Unit 1
OU2	Operable Unit 2
OU3	Operable Unit 3
OU4	Operable Unit 4

OU5	Operable Unit 5
PE	Polyethylene
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SDFP	Soil and Disposal Facility Project
SWMEC	Surface Water Management and Erosion Control
TPP	Test Pad Program
TPPFR	Test Pad Program Final Report
USEPA	United States Environmental Protection Agency
WAC	Waste Acceptance Criteria
WAO	Waste Acceptance Organization

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1. INTRODUCTION

1.1 Overview

This Construction Quality Assurance (CQA) Plan provides requirements for the construction quality control (CQC) activities that will be performed during construction of the On-Site Disposal Facility (OSDF) at the Fernald Environmental Management Project (FEMP) near Fernald, Ohio. The purpose of this document is to define the scope, formal organization, and activities necessary to achieve a high level of quality in the OSDF and confirm that the OSDF components are constructed in compliance with the Construction Drawings and Technical Specifications. This plan addresses the CQC activities to be performed during construction of the OSDF.

The OSDF CQA Plan addresses CQC activities for the following elements of the OSDF construction:

- general earthwork;
- liner system;
- final cover system;
- leachate collection, leak detection, and leachate transmission systems;
- electrical and mechanical work;
- roads and concrete work; and
- other general site work.

It should be noted that this CQA Plan does not cover CQC requirements for placement of impacted materials into the OSDF. CQC requirements for placement of

impacted materials into the OSDF are contained in the *Impacted Materials Placement Plan.*

The quality control monitoring, testing, and confirmation of compliance, along with the required frequency of tests, are provided in this Plan. Also detailed are the organization and minimum qualifications of the CQC personnel and other key parties to be involved in the construction of the OSDF as well as the minimum standards for construction testing and documentation to confirm quality.

1.2 Project Description

The design approach for the OSDF is presented in the document, "*Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2*". The design of the OSDF, is presented in the "*Final Design Package, On-Site Disposal Facility*". The OSDF Design Criteria Package (DCP) component of the Final Design Package requires preparation of a CQA Plan to address, at a minimum, the following:

- construction of the double composite liner system;
- construction of the leachate management system;
- construction of the final cover system;
- general site work including roads and concrete; and
- installation of various appurtenances such as mechanical and electrical systems, valve house, and piping.

This CQA Plan has been prepared to address these items and to satisfy the applicable requirements identified in Section 2 of this plan. The interface of the CQA Plan with other related plans is discussed in Section 1.6.

1.3 Major Components of the OSDF

The major components of the OSDF include the liner system, final cover system, leachate management system, surface-water management system, support elements, utilities, and temporary support facilities. A summary of these major components is presented below:

- *Liner and Final Cover Systems.* The liner and final cover systems are constructed using both soil and geosynthetic components (refer to Figure 1-1). The liner system consists of a double-composite liner that will have a leachate collection system (LCS) above the primary liner and a leak detection system (LDS) between the primary and secondary liners. The final cover system includes a composite cap overlain by the following layers: drainage layer; biointrusion barrier; granular filter layer; vegetative soil layer; and topsoil.

- *Leachate Management System.* The leachate management system collects leachate generated by the OSDF and conveys it to a treatment facility. Components of the leachate management system within the battery limit include: double-walled gravity drain pipes from each OSDF cell, valve houses for collection and transmission of liquids from the LCS and LDS, double-walled gravity transmission pipe, control valve house and permanent lift station.

- *Surface-Water Management System.* The surface-water management system manages surface water under both short-term (i.e., during construction and impacted material placement) and long-term (i.e., after OSDF closure) conditions. The design addresses the management of stormwater run-on and runoff, perched ground water, other construction waters, and wastewaters from various sources such as the equipment wash facility.

- *Support Facilities and Utilities.* Both permanent and temporary support facilities are included in the OSDF design. Permanent support facilities include survey benchmarks, security fencing, a perimeter access corridor, and a facility

access road. Temporary support facilities include construction and radiological control fencing, Contractor's administrative support facilities, equipment wash facility, impacted material staging areas, temporary haul roads and construction materials stockpile areas. Utilities to support OSDF construction include electrical, water, telephone, and wastewater for the Contractor's administrative support areas and temporary support facilities. The Contractor's administrative support areas are also provided with parking, , and a construction access road.

1.4 CQA Plan Scope

The CQA Plan establishes quality control activities and monitoring requirements to be implemented during construction of the OSDF. The CQA Plan was developed to conform to the Ohio Environmental Protection Agency (OEPA) requirements [ARAR: Ohio Administrative Code (OAC) 3745-27-08(F)] and relevant U.S. Environmental Protection Agency (USEPA) guidance. The scope of the CQA Plan includes:

- defining the responsibilities of parties involved with the construction of the OSDF;
- providing guidance in the proper construction of liner and cover system components;
- establishing testing protocols for the evaluation of liner and cover system components;
- establishing methods for construction documentation; and
- providing the means for confirming that the facilities constructed conform to the Applicable or Relevant and Appropriate Requirements (ARARs), specifications, and construction drawings.

The CQA Plan is intended to give guidance to the CQC Consultant and the Contractor during the construction of the OSDF and to supplement the specifications of

the OSDF Construction Contract. This plan is part of the construction contract. In the case of any conflicts between the CQA Plan and the requirements of the technical specifications, the technical specifications will govern.

1.5 CQA Plan Organization

The remainder of this CQA Plan is organized as follows:

- other OSDF plans related to this CQA Plan are summarized in the remainder of Section 1;
- the requirements from the OSDF DCP applicable to the CQA Plan are presented in Section 2;
- the definitions of key terms are presented in Section 3;
- the project organization and definitions, responsibilities, and qualifications of key parties involved with the construction of the OSDF are presented in Section 4;
- the requirements for CQC documentation are described in Section 5;
- the CQC activities for the soil components of the OSDF liner and final cover systems and general earthwork are presented in Section 6;
- the CQC activities for geomembranes, including electric leak detection testing, geosynthetic clay liner and cap, and geotextiles are presented in Sections 7 through 9, respectively;
- the CQC activities for the installation of valve houses and control valve house, including pre-engineered building concrete protective liner, HDPE pipes, and fittings are presented in Section 10;

- the CQC activities for appurtenant work items such as mechanical and electrical systems, and concrete appurtenances are described in Sections 11 and 12, respectively;

- the CQC activities for road construction are presented in Section 13; and

- the CQC activities for general site work are presented in Section 14.

1.6 Related Plans

Several other plans have been prepared for the OSDF and contain information relevant to the CQA Plan. These other plans are listed below along with a brief statement of the relationship of the plan to this CQA Plan.

- *OSDF Impacted Materials Placement (IMP) Plan.* The *IMP Plan* contains information regarding the placement, compaction, and testing of impacted materials within the OSDF.

- *OSDF Systems Plan.* The *Systems Plan* contains information regarding the OSDF and various support elements and utilities.

- *OSDF Surface-Water Management and Erosion Control (SWMEC) Plan.* The *SWMEC Plan* addresses stormwater runon and runoff and various aspects of erosion and sediment control.

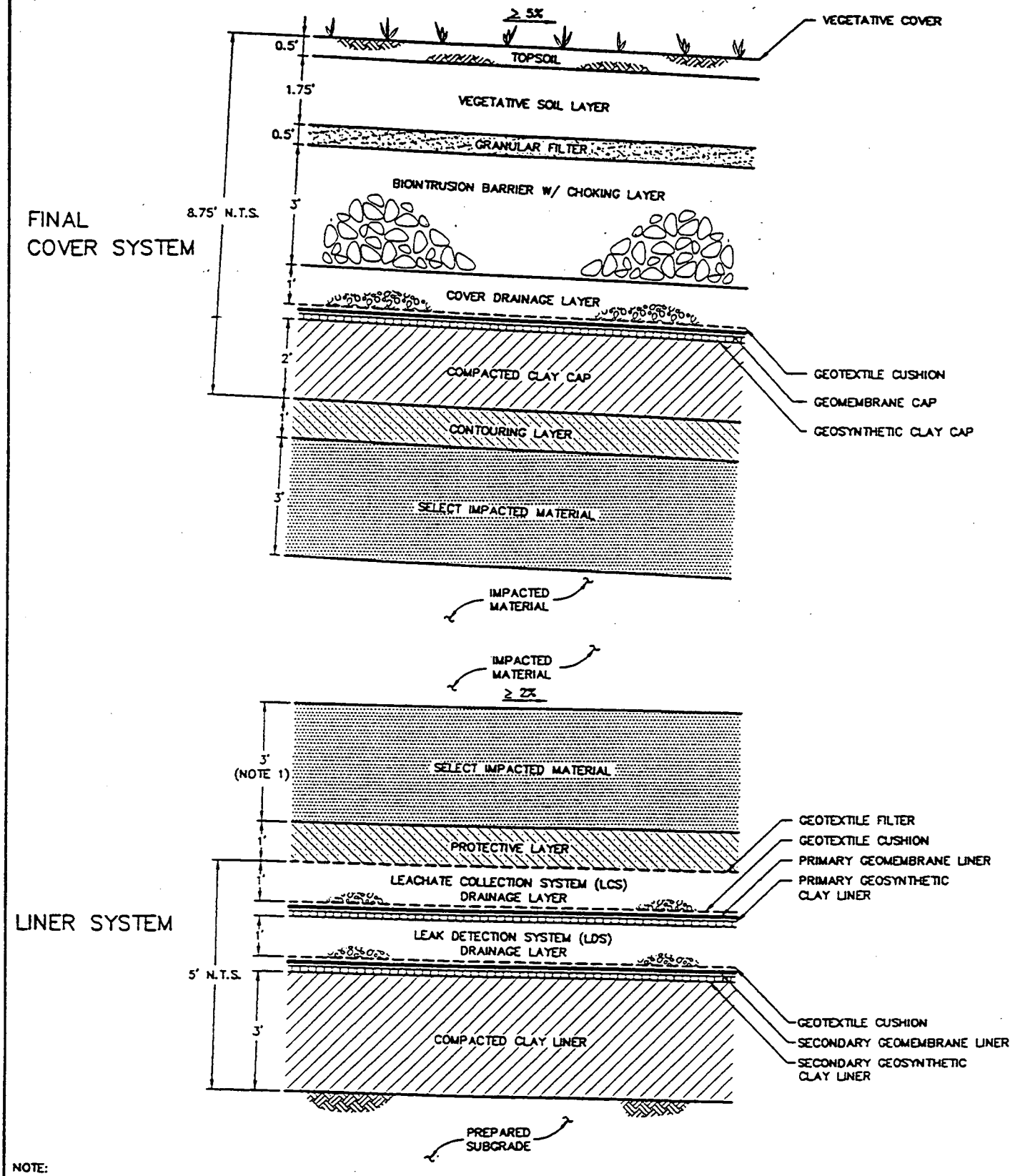
- *OSDF Borrow Area Management and Restoration (BAMR) Plan.* The *BAMR Plan* addresses the development, operation, and subsequent restoration of the on-site borrow area.

- *OSDF Remedial Action Work Plan.* The plan identifies the implementation strategy and schedule for completion of construction of the OSDF.

- *Permitting Plan and Substantive Requirements for the OSDF.* This plan identifies and address permitting requirements.

- *Leachate Management Contingency Plan for the OSDF.* This plan identifies and addresses leachate management during periods when the Leachate Transmission System is not operational.

LINER AND COVER SYSTEM DESIGN DETAIL
ON-SITE DISPOSAL FACILTY



NOTE:

1. SELECT IMPACTED MATERIAL THICKNESS ABOVE LINER SYSTEM MAY BE DECREASED TO 2 FEET IF THE FIRST LIFT OF MATERIAL TO BE PLACED OVER THE SELECT IMPACTED MATERIAL CONSISTS OF CATEGORY 1 MATERIAL

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FIGURE NO.	1-1
PROJECT NO.	GQ1001.05
DOCUMENT NO.	F9650002.CDG
FILE NO.	FOOE001.DWG

2. REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to the CQA Plan are contained in the DCP. These requirements take the form of Applicable or Relevant and Appropriate Requirements (ARARs) for the various FEMP operable units, functional requirements, and general design considerations. The following requirements applicable to the CQA Plan were obtained from the DCP.

2.2 Applicable or Relevant and Appropriate Requirements

Various ARARs provide criteria for the selection and installation of materials to be used in the OSDF liner and final cover systems. Many of the CQA standards described herein were developed from the requirements of the Ohio Administrative Code (OAC) 3745-27-08. Specific criteria for the OSDF are presented in the following sections.

2.2.1 Liner System

The function of the liner system is to isolate impacted material from the environment while containing and collecting leachate generated by the material. As shown on Figure 1-1, the liner system will contain two liners (i.e., primary and secondary liners), separated by a leak detection system, with the primary liner overlain by a leachate collection system (ARAR: 40 CFR ∋ 265.301(a)). Both the primary and secondary liners will consist of a geomembrane liner overlying a geosynthetic clay liner; in addition, the geosynthetic components of the secondary liner will be underlain by a 3-ft (0.9-m) thick layer of compacted low-permeability clay (i.e., a clay with a hydraulic conductivity not more than 1 x 10^{-7} cm/s (ARAR: OAC 3745-27-08(C)(1)(j)(ii)).

2.2.1.1 Compacted Clay Liner

The compacted clay liner shall satisfy the requirements of OAC 3745-27-08(C)(1). Specifically, the compacted clay liner shall be constructed:

- using loose lifts 8 in. thick, or less, to achieve uniform compaction; each lift shall have a maximum hydraulic conductivity of 1 x 10^{-7} cm/s (ARAR: OAC 3745-27-08(C)(1)(a));

- of a soil with a maximum clod size of 3 in, or half the compacted lift thickness, whichever is less (ARAR: OAC 3745-27-08(C)(1)(b)); and

- of a soil with:

  - 100 percent of the particles having a maximum dimension not greater than 2 in;

  - not more than 10 percent of the particles, by weight, having a dimension greater than 0.75 in;

  - not less than 50 percent of the particles, by weight, passing through the standard U.S. No. 200-mesh sieve; and

  - not less than 25 percent of the particles, by weight, having a maximum dimension not greater than 0.002 mm (ARAR: OAC 3745-27-08(C)(1)(c)).

OAC 3745-27-08(C) states that alternatives to the prescriptive requirements for soil liner materials may be used: *"if it is demonstrated to the satisfaction of the Director that materials and techniques will result in each lift having a maximum permeability of 1 x 10^{-7} cm/s."* As a result of the test pad program described in this CQA Plan the percentage of particles, by weight, having a maximum dimension not greater than 0.002 mm was changed from *"not less than 25 percent"* to *"not less than 15 percent."* A copy of the approval letter is included in Appendix A.

As part of the OSDF design, a compacted clay liner test pad program (TPP) was conducted using soil obtained from the area of OSDF excavation. During the TPP, two test pads were constructed using equipment and techniques that were suitable for use in construction of the OSDF clay liner and cap. Laboratory and field permeability testing was performed during the TPP to define the compaction conditions that yield a soil liner or cap with a hydraulic conductivity of not greater than 1×10^{-7} cm/s. The TPP was organized to comply with the requirements set forth in OAC 3745-27-08(C)(1)(m).

The results of the TPP, including laboratory and field hydraulic conductivity test results from the program, are presented in a report entitled *Test Pad Program Final Report (TPPFR) and Addendum.* The TPPFR Addendum outlines moisture/compaction requirements for developing a hydraulic conductivity window for each screened clay material stockpile. This report specifies construction equipment types and construction requirements that result in a compacted clay liner and cap satisfying the hydraulic conductivity performance criterion of OAC 3745-27-08(C)(1). The report is available for reference by the Contractor and should be consulted for the information contained therein.

During construction of the OSDF liner and cap systems, a detailed CQC program must be implemented in accordance with OAC 3745-27-08(F). The CQC activities will include moisture/density testing of soil liner materials at the frequency required by OAC 3745-27-08(C)(1)(o) (i.e., no less than five tests per acre per lift) to confirm that the compaction conditions are consistent with those established during the TPP, and monitoring activities in accordance with 40 CFR ∋ 264.303(C). In so doing, a high level of quality control will be provided to confirm that the hydraulic conductivity of the soil liner material is not greater than 1×10^{-7} cm/s.

In addition to the foregoing, the compacted clay liner shall:

- be compacted to at least 95 percent of the maximum standard Proctor dry density (ASTM D 698), or at least 90 percent of the maximum modified Proctor dry density (ASTM D 1557) (ARAR: OAC 3745-27-08(C)(1)(d));

- be compacted at a moisture content at or wet of optimum (ARAR: OAC 3745-27-08(C)(1)(e));

- not be comprised of solid waste (ARAR: OAC 3745-27-08(C)(1)(f));

- be constructed using the number of passes and lift thickness, and the same or similar type and weight of compaction equipment, used to obtain acceptable results during the soil liner test pad program (ARAR: OAC 3745-27-08(C)(1)(g));

- be placed on the bottom and excavated exterior slope of the OSDF and have a minimum bottom slope of 2 percent and a maximum slope based on: (i) compaction equipment limitations; (ii) slope stability; (iii) maximum shear strength between soil-geosynthetic and geosynthetic-geosynthetic interfaces; and (iv) resistance of geosynthetics and geosynthetic seams to tensile stresses (ARAR: OAC 3745-27-08(C)(1)(h));

- be constructed on a prepared surface that is: (i) free of debris, foreign material, and deleterious material; (ii) be able to bear the weight of the OSDF without causing or allowing a failure of the compacted clay liner to occur through settling; and (iii) without abrupt changes in grade that could cause damage to the geosynthetics (ARAR: OAC 3745-27-08(C)(1)(i)); and

- be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction, filling, and closure (ARAR: OAC 3745-27-08(C)(1)(l)).

OAC 3745-27-08(D)(1) indicates that the following conformance tests shall be performed on representative samples of the clay to be used for liner construction at a frequency not less than one test per 1,500 yd^3 of in place soil, except for the hydraulic conductivity testing, which shall be performed at a frequency not less than one test per 10,000 yd^3 of in place material:

- hydraulic conductivity on specimens compacted to achieve the conditions described in the construction specifications;
- moisture content and dry density using an approved ASTM method;
- particle size distribution using the test method ASTM D 422 for sieve and hydrometer analyses; and
- Atterberg limits using the test method ASTM D 4318.

2.2.1.2 Geosynthetic Clay Liner

The geosynthetic clay liner (GCL) shall satisfy the requirements of OAC 3745-27-08(C)(3). Specifically, the GCL shall:

- be negligibly permeable to fluid migration (interpreted herein to require that the GCL have a maximum hydraulic conductivity of 5×10^{-9} cm/s);
- be installed having a minimum overlap of 6 in., or, for end of panel seams, a minimum overlap of 12 in. (overlap shall be increased in accordance with manufacturers specifications or to account for shrinkage due to weather conditions);
- have a bentonite mass per unit area of at least one pound per square foot;
- be installed in accordance with the manufacturer's specifications in regard to handling, overlap, and the use of granular or powdered bentonite to enhance bonding at the seams; and
- be installed above the compacted clay liner for the secondary liner GCL, and above the LDS granular drainage layer for the primary liner GCL.

2.2.1.3 Geomembrane Liner

The geomembrane component of the liner and final cover systems shall satisfy the requirements of OAC 2745-27-08(C)(2). Specifically the geomembrane shall:

- be placed on a GCL which has been previously placed over a compacted clay liner (ARAR: OAC 3745-27-08(C)(2));
- be manufactured of at least 60-mil thick high density polyethylene (ARAR: OAC 3745-27-08(C)(2));
- be protected from the drainage layer by a cushion layer (ARAR: OAC 3745-27-08(C)(2));
- be negligibly permeable to fluid migration (ARAR: OAC 3745-27-08(C)(2)(a));
- be physically and chemically resistant to attack by solid waste, leachate, or other materials which may come in contact with the geomembrane (ARAR: OAC 3745-27-08(C)(2)(b));
- be seamed to allow no more than negligible amounts of leakage; the seaming material shall be physically and chemically resistant to attack by solid waste, leachate, or other materials that may come in contact with the seams (ARAR: OAC 3745-27-08(C)(2)(c));
- have acceptable properties for installation and use (ARAR: OAC 3745-27-08(C)(2)(d)); and
- as necessary, be protected from the overlying leachate collection system by a cushion layer (ARAR: OAC 3745-27-08(C)(2)(e)).

Geomembrane seams shall be tested by the Installer in accordance with the following, unless the geomembrane manufacturer's specifications for testing are more stringent, in which case the manufacturer's specifications shall be used:

- for the purpose of testing every seaming apparatus in use each day, peel and shear tests shall be performed on scrap pieces of geomembrane at the beginning of the seaming period and every 4 hours thereafter (ARAR: OAC 3745-27-08(C)(2)(g)(i));
- nondestructive testing shall be performed on 100 percent of the geomembrane seams (ARAR: OAC 3745-27-08(C)(2)(g)(ii)); and
- destructive testing for peel and shear shall be performed at least once every 500 ft of seam length (ARAR: OAC 3745-27-08(C)(2)(g)(iii)).

2.2.2 Leachate Collection System

The functions of the leachate collection system (LCS) are to collect leachate, route it from the OSDF to the leachate transmission system, and limit the buildup of hydraulic head on the underlying primary composite liner (functional requirements). The LCS shall extend over all areas that will subsequently be used for impacted material disposal and function with minimal maintenance and monitoring.

In accordance with OAC 3745-27-08(D)(2) the following conformance tests shall be performed on representative samples of the granular drainage components of the LCS:

- permeability (ASTM D 2434);
- soil classification (ASTM D 2487);
- particle-size analysis (ASTM C 136); and
- calcium carbonate content (ASTM D 3042).

The conformance tests described above shall be performed at a frequency of not less than one test per 3,000 yd^3 with the exception of calcium carbonate testing which will be performed at a frequency of one test per 5,000 yd^3.

2.2.3 Leak Detection System

The function of the leak detection system (LDS) is to detect leakage through the overlying primary composite liner system. The LDS shall be designed to collect leakage, should it occur, and route it from the OSDF to the leachate management system. The LDS shall extend over all areas that will subsequently be used for impacted material disposal and as with the LCS, function with minimal maintenance and monitoring.

In accordance with the ARAR OAC 3745-27-08-(D)(2), the following conformance tests shall be performed on representative samples of the granular drainage components of the LDS:

- permeability (ASTM D 2434);
- soil classification (ASTM D 2487);
- particle size analysis (ASTM C 136); and
- calcium carbonate content (ASTM D 3042).

The conformance tests described above shall be performed at a frequency of not less than one test per 3,000 yd^3 with the exception of calcium carbonate testing which will be performed at a frequency of one test per 5,000 yd^3.

2.2.4 Final Cover System

The final cover system must isolate impacted material in the OSDF, protect the OSDF from inadvertent intrusion, promote vegetative growth, and greatly limit infiltration of precipitation into the facility after closure. The final cover system must also be designed to minimize requirements for long-term monitoring, maintenance, and repair. The components of the final cover system are shown in Figure 1-1 and include

(in descending order), topsoil, vegetative soil layer, granular filter layer, biointrusion barrier, cover drainage layer, geotextile cushion layer, and composite cap.

2.2.4.1 Topsoil

A vegetated topsoil layer will form the uppermost component of the OSDF final cover system. The topsoil shall satisfy the requirements of OAC 3745-27-08-(C)(15)(e). The topsoil layer shall have healthy grasses or other vegetation that form a complete and dense vegetative cover (ARAR: OAC 3745-27-08(C)(15)(e)).

2.2.4.2 Vegetative Soil Layer

A vegetative soil layer will underlie the topsoil component of the OSDF final cover system. The vegetative soil layer shall satisfy the requirements of OAC 3745-27-08-(C)(15)(e). The vegetative soil layer shall be a well-graded mixture of clayey, silty, and sandy material, at least 1.75 ft thick and have sufficient thickness to support vegetative growth and to protect the geosynthetics and compacted clay components of the composite cap from damage due to root penetration (ARAR: OAC 3745-27-08(C)(15)(e)).

2.2.4.3 Granular Filter

A granular filter will underlie the vegetative soil layer component of the OSDF final cover system. The granular filter shall satisfy the requirements of the specifications and comply with the following design criteria:

- be at least 6 in. thick; and
- prevent migration of soil from the vegetative soil layer through the filter to the biointrusion barrier layer.

2.2.4.4 Biointrusion Barrier

A biointrusion barrier layer shall underlie the granular filter component of the OSDF final cover system. The purpose of this layer is to prevent intrusion of plant roots and burrowing animals into the OSDF. The biointrusion barrier layer shall satisfy the requirements of the technical specifications and consist of durable cobbles (possibly with gravel and boulder size fractions), be at least 3 ft thick and extend at least 40 ft laterally beyond the limit of impacted material disposed in the OSDF.

2.2.4.5 Cover Drainage Layer

A cover drainage layer shall underlie the biointrusion barrier component of the OSDF final cover system and overlie the geomembrane cap component of the OSDF final cover system (OAC 3745-27-08(C)(15)(a)). The cover drainage layer shall consist of a 12 in. thick granular drainage material, with the cover drainage layer meeting the requirements of OAC 3745-27-08(C)(4)(a) (ARAR: OAC 3745-27-08(C)(16)(b)(i)).

2.2.4.6 Geotextile Cushion Layer

A geotextile cushion layer shall satisfy the requirements of the technical specifications. The geotextile shall be installed above the geomembrane cap component of the OSDF final cover system to protect the geomembrane from puncture by particles in the overlying cover drainage layer and resist the effects of construction (i.e., termed construction survivability).

2.2.4.7 Composite Cap

The OSDF final cover system shall contain three low-permeability infiltration barrier layers designed to isolate impacted material from the surrounding environment

while minimizing precipitation infiltration into the OSDF. These three layers are, from top to bottom (Figure 1-1):

- 60-mil thick geomembrane cap;
- geosynthetic clay cap; and
- 2-ft thick compacted clay cap.

Taken together, these three layers are called the "composite cap". Applicable criteria for the composite cap are as follows:

- The composite cap shall overlie all areas where impacted material has been placed (ARAR: OAC 3745-27-08(C)(15)).
- The composite cap shall have a permeability less than or equal to the permeability of the liner system (ARAR: 40 CFR ∋265.310).
- The compacted clay component of the composite cap shall satisfy the requirements of the specifications and have a minimum thickness of 24 in. and a maximum hydraulic conductivity of 1 x 10^{-7} cm/s (ARAR: OAC 3745-27-08(C)(15)(ii)). In addition, the compacted clay cap must satisfy the requirements of OAC 3745-27-08(C)(1)(a) to (C)(1)(g) and (C)(1)(m) to (C)(1)(o) (ARAR: OAC 3745-27-08(C)(16)(a)(ii)).
- The HDPE geomembrane component of the composite cap shall have a minimum thickness of 60 mils, be negligibly permeable to fluid migration, and satisfy the requirements of OAC 3745-27-08(C)(2) (ARAR: OAC 3745-27-08(C)(16)(a)(ii)).
- The composite cap shall be constructed at a slope between 5 and 25 percent (ARAR: OAC 3745-27-08(C)(15)(f)(ii)).

- Any penetrations through the composite cap system shall be sealed so that the integrity of the compacted clay component of the cap is maintained (ARAR: OAC 3745-27-08(C)(15)).

2.3 Other Considerations

This CQA Plan also reflects the guidance of the Hazardous and Solid Waste Amendments of 1984 to the Resource Conservation and Recovery Act (RCRA), as well as the following Technical Guidance Documents:

- "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities", EPA/530-SW-86- 031, October 1986; and

- "Quality Assurance and Quality Control for Waste Containment Facilities", EPA/600/R-93/182, September 1993.

3. CQA PLAN DEFINITIONS

3.1 Construction Quality Assurance and Construction Quality Control

In the context of this document, construction quality assurance and construction quality control are defined as follows:

- *Construction Quality Assurance (CQA)* - The planned and systematic means and actions designed to assure adequate confidence that materials and/or services meet contractual and regulatory requirements, and will perform satisfactorily in service. For the OSDF project, CQA refers to means and actions employed by Fluor Fernald, Inc. to assure conformity of the liner and final cover system components production and confirm installation with this CQA Plan, the Construction Drawings and Technical Specifications.

- *Construction Quality Control (CQC)* - Those actions which provide a means to measure and confirm the characteristics of an item or service in relation to contractual and regulatory requirements. For the OSDF project, CQC refers to those actions taken by the CQC Consultant, Contractor, Manufacturers, or Installers to confirm that the materials and the workmanship meet the requirements of the Construction Drawings and Technical Specifications. In the case of the geosynthetic components of these systems, CQC is provided by the CQC Consultant and the Manufacturers, Fabricators, and Installers of the various geosynthetics.

3.2 Geosynthetics

Geosynthetics is the generic term for synthetic materials used in geotechnical engineering applications; the term includes geotextiles, geogrids, geonets, geomembranes, geosynthetic clay liners (GCLs), geocomposites, and HDPE pipes. There are four types of geosynthetic products referenced in this CQA Plan, which are included in the OSDF liner and final cover systems. These geosynthetics include (i)

textured HDPE geomembranes used in the composite liner and cap; (ii) GCLs used in the composite liner and cap; (iii) geotextiles used as filters or cushions or separators; and (iv) concrete protective liner; and(v) HDPE pipes used to collect and convey leachate.

3.3 CQA Lines of Communications

The CQA lines of communication between the Construction Manager, Contractor, and CQC Consultant are defined in the *OSDF Remedial Action Work Plan*.

4. PROJECT ORGANIZATION AND PERSONNEL

4.1 Overview

The OSDF construction organization chart is shown in Figure 4-1. Day-to-day construction activities at the OSDF will be managed through the direct interaction of several parties below the Soil & Disposal Facility Project (SDFP) Project Director level including but not limited to the Construction Manager, Project Engineer, Resident Engineer, Contractor, and CQC Consultant. The organization chart for the OSDF CQC Consultant is presented in Figure 4-2. The definitions, qualifications, and responsibilities of the parties responsible for construction, Resident Engineering and CQC of the OSDF are described below.

4.2 Construction Manager

The Construction Manager is the authorized representative of Fluor Fernald, Inc. who has overall technical responsibility for construction of OSDF project. The Construction Manager may delegate responsibilities, duties, and receipt of correspondence and documents as necessary.

4.3 Contractor

The Contractor is the person or organization entering into contract for construction of the OSDF project with Fluor Fernald, Inc.

4.4 Resident Engineer

4.4.1 Definition

The Resident Engineer is the individual representing the OSDF design Contractor during construction.

4.4.2 Qualifications

The Resident Engineer will hold a minimum of a baccalaureate degree in engineering and be registered as a Professional Engineer in the State of Ohio and have a minimum of ten years experience in construction management, engineering, or related fields. The Resident Engineer will have expertise that demonstrates significant familiarity with geosynthetics and soils, as appropriate, including design and construction experience related to liner and cover systems.

4.4.3 Responsibilities

The Resident Engineer is responsible for approving design and specification changes, and making design clarifications that may be required during construction of the OSDF. The Resident Engineer will assist the Construction Manager in reviewing and approving the Contractor's shop drawings and submittals as necessary. The Resident Engineer will be present on-site and attend the project coordination meetings. The Resident Engineer will be capable of discussing and interpreting elements of the OSDF design. The Resident Engineer will have the authority to recommend changes or modifications to the Construction Drawings and Technical Specifications for approval by the Construction Manager.

4.5 CQC Consultant

4.5.1 Definition

The CQC Consultant is the party, independent from the Construction Manager and the Contractor, responsible for monitoring, testing, confirming compliance and documenting activities related to the construction of the OSDF. Construction of the OSDF includes but is not limited to: liner and final cover systems, impacted material placement, and other support facilities.

4.5.2 Qualifications

The CQC Consultant will be a firm specialized in performing CQC for the construction of disposal facilities including liner and final cover systems, impacted material placement, and support facilities. The CQC consultant will have minimum of ten years experience in performing CQC activities for the construction of disposal facilities. The CQC Consultant will demonstrate its capabilities to perform CQC activities and to provide equipment, qualified personnel, and licenses required to perform CQC for the construction of OSDF. The CQC Consultant will also demonstrate experience in the preparation of CQC documentation including CQC plans, field documentation, field testing methods, laboratory testing methods, and Construction Quality Assurance (CQA) certification reports; and interpretation of technical specifications, construction drawings, and support plans for liner and cover systems, and material placement.

In addition, the CQC Consultant will provide the following documentation to the Construction Manager:

- corporate background and information;
- a detailed summary of the firm's CQC capabilities;
- a detailed summary of the firm's CQC experience; and

- a representative list of at least 10 completed facilities for which the CQC Consultant has provided CQC monitoring and testing services for the construction of soil and geosynthetic liner or cover system; for each facility, the following information will be provided:
  - name and purpose of facility, its location, and date of installation;
  - name of owner;
  - surface area of each soil and geosynthetic liner construction ; and
  - name and telephone number of contact person familiar with the project.
- résumés of CQC personnel to be assigned to the project including the Principal-in-Charge CQC Certifying Engineer, CQC Site Manager, and CQC Lead Field Monitors; and
- proof of Ohio Professional Engineering registration for the engineer to be the designated CQC Resident/Certifying Engineer.

The CQC Consultant's personnel will include:

- the Principal-in-Charge, who may operate from the office of the CQC Consultant and visiting the site periodically as required;
- the Certifying Engineer, who will be located on site ;
- the CQC Site Manager, who will be located at the site; and
- the CQC Field Monitors, who will be located at the site.

The CQC Consultant will establish an on-site soils laboratory having qualifications as specified in this Section the CQA Plan.

4.5.3 Responsibilities

The CQC Consultant will be responsible for monitoring, testing, confirmation of compliance, and documenting the activities of the Contractor relative to the construction of the OSDF. The CQC Consultant will be responsible for monitoring, testing, and confirming the compliance of construction materials delivered to the site with the submittals and/or shop drawings previously reviewed and approved by the Resident Engineer. The CQC Consultant will monitor, confirm and document that the OSDF construction is performed in accordance with the Construction Drawings, Technical Specifications, and this CQA Plan. The CQC Consultant will be responsible for obtaining samples of the various construction materials in accordance with the testing frequencies identified in this plan. The CQC Consultant will also be responsible for obtaining, labeling, and shipping samples for off-site laboratory testing in accordance with the requirements of this plan.

The CQC Consultant will be responsible for soils quality control testing to be performed by the on-site and off-site testing laboratories. The CQC Consultant will be responsible for operating and staffing the on-site and off-site soils laboratory. Test results from the on-site and off-site laboratories will be submitted to the Construction Manager within a time frame, which will not impede or delay construction activities.

The on-site soils laboratory will be equipped to perform routine index testing, including:

- standard or modified Proctor (ASTM D 698 or D 1557);
- particle-size analysis (ASTM D 422 and ASTM C 136);
- Atterberg limits (ASTM D 4318);
- moisture content (ASTM D 2216 and ASTM D 4643);
- soils classification (ASTM D 2487); and

- percent passing No. 200 sieve (ASTM D 1140).

The CQC Consultant will also be responsible for performing routine field performance tests during construction of the OSDF liner and final cover systems, which will include:

- in-situ surface moisture content (ASTM D 3017);
- in-situ density by nuclear methods (ASTM D 2922);
- lift thickness by direct measurement; and
- in-place density by sand cone (ASTM D 1556), or drive cylinder (ASTM D 2937).

The CQC Consultant will be responsible for the quality control of its on-site laboratory testing program and for documenting the calibration of the soils laboratory testing equipment. Equipment calibration certificates will be maintained in the CQC Consultant's on-site project file. Tests will be performed in accordance with ASTM or other recognized standards. Test results will be submitted to the Construction Manager within a time frame, that will not impede or delay construction of the liner and cover systems.

The CQC Consultant will monitor, perform or observe testing, confirm compliance with the Construction Drawings, Technical Specifications, Support Plans, and other related documents during construction of the OSDF and support facilities.

4.6 Principal-In-Charge

4.6.1 Definition

The Principal-in-Charge is the corporate official of the CQC Consultant at the grade of principal given responsibility and authority to direct project professionals in performance of their duties.

4.6.2 Qualifications

The Principal-in-Charge will have a minimum of ten years experience related to the design and construction of waste disposal systems. The Principal-in-Charge will be a registered professional engineer.

4.6.3 Responsibilities

The Principal-in-Charge has overall corporate responsibility for the work performed by the CQC Consultant. The Principal-in-Charge is responsible for project resource loading and review of key project documents, including the certification report prepared by the Certifying Engineer. The Principal-in-Charge will provide technical support for the Certifying Engineer when required.

4.7 Certifying Engineer

4.7.1 Definition

The Certifying Engineer has overall authority for field monitoring, testing, certification-of-compliance, documentation, and construction certification.

4.7.2 Qualifications

The Certifying Engineer will have a minimum of ten years experience in certifying similar waste disposal facilities and be a registered professional engineer in the State of Ohio. The Certifying Engineer will demonstrate knowledge of CQC activities including monitoring, testing, confirmation for compliance, and documentation.

4.7.3 Responsibilities

The responsibilities of the Certifying Engineer include but are not limited to, as follows. Certifying Engineer will:

- review the OSDF construction plans and Construction Drawings and Technical Specifications;
- review liner and cover system soils and geosynthetics-related documents (such reviews are for familiarization and for evaluation of constructibility only);
- attend project meetings related to construction activities;
- administer the CQC program including but not limited to assignments and management of on-site CQC personnel; review field reports; and review of CQC related activities;
- monitor, confirm compliance, and document construction of the OSDF and related field activities;
- provide quality assurance of CQC documentation;
- review appropriate certification and documentation from the Contractor, vendors for the construction materials, and Installer to confirm compliance to the Technical Specifications;

- review changes to the OSDF design, Construction Drawings, and Technical Specifications;
- assist the CQC Site Manager in preparing CQA Certification report; and
- sign and seal the CQA Certification report.

4.8 CQC Site Manager

4.8.1 Definition

The CQC Site Manager is in charge of day to day performance of field monitoring, testing, and documentation.

4.8.2 Qualifications

The CQC Site Manager will have a minimum of ten years experience in CQC activities on similar waste disposal facilities. The CQC Site Manager will have performed CQC activities on the construction of soil and geosynthetic liner and cover system components for at least three projects; including the construction of a minimum 100,000 cubic yards of low-permeability clay liner or cap, and the installation of at least 5,000,000 square feet of HDPE geomembrane liner and cap. The CQC Site Manager will demonstrate experience in managing CQC activities, including monitoring, testing, confirmation of compliance, and documentation.

4.8.3 Responsibilities

The responsibilities of the CQC Site Manager include but are not limited to as follows. CQC Site Manager will:

- act as the on-site representative of the CQC Consultant;

- familiarize CQC Field Monitors with the conditions, project documents (including Technical Specifications, Construction Drawings and Support Plans), and the CQC requirements;
- manage the daily activities of the CQC Field Monitors;
- attend regularly-scheduled CQC-related meetings on-site;
- review the ongoing preparation of the construction record drawings;
- review test results provided by the Field Monitors, Contractor, and vendor for construction materials;
- verify the calibration and condition of on-site testing equipment;
- review the CQC Field Monitors' daily reports and logs;
- report to the Certifying Engineer/Construction Manager, and documents in a daily report any reported relevant observations by the CQC Field Monitors;
- prepare a daily report for the project;
- oversee the collection and shipping of laboratory test samples;
- review results of laboratory testing and confirming compliance ;
- report any deviations from the CQA Plan, Support plans, Construction Drawings, and Technical Specifications to the Construction Manager and Certifying Engineer;
- review and confirming compliance appropriate certifications and documentation from the Contractor, vendors for the construction materials, and Installer;
- assist with the preparation of the CQA Certification report;

- review appropriate certification and documentation from the Contractor, vendor for the construction materials, and Installer to confirm compliance with the Technical Specifications;
- review the materials vendor's QC documentation;
- review required qualification for the Geosynthetics Installer's personnel and confirms compliance; and
- perform duties of CQC Field Monitor as needed.

4.9 Lead Field Monitors

4.9.1 Lead Soils Monitor

4.9.1.1 Definition

The Lead Soils Field Monitor is the individual in charge of field monitoring, testing, and documentation for the earthwork component of the OSDF.

4.9.1.2 Qualification

The Lead Soils Field Monitor will have a minimum of two years experience in CQC activities or similar waste disposal facilities, and will have performed CQC activities on at least two similar projects. The Lead Soils Field Monitor will have performed CQC activities for the installation of at least 100,000 inplace cubic yards of low-permeability clay liner or cap on one project or 40,000 inplace cubic yards of low permeability clay liner or cap each on two projects.

4.9.1.3 Responsibilities

The Lead Soils Field Monitor may perform some or all of the activities related to earthwork, which are described in Section 4.9.3.3.

4.9.2 Lead Geosynthetics Field Monitor

4.9.2.1 Definition

The Lead Geosynthetics Field Monitor is the individual in charge of field monitoring, testing, and documentation for the geosynthetic components of the OSDF.

4.9.2.2 Qualification

The Lead Geosynthetics Field Monitor will have a minimum of two years experience in CQC activities on similar waste disposal facilities and will have performed CQC activities on at least two similar projects. The Lead Geosynthetics Field Monitor will have performed CQC activities for the installation of at least 2,500,000 square feet (ft^2) of HDPE geomembrane and may hold current certification by the National Institute for the Certification of Engineering Technicians (NICET) for the Installation Inspection of Geosynthetic Materials.

4.9.2.3 Responsibilities

The Lead Geosynthetics Field Monitor may perform some or all of the activities related to geosynthetics which are described in Section 4.9.3.3.

4.9.3 Field Monitors

4.9.3.1 Definition

Field Monitors support the Lead Soil and Geosynthetic Field Monitors.

4.9.3.2 Qualification

Field Monitors are personnel who are specifically trained in the CQC of geosynthetics and low permeability clays liner or cap and have documented CQC monitoring experience or a technical degree.

4.9.3.3 Responsibilities

The duties of the CQC Field Monitors are monitoring, testing, confirming, compliance and documenting construction of the OSDF including soils and geosynthetics components of the liner and cover systems, impacted material placement, and other support-activities, as assigned by the CQC Site Manager.

The duties of the Field Monitors includes but are not limited to:

- performing tests on completed earthwork activities (e.g., in-situ moisture/density tests, etc.);
- monitoring material stockpiles for non-compliant materials;
- monitoring surface-water drainage in the areas of soil and geosynthetic material stockpiles;
- preparing daily field reports;
- recording CQC activities on field logs;
- collection of soils samples from site work activities in accordance with the CQA Plan;
- monitoring soil placement and compaction to confirm compliance with the Technical Specifications;

- monitoring the unloading, on-site handling, and storage of the geosynthetics;
- monitoring repairs;
- monitoring geosynthetic material deployment and installation operations;
- monitoring and documenting of testing activities;
- collecting pre-conformance and conformance samples for testing by CQC laboratories; and
- reporting deviations to the CQC Site Manager

4.10 Geotechnical CQC Laboratory

4.10.1 Definition

The Geotechnical CQC Laboratory is the party, independent from the Construction Manager and Contractor, responsible for performing geotechnical laboratory tests in accordance with standards referenced in the Construction Drawings, Technical Specifications, and this CQA Plan. The testing results provided by the Geotechnical CQC Laboratory will be used by the CQC Consultant to confirm compliance of the soils construction materials with the construction drawings, technical specifications, and CQA Plan.

Geotechnical CQC Laboratory will be required to perform pre-conformance conformance of the various soils components of the OSDF and performance testing.

4.10.2 Qualifications

The Geotechnical CQC Laboratory will have a minimum three years experience in testing of soils similar to those proposed for use in the construction of the OSDF in accordance with ASTM and other applicable soil test standards. The Geotechnical

CQC Laboratory will be capable of providing test results within a maximum of 7 days of receipt of samples and will maintain that capability throughout the duration of the earthwork construction.

Prior to construction, the Geotechnical CQC Laboratory, will submit their qualifications and QA/QC procedures to the Construction Manager for review and approval. The qualifications presented by the Geotechnical CQC Laboratory will, as a minimum, include:

- corporate background and statement of qualifications;
- equipment and list of testing capabilities including reference to ASTM or other applicable test methods;
- a laboratory QA/QC plan:
- information on staff size and experience; and
- information regarding test result turnaround time.

4.10.3 Responsibilities

The Geotechnical CQC Laboratory will be responsible for testing various soils components of the OSDF liner and final cover systems and support facilities. These tests will include, but not be limited to, pre-conformance, conformance and performance tests performed in accordance with the Construction Drawings, Technical Specifications, and CQA Plan. The CQC Consultant will be responsible for the Geotechnical CQC Laboratory testing.

4.11 Geosynthetics CQC Laboratory

4.11.1 Definition

The Geosynthetics CQC Laboratory is the party independent from the Construction Manager, Contractor, Geosynthetics Manufacturer, and Geosynthetics Installer. This laboratory is responsible for performing laboratory conformance and geomembrane seam tests on samples of geosynthetic materials in accordance with the Construction Drawings, Technical Specifications, and this CQA Plan. The testing results provided confirm by the Geosynthetics CQC Laboratory will be used by the CQC Consultant to confirm compliance with Construction Drawings, Technical Specifications, and CQA Plan.

The Geosynthetic CQC Laboratory will be required to perform conformance and performance testing on geosynthetic material samples.

4.11.2 Qualifications

The Geosynthetics CQC Laboratory will hold current accreditation by the Geosynthetic Accreditation Institute (GAI) for each test method performed and have a minimum of three years experience in testing geosynthetics similar to those proposed for use during construction of the OSDF. The Geosynthetics CQC Laboratory will be familiar with ASTM and other applicable geosynthetic test methods. The Geosynthetics CQC Laboratory will be capable of providing destructive test results for geomembrane field seams within 24 hours of receipt of samples and will maintain that capability throughout the duration of geosynthetic material installation.

Prior to construction, the Geosynthetics CQC Laboratory, will submit their qualifications to the Construction Manager for review and approval. The qualifications presented by the Geosynthetics CQC Laboratory will, as a minimum, include:

- corporate background and statement of qualifications;

- equipment and listing of testing capabilities including reference to ASTM or other applicable test methods;
- a laboratory QA/QC plan:
- information on staff size and experience;
- information regarding test result turnaround time; and
- proof of current GAI accreditation.

4.11.3 Responsibilities

The Geosynthetics CQC Laboratory will be responsible for testing various geosynthetic components of the liner and cover systems. These tests will include, but not be limited to, geosynthetic conformance and performance testing in accordance with Construction Drawings, Technical Specifications, and CQA Plan. The CQC Consultant will be responsible for the Geosynthetics CQC Laboratory testing.

4.12 Geosynthetics Manufacturers

4.12.1 Definition

The Geosynthetics Manufacturers are the firms or corporations responsible for production of the geosynthetic materials to be used in construction of the OSDF.

4.12.2 Qualifications

The Geosynthetics Manufacturers will be able to provide sufficient production capacity and qualified personnel to meet the project schedule. The geosynthetic manufacturers will meet the qualifications outlined in Sections 02714P, 02770P, and 02772P of the Technical Specifications, respectively.

4.12.3 Responsibilities

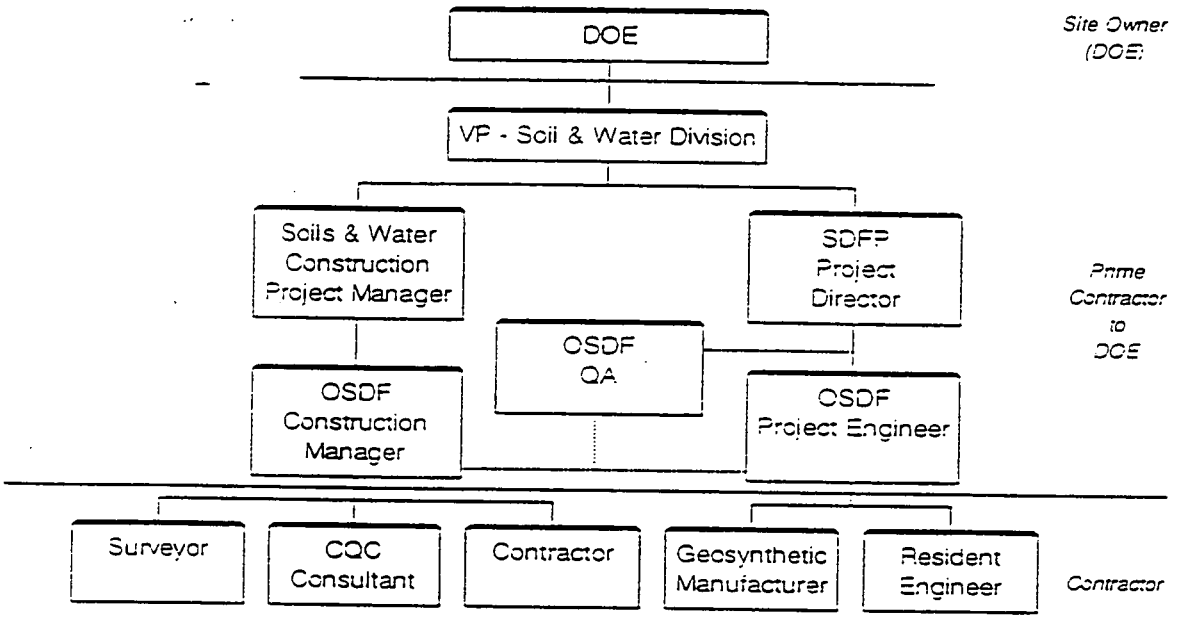
Each Geosynthetics Manufacturer will be responsible for the production and quality control of its respective geosynthetic product. In addition each Geosynthetics Manufacturer will be responsible for the geosynthetic material until final acceptance by Fluor Fernald, Inc. Each Geosynthetics Manufacturer will provide a products which shall meet the requirements of the technical specifications. Each Geosynthetics Manufacturer will submit quality control documentation to the Construction Manager for its respective products as required by the Technical Specifications.

4.13 Geosynthetics Installer

The Geosynthetics Installer will be experienced and qualified to install the geosynthetic materials of the type specified for this project. The Geosynthetics Installer will be approved and/or licensed by the Geosynthetics Manufacturer. A copy of the approval letter or license will be submitted by the Contractor to the Construction Manager as required by the Technical Specifications.

Figure 4-1

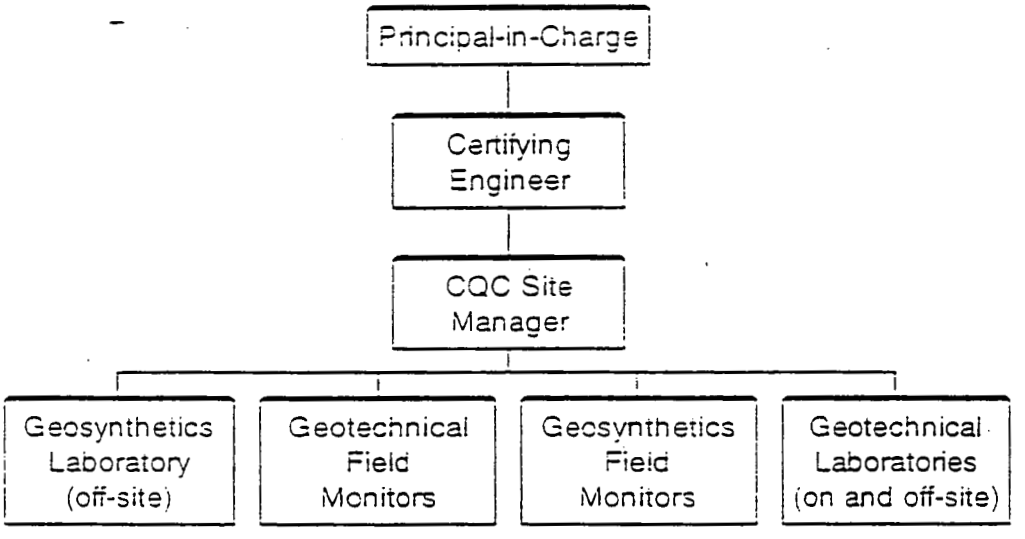
OSDF Construction Organization Chart



SDFP = Soil & Disposal Facility Project

Figure 4-2

OSDF CQC Consultant Organization Chart



NOTE: Certifying Engineer and Resident Engineer may be the same individual if CQC Consulting contractor and the OSDF Design contractor are the same.

5. DOCUMENTATION

The CQC Consultant will complete field forms including daily field report and CQC forms, test result, and monitoring, and logs, documenting CQC activities. Examples of some of the forms that will be used to document CQC activities are included in Appendix B. The CQC Site Manager will submit weekly reports to the Construction Manager summarizing daily field reports for construction activities during the proceeding week. Monitoring and data forms will be provided to the Construction Manager as testing is completed or at a frequency directed by the Construction Manager. All field forms, including daily reports, will be available for review by the Construction Manager. The CQC Site Manager shall also maintain at the job site a complete file of Construction Drawings, Technical Specifications, this CQA Plan, the Contractor's Quality Assurance and Work Plans, any checklists, test methods, completed field forms, daily and weekly field reports, and other pertinent construction and CQC documents.

5.1 Daily Record keeping

The CQC Consultant's daily field reporting will include: (i) field CQC activities; (ii) monitoring forms; (iii) and data forms.

5.1.1 Daily Field Reports

The CQC Consultant's daily field reports will include the following information as applicable:

- an identifying sheet number for cross referencing and document control;
- date, project name, location, and other pertinent project identification;

- summary on meetings held and their results;
- description(s) and location(s) of construction;
- descriptions and specific locations of areas, or units, of work being tested and/or monitored and documented;
- description of locations where tests and samples were taken;
- a narrative summary of field test results;
- off-site materials received, including quality control documentation;
- decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard testing results;
- identifying sheet numbers of data sheets and/or nonconformance identification and corrective measures reports used to substantiate the decisions described above; and
- signature of CQC Site Manager and/or the CQC Field Monitor.

Corrections to the Daily Field Reports will be single line crossed out, initialed by the correcting personnel, CQC Site Manager, and dated. Documentation of field activities will also be included on monitoring logs and test data sheets. When appropriate, the Daily Field Reports can reference information recorded on these logs or data sheets instead of reporting information in the daily field report.

5.1.2 CQC Monitoring and Data Forms

Field monitoring reports, sampling information, and test results will be recorded on appropriate monitoring and data forms. The CQC Consultant will use the monitoring and data forms to confirm completeness of the required CQC activities. Any

corrections to the monitoring and data forms will be single line crossed out, initialed by the CQC personnel responsible for the correction and dated. Examples of relevant monitoring and data forms that may be used during the OSDF construction are presented in Appendix B.

The CQC Consultant's monitoring and data forms will include the following information as applicable:

- project specific information such as project name, and location;
- the date the CQC activity was performed;
- a unique identifying sheet number for cross-referencing and document control;
- location of the CQC activity or location from which the sample was obtained;
- type of CQC activity or method used (reference to standard method when appropriate);
- test results, with all necessary calculations;
- results of the CQC activity and comparison with specification requirements (pass/fail); and
- the initials or signature of personnel involved in the CQC monitoring activity.

5.1.3 Nonconformance Identification and Reporting

A nonconformance is defined herein as material or workmanship that does not meet the specified requirement(s). Nonconformance identification and corrective measures reports should be cross-referenced to specific summary reports, monitoring forms, or data forms where the nonconformance was identified. The CQC Consultant will notify the Construction Manager of any known nonconformance within one hour of discovery

and will transmit a nonconformance report within 24 hours of discovery. The reports will include the following information as applicable:

- a unique identifying sheet number for cross-referencing and document control;
- detailed description of the problem;
- location of the problem;
- probable cause;
- how and when the problem was located;
- estimation of how long problem has existed;
- suggested corrective action;
- documentation of correction (e.g., reference to data form);
- final results;
- suggested methods to prevent similar problems; and
- signature of the appropriate CQC Field Monitor and concurrence by the CQC Site Manager.

5.2 Photographic Documentation

The CQC Consultant will be responsible for obtaining photographic documentation of the Contractor's activities, materials installation methods, and testing methods. Photographs will serve as a pictorial record of work progress, problems, and corrective measures. The photographic log included with the field forms in Appendix D will be utilized to organize and document photographs taken during construction of the OSDF.

Such data sheets could be cross-referenced or appended to summary reports, CQC monitoring forms, or data forms and/or nonconformance identification and corrective measures reports. At a minimum, photographic logs should include the following information:

- a unique identifying number on data sheets and photographs for cross-referencing and document control;
- the date and location where the photograph was taken; and
- location and description of the work;

These photographs will serve as a pictorial record of work progress, problems, and corrective measures. Color prints will be organized chronologically and kept in a permanent protective file. Negatives will be stored in a separate protective file and will be submitted to the Construction Manager with the Construction Quality Assurance Certification Report or at the end of the construction year which ever comes first.

5.3 Design and/or Specifications Changes

Design and/or specifications changes may be required during construction. In such cases, the individual identifying the change will submit written requests for such changes to the Construction Manager. The Resident Engineer will review and respond to these requests with the concurrence of the Project Engineer in accordance with FEMP site procedures. Such changes will take the form of a design change notice (DCN) to the Construction Contract. DCNs will have concurrence of Regulatory Agency prior to implementation.

5.4 Nonconformances

The Construction Manager will be informed in writing of any significant recurring nonconformance with the Construction Drawings, Technical Specifications, or CQA Plan by the CQC Consultant. The cause of the nonconformance will be determined by the CQC Consultant. The Contractor will be directed by the Construction Manager to make appropriate changes in materials or procedures in order to correct the nonconformance. When this type of evaluation is made, the results will be documented, and deviation from procedures, plans, specifications, drawings, or contract documents must be approved by the Construction Manager. Redline drawings shall be developed by the Contractor to show deviations from design document.

5.5 CQC Certification Report

At the completion of construction phases the CQC Consultant will submit a construction phase final report to the Construction Manager. This report will acknowledge: (i) that the work has been performed in compliance with the Construction Drawings and Technical Specifications; (ii) physical sampling and testing have been conducted at the appropriate frequencies; and (iii) that the summary document provides the necessary supporting information.

At a minimum, this report will include:

- summaries of CQC activities;
- CQC monitoring forms and data forms including sample location plans;
- laboratory test results;
- problem identification and corrective measures reports;

- a descriptive summary of any changes from Construction Drawings and Technical specifications; and

- a summary statement indicating compliance with Construction Drawings and Technical Specifications which is signed and sealed by the CQC Certifying Engineer.

The Contractor's as-built drawings, which include scale drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, pipe elevations, etc.), and a geomembrane panel record drawings prepared by the CQC Consultant will be included as part of the final certification report.

5.6 Storage of Records

The CQC Site Manager will be responsible for all facility CQC document storage during the construction of the OSDF. This includes the CQC Consultant's copy of the Construction Drawings and Technical Specifications, the CQA Plan, and the originals of all the data sheets and reports. When the OSDF construction is complete (i.e., closure of the final cell) and upon issuance of the final certification report, the CQC document originals will be organized and submitted to the Construction Manager. Records will be filed in accordance with the subject file index and will be retained for 30 years after closure of the OSDF. Required records will include, but not be limited to, field logbooks, other data collections forms, equipment calibration records, costs data, drawings, maintenance records, and all associated reports.

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6. SOILS CONSTRUCTION

6.1 Introduction

CQC monitoring and testing will be performed during installation of the various soil components of the OSDF, including the soil components of the liner and final cover systems. Criteria to be used for determination of acceptability of the various soil layers are identified in the Construction Drawings, Technical Specifications, Support Plans, and this CQA Plan.

This CQA Plan includes CQC requirements for the non-impacted protective layer and contouring layer as part of the CQC requirements for the liner and final cover systems. The CQC requirements for the impacted material protective layer and contouring layer will be as specified in the IMP Plan.

6.2 Related Construction Drawings, Technical Specifications and Support Plans

Several sections of the Construction Drawings, Technical Specifications, and Support Plans will be referenced by the CQC Consultant for pertinent soil materials physical properties and construction requirements. Related specifications and support plans include the following:

- Section 02100 – Surveying;
- Section 02200 – Earthwork;
- Section 02215 – Trenching and Backfilling;
- Section 02225 – Compacted Clay Liner and Cap;
- Section 02240 – Non-Impacted Protective and Contouring Layers;

- Section 02250 – Vegetative Soil Layer;
- Section 02710 – Granular Drainage Layer;
- Section 02712 – Granular Filter Material;
- Section 02280 – Biointrusion Barrier;
- Section 02920 – Topsoil;
- Section 13000 – Borrow Area Management (BAMR);
- Section 13010 – Impacted Material Placement;
- Borrow Area Management and Restoration Plan; and
- Impacted Material Placement (IMP) Plan.

6.3 Acceptance of Surveys

During construction of the soil components of the OSDF, the CQC Consultant will routinely review Construction Drawings submitted by the Contractor. The Construction Drawings are used to verify location of work, layer thickness, or final grades, and for determination of acceptability of the various soil layers in the liner and final cover systems. Prior to the placement of successive soil or geosynthetic layers, the CQC Consultant will review for acceptance the Contractor's survey results for each layer. The survey results will indicate the preceding layer thickness, lines, and grades. After the survey results have been reviewed and accepted in writing by the CQC Consultant it will be the responsibility of the Construction Manager to notify the Contractor of acceptance or any noncompliance.

6.4 General Soil Construction

6.4.1 Overview

General soil construction includes earthwork and trenching and backfilling. Earthwork consists of construction of subgrade, compacted fill, clayey rockfill and top of contouring layer preparation. Trenching and backfilling consists of construction of embedment fill and trench backfill. Prior to the start of general soil construction, the CQC Consultant will review and understand the Related Construction Drawings, Technical Specifications, and Support Plans.

During construction, conformance testing, construction monitoring, and performance testing of the fill materials will be performed by the CQC Consultant. Pre-conformance testing will be performed on potential clay liner sources. Certification testing will be performed by the Contractor on materials from off-site borrow sources. The testing and monitoring activities associated with the general soil construction of the OSDF are described subsequently. Monitoring and testing activities associated with the subgrade and top of contouring preparation are also described.

6.4.2 Pre-conformance and Certification Testing

Materials used for general soils construction, with the exception of pipe embedment fill, will be obtained from the on-site sources including but not limited to OSDF excavation, trenching, stockpiles, OSDF borrow area or other on-site borrow sources approved by the Construction Manager. Pre-conformance testing of the material will be conducted to identify materials suitable for clay liner and cap material, which is described in Section 6.5.2. Generally, material from the on-site borrow area that is not suitable for clay liner and cap material is candidate material for general soil construction. Therefore, the pre-conformance testing for the clay liner and cap material can be used to identify candidate material for general soil construction. Additional pre-conformance testing of candidate materials may be requested by the Construction Manager.

The Contractor will provide certification test results for proposed off-site sources of materials, including pipe embedment fill as specified in the Technical Specifications. The Construction Manager may require the CQC Consultant to perform tests on samples of material from the proposed sources as part of the approval process.

6.4.3 Conformance Testing

The conformance testing requirements for general soil construction are summarized in Table 6-1. These requirements are based on the Technical Specification and in case of conflict between these tables and Technical Specifications, the Technical Specifications control. During general soil construction, conformance tests will be used to evaluate the compliance of materials with the Technical Specification. Tests will be performed in accordance with the current version of ASTM test procedures indicated in Table 6-2 which are in effect at the time of award of construction contract, unless otherwise specified or approved by the Construction Manager. The properties of the various soil materials required by the Technical Specifications are included in Table 6-1.

The frequency of conformance tests will conform to the minimum frequencies presented in Table 6-2. The frequency of testing may be increased at the discretion of the Construction Manager or if variability of the materials is observed and reported by the CQC Consultant. The testing frequencies described herein for compacted fill will also apply to materials used by the Contractor in areas outside the limits of the final cover system of the OSDF.

6.4.4 Construction Monitoring

During placement of the various soil components, the CQC Consultant will visually monitor and document the Contractor's activities during earthwork and other general soil construction for the following:

- changes in the soil consistency;
- the thickness of lifts as loosely placed;
- soil-moisture conditioning prior to placement including general observations regarding moisture distribution, clod size, etc.;
- the action of the compaction and heavy hauling equipment on the construction surface (e.g., sheepsfoot penetration, pumping, cracking, etc.);
- the number of passes used to compact each lift;
- the presence of ponded water; and
- final lift or layer thickness.

6.4.5 Performance Testing

Performance testing during general soil construction will be conducted in accordance with the Technical Specifications and this CQA Plan. The CQC field testing methods, used to confirm compliance during general soil construction, will be performed by the CQC Consultant in accordance with current ASTM or other applicable test. Test results will be documented and reported to the Construction Manager.

Performance testing will be conducted during the progress of the work. The minimum construction performance testing frequencies are presented in Table 6-3. The frequency may be increased at the discretion of the Construction Manager or if variability of the materials is observed by the CQC Consultant. Sampling locations will be selected by the CQC Consultant. If necessary, the location of routine in-place density tests will be determined using a non-biased sampling approach.

The standard compaction Proctor Test (ASTM D 698) will be used for the determination of moisture/density relationships unless otherwise indicated. In-place surface moisture/density nuclear test methods (ASTM D 3017 and D 2922) will be used for in-situ field testing. The sand cone test method (ASTM D 1556) or drive cylinder test method (ASTM D 2937) will be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration.

Additional testing may be performed at the discretion of the Construction Manager when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- rollers slip during rolling operation;
- lift thickness is greater than specified;
- soil is at non-compliant and/or variable moisture content;
- dirt-clogged rollers are used to compact the material;
- fill materials differ substantially from those specified;
- the degree of compaction is doubtful; and
- as directed by the Construction Manager.

During construction, the frequency of testing may also be increased in the following situations:

- adverse weather conditions;
- breakdown of equipment;
- at the start and finish of grading;

- material fails to meet technical specifications; and
- the work area is reduced.

6.5 Liner System Construction

6.5.1 Overview

There are several soil components included in the OSDF liner system as shown on Figure 1-1. The soil components or layers of the OSDF liner system include the following, from top to bottom:

- granular LCS drainage layer and LCS drainage corridor having a hydraulic conductivity of 1×10^{-1} cm/s or greater and 10 cm/s, respectively;
- granular LDS drainage layer and LDS drainage corridor having a hydraulic conductivity of 1×10^{-1} cm/s or greater and 10 cm/s, respectively; and
- compacted clay liner having a hydraulic conductivity of 1×10^{-7} cm/s or less.

Prior to the start of liner system construction, the CQC Consultant will review and understand the related Construction Drawings, Technical Specifications, and Support Plans. During construction, preconformance and conformance testing, construction monitoring, and performance testing of the above soil components will be performed. These activities are described subsequently.

The prepared subgrade that will support the OSDF liner system will be as specified in the Technical Specifications prior to the installation of the liner system materials. The subgrade preparation will be monitored and tested in accordance with Section 6.4 of this CQA Plan.

6.5.2 Pre-conformance Testing

Pre-conformance testing of soils from the on-site borrow area will be performed to identify candidate materials to be screened and stockpiled for potential use as compacted clay liner and cap material. The CQC Consultant will collect samples from test pits excavated by the Contractor. Approximately 1 test pit will be excavated for every 1.5 acres of on-site borrow area to be developed. Samples will be collected to assess moisture content variation with depth as test pit excavation progresses. Moisture content measurements will be made on grab samples collected at approximately 2-ft depth intervals. A minimum of two bulk samples will be collected from each test pit. Moisture content measurements, Atterberg limits, and particle size (sieve) analysis will be performed on bulk samples. Hydrometer tests will be performed on approximately 25 percent of the bulk samples to determine clay content. Hydrometer tests will be performed on marginal samples that appear to just meet the requirements for compacted clay liner and cap material.

The Contractor will provide certification test results for proposed off-site sources of materials (e.g., granular LCS drainage layer). The Construction Manager may require the CQC Consultant to perform tests on samples of material from the proposed off-site sources as part of the approval process.

6.5.3 Conformance Testing

The conformance testing requirements for the soil components of the OSDF liner system and non-impacted protective layer are summarized in Table 6-4. Conformance tests used to evaluate the suitability of soil materials during construction of OSDF liner system will be performed in accordance with the current version of ASTM test procedures indicated in Table 6-5 which are in effect at the time of award of construction contract, unless otherwise specified or approved by the Construction Manager. The properties of the various soil materials are included in Table 6-4.

The frequency of conformance tests will conform to the minimum frequencies presented in Table 6-5. The frequency of testing may be increased at the discretion of the Construction Manager or if variability of the materials is observed and reported by the CQC Consultant.

As shown in Table 6-5, hydraulic conductivity (permeability) tests will be conducted on screened materials proposed for use as the compacted clay liner material as well as the granular materials for the LDS and LCS drainage layers and corridors.

The stockpile specific acceptable permeability zone (APZ) for clay liner material will be established as described in the TPPFR Addendum. Permeability testing of clay liner materials will be accomplished in accordance with ASTM D 5084 at a confining stress of 5 psi. Laboratory remolded samples will be used for conformance testing and confirmation of compliance of the compacted clay liner materials prior to construction. Acceptance of clay stockpiles will be documented by submitting an approval letter to the Construction Manager.

Permeability testing of the LDS and LCS drainage layers and corridors will be performed in accordance with ASTM D 2434.

The CQC Consultant will be responsible for documenting pertinent sampling information including the date the sample was obtained, sample identification number, and location.

6.5.4 Construction Monitoring

During placement of the various OSDF liner system soil components and the non-impacted protective layer, the CQC Consultant will visually monitor and document the Contractor's activities during earthwork and construction of the soil components of the liner system for the following:

- changes in the soil consistency;

- the thickness of lifts as loosely placed;
- soil-moisture conditioning prior to placement including general observations regarding moisture distribution, clod size, etc.;
- the action of the compaction and heavy hauling equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc.);
- equipment ground pressure;
- the number of passes used to compact each lift;
- desiccation cracks or the presence of ponded water; and
- final lift or layer thickness.

6.5.5 Performance Testing

Performance testing during construction of the soil components of the OSDF liner system will be conducted in accordance with the Technical Specifications and CQA Plan. The CQC field testing methods, used to confirm compliance of soils during construction, will be performed by the CQC Consultant in accordance with current version of ASTM test procedures indicated in Table 6-6 which are in effect at the time of award of construction contract, unless otherwise specified or approved by the Construction Manager. Test results will be documented and reported to the Construction Manager.

Performance testing will be conducted during the progress of the work. The minimum construction performance testing frequencies are presented in Table 6-6. The frequency may be increased at the discretion of the Construction Manager or if variability of the materials is observed by the CQC Consultant. Sampling locations will

be selected by the CQC Consultant. If necessary, the location of routine in-place density tests will be determined using a non-biased sampling approach.

The standard compaction Proctor Test (ASTM D 698) will be used for the determination of moisture/density relationships unless otherwise indicated. In-place surface moisture/density nuclear test methods (ASTM D 3017 and D 2922) will be used for in-situ field testing. The sand cone test method (ASTM D 1556) or drive cylinder test method (ASTM D 2937) will be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration.

Additional testing may be performed at the discretion of the Construction Manager when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- rollers slip during rolling operation;
- lift thickness is greater than specified;
- earthfill is at non-compliant and/or variable moisture content;
- it is suspected that less than the specified number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- rollers may not have used optimum ballast;
- soil materials differ substantially from those specified;
- the degree of compaction is doubtful; and
- as directed by the Construction Manager.

During construction, the frequency of testing may also be increased in the following situations:

- adverse weather conditions;
- breakdown of equipment;
- at the start and finish of grading;
- material fails to meet technical specifications; and
- the work area is reduced.

6.6 Final Cover System Construction

6.6.1 Overview

These are several soil components in the OSDF final cover system as shown on Figure 1-1. The soil components or layers of the OSDF final cover system include the following, from top to bottom:

- topsoil layer;
- vegetative soil layer;
- granular filter layer;
- biointrusion barrier with choking layer;
- cover drainage layer having a hydraulic conductivity of 1×10^{-1} cm/s or greater; and
- compacted clay cap having a hydraulic conductivity of 1×10^{-7} cm/s or less.

Prior to the start of final cover system construction, the CQC Consultant will review and understand the related Construction Drawings, Technical Specifications, and Support Plans. During construction, preconformance and conformance testing, construction monitoring, and performance testing of the above soil components will be performed. These activities are described subsequently.

The prepared top of contouring layer that will support the OSDF final cover system will be as specified in the Technical Specifications prior to the installation of the final cover system materials. The top of contouring layer preparation will be monitored and tested in accordance with Section 6.4 of this CQA Plan.

6.6.2 Pre-conformance Testing

Pre-conformance testing of the borrow area will be conducted to identify materials suitable for the clay liner and cap material. This pre-conformance testing is described in Section 6.5.2.

The Contractor will provide certification test results for the proposed off-site sources of materials. The Construction Manager may require the CQC Consultant to perform tests on samples of material from the proposed off-site sources as part of the approval process.

6.6.3 Conformance Testing

The conformance testing requirements for the soil components of the OSDF final cover system and non-impacted contouring layer are summarized in Table 6-7. Conformance tests used to evaluate the suitability of soil materials during construction will be performed in accordance with the current version of ASTM test procedures indicated in Table 6-8 which are in effect at the time of award of construction contract, unless otherwise specified or approved by the Construction Manager. The properties of the various soil materials are summarized in Table 6-7.

The frequency of conformance tests will conform to the minimum frequencies presented in Table 6-8. The frequency of testing may be increased at the discretion of the Construction Manager or if variability of the materials is observed and reported by the CQC Consultant. The testing frequencies described herein for compacted fill will also apply to materials used by the Contractor in areas outside the limits of the final cover system of the OSDF.

As shown in Table 6-8, hydraulic conductivity (permeability) tests will be conducted on screened materials proposed for use as the compacted clay cap material as well as the granular material that will comprise the cover drainage layer.

Permeability testing of clay cap materials will be accomplished in accordance with ASTM D 5084 at a confining stress of 5 psi. Laboratory remolded samples will be used for conformance evaluation of the compacted clay cap materials prior to construction. The stockpile specific acceptable permeability zone (APZ) for clay cap material will be established as described in the TPPFR Addendum.

Permeability, sieve analysis, and carbonate content tests of the cover drainage layer will be performed in accordance to the test methods listed in Table 6-9.

For the biointrusion barrier, the CQC Consultant may visit, with the approval of the Construction Manager, the proposed quarry.

The CQC Consultant will be responsible for documenting pertinent sampling information including the date the sample was obtained, sample identification number, and location.

6.6.4 Construction Monitoring

During placement of the various soil components of the OSDF final cover system and non-impacted contouring layer, the CQC Consultant will visually monitor and

document the Contractor's activities during earthwork and construction of the soil components of the final cover system for the following:

- changes in the soil consistency;
- the thickness of lifts as loosely placed;
- soil-moisture conditioning prior to placement including general observations regarding moisture distribution, clod size, etc.;
- the action of the compaction and heavy hauling equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc.);
- the number of passes used to compact each lift;
- desiccation cracks or the presence of ponded water; and
- final lift or layer thickness.

6.6.5 Performance Testing

Performance testing will be conducted in accordance with the Technical Specifications and CQA Plan. The CQC field testing methods, used to confirm compliance of soils during construction, will be performed by the CQC Consultant in accordance with current version of ASTM test procedures indicated in Table 6-9 which are in effect at the time of award of construction contract, unless otherwise specified or approved by the Construction Manager. Test results will be documented and reported to the Construction Manager.

Performance testing will be conducted during the progress of the work. The minimum construction performance testing frequencies are presented in Table 6-9. The frequency may be increased at the discretion of the Construction Manager or if variability of the materials is observed by the CQC Consultant. Sampling locations will

be selected by the CQC Consultant. If necessary, the location of routine in-place density tests will be determined using a non-biased sampling approach.

The standard compaction Proctor Test (ASTM D 698) will be used for the determination of moisture/density relationships unless otherwise indicated. In-place surface moisture/density nuclear test methods (ASTM D 3017 and D 2922) will be used for in-situ field testing. The sand cone test method (ASTM D 1556) or drive cylinder test method (ASTM D 2937) will be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration.

Additional testing may be performed at the discretion of the Construction Manager when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- rollers slip during rolling operation;
- lift thickness is greater than specified;
- earthfill is at non-compliant and/or variable moisture content;
- it is suspected that less than the specified number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- rollers may not have used optimum ballast;
- soil materials differ substantially from those specified;
- the degree of compaction is doubtful; and
- as directed by the Construction Manager.

During construction, the frequency of testing may also be increased in the following situations:

- adverse weather conditions;
- breakdown of equipment;
- at the start and finish of grading;
- material fails to meet technical specifications; and
- the work area is reduced.

6.7 Perforations in Soil Components

Perforations that must be filled with soil-bentonite mix will include, but not be limited to, the following:

- in-place density test probe locations;
- sand cone or drive cylinder test locations;
- survey stake locations; and
- test pit locations.

Perforations in the compacted clay liner and cap resulting from field tests or other construction activities, as described above, will be filled in accordance with the requirements of Section 02225 of the Technical Specifications and this CQA Plan. In addition, perforations in the subgrade and contouring layer will be filled in accordance with the requirements of Sections 02200 and 02240, respectively. Perforations in other soil layers will be filled in accordance with the requirements of the respective section of the Technical Specification.

6.8 Field Equipment Decontamination

The CQC Consultant will perform decontamination of field equipment used in the sampling and testing of soils known or suspected of containing low-level radioactive wastes in accordance with the procedures outlined in ASTM D 5608. Fluor Fernald, Inc. site procedures shall be followed when decontaminating and moving equipment out of radiological controlled areas. The practice of decontamination is applicable to most conventional sampling or field testing equipment constructed of metallic and hard, smooth synthetic materials. Materials with rough or porous surfaces, or having a sorption rate, should not be used due to the difficulties with decontaminations.

6.9 Deficiencies

If a defect is discovered in the soils construction, the CQC Consultant will immediately determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQC Consultant will determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQC Consultant deems appropriate. The CQC Consultant will take steps to confirm that measurement error (either human or instrument) is checked and eliminated as a source of error before requiring corrective action. If the defect is related to adverse site conditions, such as overly wet soils or surface desiccation, the CQC Consultant will define the limits and nature of the defect.

After determining the extent and nature of non-conforming condition, the CQC Consultant will verbally notify the Construction Manager and Contractor within 1 hour and schedule appropriate retests when the work deficiency is to be corrected within 1 hour of deficiency discovery.

The CQC Consultant will verify that the Contractor has corrected noted deficiencies to the satisfaction of the Construction Manager. If a specified criterion

cannot be met, or unusual weather conditions hinder work, the Contractor shall submit suggested repair methods to the Construction Manager for review.

At locations where the field testing indicates in-situ conditions which do not comply with the requirements of the Technical Specifications, the failing area shall be reworked to the satisfaction of the Construction Manager. 'All retests performed by the CQC Consultant must verify that the deficiency has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

The CQC Consultant will monitor the repair and rework of subgrade and top of contouring layer which may contain excess or insufficient moisture. If such conditions are found to exist, the CQC Consultant will confirm the suitability of the subgrade and top of contouring layer by the following methods as applicable:

- moisture/density testing; and
- continuous visual inspection during proof-rolling;

6.10 Documentation

The CQC monitoring reports, sample location descriptions, test results, and laboratory test results will be documented by the CQC Consultant on forms similar to the examples included in Appendix A. Reports and forms will be provided to the Construction Manager as requested. Weekly reports will be submitted to the Construction Manager within 7-calendar days from the last working day of the reported week. Test data sheet including test results and supporting information will be submitted to the Construction Manager within 3 calendar days from the completion of test(s).

Initial evaluation of various soil types by CQC personnel during construction will be visual; CQC personnel will monitor changes in color or texture indicative of a change in soil type. The CQC personnel will monitor soils for deleterious materials

(e.g., roots, stumps, glass, and large objects). When necessary, the visual-methods for the description and identification of soils will be conducted by the CQC Consultant in accordance with test method ASTM D 2488.

TABLE 6-1
CONFORMANCE TESTING, MONITORING, AND PERFORMANCE TESTING REQUIREMENTS FOR GENERAL SOIL CONSTRUCTION

GENERAL SOIL CONSTRUCTION (TRENCHING AND EARTHWORK)			
DESCRIPTION OF COMPONENT	**CONFORMANCE TESTING REQUIREMENTS**	**MONITORING REQUIREMENTS**	**PERFORMANCE TESTING REQUIREMENTS**
SUBGRADE (SECTION 02200)	Fill for areas where unsuitable subgrade has been removed shall be Classified as GC, SC, SM, ML, CL, or CH per ASTM D 2487;	Monitor subgrade work activities to confirm compliance to Construction drawings, support plans, and Section 02200.	1. Fill area from which subgrade has been removed with fill material compacted to at lease 95% standard Proctor maximum dry density per ASTM D 698. Compact the uppermost lift of compacted fill beneath road and access corridor alignments to a minimum 98 percent of standard Proctor maximum dry density per ASTM D 698; 2. Proofroll by driving a loaded dump truck (minimum weight of 10 tons per axle and minimum loaded weight of 20 tons) back and forth across an area. Soils shall not exhibit pumping or develop ruts more than 2 inches in depth. 3. Tolerance for subgrade shall be -0.3 to +0.1 feet of the grades indicated on the Construction drawings.
COMPACTED FILL (SECTION 02200)	1. Classified as GC, SC, SM, ML, CL 9or CH per ASTM D 2487; 2. Maximum visible rock particle size is 5 inches for a 8-inch (+/- 1-inch) thick loose lift; 3. Maximum visible rock particle size is 2-inches for a 4-inch (+/- 1-inch) thick loose lift and; 4. Maximum clod size is 3-inch.	Monitor material, placement, and compaction for compacted fill activities to confirm compliance to Construction Drawings, support plans, and Section 02200.	1. Compacted fill material in each lift to at least 95 percent of standard Proctor maximum dry density per ASTM D 698; 2. Compact fill at a moisture content within 3 +/- 1 percent of the standard Proctor optimum moisture content per ASTM D 698. 3. Tolerance for earthwork construction shall be +/- 0.3 feet of the grades indicated on the Construction Drawings.
PERFORATIONS (SECTION 02200) (SECTION 02225)	Backfill for perforations shall be 10 percent by weight bentonite mixed with clay liner or cap material by weight basis.	Monitor mixing and placement activities for perforations to confirm compliance to Section 02200 and 02225.	NOT APPLICABLE
CLAYEY ROCK FILL (SECTION 02200)	Clayey rock fill with rock particles that are less than 12-inch.	Monitor material, placement, and compaction for clayey rock fill to confirm compliance to Construction Drawings and Section 02200.	Soils shall not exhibit pumping or develop ruts more than 2 inches in depth.

TABLE 6-1 (cont.)

GENERAL SOIL CONSTRUCTION (TRENCHING AND EARTHWORK)			
DESCRIPTION OF COMPONENT	**CONFORMANCE TESTING REQUIREMENTS**	**MONITORING REQUIREMENTS**	**PERFORMANCE TESTING REQUIREMENTS**
PIPE EMBEDMENT FILL (SECTION 02215)	Gradation testing shall be in accordance to ASTM C 136 and the gradation shall meet the requirements of Section 703.6of the Ohio DOT specifications. This gradation is as follows: SIEVE SIZE — TOTAL PERCENT PASSING No. 4 — 90-100 No. 50 — 70-40 No. 200 — 0-10	Monitor material, placement, and compaction of embedment fill to confirm compliance to Construction Drawings, support plans and Part 3 of Technical Specification Section 02215.	The tolerance for the depth of embedment fill for pipes and culverts shall be within 0 to +0.2 feet of the depth indicated on the Construction Drawings.
TRENCH BACKLFILL (SECTION 02215)	Conformance requirements are the same as compacted fill.	Monitor material, placement, and compaction of trench backfill to confirm compliance to Construction Drawings, support plans, and Part 3 of Technical Specification Section 02215.	1. Compact fill material in each lift to at least 95 percent of standard Proctor maximum dry density per ASTM D 698; 2. Compact fill at a moisture content within 3 +/- 1 percent of the standard Proctor optimum moisture content per ASTM D 698. 3. The tolerance for the trench bottom shall be 0 + 0.2 feet of the depth indicated on the Construction Drawings.

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TABLE 6-2
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR GENERAL SOIL CONSTRUCTION

TEST NAME/TEST METHOD	SOIL TYPE[3, 4]			
	COMPACTED FILL	EMBEDMENT FILL	CLAYEY ROCK FILL	TRENCH BACKFILL
SPECIFICATION SECTION	02200	02215	02240	02215
Particle Size Analysis/ASTM D 422 (sieve only)	1 test per 5,000 yd^3	N/A	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Particle Size Analysis/ASTM C 136	N/A	1 test per 1,000 yd^3		
Atterberg Limits/ASTM D 4318	1 test per 5,000 yd^3	N/A	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Moisture Content/ASTM D 2216 or ASTM D 4643	1 test per 5,000 yd^3		1 test per 5,000 yd^3	1 test per 5,000 yd^3
Soil Classification/ASTM D 2487	1 test per 5,000 yd^3	1 test per 1,000 yd^3	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Standard Proctor/ASTM D 698	1 test per 5,000 yd^3	N/A	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Hydraulic Conductivity/ASTM D 5084	N/A	N/A	N/A	N/A
Hydraulic Conductivity/ASTM D 2434	N/A	N/A	N/A	N/A
Carbonate Content/ASTM D 3042[2]	N/A	N/A	N/A	N/A
Organic Content/ASTM D 2974	N/A	N/A	N/A	N/A

NA = Not Applicable

NOTE: 1. Also perform hydrometer analysis once every tenth test.
2. Sample to be tested at pH of 4.
3. More frequent testing may be directed by the Construction Manager when indicated by soil variability.
4 Volumes for test frequency is based on in-place volume of material after compaction to specified density.

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TABLE 6-3
MINIMUM PERFORMANCE TESTING FREQUENCIES FOR GENERAL SOIL CONSTRUCTION

TEST NAME/TEST METHOD	SOIL TYPE [3,4]				
	COMPACTED FILL	TRENCH BACKFILL	ANCHOR TRENCH BACKFILL	CLAYEY ROCK FILL	EMBEDMENT FILL
SPECIFICATION SECTION	02200	02215	02215	02200	02215
In-situ Moisture/ASTM D 3017	2 tests per acre per lift[1]	1 test per 250 lineal ft per lift	1 test per 250 lineal ft per lift	N/A	N/A
In-situ Density/ASTM D 2922	2 tests per acre per lift[1]	1 test per 250 lineal ft per lift	1 test per 250 lineal ft per lift	N/A	N/A
Sand Cone/ASTM D 1556 or Drive Cylinder/ASTM D 2937	1 test per 25 nuclear tests	N/A	N/A	N/A	N/A

N/A = Not Applicable

NOTE: 1. A minimum of two nuclear moisture and density tests each day of active soils construction.
2. Non-impacted protective layer performance requirements are in Section 02440 of the Technical Specifications.
3. Subgrade performance requirements are in Table 6-1.

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TABLE 6-4
CONFORMANCE TESTING, MONITORING, AND PERFORMANCE TESTING REQUIREMENTS FOR LINER SYSTEM CONSTRUCTION

LINER SYSTEM			
DESCRIPTION OF COMPONENT	**CONFORMANCE TESTING REQUIREMENTS**	**MONITORING REQUIREMENTS**	**PERFORMANCE TESTING REQUIREMENTS**
SUBGRADE (SECTION 02200)	Fill for areas where unsuitable subgrade has been removed shall be Classified as GC, SC, SM, ML, CL, or CH per ASTM D 2487;	Monitor subgrade work activities to confirm compliance to Construction Drawings, support plans, and Technical Specification Section 02200.	1. Fill area from which subgrade has been removed with fill material compacted to at lease 95% standard Proctor maximum dry density per ASTM D 698. 2. Proofroll by driving a loaded dump truck (minimum weight of 10 tons per axle and minimum loaded weight of 20 tons) back and forth across an area. Soils shall not exhibit pumping or develop ruts more than 2 inches in depth. 3. Tolerance for subgrade shall be –0.3 to +0.1 feet of the grades indicated on the Construction drawings.
CLAY LINER SECTION 02225	**PRECONFORMANCE REQUIEMENTS** 1. Clay liner shall be Classified as CH or CL per ASTM D 2487; 2. Clay liner shall be sleeved in accordance with ASTM D 422 and the results shall meet the particle size requirements: • 100 percent of the particles, by weight, having a maximum dimension of not less than 2 inches; • not more than 10 percent of the particles, by weight, having a dimension greater than 0.75 inches; • not less than 50 percent of the particles, by weight, passing through the standard U.S. sieve No. 200; • not less than 15 percent of the particles, by weight, having a maximum dimension not greater than .002 mm.	Monitor clay liner screening, placement, moisture conditioning, and compaction, to confirm compliance support plans, Construction Drawings, and Technical Specification Section 02225.	1. The moisture and dry unit weight of clay liner placed shall be within the acceptable permeability zone (APZ) defined as those combinations of moisture content and dry unit weight that meet the following criteria: • Moisture content that is on or to the right (in the direction of increasing moisture content) of the line of optimums determined by connecting the optimum moisture contents from the standard and modified proctor tests (ASTM D 698 and ASTM D 1567 respectively); • Moisture content not greater than 3 percentage points wet of the standard Proctor optimum moisture content (ASTM D 698) • Dry unit weight of at least 95% of the standard Proctor maximum dry unit weight (ASTM D 598)

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TABLE 6-4 (CONT.)

LINER SYSTEM			
DESCRIPTION OF COMPONENT	**CONFORMANCE TESTING REQUIREMENTS**	**MONITORING REQUIREMENTS**	**PERFORMANCE TESTING REQUIREMENTS**
	3. Plasticity index (ASTM D422) of at least 10 percent, but less than 40 percent. **CONFORMANCE REQUIREMENTS** 1. Hydraulic conductivity (ASTM D 5084) not more than $1x10^{-7}$ cm/sec at a confining pressure of 5 pounds per square inch.		2. Clay liner shall be constructed to within 0.0 to +0.3 feet of the thicknesses shown on the Construction Drawings; 3. Clay liner shall be constructed to within +/- 0.2 feet of the grades indicated on the Construction Drawings.
LEACHATE DETECTION SYSTEM (SECTION 02710) LEACHATE COLLECTION SYSTEM (SECTION 02710)	1. Granular drainage material shall be tested in accordance to ASTM C 136 and the gradation shall meet the following gradation requirement for modified No. 78 stone: **SIEVE SIZE — TOTAL PERCENT PASSING** ¾-inch — 100 ½-inch — 85-100 8/8-inch — 40-75 No. 4 — 5-25 No. 8 — 0-10 No. 168 — 0-5 No. 200 — 0-2 2. Granular drainage material shall have a minimum hydraulic conductivity of $1x10^{1}$ cm/sec when tested to ASTM D 2434; 3. Granular drainage corridor material shall be tested in accordance to ASTM C 136 and the gradation shall meet the following gradation requirement for No. 57 stone; **SIEVE SIZE — TOTAL PERCENT PASSING** 1-1/2-inch — 100 1-inch — 95-100 1/2-inch — 25-60 No. 4 — 0-5 No. 200 — 0-2	Monitor the placement and compaction of the granular drainage material to confirm compliance to support plans, Construction Drawings and Part 3 of Technical Specification Section 02710.	LDS drainage layer, LCD drainage layer, LDS drainage corridor, and LCS drainage corridor shall be constructed within 0.0 to +/-0.1 feet of the thickness indicated on the Construction Drawings.

TABLE 6-4 (cont.)

LINER SYSTEM			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
	4. Granular drainage corridor material shall have a minimum hydraulic conductivity of 10 cm/sec when tested to ASTM D 2434; 5. Granular drainage material including the corridor material shall be classified a GP when classified in accordance to ASTM D 2487; 6. Granular drainage material including the corridor material shall have less than 5 percent by weight loss when tested in accordance to ASTM D 3042 at a pH of 4;		
NONIMPACTED PROTECTIVE LAYER (SECTION 02240)	1. In the Impacted Runoff catchment area shall meet the material and testing requirements for granular drainage layer specified in Technical Specification Section 02710. 2. Shall be compacted fill with rock particles that are less than 3-inch.	Monitor the placement and compaction of the nonimpacted protective layer to confirm compliance to support plans, Construction Drawings, and Part 7 of the Impacted Material Placement Plan.	The nonimpacted protective layer shall be constructed to within 0.0 to +0.1 feet of the thickness shown on the Construction Drawings.

TABLE 6-5
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS AND NON-IMPACTED PROTECTIVE LAYER

TEST NAME/TEST METHOD	SOIL TYPE [4]		
	COMPACTED CLAY LINER	GRANULAR DRAINAGE MATERIAL	NON-IMPACTED PROTECTIVE LAYER
SPECIFICATION SECTION	02225	02710	02240
Particle Size Analysis/ASTM D 422 (sieve only)	1 test per 1,500 yd^3 [1]	N/A	1 test per 5,000 yd^3
Particle Size Analysis/ASTM C 136	N/A	1 test per 3,000 yd^3	
Atterberg Limits/ASTM D 4318	1 test per 1,500 yd^3	N/A	1 test per 5,000 yd^3
Moisture Content/ASTM D 2216 or ASTM D 4643	1 test per 1,500 yd^3	N/A	1 test per 5,000 yd^3
Soil Classification/ASTM D 2487	1 test per 1,500 yd^3	1 test per 3,000 yd^3	1 test per 5,000 yd^3
Standard Proctor/ASTM D 698	1 test per 1,500 yd^3	N/A	1 test per 5,000 yd^3
Hydraulic Conductivity/ASTM D 5084	1 test per 10,000 yd^3 (remold sample)[3]	N/A	N/A
Hydraulic Conductivity/ASTM D 2434	N/A	1 test per 3,000 yd^3	N/A
Carbonate Content/ASTM D 3042[2]	N/A	1 test per 5,000 yd^3	N/A
Organic Content/ASTM D 2974	N/A	N/A	N/A

NA = Not Applicable

NOTE: 1. Also perform hydrometer analysis once every tenth test.
2. Sample to be tested at pH of 4.
3. For Phase I, this frequency was revised to 1 test per 10,000 yd^3 based on the TPPFR addendum.
4. More frequent testing may be directed by the Construction Manager when indicated by soil variability.
5 Volumes for test frequency is based on in-place volume of material after compaction to specified density.

TABLE 6-6
MINIMUM PERFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS AND NON-IMPACTED PROTECTIVE LAYER

TEST OT TEST METHOD	COMPACTED CLAY LINER	GRANULAR DRAINAGE MATERIAL	PROTECTIVE LAYER (3)
SPECIFICATION SECTION	02225	02710	02240
In-situ Moisture/ASTM D 3017	5 tests per acre per lift[1]	N/A	N/A
In-situ Density/ASTM D 2922	5 tests per acre per lift[1]	N/A	N/A
Sand Cone/ASTM D 1556 or Drive Cylinder/ASTM D 2937	1 test per 25 nuclear tests	N/A	N/A

N/A = Not Applicable

NOTE: 1. A minimum of two nuclear moisture and density tests each day of active soils construction.
2. Non-impacted protective layer performance requirements are in Table 6-4.
3. Subgrade performance requirements are in Section 02200 of the Technical Specifications.

TABLE 6-7
CONFORMANCE TESTING, MONITORING, AND PERFORMANCE TESTING REQUIREMENTS FOR CONSTRUCTION FINAL COVER SYSTEM

COVER SYSTEM			
DESCRIPTION OF COMPONENT	**CONFORMANCE TESTING REQUIREMENTS**	**MONITORING REQUIREMENTS**	**PERFORMANCE TESTING REQUIREMENTS**
NONIMPACTED CONTOURING LAYER (SECTION 02240)	Shall be compacted fill with rock particles that are less than 4 inches.	Monitor the placement and compaction of the nonimpacted protective layer to confirm compliance to Part 7 of the Impacted Material Placement Plan.	Place the non-impacted contouring layer in two loose lifts. The first lift is 10 in. thick ±1 in. thick. Dry unit weight of at least 75 percent of standard Proctor maximum dry density per ASTM D 698. Moisture content within 3 +/- 1 percent of the standard Proctor optimum moisture content per ASTM D 698.
CLAY LINER (SECTION 02225)	PRECONFORMANCE REQUIEMENTS 1. Clay liner shall be Classified as CH or CL per ASTM D 2487; 2. Clay liner shall be sieved in accordance with ASTM D 422 and the results shall meet the particle size requirements: • 100 percent of the particles, by weight, having a maximum dimension of not less than 2 inches; • not more than 10 percent of the particles, by weight, having a dimension greater than 0.75 inches; • not less than 50 percent of the particles, by weight, passing through the standard U.S. sieve No. 200; • not less than 15 percent of the particles, by weight, having a maximum dimension not greater than .002 mm. 3. Plasticity index (ASTM D422) of at least 10 percent, but less than 40 percent.	Monitor clay liner screening, placement, moisture conditioning, and compaction, to confirm compliance support plans, Construction Drawings, and Technical Specification Section 02225.	1. The moisture and dry unit weight of clay liner placed shall be within the acceptable permeability zone (APZ) defined as those combinations of moisture content and dry unit weight that meet the following criteria: • Moisture content that is on or to the right (in the direction of increasing moisture content) of the line of optimums determined by connecting the optimum moisture contents from the standard and modified proctor tests (ASTM D 698 and ASTM D 1557 respectively); • Moisture content not greater than 3 percentage points wet of the standard Proctor optimum moisture content (ASTM D 698) 2. Dry unit weight of at least 95% of the standard Proctor maximum dry unit weight (ASTM D 698) 3. Clay CAP shall be constructed to within 0.0 to +0.3 feet of the thicknesses shown on the Construction Drawings;

TABLE 6-7 (cont.)

DESCRIPTION OF COMPONENT	COVER SYSTEM		
	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
	CONFORMANCE REQUIREMENTS Hydraulic conductivity (ASTM D 5084) not more than 1×10^{-7} cm/sec at a confining pressure of 5 pounds per square inch.		4. Clay cap shall be constructed to within +/- 0.2 feet of the grades indicated on the Construction Drawings.
COVER DRAINAGE LAYER (SECTION 02710)	1. The granular drainage material will be tested in accordance to ASTM C 136 and the gradation shall meet the following gradation requirement for Modified No. 78 Stone: SIEVE SIZE — TOTAL PERCENT PASSING ¾-inch — 100 ½-inch — 85-100 3/8-inch — 40-75 No. 4 — 5-25 No. 8 — 0-10 No. 16 — 0-5 No. 200 — 0-2 2. The minimum hydraulic conductivity shall be 1×10^{-1} cm/sec when tested to ASTM D 2434. 3. Granular drainage material shall be classified as GP per ASTM D 2487. 4. Granular drainage material shall have less than 5 percent by weight loss when tested per ASTM D 3042 at a pH of 4.	Monitor the placement and compaction of the cover drainage layer to confirm compliance to support plans, Construction Drawings, and Part 3 of Technical Specification Section 02710.	The cover drainage layer shall be constructed within 0.0 to +/-0.1 feet of the thickness indicated on the Construction Drawings.
BIOINTRUSION LAYER (SECTION 02280)	1. Shall be Type D Dumped Rockfill that shall meet the requirements of Item 601.7 and 703.04(3) of the Ohio DOT specifications; 2. Shall be tested for specific gravity in accordance with ASTM C 127 and have a minimum bulk specific gravity of 2.60; 3. Shall be tested for maximum absorption in accordance with ASTM C 127 and shall have a maximum absorption of 2.0 percent.	Monitor the placement of the biointrusion barrier to confirm compliance to support plans, Construction Drawings, and Part 3 of Technical Specification Section 02280.	The biointrusion barrier shall be constructed to within –0.1 to +0.3 feet of the thickness shown on the Construction Drawings.

TABLE 6-7 (cont.)

COVER SYSTEM			
DESCRIPTION OF COMPONENT	**CONFORMANCE TESTING REQUIREMENTS**	**MONITORING REQUIREMENTS**	**PERFORMANCE TESTING REQUIREMENTS**
BIOINTRUSION CHOKESTONE LAYER (SECTION 2280)	1. Shall be tested in accordance to ASTM C 136 and shall meet the requirements of AASHTO M 43 for No. 57 coarse aggregate; 2. Shall be tested for specific gravity in accordance with ASTM C 127 and have a minimum bulk specific gravity of 2.60. 3. Shall be tested for maximum absorption in accordance with ASTM C 127 and shall have a maximum absorption at 2.0 percent.	Monitor the placement of the biointrusion chokestone layer to confirm compliance to support plans, Construction Drawings, and Part 3 of Technical Specification Section 02280.	Survey tolerances are not specified.
GRANULAR FILTER LAYER (SECTION 02712)	1. Shall be classified as SW in accordance to ASTM D 2487; 2. Shall have the following gradation when tested in accordance to ASTM C 136; SIEVE — TOTAL PERCENT PASSING 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	Monitor the placement and compaction of the granular filter layer to confirm compliance support plans, Construction Drawings, and Part 3 of Technical Specification Section 02712.	The granular filter shall be constructed within 0.0 to +0.1 feet of the thickness shown on the Construction Drawings.
VEGETATIVE SOIL LAYER (SECTION 02250)	1. Shall be relatively free of debris, foreign objects, large rock fragments, and organics. Also shall be free of visible rock particles larger than 4 inches in maximum dimension when tested in accordance to ASTM D 422. 2. Shall be classified CL, SC, or GC in accordance to ASTM D 2487 and ASTM D4316.	Monitor the placement and compaction of the vegetative soil layer to confirm compliance to Construction Drawings, support plans, and Part 3 of Technical Specification Section 02250.	1. Shall be compacted to 92 percent of maximum dry unit weight (ASTM D 698); 2. Shall have a moisture content within 3 +/- percent of the standard Proctor optimum moisture content (ASTM D 698).

TABLE 6-7 (cont.)

COVER SYSTEM			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
TOP SOIL (SECTION 02920)	1. Shall be a loam, clay loam, silty clay loam, silt loam, or sandy clay loam, as classified by the U.S. Department of Agriculture Soil Conversation Service Agriculture Handbook 436 and be loose and friable; 2. Fraction passing the U.S. Standard No. 10 sieve shall contain not more than 40 percent clay-sized fraction as determined in accordance with ASTM D 422; 3. Shall be free of metal, debris, foreign objects, large rock fragments, and stumps and other deleterious material; 4. Shall contain not less than 2 percent organic matter as determined by loss on ignitions of samples oven dried to constant weight (per ASTM D 2974 Method A for moisture content determination and method C for ash content determination)	Monitor the placement of the topsoil to confirm compliance to Construction Drawings, support plans, and Part 3 of Technical Specification Section 02920.	3. The topsoil layer shall be constructed to within +/-0.1 feet of the thickness shown on the Construction Drawings. 4. The topsoil layer shall be constructed to within 0.0 to +0.5 feet of the grades indicated on the Construction Drawings.

TABLE 6-8
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR OSDF FINAL COVER SYSTEM COMPONENTS AND NON-IMPACTED CONTOURING LAYER

TEST NAME/TEST METHOD	SOIL TYPE[4]							
	COMPACTED CLAY CAP	COVER DRAINAGE LAYER	BIOINTRUSION BARRIER		GRANULAR FILTER	VEGETATIVE SOIL LAYER	TOPSOIL	NON-IMPACTED CONTOURING LAYER
			PRIMARY BIOINTRUSION BARRIER	CHOKE STONE				
SPECIFICATION SECTION	02225	02710	02280	02280	02712	02250	02920	02240
Particle Size Analysis/ASTM D 422 (sieve only)	1 test per 1,500 yd^3 [1]	N/A	N/A	N/A	N/A	1 per 5,000 yd^3	1 per 5,000 yd^3 [3]	1 test per 5,000 yd^3
Particle Size Analysis/ASTM C 136	N/A	1 test per 3,000 yd^3	N/A	1 test per 10,000 yd^3	1 test per 5,000 yd^3	N/A	N/A	N/A
Atterberg Limits	1 test per 1,5000 yd^3	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3	N/A	1 test per 5,000 yd^3
Moisture Content/ASTM D 2216 or ASTM D 4643	1 test per 1,500 yd^3	N/A	N/A	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3
Soil Classification/ASTM D 2487	1 test per 1,500 yd^3	1 test per 3,000 yd^3	N/A	N/A	1 test per 5,000 yd^3	1 test per 5,000 yd^3	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Standard Proctor/ASTM D 698	1 test per 1,500 yd^3	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3	N/A	1 test per 5,000 yd^3
Hydraulic Conductivity/ASTM D 5084	1 test per 10,000 yd^3 [4] (remold)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hydraulic Conductivity/ASTM D 2434	N/A	1 test per 3,000 yd^3	N/A	N/A	N/A	N/A	N/A	N/A
Carbonate Content/ASTM D 3042[2]	N/A	1 test per 5,000 yd^3				N/A	N/A	N/A
Organic Content/ASTM D 2974	N/A	N/A	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3	N/A
Bulk Specific Gravity/ASTM C 127	N/A	N/A	1 test per 10,000 yd^3	1 test per 10,000 yd^3	N/A	N/A	N/A	N/A
Maximum Absorption/ASTM C 127	N/A	N/A	1 test per 10,000 yd^3	1 test per 10,000 yd^3	N/A	N/A	N/S	N/A

000103

TABLE 6-8 (cont.)

NA = Not Applicable

NOTE: 1. Also perform hydrometer analysis once every tenth test.
2. Sample to be tested at pH of 4.
3. For Phase I, this frequency was revised to 1 test per 10,000 yd^3 based on the TPPFR addendum.
4. More frequent testing may be directed by the Construction Manager when indicated by soil variability.
5 Volumes for test frequency is based on in-place volume of material after compaction to specified density.

TABLE 6-9
MINIMUM PERFORMANCE TESTING FREQUENCIES FOR OSDF COVER SYSTEM COMPONENTS AND NON-IMPACTED CONTOURING LAYER

TEST NAME/TEST METHOD	SOIL TYPE							
	CONTOURING LAYER[2]	COMPACTED CLAY CAP	COVER DRAINAGE LAYER	BIOINTRUSION BARRIER		GRANULAR FILTER	VEGETATIVE SOIL LAYER	TOPSOIL
				PRIMARY BIOINTRUSION BARRIER	CHOKE STONE[3]			
SPECIFICATION SECTION	02240	02225	02710	02280	02280	02712	02250	02920
In-situ Moisture/ASTM D 3017	1 test per 10,000 ft^2 per lift	5 tests per acre per lift[1]	N/A	N/A	N/A	N/A	2 tests per acre per lift[1]	N/A
In-situ Density/ASTM D 2922	1 test per 10,000 ft^2 per lift[4]	5 tests per acre per lift[1]	N/A	N/A	N/A	N/A	2 tests per acre per lift[1]	N/A
Sand Cone/ASTM D 1556 or Drive Cylinder/ASTM D 2937	1 test per 25 nuclear tests	1 test per 25 nuclear tests	N/A	N/A	N/A	N/A	1 test per 25 nuclear tests	N/A

N/A = Not Applicable

NOTE
1. A minimum of two nuclear moisture and density tests each day of active soils construction.
2. A minimum of 1 in-situ moisture (ASTM D 3017) and 1 in-situ density (ASTM D 2922) will be performed for each 100 ft. x 100 ft. (30m x 30m) grid element per lift.
3. Compact with 4 pass of bull dozer as specified in Section 02280 of Technical Specifications.
4. Nuclear density probe depth for the first lift of contouring layer shall be 4".

000105

7. GEOMEMBRANE LINER AND CAP

7.1 Introduction

The CQC Consultant will perform conformance testing and will monitor the installation of geomembranes as required by Section 02770 of the Technical Specifications and this CQA Plan. The testing used to evaluate the conformance of the geomembrane with the requirements of the Technical Specifications will be carried out by the CQC Consultant in accordance with the current versions of the ASTM or other applicable test procedures indicated in Tables 7-1 and 7-2 which are in effect at the time of award of construction contract, unless otherwise specified or approved by the Construction Manager.

7.2 Related Construction Drawings and Technical Specifications

The Contractor and Geosynthetics Installer shall comply with the Construction Drawings and Section 02770 of the Technical Specifications. This specification shall be referenced for the various properties, manufacturing quality control, and installation requirements of the geomembrane materials.

7.3 Manufacturing Plant Visit

Representatives from Fluor Fernald, Inc. and the CQC Consultant will visit the plant that will be used to manufacture geomembrane to confirm manufacturing quality control methods are in compliance with Section 02770P of the Technical Specifications. If possible, such a visit will be performed prior to or during the manufacturing of the geomembrane rolls for the OSDF project. The review party will review the manufacturing process, quality control procedures, laboratory facilities, and testing procedures.

During the project specific plant visit, the review party will:

- confirm that properties in the procurement specification provided in writing by the Geosynthetics Manufacturer meet all specifications;
- confirm that the measurements of properties by the Geosynthetics Manufacturer are properly documented and test methods used are acceptable;
- spot inspect the rolls and confirm that they are free of holes, blisters, or any sign of contamination by foreign matter;
- review packaging and transportation methods to confirm that these methods are not damaging the geomembrane;
- confirm that all rolls are properly labeled; and
- confirm that extrusion rods and/or beads manufactured for the field seaming of the geomembrane are derived from the same base resin type as the geomembrane.

Upon completion of the manufacturing plant visit, a report describing the findings and observations FFQADP will be prepared by Fluor Fernald, Inc.

7.4 Transportation, Handling and Storage

The CQC Consultant will monitor the transportation, handling, and storage of the geomembrane on-site. The Contractor shall designate a laydown area for the geomembrane storage location. Rolls of geomembrane shall not be stacked upon one another to the extent that deformation of the core occurs, to the point where accessibility for sampling is inhibited, or the height of the stack exceeds recommendation of the Manufacturer. It will be the responsibility of the Contractor to protect the geomembrane stored on-site from theft, vandalism, and damage.

Upon delivery at the site, the Contractor and CQC Consultant will monitor the rolls for defects and damage. This monitoring will be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant will indicate to the Construction Manager:

- rolls, or portions thereof, which should be rejected and removed from the site because they have severe or nonrepairable flaws which may compromise geomembrane quality; and

- rolls, which include minor or repairable flaws, which do not compromise geomembrane quality.

The CQC Consultant will also monitor that equipment used to handle the geomembrane on-site is adequate and does not pose any risk of damage to the geomembrane when used properly.

7.5 Conformance Testing

7.5.1 Sampling Requirements

Before or upon delivery of the geomembrane rolls to the OSDF, the CQC Consultant will confirm that representative geomembrane conformance samples are obtained at the specified frequency and forwarded to the Geosynthetics CQC Laboratory for testing. Geomembrane conformance samples will be taken across the entire width of the roll and will not include the first 3 ft of material. The required minimum geomembrane conformance sampling frequencies are provided in Table 7-1. The CQC Consultant will mark the machine direction on the samples with an arrow and affix a label, tag, or otherwise mark each sample with the following information:

- date sampled;

- project number;

- lot/batch number and roll number;
- conformance sample number; and
- CQC personnel identification.

7.5.2 Testing Requirements

Conformance testing of the geomembrane materials delivered to the site will be conducted to confirm compliance with both the Technical Specifications and the manufacturer's list of minimum average roll values. As a minimum, the geomembrane conformance test requirements listed in Table 7-1 will be performed by the Geosynthetics CQC laboratory.

7.5.3 Test Results

All conformance test results will be reviewed, accepted, and reported by the CQC Consultant before delivery of the geomembrane. Any nonconformance of the material's properties with the requirements of the Technical Specifications will be reported to Construction Manager. In all cases, the test results will meet or exceed the property values listed in Table 02770P-1 of the Technical Specifications.

7.5.4 Conformance Test Failure

In the case of failing test results, the CQC Consultant, Project QA, or Manufacturer may request that another sample from the failing roll be retested by the Geosynthetics CQC Laboratory with the manufacturer's technical representative present during the test. If the retest fails or if the option to retest is not exercised, then two isolation conformance samples will be obtained by the CQC Consultant. These isolation samples will be taken from rolls, which have been determined by correlation with the

manufacturer's roll number, to have been manufactured prior to and after the failing roll. This method for choosing isolation rolls for testing should continue until passing tests are achieved. All rolls which fall numerically between the passing roll numbers will be rejected by the Construction Manager. The CQC Consultant will verify that the Manufacturer has replaced all rejected rolls. The CQC Consultant will document actions taken in conjunction with geomembrane conformance test failures.

7.6 Anchor Trench

The CQC Consultant will confirm and document that the anchor trench has been constructed in accordance to Construction Drawings. Geosynthetic materials in the anchor trench shall be temporarily anchored with sand bags or other suitable methods approved by the Construction Manager. The anchor trench shall be backfilled with suitable material as indicated in the Construction Drawings and Technical Specifications. In-place moisture/density by nuclear methods testing of the compacted anchor trench backfill will be performed at the frequencies given in Table 6-3.

The anchor trench shall be constructed with a slightly rounded inside corner where the geosynthetics enter the trench. No loose soil shall be allowed to underlie the geosynthetics in the anchor trench. The CQC Consultant will confirm that all temporary ballast (i.e., sandbags) and deleterious materials are removed from the anchor trench prior to backfilling. Backfilling of the anchor trench shall be performed when the geomembrane is in its most contracted state to prevent stress inducement and using extreme care to prevent any damage to the geosynthetic materials.

7.7 Geomembrane Placement

7.7.1 Field Panel Identification

A field panel is the unit area of geomembrane, which is to be seamed in the field, i.e., a field panel is a roll or a portion of roll cut in the field.

The CQC Consultant will confirm that each field panel is given an "identification code" (number or letter-number) consistent with the layout plan. This identification code shall be agreed upon by the Construction Manager, Geosynthetics Installer, and CQC Consultant. This field panel identification code shall be as simple and logical as possible. The Geosynthetic Manufacturer's roll numbers shall be traceable to the field panel identification code.

The CQC Consultant will document the correspondence between roll numbers and field panel identification codes. The field panel identification code will be used for quality assurance/quality control records.

7.7.2 Field Panel Placement

The CQC Consultant will monitor that field panels are installed at the location indicated in the Geosynthetics Installer's layout plan, as approved or modified. The CQC Consultant will record the field panel identification code, manufacturer's roll number, location, date of installation, and dimensions of each field panel.

Geomembrane placement shall not proceed at an ambient temperature below 40EF or above 104EF unless authorized in writing by the Construction Manager. Geomembrane placement shall not proceed during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds. The CQC Consultant will monitor that the above conditions are fulfilled and that the supporting soil has not been damaged by adverse weather conditions.

The CQC Consultant will monitor geomembrane deployment for the following:

- any equipment used does not damage the geomembrane by handling, trafficking, excessive heat, leakage of hydrocarbons or other means;

- the prepared surface underlying the geomembrane has not deteriorated since previous acceptance, and is still acceptable immediately prior to geomembrane placement;
- adjacent geomembrane panels are shingled in the direction of slope;
- any geosynthetic elements immediately underlying the geomembrane are clean and free of foreign objects or debris;
- personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane;
- the method used to unroll the panels does not cause scratches or crimps in the geomembrane and does not damage the supporting soil;
- the method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);
- adequate temporary loading and/or anchoring (e.g., sandbags), not likely to damage the geomembrane, has been placed to prevent uplift by wind. Continuous loading, by adjacent sand bags or other approved objects is recommended along edges of panels to minimize risk of wind uplifting the panels; and
- direct contact with the geomembrane is minimized; i.e., the geomembrane is protected by geotextiles, extra geomembrane, or other suitable materials, in areas where excessive traffic may be expected.

The CQC Consultant will monitor the geomembrane panels, after placement and prior to seaming, for damage. The CQC Consultant will advise the Construction Manager which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels that have been rejected will be marked

and their removal from the work area recorded by the CQC Consultant. Repairs shall be made according to procedures described in this Section.

7.8 Field Panel Seaming

7.8.1 Panel Layout

The CQC Consultant will review the panel layout drawing previously submitted to the Construction Manager by the Geosynthetics Installer and verify that it is consistent with accepted state of practice. In general, seams shall be oriented parallel to the line of maximum slope, i.e., oriented along, not across, the slope. In corners and odd-shaped geometric locations, the number of seams should be minimized. No horizontal seam shall be within 10 ft from the toe of the slope, or areas of potential stress concentrations, unless otherwise authorized by the Construction Manager. A seam numbering system compatible with the field panel identification numbering system shall be agreed upon prior to any seaming.

7.8.2 Seaming Equipment and Products

Approved processes for field seaming are extrusion welding and fusion welding. Proposed alternate processes shall be documented and submitted to the Construction Manager for approval. Only equipment, which have been specifically recommended by the Manufacturer by make and model shall be used. Seaming equipment shall be permanently marked with an identification number.

7.8.2.1 Filet Extrusion Process

The filet extrusion-welding apparatus shall be equipped with gauges showing the preheat and extrudate temperatures. The CQC Consultant will establish where the temperature sensors are located and record the information on a daily field report. The

CQC Consultant will confirm that the extrudate is comprised of the same resin as the geomembrane sheeting. The CQC Consultant will monitor ambient temperatures; When ambient temperature is below 50°F the CQC Consultant will monitor the geomembrane surface temperature at appropriate intervals but not to exceed four hours of welding.

The CQC Consultant will also monitor that:

- the number of spare operable seaming apparatus agreed by the Construction Manager are maintained on site;
- equipment used for seaming is not likely to damage the geomembrane;
- the extruder is purged prior to beginning a seam until all heat-degraded extrudate has been removed from the barrel;
- the electric generator is placed in a drip pan to contain spillage from the fuel tank and to prevent damage to the geomembrane; and
- a smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.

7.8.2.2 Fusion Process

The fusion-welding apparatus must be automated, self-propelled devices. The fusion-welding apparatus shall be equipped with gauges giving the applicable temperatures and welding speed. The CQC Consultant will monitor ambient temperatures and apparatus temperatures.

The CQC Consultant will also monitor that:

- the number of spare operable seaming apparatus agreed by the Construction Manager are maintained on site;

- equipment used for seaming will not damage the geomembrane;
- the electric generator is placed in a drip pan to contain spillage from the fuel tank and to prevent damage to the geomembrane;
- a smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage; and
- a movable protective layer is used as necessary directly below each overlap of geomembrane that is to be seamed to prevent build-up of moisture between the sheets.

7.8.3 Seam Preparation

The CQC Consultant will monitor that:

- prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material;
- seams are overlapped a minimum of 4 inches;
- if seam overlap grinding is required, the process is completed according to the Technical Specifications, prior to the seaming operation, and in a way that does not damage the geomembrane;
- the grind depth shall not exceed 10 percent of the geomembrane thickness;
- grinding marks shall not appear beyond the extrudate after it is placed; and
- seams are aligned with the fewest possible number of wrinkles and "fishmouths".

7.8.4 Weather Conditions for Seaming

The normally required weather conditions for seaming are as follows:

- Between ambient temperatures of 40EF and 50EF, seaming is possible if the geomembrane is preheated by either sun or hot air device, and if there is no cooling of the geomembrane to below 50EF resulting from wind.
- Unless authorized in writing by the Construction Manager, no seaming shall be attempted at an ambient temperature below 40EF or above 104EF.
- In all cases, the geomembrane seam areas shall be dry and protected from wind.

The CQC Consultant will confirm that methods used by the Geosynthetic Installer for seaming at ambient temperatures below 40EF or above 104EF will produce seams that are equivalent to seams produced at ambient temperatures between 40EF and 104EF and protect the overall quality of the geomembrane. The CQC Consultant will monitor that seaming conducted during abnormal weather conditions is performed in accordance with the methods approved by the Construction Manager.

7.8.5 Overlapping and Temporary Bonding

The CQC Consultant will monitor that:

- the panels of geomembrane have a finished overlap of a minimum of 4 in. for both extrusion and fusion welding, but in any event sufficient overlap shall be provided to allow peel tests to be performed on the seam;
- no solvent or adhesive is used unless the product is approved in writing by the Construction Manager (samples shall be submitted to the Construction Manager for testing and evaluation); and

- the method used to temporarily bond adjacent panels together does not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any spot welding apparatus is controlled such that the geomembrane is not damaged.

7.8.6 Trial Seams

The CQC Consultant will confirm that the Geosynthetics Installer performs trial seam tests in accordance with Section 02770 of the Technical Specifications. The CQC will monitor and document the Geosynthetic Installer's trial seam testing procedures. The trial seam samples will be assigned an identification number and marked accordingly by the CQC Consultant. Each sample will be marked with the date, time, machine temperature(s) and setting(s), number of seaming unit, and name of seaming technician. Trial seam samples shall be maintained by the Geosynthetics Installer until a passing destructive test is achieved on seam represented by the trial seam sample.

7.8.7 General Seaming Methods

No geomembrane seaming shall be performed unless the CQC Consultant is on-site. The CQC Consultant will monitor the general seaming methods used by the Geosynthetics Installer as follows:

- If required, a firm substrate shall be provided by using a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.

- Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 in. beyond the cut in all directions.

- If seaming operations are carried out at night, adequate illumination shall be provided by the Contractor to the satisfaction of the Construction Manager.

- Seaming shall extend to the outside edge of panels to be placed in the anchor trench.

7.9 Nondestructive Seam Continuity Testing

The CQC Consultant will monitor that the Geosynthetics Installer nondestructively test field seams over their full length using a vacuum test unit or air pressure test (for double fusion seams only). Spark testing may be performed when specifically approved by the Construction Manager if the seam cannot be tested using the vacuum or air pressure test methods. The purpose of nondestructive tests is to check the continuity of seams. The nondestructive seam testing shall be carried out as the seaming work progresses, not at the completion of all field seaming. The CQC Consultant will:

- monitor nondestructive testing;

- document the results of the nondestructive testing and the method of testing; and

- inform the Geosynthetic Installer, Contractor, and Construction Manager of any noncompliance.

Any required seam repairs shall be made in accordance with the Technical Specifications. The CQC Consultant will:

- monitor the repair methods;

- monitor the retesting methods; and

- document the results.

The seam number, date of observation, dimensions and/or descriptive location of the seam length tested, name of person performing the test, and outcome of the test will be recorded by the CQC Consultant.

7.10 Destructive Testing

Destructive seam testing shall be performed during the geomembrane installation. The purpose of this testing is to evaluate seam strength. Destructive seam testing shall be done as the seaming work progresses, not at the completion of all field seaming.

7.10.1 Location and Frequency

The CQC Consultant will select all destructive seam test sample locations. Sample locations will be established as follows.

- A minimum frequency of one test location per 500 ft of seam length. This minimum frequency is to be determined as an average taken throughout the entire facility.

- Test locations will be determined during seaming at the CQC Consultant's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding.

The Geosynthetics Installer will not be informed in advance of the locations where the seam samples will be taken.

7.10.2 Sampling Requirements

Destructive seam testing shall be performed as the seaming progresses in order to obtain the Geosynthetics CQC Laboratory test results before the geomembrane is covered by overlying materials. The CQC Consultant will:

- observe sample cutting;
- assign a number to each sample, and mark it accordingly; and
- record sample location on layout drawing.

Holes in the geomembrane resulting from destructive seam test sampling shall be repaired in accordance with repair methods described in Section 02770 of the Technical Specifications. The continuity of the new seams in the repaired area shall be nondestructively tested according to Section 7.9.

7.10.3 Size of Samples

At a given sampling location, two types of samples (field test samples and laboratory test samples) shall be taken. First, a minimum of two field samples or test strips shall be taken for field testing. Each of these test strips shall be 1 in. wide by 12 in. long, with the seam centered parallel to the width. The distance between these two specimens shall be 42 in. If both specimens pass the field test described in this Section, a second full laboratory destructive sample will be taken for testing by the Geosynthetics CQC Laboratory.

The full destructive sample shall be located between the two field test strips. The sample shall be 12 in. wide by 42 in. long with the seam centered lengthwise. The sample will be cut into three parts and distributed as follows:

- one 12 in. by 12 in. portion to the Geosynthetics Installer;

- one 12 in. by 12 in. portion to the Construction Manager for archive storage; and
- one 12 in. by 18 in. portion for Geosynthetics CQC Laboratory testing.

7.10.4 Field Testing

The test strips shall be tested in the field, for peel adhesion, using a calibrated gauged tensiometer. In addition to meeting the strength requirements as specified in Section 02770 of the Technical Specifications, specimens shall exhibit a Film Tear Bond and shall not fail in the weld. If any field test sample fails to meet these requirements, the destructive sample has failed.

The CQC Consultant will witness field tests and mark samples and portions with their number. The CQC Consultant will also log the date, number of seaming unit, seaming technician identification, destructive sampling, and pass or fail description.

7.10.5 Geosynthetics CQC Laboratory Testing

Destructive test samples will be tested by the Geosynthetics CQC Laboratory. Testing will include "Bonded Seam Strength" and "Peel Adhesion" (ASTM D 4437). The minimum acceptable values to be obtained in these tests are presented in Section 02770 of the Technical Specifications. At least five specimens will be tested for each test method. Specimens will be selected alternately by test from the samples (i.e., peel, shear, peel, shear...). Both the inside and outside tracks of the double track fusion seams will be tested for peel adhesion. A passing test will meet the minimum required values in at least four out of five specimens.

The Geosynthetics CQC Laboratory will provide test results no more than 24 hours after they receive the samples. The CQC Site Manager will review laboratory test

results as soon as they become available, and make appropriate recommendations to the Construction Manager.

7.10.6 Requirement for Destructive Test Failure

The following requirements will apply whenever a sample fails a destructive test, whether that test was conducted in the field or by the Geosynthetics CQC Laboratory. The CQC Consultant will monitor that the Geosynthetics Installer follow one of two options:

- The Geosynthetics Installer can reconstruct the seam (e.g., remove the old seam and reseam) between any two passed destructive test locations.

- The Geosynthetics Installer can trace the welding path to an intermediate location a minimum of 10 ft from the point of the failed test in each direction and take a small sample for additional field testing in accordance with the destructive test procedure at each location. If these additional isolation samples pass the field test, then full laboratory samples are taken at both locations. If these laboratory samples meet the specified strength criteria, then the seam is reconstructed between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

Failed seams will be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 ft of reconstructed seam, a sample taken from the zone in which the seam has been reconstructed must pass destructive testing. Repairs shall be made in accordance with this Section. The CQC Consultant will document all actions taken in conjunction with destructive test failures.

7.11 Defects and Repairs

7.11.1 Identification

Seams and panel areas of the geomembrane will be examined by the CQC Consultant for identification of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane will be clean at the time of examination. The Construction Manager will require the geomembrane surface to be broomed or washed by the Contractor if the amount of dust or mud inhibits examination.

7.11.2 Repair Requirements

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired by the Geosynthetics Installer in accordance with Section 02770 of the Technical Specifications. Several methods exist for the repair of these areas. The final decision as to the appropriate repair methods shall be agreed upon between the Contractor and Construction Manager.

In addition, the following conditions will be monitored by the CQC Consultant:

- surfaces of the geomembrane which are to be repaired shall be abraded no more than one hour prior to the repair;
- surfaces must be clean and dry at the time of the repair;
- seaming equipment used in repairing methods must be approved;
- patches or caps shall extend at least 6 in. beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 in.; and

- the geomembrane below large caps should be appropriately cut to avoid water or gas collection between the two sheets.

7.11.3 Verification of Repairs

Each repair shall be numbered and logged. Each repair shall be non-destructively tested using approved methods. Repairs that pass the non-destructive test shall be taken as an indication of an adequate repair. Large caps may be of sufficient extent to require destructive test sampling, at the discretion of the Construction Manager or as specified in Table 7-2. The CQC Consultant will observe non-destructive testing of repairs and will record the number of each repair, date, and test outcome.

7.12 Electrical Leak Detection Testing

Electrical leak detection testing of the primary geomembrane liner and the geomembrane cap shall be conducted as supplemental CQC testing by the Contractor. This testing shall be conducted in a manner to protect the installation of geomembrane and GCL components of the liner and final cover system. The Contractor shall perform the work, document the results of the work, and delineate and repair detected leaks.

The CQC Consultant will monitor the Contractor's electrical leak detection testing of primary geomembrane liner and the geomembrane cap. The CQC Consultant will:

- confirm adequate water supply and pressure during the testing;
- maintain a location map delineating areas completed by electrical leak detection testing;
- document monitoring of the electrical leak detection testing; and
- inform the Contractor and Construction Manager of any non-compliance.

The CQC Consultant will confirm that any required repairs are made in accordance with Section 02770 of the Technical Specifications and Section 7.11 of this CQA Plan.

7.13 Liner and Cap System Acceptance

The Contractor shall retain all responsibility for the geosynthetics from site delivery until in place acceptance by the Construction Manager. The terms for liner and cap systems acceptance are described in Section 02770 of the Technical Specifications.

7.14 Materials in Contact with the Geomembrane

The methods outlined in this section are intended to confirm that the installation of materials in contact with the geomembrane do not cause damage. Additional quality control methods are necessary to confirm that systems built with these materials will be constructed in a way that proper performance is achieved.

7.14.1 Soils

The CQC Consultant will monitor that the Contractor takes necessary precautions to prevent damage to the geomembrane during installation or during the installation of other components of the liner or cover system or by other construction activities. The CQC Consultant will monitor the following:

- placement of granular drainage materials above the geomembrane which shall not proceed at an ambient temperature below 40EF or above 104EF unless otherwise approved by the Construction Manager;

- granular drainage material placement operations above the geomembrane which shall be made by the Contractor to minimize wrinkles in the geomembrane;

- equipment shall not be driven directly on the geomembrane;
- the specified minimum granular drainage material or protective layer thickness is used between a light track-mounted dozer and the geomembrane;
- the specified minimum granular drainage material, protective layer, or select impacted material thickness is used between rubber-tired vehicles and the geomembrane; and
- the specified minimum soil thickness is used in heavily trafficked areas such as access ramps.

7.14.2 Appurtenances

The CQC Consultant will monitor that:

- installation of the geomembrane in appurtenant areas, and connection of geomembrane to sumps and appurtenances have been made in accordance with the Construction Drawings and Technical Specifications;
- extreme care is taken by the Geosynthetics Installer when seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and
- the geomembrane has not been visibly damaged when making connections to sumps and appurtenances.

TABLE 7-1:

GEOMEMBRANE CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[1]
Density	ASTM D792 Method A or ASTM D1505	1 test per 100,000 ft^2
Thickness	ASTM D 5994	1 test per 100,000 ft^2
Tensile Strength at Yield	ASTM D638	1 test per 100,000 ft^2
Tensile Strength at Break	ASTM D638	1 test per 100,000 ft^2
Elongation at Yield	ASTM D638	1 test per 100,000 ft^2
Elongation at Break	ASTM D638	1 test per 100,000 ft^2
Carbon Black Content	ASTM D1603	1 test per 100,000 ft^2
Carbon Black Dispersion	ASTM D5596	1 test per 100,000 ft^2

Notes:
1. Test shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot shall be as defined by ASTM D 4354.
2. Test procedure for test method ASTM D 638 will be as modified by NSF 54 Annex A.
3. Where conditioning of the test sample is required, conditioning shall be minimum 1 hour at standard laboratory atmosphere.

TABLE 7-2:

GEOMEMBRANE SEAM TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY
Peel Adhesion [5]	ASTM D 4371 [1,3,4]	1 test every 500 ft of seam length
Bonded Seam Strength [5]	ASTM D 4437 [2,3,4]	1 test every 500 ft of seam length
Vacuum Testing	—	100 percent of extrusion welded seams
Air Pressure Testing	—	100 percent of fusion welded seams
Electrical Leak Detection		See Note 6

Notes:

1. For peel adhesion, seam separation shall not extend more than 10 percent into the seam interface. Testing shall be discontinued when the sample has visually yielded.
2. For shear tests, the sheet shall yield before failure of the seam.
3. For either test, sample failure shall be a Film Tear Bond (FTB) as outlined in NSF 54, Appendix A.
4. Where conditioning of the test sample is required, conditioning shall be minimum 1 hr. at standard laboratory atmosphere.
5. Minimum values for peel adhesion and bonded seam strength are included in technical specification Section 02770.
6. Electrical leak detection testing of all fusion and extrusion welded seams is required for the primary geomembrane liner and cap.

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8. GEOSYNTHETIC CLAY LINER AND CAP

8.1 Introduction

The CQC Consultant will perform conformance testing and will monitor the installation of the geosynthetic clay liner (GCL) and geosynthetic clay cap (GCC) as required by Section 02772 of the Technical Specifications and this CQA Plan. The testing used to evaluate the conformance of the GCL and GCC with the requirements of the Technical Specifications will be performed by the CQC Consultant in accordance with the current versions of the ASTM or other applicable test procedure indicated in Table 8-1 which are in effect at the time of award of construction contract, unless otherwise specified or approved by the Construction Manager.

8.2 Related Construction Drawings and Technical Specifications

The Contractor and Geosynthetics Installer shall comply with the Construction Drawings and Section 02772 of the Technical Specifications. The CQC Consultant will reference these documents for the various properties, manufacturing quality control, and installation requirements of the GCL and GCC materials.

8.3 Manufacturing Plant Visit

The Fluor Fernald, Inc. and the CQC Consultant, will visit the plant of the GCL and GCC Manufacturer for the purpose of confirming that manufacturing quality control procedures are in conformance with Section 02770P of the Technical Specifications. If possible, such a visit will be performed prior to or during the manufacturing of the geomembrane rolls for the SDFP project. The review party will review the manufacturing process, quality control methods, laboratory facilities, and testing procedures.

During the project specific plan visit, the review party will:

- confirm that properties in the procurement specifications provided in writing by the GCL and GCC Manufacturer meet specifications;
- confirm that the measurements of properties by the GCL and GCC Manufacturer are properly documented and test methods used are acceptable;
- spot inspect the rolls and confirm that they are free of defects, or any sign of contamination by foreign matter;
- review packaging and transportation methods to confirm that these methods are not damaging the GCL and GCC; and
- confirm that all rolls are properly labeled.

Upon completion of the manufacturing plant visit, a report describing the findings and observations by the review party will be prepared by Fluor Fernald, Inc.

8.4 Transportation, Handling, and Storage

The CQC Consultant will monitor the transportation, handling, and storage of the GCL and GCC on-site. Handling of the rolls shall be performed in a competent manner such that damage does not occur to the GCL and GCC or its protective wrapping. Protective wrapping that is damaged or stripped off the rolls shall be repaired immediately to the satisfaction of the Construction Manager. Rolls of GCL or GCC shall not be stacked upon one another to the extent that deformation of the core occurs, to the point where accessibility is inhibited, or the height of the stack exceeds the Manufacturer's recommendation, During transportation, handling, and storage the GCL and GCC rolls will be protected from ultraviolet light exposure, precipitation or ponding water, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Stored GCL or GCC shall be covered with tarp.

Upon delivery at the site, the Contractor and CQC Consultant will monitor the rolls for defects and damage. This monitoring will be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant will indicate to the Construction Manager:

- rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws; and
- rolls, which include minor repairable flaws.

The CQC Consultant will also monitor that equipment used to handle the geosynthetics on-site is adequate and does not pose any risk of damage to the geosynthetics when used properly.

8.5 Conformance Testing

8.5.1 Sampling Requirements

Before or upon delivery of the rolls of GCL and GCC, the CQC Consultant will confirm that representative conformance samples are removed and forwarded to the Geosynthetics CQC Laboratory for testing. Conformance samples will be a minimum of 3 ft long by the roll width. The CQC Consultant will mark the machine direction on the samples and tape or otherwise secure the cut edges of the sample to eliminate the loss of the granular bentonite. The required minimum GCL and GCC sampling frequencies are provided in Table 8-1. The rolls shall be immediately re-wrapped and replaced in their shipping trailers or in the temporary field storage area. The CQC Consultant will mark the machine direction on the samples with an arrow and affix a label, tag, or otherwise mark each sample with the following information:

- date sampled;
- project number;

- lot/batch number and roll number;
- conformance sample number; and
- CQC personnel identification.

8.5.2 Testing Requirements

Conformance testing of the GCL and GCC materials delivered to the site will be conducted to confirm compliance with Section 02770P of the Technical Specifications. As a minimum, the GCL and GCC conformance test methods listed in Table 8-1 will be performed by the Geosynthetics CQC Laboratory.

8.5.3 Test Results

The CQC Consultant will review results from laboratory conformance testing and report any nonconformance to the Construction Manager. The GCL and GCC conformance test result will meet or exceed the minimum property values presented in Section 02772P of the Technical Specifications.

8.5.4 Conformance Test Failure

In the case of failing test results, the Manufacturer or CQC Consultant may request that another sample from the failing roll be retested by the Geosynthetics CQC Laboratory with the manufacturer's technical representative present during the test. If the retest fails or if the option to retest is not exercised, then two isolation conformance samples will be obtained by the CQC Consultant. These isolation samples will be taken from rolls, which have been determined by correlation with the manufacturer's roll number, to have been manufactured prior to and after the failing roll. This method for choosing isolation rolls for testing should continue until passing tests are achieved. Rolls which fall numerically between the passing roll numbers will be rejected by the

Construction Manager. The CQC Consultant will verify that the Manufacturer has replaced all rejected rolls. The CQC Consultant will document actions taken in conjunction with GCL and GCC conformance test failures.

8.6 Surface Preparation

The GCL and GCC shall not be placed on surfaces which are softened due to high water content or have desiccation cracks as defined in Technical Specification Section 02225. The CQC Consultant and the Geosynthetics Installer will jointly verify that the surface on which the GCL and GCC will be installed is acceptable. The Contractor shall comply with the compacted clay liner surface preparation and acceptance requirements identified in Section 02225 of the Technical Specifications. The CQC Consultant will notify the Construction Manager of any observed change in the supporting soil condition that may require repair work and verify that compacted clay liner repair work is completed in accordance with the requirements of the Technical Specifications and this CQA Plan.

8.7 Placement

The CQC Consultant will confirm that the Geosynthetics Installer has taken all necessary precautions to protect the underlying subgrade and top of contouring layer during GCL and GCC installation operations and that placement of GCL and GCC are in accordance with Manufacturer's recommendations and/or Technical Specifications, whichever is most stringent. The CQC Consultant will confirm that GCL and GCC are handled in such a manner that they are not damaged, and the following conditions are met:

- on slopes, the GCL and GCC are secured and then rolled down the slope in such a manner as to continually keep the GCL and GCC panel in tension and prevent loss of bentonite;

- in the presence of wind, GCL and GCC are weighted with sandbags or the equivalent;
- adjacent GCL panels are shingled in the direction of the slope;
- GCL and GCC are kept continually under tension to minimize the presence of wrinkles;
- GCL and GCC are cut using a utility blade in a manner recommended by the Manufacturer;
- during placement, care is taken not to entrap fugitive clay, sand, stones, or debris under the GCL and GCC;
- the exposed GCL and GCC are protected from damage in heavily trafficked areas;
- a visual examination of the GCL and GCC is carried out over the entire surface, after installation, to confirm that damaged areas, if any, are identified and repaired; and
- if a white colored GCL and GCC is used, take appropriate measures to protect against "snowblindness" of personnel.

8.8 Overlaps

The CQC Consultant will monitor and confirm the GCL and GCC overlapping procedures conform to the requirements of Section 02772 of the Technical Specifications and manufacturer's recommendations, whichever is more stringent.

8.9 Repair

The CQC Consultant will monitor the repair of any holes or tears in the GCL and GCC or the geotextile backing. Patching requirements will conform to the most stringent of manufacturer's recommendations and Technical Specification Section 02772 requirements.

The CQC Consultant will monitor for hydrated GCL. Any GCL hydrated to a moisture content in excess of 40 percent, when measured in accordance with ASTM D 4643, will be marked for removal and replacement by the Contractor.

TABLE 8-1:

GCL AND GCC CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[1]
Direct Shear[2]	ASTM D 6243	1 test per 100,000 ft^2
Hydraulic Conductivity[3]	ASTM D 5887	1 test per 100,000 ft^2

Notes:

1. Testing shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot is defined by ASTM D 4354.

2. Each sample will be tested using the most recent version of the ASTM for the following: (i) internal shear strength; and (ii) interface shear strength of geosynthetic clay liner and the geomembrane liner and the geosynthetic clay cap and the geomembrane cap.

3. Section 10 of ASTM D 5887 provides the equations to calculate the index flux. Hydraulic conductivity will also be calculated using average of three thickness measurements on the clay component of the GCL. The thickness measurements will be taken at the completion of the test within 30 minutes after dismounting the test specimen. Calipers or similar devices will be used for measuring after carefully cutting the test specimen with a sharp razor knife

Table 8-1 (cont.)

and folding back the geotextile backing. The hydraulic conductivity will be calculated in accordance with the applicable method presented in Section 9 of the referenced ASTM D 5084, noting the length of the specimen is the average of the three thickness measurements (cm) and the hydraulic conductivity (cm/sec) along with the items required in Section 11 of ASTM D 5887.

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9. GEOTEXTILES

9.1 Introduction

The CQC Consultant will perform conformance testing and will monitor the installation of geotextile filters, cushions, and separators (geotextiles) as required by Section 02714 of the Technical Specifications and this CQA Plan. The testing used to evaluate the conformance of the geotextiles with the requirements of the Technical Specifications will be performed by the CQC Consultant in accordance with current versions of the ASTM or other applicable test methods indicated in Tables 9-1 and 9-2 which are in effect at the time of award of construction contract, unless otherwise specified or approved by the Construction Manager.

9.2 Related Construction Drawings and Technical Specifications

The Contractor and Geosynthetics Installer shall comply with Section 02714 of the Technical Specifications. The CQC Consultant will reference this specification for specific details of the geotextile material properties, manufacturing quality control, and installation requirements of the geotextiles.

9.3 Manufacturing Plant Visit

Manufacturer quality control testing of geotextile will be conducted by Manufacturer as part of the geotextile submittal process. In addition, samples will be obtained from the manufacturing plant by the CQC Consultant for conformance testing and approved prior to material shipment to site. A manufacturing plant visit by Fluor Fernald, Inc. and the CQC Consultant may be conducted if there are concerns on the Manufacturer's quality control procedures during the submittal process.

9.4 Transportation, Handling and Storage

The CQC Consultant will monitor the transportation, handling, and storage of the geotextile on-site. The Construction Manager will designate a geotextile storage location. During transportation, handling, and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

Handling of the geotextiles rolls shall be performed in a manner such that damage does not occur to the geotextile nor to its protective wrapping. Rolls of geotextiles shall not be stacked upon one another to the extent that deformation of the core occurs, to the point where accessibility can cause damage in handling, or to a height that exceeds the recommendation of the Manufacturer. Furthermore, geotextile rolls shall be stacked in such a way that access for conformance sampling is possible. Protective wrappings shall be removed less than one hour prior to unrolling the geotextile. After unrolling, a geotextile shall not be exposed to ultraviolet light for more than 10 calendar days or in accordance with Manufacturer's recommendations, unless otherwise authorized in writing by the Construction Manager.

Outdoor storage of rolls shall not exceed the manufacturers recommendations or longer than 6 months whichever is less. For storage periods longer than 6 months a temporary enclosure shall be placed over the rolls, or they shall be moved to an enclosed facility. The location of temporary field storage shall not be in areas where water can accumulate. The rolls shall be elevated off the ground to prevent runoff-run-on water from soaking the geotextile rolls.

Upon delivery at the site, the Contractor, Geosynthetics Installer, and CQC Consultant will monitor the rolls for defects and damage. Monitoring will be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant will indicate to the Construction Manager:

- rolls, or portions thereof, that should be rejected and removed from the site because they have severe flaws; and
- rolls that include minor repairable flaws.

The CQC Consultant will also monitor that equipment used to handle the geotextiles on-site is adequate and does not pose any risk of damage to the geotextiles when used properly.

9.5 Conformance Testing

9.5.1 Sampling Requirements

Samples will be taken across the entire width of the roll and will not include the first 3 feet. Unless otherwise specified, samples will be 3 feet long by the roll width. The required minimum geotextile conformance sampling frequencies are provided in Tables 9-1 and 9-2. The CQC Consultant will mark the machine direction on the samples with an arrow and affix a label, tag, or otherwise mark each sample with the following information:

- date sampled;
- project number;
- lot/batch number and roll number;
- conformance sample number; and
- CQC personnel identification.

The geotextile rolls that are sampled shall be immediately rewrapped in their protective coverings to the satisfaction of the Construction Manager.

9.5.2 Testing Requirements

Conformance testing of the geotextile materials delivered to the site will be conducted to confirm compliance with both the Technical Specifications and the manufacturer's list of minimum average roll values. As a minimum, the geotextile conformance test requirements listed in Tables 9-1 and 9-2 will be performed by the Geosynthetics CQC Laboratory.

9.5.3 Test Results

The CQC Consultant will review laboratory conformance test results and verify compliance of the test results with the property valves in Section 02714P of the Technical Specifications prior to deployment of the geotextiles. Any nonconformance will be reported to the Construction Manager.

9.5.4 Conformance Test Failure

In the case of failing test results, the Manufacturer or CQC Consultant may request that another sample from the failing roll be retested by the Geosynthetics CQC Laboratory with the manufacturer's technical representative present during the test. If the retest fails or if the option to retest is not exercised, then two isolation conformance samples will be obtained by the CQC Consultant. These isolation samples will be taken from rolls, which have been determined by correlation with the manufacturer's roll number, to have been manufactured prior to and after the failing roll. This method for choosing isolation rolls for testing should continue until passing tests are achieved. All rolls which fall numerically between the passing roll numbers will be rejected by the Construction Manager. The CQC Consultant will verify that the Manufacturer has replaced all rejected rolls. The CQC Consultant will document actions taken in conjunction with geotextile conformance failures.

9.6 Placement

The CQC Consultant will monitor the placement of geotextiles to confirm they are not damaged in any way, and the following conditions are met.

- On slopes, the geotextiles shall be securely anchored in the anchor trench and then rolled down the slope in such a manner as to continually keep the geotextile sheet in tension.

- In the presence of wind, geotextiles shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with earth cover material.

- Trimming of the geotextiles shall be performed using only an upward cutting hook blade. Special care must be taken to protect other materials from damage that could be caused by the cutting of the geotextiles.

- The CQC Consultant will monitor that the Geosynthetics Installer is taking necessary precautions to prevent damage to underlying layers during placement of the geotextile.

- During placement of geotextiles, care shall be taken not to entrap in the geotextile stones, excessive dust, or moisture that could damage the geomembrane, generate clogging of drains or filters, or hamper subsequent seaming.

- A visual examination of the geotextile shall be carried out over the entire surface, after installation, to ensure that no potentially harmful foreign objects, (e.g., stones, sharp objects, small tools, sandbags, etc.) are present.

9.7 Seams and Overlaps

Geotextiles shall be continuously sewn (i.e., spot sewing is not allowed).

The CQC Consultant will monitor seaming of geotextile seaming procedures to confirm that seams and overlaps are in accordance with Section 02714 of the Technical Specifications.

9.8 Repair Requirements

The CQC Consultant will monitor that holes or tears in the geotextile are repaired in accordance with Section 02714 of the Technical Specifications. The CQC Consultant will observe repairs and assure that any noncompliance with the above requirements is corrected.

9.9 Placement of Soil Materials

The CQC Consultant will monitor the Contractor's placement of soil materials located on top of a geotextile, to verify:

- that no damage occurs to the geotextile;
- that no shifting of the geotextile from its intended position occurs and underlying materials are not exposed or damaged;
- that on side slopes, soil backfill are placed over the geotextile from the bottom of the slope upward; and
- that excess tensile stress does not occur in the geotextile.

Soil backfilling or covering of the geotextile with another geosynthetic shall be completed within 10 days of unrolling the geotextile, or in accordance with the Manufacturer's recommendations, unless otherwise authorized in writing by the Construction Manager.

TABLE 9-1:

GEOTEXTILE FILTER CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[4]
Mass per Unit Area	ASTM D5261	1 test per 100,000 ft^2
Grab Strength	ASTM D4632[1]	1 test per 100,000 ft^2
Trapezoidal Tear Strength	ASTM D4533[2]	1 test per 100,000 ft^2
Puncture Resistance	ASTM D4833[3]	1 test per 100,000 ft^2
Burst Strength	ASTM D3786	1 test per 100,000 ft^2
Apparent Opening Size	ASTM D4751	1 test per 100,000 ft^2
Permittivity	ASTM D4491	1 test per 100,000 ft^2

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 a flat tip centered within the ring clamp.
4. Testing shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot is defined by ASTM D 4354.

TABLE 9-2:

GEOTEXTILE CUSHION AND SEPARATOR CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[4]
Mass per Unit Area	ASTM D5261	1 test per 100,000 ft^2
Grab Strength	ASTM D4632[1]	1 test per 100,000 ft^2
Trapezoidal Tear Strength	ASTM D4533[2]	1 test per 100,000 ft^2
Puncture Resistance	ASTM D4833[3]	1 test per 100,000 ft^2
Burst Strength	ASTM D3786	1 test per 100,000 ft^2

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 a flat tip centered within the ring clamp.
4. Testing shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot is defined by ASTM D 4354.

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10. HDPE PIPE AND FITTINGS, CONCRETE PROTECTIVE LINER, AND PRE-ENGINEERED BUILDINGS

10.1 Introduction

The CQC Consultant will confirm compliance of the materials and equipment and monitor installation of the HDPE pipes and fittings, concrete protective liner, and pre-engineered buildings to confirm compliance with the Construction Drawings and Technical Specifications. The CQC Consultant will review and be familiar with the Construction Drawings and Technical Specifications related to these work elements prior to the Contractor beginning this work.

10.2 Related Construction Drawings and Technical Specifications

The work performed by the Contractor will comply with the Construction Drawings and relevant Sections of Divisions 2, 3, and 13 of the Technical Specifications. Specifications within these Divisions will be referenced by the CQC Consultant for specific details and requirements for transporting, handling, and installation of HDPE pipes and fittings, concrete protective liner, and pre-engineered buildings.

10.3 Transportation, Handling and Storage

10.3.1 HDPE Pipe and Fittings

The pipe is to be placed on wooden pallets and bundled together with plastic straps for bulk handling and shipment. The packing will be such that either fork lifts or cranes equipped with slings can be used for safe handling. The pipe will be segregated by wall thickness or standard dimension ratio (SDR) and inside diameter.

The CQC Consultant will monitor the offloading of the palletized pipe to confirm that handling of the pallets is done in a competent manner and that the pallets are not placed in areas where water can accumulate. A numbering system will be agreed upon between the CQC Consultant and Construction Manager and each pipe individually numbered at the time of off loading. The pallets will not be stacked more than three high or in such a manner that could cause damage to the pipe. Outdoor storage should be no longer than 12 months. For outdoor storage periods longer than 12 months will confirm a temporary cover is placed over the pipes and fittings, or they have been moved to within an enclosed facility.

The maximum allowable depth of cuts, gouges, or scratches on the exterior surface of the HDPE pipe or fittings is 10 percent of the wall thickness. The interior of the pipes will be free of cuts, gouges, and scratches. Any HDPE pipe and fittings that become excessively gouged, twisted, or crimped, will be identified by CQC Consultant and replaced in accordance with the Technical Specifications.

CQC Consultant will monitor the proper handling and storage of the HDPE pipe and fittings and protection of the HDPE pipe and fittings from excessive heat or cold, dirt or other damaging or deleteratious conditions and that any additional storage measures required by the Manufacturer are provided by the Contractor.

10.3.2 Concrete Protective Liner

Transportation, handling, and storage of concrete protective liner will be in accordance with Manufacturer's recommendations. CQC Consultant will confirm that the materials are transported, handled, and stored in such a manner that they are not damaged; and the material are delivered bearing the Manufacturer's labels identifying material type, project name, and lot production information.

10.3.3 Pre-Engineered Building

CQC Consultant will confirm that the pre-engineered building pre-fabricated components, sheets, panels, and other manufactured items transport, handle, and store in such a manner that materials are not damaged; and that materials will be stocked on platforms or pallets above grade or on concrete slab, covered with opaque tarpaulins or other approved weather-resistant ventilated covering. Metal sheets and panels will be stored in a manner to allow drainage of any potential water accumulation. Sheets and panels will not be stored such that they are in contact with other materials that might cause staining.

10.4 Installation Requirements

10.4.1 HDPE Pipe and Fittings

Care will be taken during installation of the HDPE pipe and fittings such that they will not be cut, kinked, or otherwise damaged. Fabric or rubber-protected slings and straps will be used by the Contractor when installing HDPE pipe and fittings. The use of chains, cables, or hooks inserted into the pipe ends is not permitted.

The Contractor will install the HDPE pipe and fittings in such a manner that the materials are not damaged. Slings for handling the pipeline will not be positioned at butt-fused joints. Sections of the pipes with deep cuts and/or gouges exceeding the allowance, as identified in Section 02605 of the Technical Specifications, will be removed and the ends of the pipeline rejoined. Care shall be exercised when lowering pipe into the trench to prevent damage or twisting of the pipe.

Contractor will not lay any pipe until the Construction Manager has approved the bedding conditions.

CQC Consultant will be present during HDPE pipe and fittings installation to confirm compliance with Section 02605 of technical specification and Contract drawings.

10.4.2 Concrete Protective Liner

The CQC Consultant will confirm the materials used meet the requirement of the Technical Specification and installation of the concrete protective liner to confirm proper installation and welding as required by Section 03110 of the Technical Specifications. The concrete protective liner installation includes but is not limited to:

- valve house foundation excavation, rebar placement, and wooden forming with concrete protective liner sheeting construction;
- placing concrete for the foundation walls and floor and the addition of concrete protective sheeting on the floor slab; and
- extrusion welding sheeting together at the joint and spark testing extrusion welds.

Installation of concrete protective liner will conform to Manufacturer's installation requirements. CQC Consultant will monitor the installation and document any damages, necessary repairs and/or replacements will made during installation.

CQC Consultant will monitor a trial weld performed at the beginning of each day. Trial weld coupon will be accepted by passing spark test as defined by the Manufacturer at the recommended voltages provided by the Manufacturer. In the event of humidity in excess of 80 percent, a "cold strength" test as indicated in the Technical Specifications will be performed. If the weld breaks, welding operations will be suspended until relative humidity drops and a successful "cold strength" test is performed.

Prior to any welding of protective liner panels, CQC Consultant will verify and document: (i) the absence of moisture on or behind the joining surfaces; (ii) climate conditions are conducive to joining panel sections per the Manufacturer's instructions; (iii) joining surfaces are clean; and (iv) beveled edges have been prepared where required.

Spark tests will be performed as recommended by the Manufacturer at the recommended voltages provided by the Manufacturer on the root pass of the weld. Any portions of the weld that display failure through the spark test shall be reworked and re-tested until passing results are achieved. Additionally, this test will be repeated on completed welds. Spark testing will be required on 100 percent of all welds.

CQC Consultant will confirm and document the concrete protective liner installation is supervised by the approved Manufacturer's installer in accordance with Section 03110 of the Technical Specifications.

10.4.3 Pre-Engineered Building

CQC Consultant will monitor installation and performance verification to confirm compliance with Section 13120 of the Technical Specifications and the Contract Documents.

Installation will conform to the Manufacturer's requirements for installation and erection of the pre-engineered building.

Completed work will be free of rattles and loose components and allow for expansion and contraction to prevent damage to components.

Work will be plumb and level, true to line and plane, rigid and weathertight.

- The allowances for framing members: 1/4 inch from level, 1/8 inch from plumb;

- The allowance for siding and roofing: 1/8 from true position.

10.5 HDPE Pipe Joining Requirements

10.5.1 Butt-Fusion Joining

The CQC Consultant will monitor the assembling of lengths of HDPE pipe into suitable installation lengths by the butt-fusion process. All pipes and fittings shall be joined by the butt-fusion process unless an alternate method is specifically approved by the Construction Manager. Butt-fusion means the butt-joining of the pipe by softening the aligned faces of the pipe ends in a suitable apparatus and pressing them together under controlled pressure. Butt-fusion joining of the HDPE pipes and fittings shall be performed by the Contractor in accordance with the pipe manufacturer's recommendations as to equipment and technique.

The CQC Consultant will be familiar with the approved butt-fusion joining installation procedures submitted by the Contractor. Any conflicts between the approved joining procedures and these CQC methods are to be brought to the immediate attention of the Construction Manager. The CQC methods to be followed during butt-fusion joining are summarized below.

- Trial fusion joints will be monitored in the same manner as production joints.
- Each butt fusion joint will be assigned a number. The number will be recorded on the pipe using either a crayon or other approved marker. The number will be recorded on both sides of the joint and on the Butt-Fusion Welding Log.
- CQC Consultant will monitor the joining of all butt fusion joints. The following information will be recorded on the Butt-Fusion Joining Log:
    - joint number;

- pipe diameter and SDR;
- machine identification number;
- operator identification;
- gauge pressure during fusion;
- gauge pressure during cool down;
- joining plate temperature;
- pipe alignment; and
- approximate amount of "roll-back".

- Any joints that are not acceptable will be cut out and rewelded. Documentation of the rewelding procedures will be recorded on the Butt-Fusion Joining Log.
- The approximate location of the butt-fusion joints relative to bounding structures such as pre-engineered buildings or valves will be recorded.

10.5.2 Electrofusion Joining

When specifically approved in writing by the Construction Manager, pipes may be joined using an electrofusion coupling. Electrofusion couplings shall be installed by the Contractor using approved written procedures in strict compliance with Manufacturer's recommendations.

The CQC Consultant will be familiar with approved electrofusion joining procedures submitted by the pipe installer and approved by the Construction Manager. Any conflicts between approved installation procedures and these CQC methods are to

be brought to the immediate attention of the Construction Manager. The CQC methods to be followed during electrofusion joining are summarized below:

- Electrofusion joining will be fully monitored.
- The CQC Consultant will review and be familiar with the approved joining procedures submitted by the Contractor.
- Electrofusion couplings will be assigned a number. The number will be recorded using a crayon or other approved marker on the coupling.
- The CQC Consultant will document the pipe is fully installed into the coupling before joining commences.
- The following joining information will be recorded on the Electrofusion Joining Log:
  - joint number;
  - pipe diameter and SDR;
  - machine identification number;
  - operator identification;
  - serial and model number on coupling;
  - joint preparation includes scraping and cleaning;
  - seating of pipe at center of coupling;
  - alignment of pipe;
  - heating time;

- cool down time;
- joint not disturbed during cool down time; and
- acceptability of joint as shown on computer output (i.e., Weld OK, Abort, etc.).

- Any extrusion welding of the coupling to the pipe will be noted on the form.
- The approximate location of the electrofusion joints relative to bounding structures such as pre-engineered buildings or valves will be recorded. The approximate locations will be shown on the as-built drawings for the pipe.

10.5.3 Extrusion Welded Sleeves

When specifically approved in writing by the Construction Manager, pipes may be welded using extrusion welded sleeves. Extrusion welded sleeves shall be installed by the Contractor using written procedures approved in advance by the Construction Manager.

The CQC Consultant will be familiar with the extrusion welded sleeves installation procedures submitted by the pipe installer and approved by the Construction Manager. Any conflicts between approved installation procedures and these CQC methods are to be brought to the immediate attention of the Construction Manager. The CQC methods to be followed during pipe joining using extrusion welded sleeves are summarized below:

- All extrusion welds will be fully monitored.
- The CQC Consultant will review and be familiar with the approved installation procedures.

- All extrusion welded sleeves will be assigned a number. The number will be recorded using a crayon or other approved marker on the sleeve and adjoining pipe and on the Extrusion Welded Sleeve Log (see Appendix A).
- Check to see the pipe ends are free and sufficient space beneath pipe has been excavated.
- Document diameter and SDR of sleeve.
- Check the length of sleeve and beveling of sleeve ends.
- Document pipe has been cleaned, properly ground and cleaned again.
- Check to see sleeve is centered and aligned vertically and horizontally.
- Check to see moisture is removed and observe welding procedure.
- The CQC Consultant will document the pipe is fully installed into the sleeve before welding commences.
- The following welding information will be recorded on the Extrusion Welded Sleeve Log:
  - joint number;
  - pipe diameter and SDR;
  - machine identification number;
  - operator identification;
  - joint preparation including scraping, grinding and cleaning;
  - seating of pipe at center of sleeve;

- preheat and extrude temperature;
- joint not disturbed during cool down time; and
- acceptability of weld (i.e., Accept or Reject)

- The approximate location of the sleeve relative to bounding structures such as pre-engineered buildings or valves will be recorded.

10.6 Pressure Testing Requirement

The Contractor shall conduct field testing and inspection of installed HDPE pipes, fittings and valves as specified in Section 02605 of the Technical Specifications. Hydrostatic pressure testing shall be the preferred method of pressure testing. A pneumatic pressure testing method may be used when approved in writing by the Construction Manager.

The CQC Consultant will be familiar with the pressure testing procedures submitted by the Contractor and approved by the Construction Manager. Any conflicts between approved testing procedures and these CQC methods are to be brought to the immediate attention of the Construction Manager. The CQC methods to be followed during pressure testing are summarized below:

- Prior to testing, the CQC Consultant will become familiar with the testing requirements.
- Pressure testing will be fully monitored.
- A separate pressure test log will be completed for each section of pipe to be tested.
- Prior to filling, make sure valves are closed and fittings are in place.

- Observe location of pressure gauge.
- Observe pressure build-up in pipe.
- Check to see that target pressure is applied.
- Observe and document that pressure is stable.
- Record pressure at least every 30 minutes during course of test.
- Indicate on form if pipe section passed or failed.

11. MECHANICAL AND ELECTRICAL

11.1 Introduction

The CQC Consultant will confirm the materials used in and installation of mechanical and electrical systems comply with the Construction Drawings and Technical Specifications. CQC Consultant will review and become familiar with the Construction Drawings and Specifications related to these work elements prior to Contractor beginning the Work. The mechanical and electrical systems include, but are not limited to, the following:

- process piping and appurtenances;
- tanks and appurtenances;
- valves;
- heating;
- fans;
- valve house and control valve house control panels and associated instrumentation, alarm lights, and all other work;
- overhead power distribution system, power wiring, including power circuit connections for pump motors, and equipment mounting boards; and

11.2 Related Construction Drawings and Technical Specifications

The mechanical work performed by the Contractor shall comply with Division 15 of the Technical Specifications. These specifications will be referenced for specific

details of the mechanical equipment requirements and installation. The electrical work performed by the Contractor shall comply with Construction Drawings and Division 16 of the Technical Specifications. These specifications shall be referenced for specific details of the electrical requirements and installation.

11.3 Transportation, Handling, and Storage

11.3.1 Process Piping and Appurtenances

CQC Consultant will confirm and document the delivery of process piping and appurtenances to the site without any damage. Pipes shall arrive with plastic end caps on each length of pipe. Storage and on-site handling shall be in accordance with Manufacturer's Recommendations and Section 15060 of the Technical Specifications.

11.3.2 Tanks and Appurtenances

CQC Consultant will confirm and document delivery of materials in original, unbroken pallets, packages, containers or bundles bearing the label of the Manufacturer. Storage of materials shall be in an enclosed area free from extreme temperatures and free from contact with soil and water and in accordance with Manufacturer's recommendation, and Section 15070 of the Technical Specifications.

11.3.3 Valves

CQC Consultant will confirm and document delivery of materials in original, unbroken, pallets, packages, containers, or bundles bearing the label of the Manufacturer and storage of materials are in an enclosed area free from contact of soil and water and in accordance with Section 15080 of the Technical Specifications.

11.3.4 Heating

CQC Consultant will confirm and document delivery of heaters and associated equipment free from any apparent physical damage and on-site storage is provided in accordance with Manufacturer's recommendation, and Section 01550 of the Technical Specifications.

11.3.5 Fans

CQC Consultant will confirm and document delivery of ceiling fans and cabinet fans and associated equipment free from any apparent physical damage and on-site storage is provided in accordance with Manufacturer's recommendation.

11.3.6 Installation and Testing Requirements

The CQC Consultant will monitor the work of the Contractor in the installation of all mechanical and electrical appurtenances in accordance with national codes and other regulations or authorities having jurisdiction over the work. The CQC Consultant will verify the applicable mechanical and electrical codes are current before work is begun, and once every two months thereafter, until work is completed or otherwise interrupted. The CQC Consultant will observe and document construction acceptance testing procedures performed by the Contractor. The CQC Consultant will also observe and document operational testing procedures performed by the Contractor.

11.4 Installation and Testing Requirements

11.4.1 Process Piping and Appurtenances

The CQC Consultant will monitor the assembling joints between process piping and HDPE to confirm compliance with Sections 02605 and 15060 of the Technical Specifications.

The CQC Consultant will confirm that the Contractor provided a qualified inspector certified to inspect welds in accordance with ASME B 31.3 or otherwise approved by the Construction Manager. CQC Consultant will confirm Contractor's weld inspection in accordance with Section 15060 of the Technical Specifications.

CQC Consultant will monitor the installation of the process piping and appurtenances to confirm installation in accordance with Section 15060 of the Technical Specifications and Construction Drawings.

CQC Consultant will be familiar with the pressure testing procedures submitted by the Contractor and their conformance with ASME B 31.9. The CQC methods to be followed during pressure testing are summarized below:

- Prior to testing, the CQC Consultant will become familiar with the testing requirements;
- Confirm valves that may be directional/flow sensitive are installed correctly and tank HDPE piping is isolated from carbon steel piping being tested;
- Pressure testing will be fully monitored;
- Confirm calibration of pressure gauge in accordance with NIST standards within one year of test data in accordance with Section 02605 of the Technical Specifications;

- Observe pressure build-up in pipe;
- Confirm hydrostatic pressure testing in accordance with the Technical Specification;
- Observe and document that test pressure is stable and indicate on form if pipe section passed or failed.

11.4.2 Tanks and Appurtenances

CQC Consultant will confirm that tanks, material and equipment identified in Section 15070 are installed in accordance with the Manufacturer's written installation instructions and recommendations.

CQC Consultant will confirm that the connections are free of leaks and the system functions in accordance with Section 15070 of the Technical Specifications.

11.4.3 Valves

CQC Consultant will confirm that valves are installed in accordance with the Manufacturer's written installation instructions and recommendations and Section 15080 of the Technical Specifications.

CQC Consultant will monitor the working of each valve to confirm it is functional.

CQC Consultant will monitor pressure testing (as identified in 11.3.1 of this Plan), of valves and confirm valves are free of leaks.

CQC Consultant will be present during installation and testing of valves.

11.4.4 Heating

CQC Consultant will confirm unit heaters are installed in accordance with Manufacturer's installation instructions and Section 15500 of the Technical Specifications. After completion of installation, CQC Consultant will monitor the testing of each unit heater as specified in Section 15500 of the Technical Specifications.

11.4.5 Fans

CQC Consultant will confirm ceiling fans and cabinet fans are installed in accordance with Manufacturer's installation instructions and Section 15865.

CQC Consultant will confirm Contractor's testing that evaluates required operation and performance as defined in Section 15865 of the Technical Specifications.

11.4.6 Instrumentation

CQC Consultant will monitor installation to confirm and document compliance with Section 16900 of the Technical Specifications.

After completion of installation, CQC Consultant will confirm and document that Contractor has calibrated instrument equipment to Manufacturer's Standards.

11.4.7 Overhead Service and Ground

Testing and inspection will be monitored by CQC Consultant and CQC Consultant will confirm and document that inspection and testing conforms to the requirements of NETA ATS.

CQC Consultant will monitor grounding installation to confirm and document compliance with Section 16450 of the Technical Specifications.

11.5 Record Drawings

The CQC Consultant will monitor the maintenance by the Contractor of redline drawings on which the actual installation of all mechanical and electrical work shall be accurately shown, indicating any variation from Construction Drawings. Changes in layout or circuitry shall be clearly and completely indicated as the work progresses. These redline drawings shall be reviewed by the Resident Engineer and Construction Manager and used to determine the progress of mechanical and electrical work.

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12. CONCRETE

12.1 Introduction

This CQC Consultant will monitor the construction and perform conformance testing of all concrete materials and finished products to confirm compliance with Construction Drawings and Technical Specifications. CQC Consultant will review and be familiar with the Construction Drawings and Technical Specifications related to this work prior to Contractor beginning the work.

12.2 Monitoring

The CQC Consultant will monitor prepared subgrade, formwork, reinforcing steel layout and other scheduled structures specified in Section 03100 of the Technical Specifications and in the Construction Drawings. CQC Consultant will monitor concrete workmanship to confirm that the Contractor does not place concrete until foundations, forms, reinforcing steel, pipes, conduits, sleeves, anchors, hangers, inserts, and other work required to be built into concrete has been inspected and approved by the Construction Manager. The CQC Consultant will also monitor concrete curing times, curing temperatures, and placement methods on delivery and during placement of concrete. The Contractor is required to notify the Construction Manager and CQC Consultant at least 24 hours in advance of concrete placement activities and scheduling the inspections activities described above.

12.3 Field Quality Control Testing

Concrete conformance testing will be the responsibility of the CQC Consultant. The concrete test program will meet the following requirements:

- Concrete samples will be obtained by the CQC Consultant at a frequency of one set of standard cylindrical test specimens for every 25 cubic yards of concrete or any portion of thereafter for each work shift and for each concrete mix design. For each work shift, when concrete is delivered, at least one set of specimens will be made. A set of test specimens will consist of at least three standard cylinders. Each set of test specimens will be tested for 7-day and 28-day compressive strength.

- Compressive strengths will be determined from the standard test specimens taken according to ASTM C 31 and ASTM C 172, and cured and tested in accordance with ASTM C 39. Core drilling, if required, and testing will be in accordance with ASTM C 42.

- Slump and air content will be determined with no less frequency than that of concrete strength specimen sets. Air content and slump will be determined in accordance with ASTM C 231 and ASTM C 143, respectively.

The CQC Consultant will be responsible for reporting test results to the Contractor and the Construction Manager. Materials determined by the Construction Manager to fail the requirements of the Construction Drawings and Technical Specifications will be rejected.

13. PERMANENT ROAD CONSTRUCTION

13.1 Introduction

The CQC Consultant will monitor and test materials used in the construction of the various roads and paved surfaces to assure compliance with Construction Drawings and Technical Specifications.

13.2 Subgrade Preparation

In-place moisture/density testing by nuclear methods (ASTM D3017 and D2922) will be performed by the CQC Consultant for compacted fill materials. Fill placement and compaction will be performed in accordance with Section 02200 of the Technical Specifications. For access corridor subgrades, nuclear moisture/density tests will be performed at a minimum frequency of 1 test per 500 lineal ft per lift. The CQC Consultant will monitor the Contractor's proofrolling of cut sections in accordance with the requirements in Section 6.4 of this CQA Plan.

13.3 Geotextile Conformance Testing and Placement

Conformance testing of the geotextile separator will be in accordance with the Section 02714 of the Technical Specifications. The CQC Consultant will monitor the Contractor's geotextile installation methods and procedures in accordance with the requirements of Section 9 of this CQA Plan.

13.4 Base Layer

The CQC Consultant will monitor the base aggregate for the access corridor to confirm it is constructed to the thickness, grades, and limits shown on the Construction Drawings. The CQC Consultant will monitor the test strip required in Section 13.6 of this CQA Plan.

13.5 Quality Control Testing

Quality control testing of the materials used in construction of the roads and paved surfaces will be the responsibility of the CQC Consultant. The frequency of CQC testing for the base aggregate materials is as follows:

- Particle-size analysis (ASTM C136) at a frequency of one test per 5,000 yd^3; and
- density and moisture (ASTM D 2922 and ASTM D 3017) at a frequency of one test per 100 lineal feet per lift.

Requirements for in-situ density of base aggregates used in access corridor roads shall be defined during the compaction of a test strip The test strip for base aggregate shall be compacted in accordance with the requirements of Item 304.05 of the Ohio DOT Specifications.

13.6 Repair

If a defective area is discovered, the CQC Consultant will evaluate the extent and nature of the defect. After this determination the Contractor shall correct the deficiency to the satisfaction of the Construction Manager. The Contractor shall not perform additional work in the area until the Construction Manager approves the correction of

the defect. In the event of damage, the Contractor shall immediately make repairs and replacements as necessary to the satisfaction of the Construction Manager.

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14. GENERAL SITE WORK

14.1 Introduction

The CQC Consultant will monitor the activities which are to be performed for various general site work items including, but not limited to rip rap, culverts, and chain link fences and gates, for compliance with Construction Drawings and Technical Specifications.

14.2 Rip Rap

14.2.1 Conformance Testing

Conformance testing of Type D rip rap used for temporary applications is not required. Conformance testing of Type C rip rap used for permanent systems will be performed, and will include measurement of specific gravity and maximum absorption in accordance with ASTM C 127. The required properties are presented in Section 02271 of the Technical Specifications.

The CQC Consultant will, with the approval of the Construction Manager, visit the quarry to observe the proposed material to be used as Type C rip rap.

14.2.2 Performance Test and Monitoring

Performance testing of rip rap is not required. The CQC Consultant will monitor placement of the rip rap to confirm that the placement requirements of Section 02271 of the Technical Specifications are met.

14.3 Culverts

14.3.1 Conformance Testing

Conformance test of culverts is not required. Conformance testing of backfill material will be in accordance with the requirements of Section 02215.

14.3.2 Performance Testing and Monitoring

Performance testing is required of only material used to backfill culverts. Performance testing will be in accordance with the requirements of Section 02215. The CQC Consultant will confirm and document the culverts are of the type and size shown on the Construction Drawings.

14.4 Chain Link Fence

14.4.1 Conformance Testing

Conformance testing of the chain link fence is not required.

14.4.2 Performance Testing and Monitoring

Performance testing of chain link fence is not required. The CQC Consultant will randomly monitor the installation of the chain link fence. Monitoring will include, but is not limited to, plumbness of posts, embedment of posts, post dimensions, connection of fabric to posts, installation of barbed wire. If deficiencies are found, the CQC Consultant will increase the frequency of monitoring and notify the Construction Manager.

APPENDIX A

APPROVAL LETTER

5767

OhioEPA

State of Ohio Environmental Protection Agency

3679

Southwest District Office

401 East Fifth Street
Dayton, OH 45402-2911

TELE: (937) 285-6357 FAX: (937) 285-6249

George V. Voinovich, Governor
Nancy P. Hollister, Lt. Governor
Donald R. Schregardus, Director

June 18, 1997

RE: DOE FEMP
APPROVAL TEST PAD
FINAL REPORT

Mr. Johnny Reising
U.S. Department of Energy, Fernald Area Office
P.O. Box 538705
Cincinnati, OH 45253-8705

Dear Mr. Reising:

This letter provides Ohio EPA approval of the "Draft Test Pad Program Final Report for the On-Site Disposal Facility".

If you have any questions, please contact Tom Ontko or me.

Sincerely,

for Tom Ontko

Thomas A. Schneider
Fernald Project Manager
Office of Federal Facilities Oversight

cc: Jim Saric, U.S. EPA
Terry Hagen, FDF
Ruth Vandergrift, ODH
Mike Proffitt, DD&GW
Bob Geiger, PRC
Manager, TPSS/DERR,CO
Dave Ward, HSIGeoTrans

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 2
To Ken Cargill	From Mike Hickey
Co.	Co.
Dept.	Phone #
Fax # 404-705-9400	Fax #

(jaloveck) partial action responses to DOE-0735-97 (10396)

446.3 35 JUL '97 1-1837 ID

DPADFREP.APP

GE 3900/300/17/1

(rev. 9/96)

000179

Printed on Recycled Paper

APPENDIX B

EXAMPLES OF CQC FORMS

GeoSyntec Consultants

FLUOR FERNALD, INC.

SUBMITTAL COVER SHEET **REFERENCE NO.:** _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

CONTRACTOR: _____

SUBMITTAL NO.: - REVISION NO.:

SUBMITTAL TITLE:

SPECIFICATION SECTION: CQA PLAN SECTION:

DATE SUBMITTED: (day/ month/ year) DATE REVIEWED: (day/ month/ year)

RESUBMITTAL REQUIRED: ☐ YES ☐ NO

DATE APPROVED: (day/ month/ year)

COMMENTS:

DISTRIBUTION:

PREPARED BY: _____

APPROVED BY: _____

000181

GeoSyntec Consultants

FLUOR FERNALD, INC.

SUBMITTAL LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:_____ TASK NO.:_____

DESCRIPTION: _____ YEAR: _____

CONTRACTOR: _____

REFERENCE NO.	SUBMITTAL TITLE	REVISION	DATE SUBMITTED (day/mo)	DATE REVIEWED (day/mo)	RE-SUBMIT YES	RE-SUBMIT NO	DATE APPROVED (day/mo)	COMMENTS

000182

GeoSyntec Consultants

FLUOR FERNALD, INC.

CLARIFICATION FORM **REFERENCE NO.:** _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

OWNER: _____

REFERENCES:

SPECIFICATION SECTION: CQA PLAN SECTION:

CLARIFICATION:

REQUESTED BY: _____
(SIGNATURE AND TITLE) (day/mo/year)

RESPONSE:

000183

RESPONDED BY: _____
(SIGNATURE AND TITLE) (day/mo/year)

COPY TO: _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

CHANGE ORDER/CLARIFICATION LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

CONTRACTOR: _____

REFERENCE NO.	TITLE	DATE SUBMITTED (day/mo)	STATUS		DATE APPROVED/ REJECTED (day/mo)	COMMENTS
			ACCEPTED	REJECTED		

000184

3679

GeoSyntec Consultants

FLUOR FERNALD, INC.

TRANSMITTAL LETTER

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

ATTENTION: _____

ADDRESS: _____

_____

☐ FOR APPROVAL	☐ DRAWINGS	☐ TEST RESULTS	☐ _____
☐ FOR COMMENTS	☐ PHOTOS	☐ DOCUMENTS	☐ _____
☐ AS REQUESTED	☐ LOGS	☐ CONTRACTS	☐ _____

NO. OF COPIES	DRAWING NUMBER	DESCRIPTION	DATE

REMARKS

000185

COPY TO: _____ FROM: _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

CHANGE ORDER (CO)

REFERENCE NO.: _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

FINANCIAL IMPACT: YES ..... NO ..... NA	SCHEDULE IMPACT: YES ... NO ..... NA
SAVINGS: ..... YES ..... EST. $ ..... NO	SAVINGS: ..... YES ..... EST. DAYS ..... NO
COST: ..... YES ..... EST. $ ..... NO	DELAY: ..... YES ..... EST. DAYS ..... NO

REFERENCES: .....

SPECIFICATION SECTION: ..... CQA PLAN SECTION: .....

MATERIAL TYPE: .....

ITEM BEING CHANGED OR ADDED: .....

REASON FOR CHANGE: .....

EFFECTIVE DATE OF CHANGE: ..... (day) ..... (mo) ..... (year)

FINANCIAL AND SCHEDULE CONSIDERATIONS: .....

OWNER'S REPRESENTATIVE day/mo/yr

CQA REPRESENTATIVE day/mo/yr

000186

PROJECT MANAGER day/mo/yr

COPY TO: _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

DAILY WEATHER LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

TIME PERIOD: AM QA ID: _____

GENERAL CONDITIONS: _____ CLEAR _____ LIGHT CLOUD COVER _____ OVERCAST

WIND: _____ LIGHT _____ MODERATE _____ STRONG _____ GUSTY

TEMPERATURE RANGE: _____ °F °C

PRECIPITATION: _____ NONE _____ DRIZZLE/FOG _____ RAIN

COMMENTS: _____

TIME PERIOD: PM QA ID: _____

GENERAL CONDITIONS: _____ CLEAR _____ LIGHT CLOUD COVER _____ OVERCAST

WIND: _____ LIGHT _____ MODERATE _____ STRONG _____ GUSTY

TEMPERATURE RANGE: _____ °F °C

PRECIPITATION: _____ NONE _____ DRIZZLE/FOG _____ RAIN

COMMENTS: _____

TIME A.M.	AMBIENT TEMPERATURE °F °C	GEOMEMBRANE LINER TEMPERATURE °F °C	COMMENTS

TIME P.M.	AMBIENT TEMPERATURE °F °C	GEOMEMBRANE LINER TEMPERATURE °F °C	COMMENTS

NOTE: (1) AMBIENT TEMPERATURES MEASURED AT APPROXIMATELY _____ ft. ABOVE GROUND LEVEL.

 FILE NO. 1-06-DWL

SHEET NO. _____ OF _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

FIELD OBSERVATION REPORT

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

WEATHER: _____

AREA:

CONTRACTOR:

EQUIPMENT USED:

WORK PERFORMED:

000188

COPY TO: _____ PER: _____

3679

GeoSyntec Consultants

FLUOR FERNALD, INC.

WEEKLY FIELD REPORT

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ WEEK ENDING: _____

000189

COPY TO: _____ PER: _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

WEEKLY FIELD REPORT

DATE: _____ day _____ month _____ year

COPY TO: _____ 000190 PER: _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

DAILY FIELD REPORT

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:_____ TASK NO.:_____

DESCRIPTION:_____ DATE: _____ day_____ month _____ year

CONTRACTOR:_____

WEATHER:_____

COPY TO:_____ PER:_____ HRS:_____

 FILE NO. 1-04-DFR

SHEET NO._____ OF_____

GeoSyntec Consultants

FLUOR FERNALD, INC.

DAILY FIELD REPORT

DATE: _____ day _____ month _____ year

COPY TO: _____ PER: _____

 FILE NO. 1-048-DFR

000192

SHEET NO. _____ OF _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

SENIOR PERSONNEL SUMMARY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: ______ TASK NO.: ______

DESCRIPTION: ______ YEAR: ______

NAME	REF ID	COMPANY	POSITION	COMMENTS

000193

GeoSyntec Consultants

FLUOR FERNALD, INC.

PERSONNEL/EQUIPMENT DAILY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ WEEK BEGINNING: _____

PERSON/ITEM	REF ID	COMPANY	MON	TUES	WED	THURS	FRI	SAT	SUN

000194

GeoSyntec Consultants

FIELD FORMS – ORDER SHEET

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO:_____ TASK NO.:_____ DATE ORDERED:_____

DESCRIPTION:_____ DATE:_____ day_____ month_____ year DATE NEEDED:_____

NO. OF COPIES	FORM NO.	GENERAL FORM TITLE
	1-1A-FSF	Field Order Forms-Order Sheet (Front Side)
	1-1B-FSF	Field Order Forms-Order Sheet (Back Side)
	1-02-SPS	Senior Personnel Summary Log
	1-03-PDL	Personnel/Equipment Daily Log
	1-04A-DFR	Daily Field Report
	1-04B-DFR	Daily Field Report (Continued)
	1-05A-WFR	Weekly Field Report
	1-05B-WFR	Weekly Field Report (Continued)
	1-06-DWL	Daily Weather Log
	1-07-FOR	Field Observation Report
	1-08-TLF	Transmittal Letter
	1-09-COF	Change Order
	1-10-CRF	Clarification Form
	1-11-COL	Change Order Log
	1-12-SCS	Submittal Cover Sheet
	1-13-SLF	Submittal Log
	1-14-MSS	Meeting Sign-In Sheet
	1-15-PLF	Photographic Log
	1-16-SDL	Survey Data Log
	1-18-PTL	Pressure Test Log
	1-19-CPF	Concrete Placement Form
	1-20-CSF	Compressive Strength Test Of Concrete Specimens
	1-21-FRF	Field Release Form

NO. OF COPIES	FORM NO.	SOILS FORM TITLE
	2-01-SSL	Soil Sample Log
	2-02-PSF	Percent of Soil Finer Than No. 200 Sieve
	2-03-LDM	Lab Determination of Moisture Content of Soil
	2-04-FLC	Field Laboratory Compaction Test ASTM D 698 Method A
	2-05-FLC	Field Laboratory Compaction Test ASTM D 698 Method B
	2-06-FLC	Field Laboratory Compaction Test ASTM D 698 Method C
	2-08-FLC	Field Laboratory Compaction Test ASTM D 1557 Method A
	2-09-FLC	Field Laboratory Compaction Test ASTM D 1557 Method B
	2-10-FLC	Field Laboratory Compaction Test ASTM D 1557 Method C
	2-12-MDR	Moisture Density Relationships
	2-13-ALT	Atterberg Limits Test (ASTM D 4318)
	2-14-PMS	Particle Size Analysis, Mechanical Sieve Method (ASTM D 422)
	2-15-PHM	Partical Size Analysis, Hydrometer Method (ASTM D 422)
	2-16-PSD	Partical Size Distrubution and Soil Classification Test Results
	2-17-FSC	Field Sand Cone Density Test (ASTM D 1556)
	2-18-DDC	Determination of Density Drive Cylinder
	2-19-NGS	Nuclear Gauge Standard Count Log (ASTM D 2922) (ASTM D 3019)
	2-20-FNM	Field Nuclear Moisture/Density Test Log
	2-22-LTS	Laboratory Test Summary
	2-23-LTR	Laboratory Test Request
	2-24-DCP	Dynamic Cone Penetration Test Log
	2-25-BLG	Boring Log
	2-26-WCD	Well Construction Diagram

NO. OF COPIES	FORM NO.	GEOSYNTHETICS FORM TITLE
1	3-01-MIF	Material Inventory
	3-02A-TRF	Material Test Request Form
	3-02B-TRF	Material Test Request Form
	3-02C-TRF	Material Test Request Form
	3-02D-TRF	Material Test Request Form
	3-02E-TRF	Material Test Request Form
	3-02F-TRF	Material Test Request Form
	3-03-CAS	Certificate of Acceptance Subgrade Surface
	3-04-PPL	Panel Placement Log
	3-05-TSE	Trial Seam Log-(Extrusion)
	3-06-TSF	Trial Seam Log-(Fusion)
	3-07-SSL	Production Seam Summary Log
	3-08A-SPR	Seam and Panel Repair Location Log
	3-08B-SYM	Symbols (Back of Seam Log)
	3-09-RSL	Repair Summary Log
	3-10-DTL	Destructive Test Log

SHEET NO._____ OF_____

GeoSyntec Consultants

FLUOR FERNALD, INC.

MEETING SIGN-IN SHEET

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:____ TASK NO.:____

DESCRIPTION: ____ DATE: ____ day ____ month ____ year

SUBJECT: ____ REFERENCE NO. ____

NAME	ORGANIZATION	TELEPHONE

NOTE: FOR FIRST TIME ATTENDEES, PLEASE ATTACH A BUSINESS CARD.

000196

GeoSyntec Consultants

FLUOR FERNALD, INC.

PHOTOGRAPHIC LOG **ROLL NO.:** _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

PHOTOGRAPH NO.	DATE (day/month)	DESCRIPTION

GeoSyntec Consultants

FLUOR FERNALD, INC.

SURVEY DATA LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

SURVEYOR: _____ ALLOWABLE TOLERANCE: _____ QA ID: _____

SURVEY POINT NO.	LOCATION		ELEVATION (TOP OF)						DEPTH OF ZONE			
									___ in. MIN	___ in. MIN	___ in. MIN	___ in. MIN
	NORTH	EAST										

000198

3679

©GeoSyntec Consultants FILE NO. 1-16-SDL CHECKED BY: _____ SHEET NO. _____ OF _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

CONTRACTOR: _____

TEST DESCRIPTION: _____

_____

PASS/FAIL CRITERION: _____

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ MANHOLE: ☐ OTHER: _____

TEST LOCATION: _____

_____

READING NO.	DATE (day/mo)	TIME	READING	CHANGE IN READING	PASS/ FAIL	COMMENTS	QA ID

VISUAL MONITORING: _____ _____

CONTRACTOR'S REPRESENTATIVE day/mo/yr CQA REPRESENTATIVE day/mo/yr

FINAL APPROVAL: _____ _____

CONTRACTOR'S REPRESENTATIVE day/mo/yr CQA REPRESENTATIVE day/mo/yr

COPY TO: _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

CONCRETE PLACEMENT FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO

DESCRIPTION: _____ PROJECT NO.: _____ TASK NO.: _____

DATE: _____ day _____ month _____ year

DESIGN MIX DATA/NO.: _____

COMPRESSIVE STRENGTH: _____ (psi) AT _____ (days) SLUMP RANGE (in.): _____ to _____ AIR CONTENT RANGE (%): _____ to _____

FIELD AND LABORATORY: CONCRETE SUPPLIER: _____ TESTING LABORATORY _____

TRUCK NO.	TICKET NO.	SIZE OF LOAD (yd^3)	TIME				LOCATION	TEMPERATURE		TESTING					
			LOAD BATCHED	BEGIN PLACEMENT	FINISH PLACEMENT	SAMPLED		AMBIENT (°F/C)	ASTM C 1064 CONCRETE (°F/C)	WATER ADDED (gal)	ASTM C 143 SLUMP (in.)	ASTM C 173 AIR CONTENT (%)	PASS/ FAIL	QA ID	NO. OF CYLINDERS

000200

LOCATION NOTES: _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

COMPRESSIVE STRENGTH TEST OF CONCRETE SPECIMENS

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:_____ TASK NO.:_____

DESCRIPTION:_____ DATE: _____ day _____ month _____ year

DESIGN MIX DATA: DESIGN MIX NO.: _____ AIR CONTENT(%):_____to_____

COMPRESSIVE STRENGTH:_____ (psi) AT _____ (days) SLUMP RANGE(in.):_____to_____

FIELD AND LABORATORY: CONCRETE SUPPLIER: ..... CONTRACTOR: .....

LOCATION OF PLACEMENT: .....

CONCRETE TRUCK NO.: ..... TICKET NUMBER: .....

SIZE OF LOAD (yd^3): ..... AMBIENT TEMPERATURE (F/C): .....

DATE SAMPLED: ..... CONCRETE TEMPERATURE (F/C): .....

TIME BATCHED: ..... SLUMP (in.): .....

TIME SAMPLED: ..... AIR CONTENT (% by Vol.): .....

TIME COMPLETED: ..... WET WEIGHT (lb/ft^3): .....

TESTING LABORATORY: ..... WATER ADDED (gal.): ..... QA ID .....

Field Sample No.	Laboratory Sample No.	Age (days)	TOTAL LOAD (lbs.)	Area (in^2)	Compressive Strength (psi)	Pass/Fail

COPY TO:_____

3679

GeoSyntec Consultants

FLUOR FERNALD, INC.

FIELD RELEASE FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

As of .....(day).....(month).....(year), the construction services provided by Geosyntec Consultants for the ..... project is complete, except for the following: .....

.....

.....

.....

.....

.....

.....

.....

.....

The Owner's representative authorizes GeoSyntec Consultants to demobilize its on-site personnel, providing the following conditions are met:

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

OWNER'S REPRESENTATIVE day/mo/yr

CQA REPRESENTATIVE day/mo/yr

PROJECT MANAGER day/mo/yr

000202

COPY TO: _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

SOIL SAMPLE LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO

DESCRIPTION: _____ PROJECT NO.: _____ TASK NO.: _____

MATERIAL TYPE: _____ YEAR: _____

SITE SAMPLE NO.	OFF-SITE LAB SAMPLE NO.	VISUAL DESCRIPTION	SOURCE (LOCATION/DEPTH)	DATE SAMPLED (day/mo)	TEST METHODS	QA ID

000203

COMMENTS: _____

_____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PERCENT OF SOIL FINER THAN NO. 200 SIEVE (ASTM D 1140)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ MATERIAL SOURCE: _____ SAMPLE NO.: _____

SOIL SAMPLE SIZE ASTM D 1140

NOMINAL DIAMETER OF LARGEST PARTICLE (SIEVE)	NO. 10	NO. 4	3/4 in.
APPROXIMATE MINIMUM WT. OF SAMPLE (g)	200	500	1500

QA ID: _____

A	WT. OF TARE NO. _____	(g)	
B	WT. OF DRY SOIL BEFORE WASH PLUS TARE	(g)	
C	WT. OF DRY SOIL BEFORE WASH = B − A	(g)	
D	WT. OF DRY SOIL AFTER WASH PLUS TARE	(g)	
E	WT. OF DRY SOIL AFTER WASH = D − A	(g)	
F	WT. OF DRY SOIL WASHED THROUGH NO. 200 = C − E	(g)	
G	PERCENT OF SOIL FINER THAN NO. 200 SIEVE = (F/C)x100	(%)	

NOTES:

000204

3679

GeoSyntec Consultants

FLUOR FERNALD, INC.

LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOIL

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____

OVEN METHOD (ASTM D 2216): Recommended Mass Of Moist Sample QA ID: _____

100% PASING THE NO. 10 (2-mm) SIEVE	20 grams
100% PASSING THE NO. 4 (4.75-mm) SIEVE	100 grams
100% PASSING THE NO. 3/8-in. (9.5-mm) SIEVE	500 grams
100% PASSING THE NO. 3/4-in. (19-mm) SIEVE	2.5 kilograms

	SAMPLE NO.					
	TARE NO.					
A	WT. OF TARE					
B	WT. OF WET SOIL & TARE					
C	WT. OF DRY SOIL & TARE					
D	WT. OF WATER = B-C					
E	WT. OF DRY SOIL = C-A					
F	MOISTURE CONTENT = (D/E) X 100					
	FIELD DENSITY TEST (FDT) NO.					

MICROWAVE METHOD (ASTM D 4643): Recommended Mass Of Moist Sample QA ID: _____

90% PASSING THE NO. 10 (2-mm) SIEVE	100 TO 200 grams
90% PASSING THE NO. 4 (4.75-mm) SIEVE	200 TO 500 grams
90% PASSING THE 3/4-in. (19-mm) SIEVE	500 TO 1000 grams

INITIAL SETTING TO BE AT 3.0 MINUTES, CONTINUE DRYING SAMPLE AT 1.0 MINUTE SETTING UNTIL MOISTURE CONTENT VARIATION BETWEEN SETTINGS IS LESS THAN 0.1%

	SAMPLE NO.					
	TARE NO.					
A	WT. OF TARE					
B	WT. OF WET SOIL & TARE					
C	WT. OF DRY SOIL & TARE					
D	WT. OF WATER = B-C					
E	WT. OF DRY SOIL = C-A					
F	MOISTURE CONTENT = (D/E) X 100					
	FIELD DENSITY TEST (FDT) NO.					

000205

GeoSyntec Consultants

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST (ASTM D 698 METHOD A)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:_____ TASK NO.:_____

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

MATERIAL TYPE: _____ MATERIAL SOURCE: _____ SAMPLE NO.: _____

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/4-in. (19-mm) SIEVE IS LESS THAN 30%,
AND IF THE MATERIAL RETAINED ON THE NO. 4 (4.75-mm) SIEVE IS LESS THAN 20%
ALL MATERIAL RETAINED ON THE NO. 4 (4.75-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 4-in. DIAMETER MOLD / 5.5-lb RAMMER / 12-in. DROP / 3 LAYERS / 25 BLOWS PER LAYER.

000206

COMPACTION OF SOIL QA ID: _____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A - B	(grams)					
D	WET UNIT WT.(1) = C X 0.066	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/30 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (30 / 453.6) = 0.066). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/30 ± 0.0005 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT - ASTM D 2216 QA ID: _____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G - H	(grams)					
J	WT. DRY SOIL = H - F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

GeoSyntec Consultants

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST

(ASTM D 698 METHOD B)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO

DESCRIPTION: _____ PROJECT NO.: _____ TASK NO.: _____

MATERIAL TYPE: _____ MATERIAL SOURCE: _____ DATE: _____ day _____ month _____ year SAMPLE NO.: _____

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/4-in. (19-mm) SIEVE IS LESS THAN 30%, IF THE MATERIAL RETAINED ON THE NO. 4 (4.75-mm) SIEVE IS GREATER THAN 20%, AND IF THE MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS LESS THAN 20%.
ALL MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 4-in. DIAMETER MOLD / 5.5-lb RAMMER / 12-in. DROP / 3 LAYERS / 25 BLOWS PER LAYER.

COMPACTION OF SOIL

QA ID: _____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A - B	(grams)					
D	WET UNIT WT.(1) = C X 0.066	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/30 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (30 / 453.6) = 0.066). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/30 ± 0.0005 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT - ASTM D 2216

QA ID: _____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G - H	(grams)					
J	WT. DRY SOIL = H - F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

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 FILE NO. 2-05-FLC

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3679

GeoSyntec Consultants

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST (ASTM D 698 METHOD C)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

MATERIAL TYPE: _____ MATERIAL SOURCE: _____ SAMPLE NO.: _____

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/4-in. (19-mm) SIEVE IS LESS THAN 30%,
AND IF THE MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS GREATER THAN 20%,
ALL MATERIAL RETAINED ON THE NO. 3/4-in. (19.0-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 6-in. DIAMETER MOLD / 5.5-lb RAMMER / 12-in. DROP / 3 LAYERS / 56 BLOWS PER LAYER.

000208

COMPACTION OF SOIL

QA ID: _____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A - B	(grams)					
D	WET UNIT WT.(1) = C X 0.029	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/3.333 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (13.333/453.6) = 0.029). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/13.333 ± 0.0009 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT - ASTM D 2216

QA ID: _____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G - H	(grams)					
J	WT. DRY SOIL = H - F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

 FILE NO. 2-06-FLC CHECKED BY: _____ SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST

(ASTM D 1557 METHOD A)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:____ TASK NO.:____

DESCRIPTION: ____ DATE: ____ day ____ month ____ year

MATERIAL TYPE: ____ MATERIAL SOURCE: ____ SAMPLE NO.: ____

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/4-in. (19-mm) SIEVE IS LESS THAN 30%
AND IF THE MATERIAL RETAINED ON THE NO. 4 (4.75-mm) SIEVE IS LESS THAN 20%.
ALL MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 4-in. DIAMETER MOLD / 10-lb RAMMER / 18-in. DROP / 5 LAYERS / 25 BLOWS PER LAYER.

COMPACTION OF SOIL QA ID: ____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A - B	(grams)					
D	WET UNIT WT.(1) = C X 0.066	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/30 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (30 / 453.6) = 0.086). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/30 ± 0.0005 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT - ASTM D 2216 QA ID: ____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G - H	(grams)					
J	WT. DRY SOIL = H - F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

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GeoSyntec Consultants

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST

(ASTM D 1557 METHOD B)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

MATERIAL TYPE: _____ MATERIAL SOURCE: _____ SAMPLE NO.: _____

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 4-in. (4.75-mm) SIEVE IS GREATER THAN 20%, AND THE MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS LESS THAN 20%.
ALL MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 4-in. DIAMETER MOLD / 10-lb RAMMER / 18-in. DROP / 5 LAYERS / 25 BLOWS PER LAYER.

0002.10

COMPACTION OF SOIL

QA ID: _____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A - B	(grams)					
D	WET UNIT WT.(1) = C X 0.066	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/30 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (30 / 453.6) = 0.066). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/30 ± 0.0005 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT - ASTM D 2216

QA ID: _____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G - H	(grams)					
J	WT. DRY SOIL = H - F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

GeoSyntec Consultants

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST

(ASTM D 1557 METHOD C)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO

DESCRIPTION: _____ PROJECT NO.: _____ TASK NO.: _____

MATERIAL TYPE: _____ MATERIAL SOURCE: _____ DATE: _____ day _____ month _____ year

SAMPLE NO.: _____

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS GREATER THAN 20% AND THE MATERIAL RETAINED ON THE NO. 3/4 (19.0-mm) SIEVE IS LESS THAN 30%.
ALL MATERIAL RETAINED ON THE NO. 3/4-in. (19.0-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 6-in. DIAMETER MOLD / 10-lb RAMMER / 18-in. DROP / 5 LAYERS / 56 BLOWS PER LAYER.

COMPACTION OF SOIL

QA ID: _____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A - B	(grams)					
D	WET UNIT WT.(1) = C X 0.029	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/3.333 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL. THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (13.333/453.6) = 0.029). THE MOLD MUST BE CALIBRATED. TO VERIFY A CAPACITY OF 1/13.333 ± 0.0009 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT - ASTM D 2216

QA ID: _____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G - H	(grams)					
J	WT. DRY SOIL = H - F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

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FILE NO. 2-10-FLC

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SHEET NO. _____ OF _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

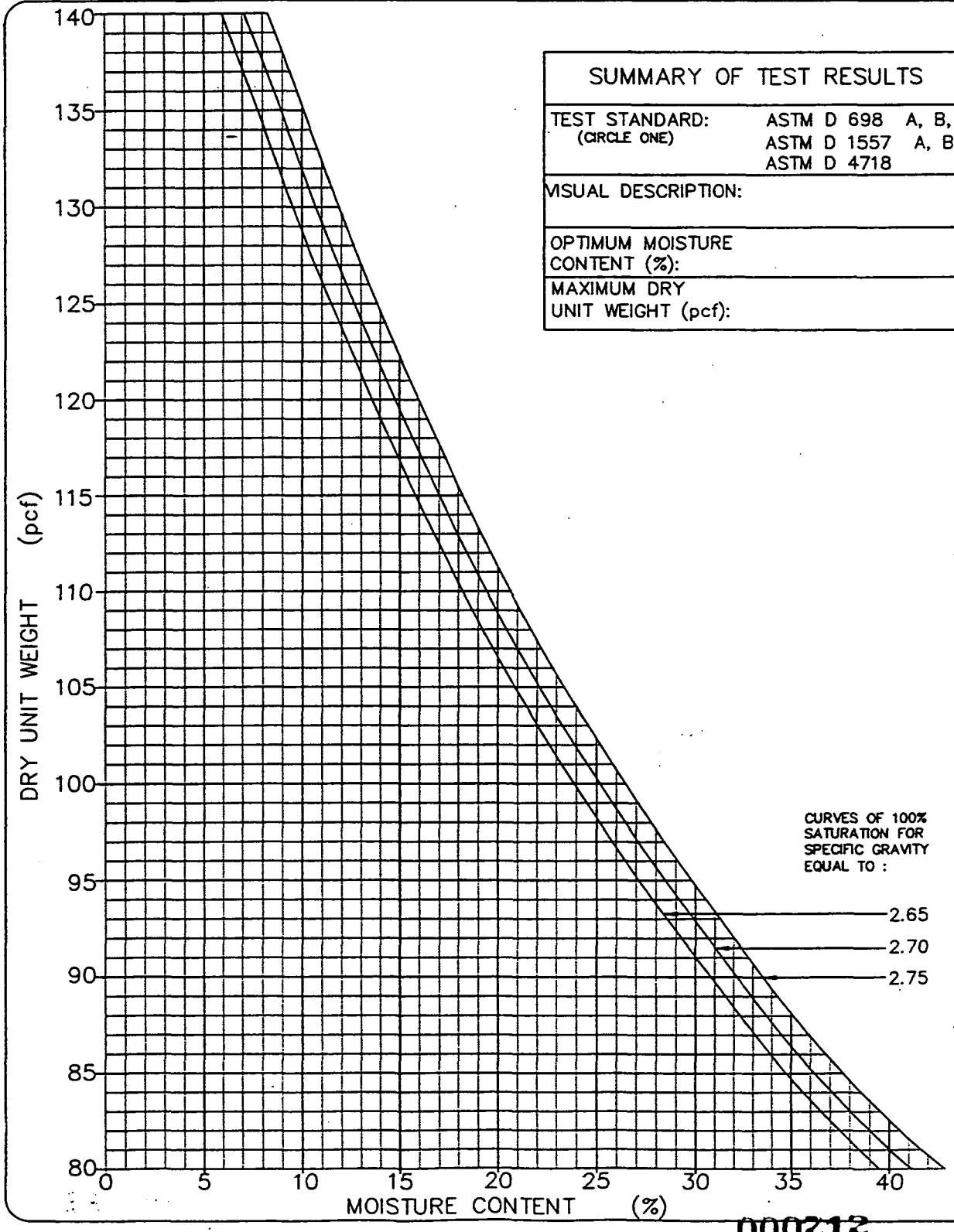
MOISTURE–DENSITY RELATIONSHIP

PROJECT: ON–SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ MATERIAL SOURCE: _____ SAMPLE NO.: _____



SUMMARY OF TEST RESULTS		QA ID
TEST STANDARD: (CIRCLE ONE)	ASTM D 698 A, B, C ASTM D 1557 A, B, C ASTM D 4718	
VISUAL DESCRIPTION:		
OPTIMUM MOISTURE CONTENT (%):		
MAXIMUM DRY UNIT WEIGHT (pcf):		

000212

3679

GeoSyntec Consultants

FLUOR FERNALD, INC.

ATTERBERG LIMITS TEST

(ASTM D 4318)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

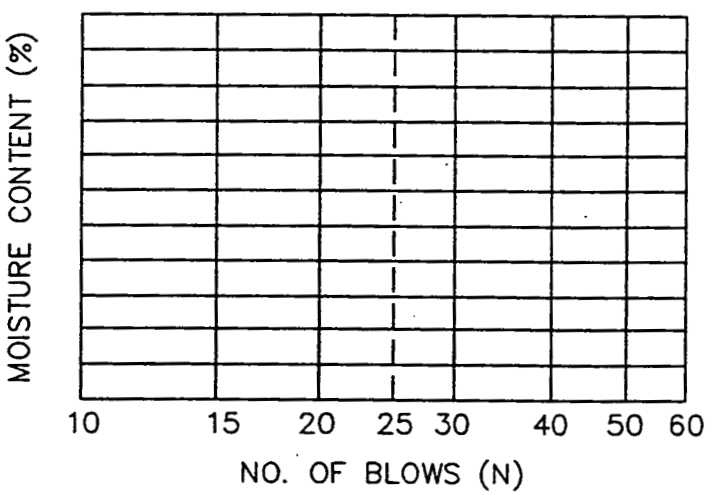
MATERIAL TYPE: _____ MATERIAL SOURCE: _____ SAMPLE NO.: _____

LIQUID LIMIT DETERMINATION

QA ID: _____

	TARE NO.					
A	WT. OF TARE	(grams)				
B	WT. OF WET SOIL & TARE	(grams)				
C	WT. OF DRY SOIL & TARE	(grams)				
D	WT. OF WATER = B-C	(grams)				
E	WT. OF DRY SOIL = C-A	(grams)				
F	MOISTURE CONTENT = (D/E)X100	(%)				
N	NUMBER OF BLOWS					

DRYING TARE NO.



CURING TARE NO.

PLASTIC LIMIT DETERMINATION

QA ID: _____

	TARE NO.					
A	WT. OF TARE	(grams)				
B	WT. OF WET SOIL & TARE	(grams)				
C	WT. OF DRY SOIL & TARE	(grams)				
D	WT. OF WATER = B-C	(grams)				
E	WT. OF DRY SOIL = C-A	(grams)				
F	MOISTURE CONTENT = (D/E)X100	(%)				

LIQUID LIMIT (LL) = _____ PLASTIC LIMIT (PL) = _____ PLASTICITY INDEX (PI) = _____

000213

GeoSyntec Consultants

FLUOR FERNALD, INC.

PARTICLE SIZE ANALYSIS–SIEVE METHOD (ASTM D 422)

PROJECT: ON–SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

SOIL SAMPLE SIZE

APPROXIMATE MINIMUM WT. OF SAMPLE (PASSING NO. 10 SIEVE) (grams)	SAND	FINE GRAIN
	115	65

	BEFORE WASH	AFTER WASH
TARE NO.		
WT. OF DRY SAMPLE PLUS TARE (grams)		
WT. OF TARE (grams)		
WT. OF DRY SAMPLE (grams)		

SIEVE ANALYSIS

QA ID: _____

SIEVE NO.	DIAMETER (mm)	WT. RETAINED (grams)	% RETAINED	% FINER	PROJECT SPECIFICATIONS
3 in	76.2				
2 in	50.8				
1 1/2in	38.1				
1 in	25.4				
3/4 in	19.1				
1/2 in	12.7				
3/8 in	9.53				
No. 4	4.75				
No. 10	2.00				
No. 20	0.850				
No. 40	0.425				
No. 60	0.250				
No. 100	0.125				
No. 200	0.075				
PAN	———		———	———	

COMMENTS:

%FINER = 100 − Σ% RETAINED

GeoSyntec Consultants

FLUOR FERNALD, INC.

PARTICLE SIZE ANALYSIS—HYDROMETER METHOD (ASTM D 422)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

HYDROMETER ANALYSIS QA ID: _____

TARE NO.: _____ PERCENT PASSING NO. 200 SIEVE = _____

DISPERSING AGENT: _____ AMOUNT: 125 ml from 40 grams/liter batch

ORIGINAL WEIGHT OF SOIL: _____ MOISTURE CONTENT: _____

DATE (day/mo)	TIME OF READING	ELAPSED TIME (MIN)	OBSERVED TEMP. (°F/°C)	TOTAL CORRECTION	ORIGINAL HYD. READING	CORRECTED HYD. READING	MEAN PARTICLE DIAM., From Chart (mm)	% FINER	PROJECT SPECIFICATIONS

000215

GeoSyntec Consultants

FLUOR FERNALD, INC.

PARTICLE SIZE DISTRIBUTION AND SOIL CLASSIFICATION TEST RESULTS (ASTM C 136/D 422) (ASTM D 2487)

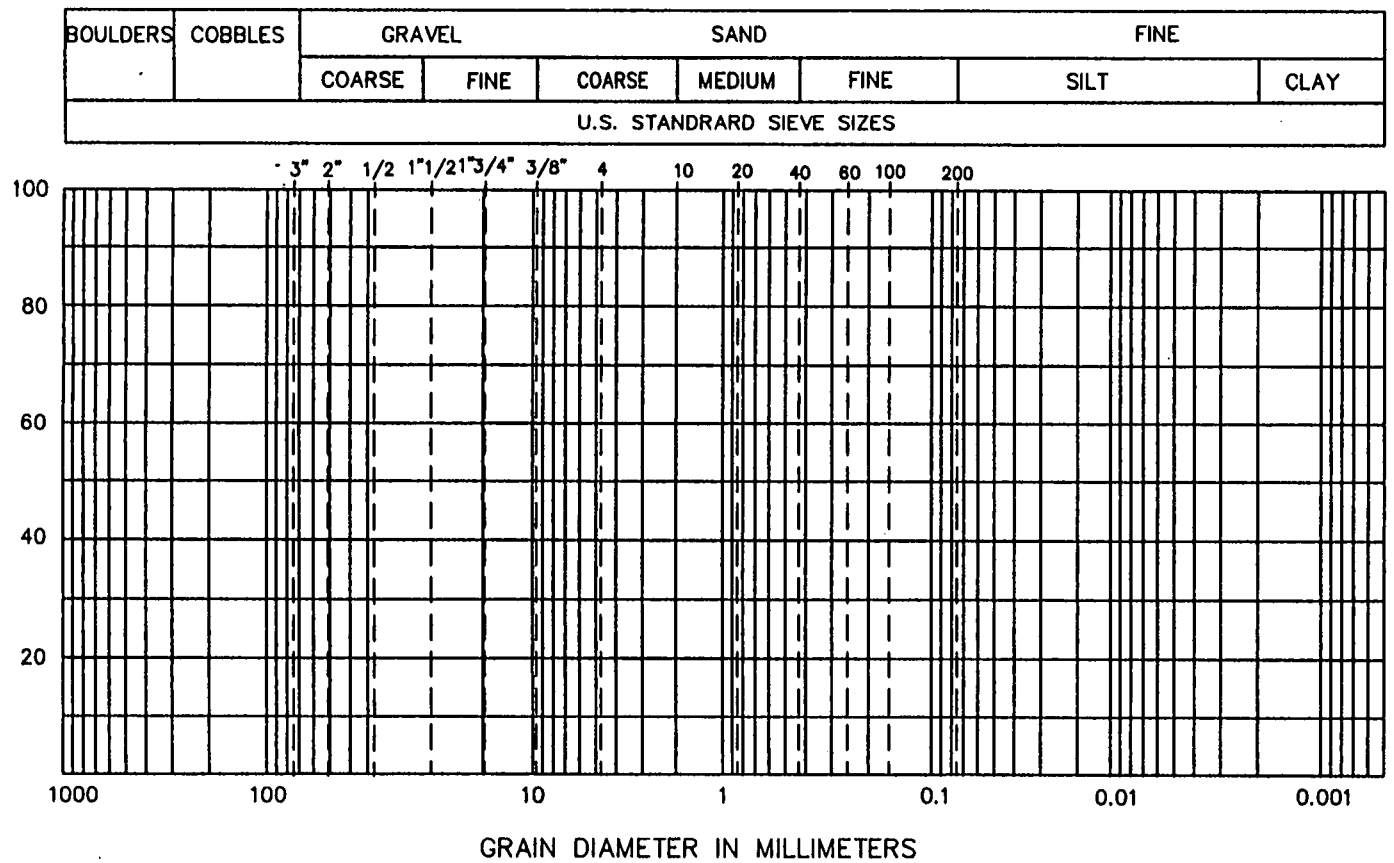
PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____ QA ID: _____

CURVE COEFFICIENTS: $C_{uniformity} = (\frac{D_{60}}{D_{10}}) =$ $C_{curvature} = (\frac{D_{30}^2}{D_{60} \times D_{10}}) =$



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ATTERBERG LIMITS

(LL) . . . . . .

(PL) . . . . . .

(PI) . . . . . .

SIEVE RESULTS

SIEVE SIZE	% FINER
3-in.	
2-in.	
1 1/2-in.	
1-in.	
3/4-in.	
1/2-in.	
3/8-in.	
NO. 4	
NO. 10	
NO. 20.	
NO. 40	
NO. 60	
NO. 100	
NO. 200	

HYDROMETER RESULTS

PARTICLE DIA.	% FINER

SOIL CLASSIFICATION (ASTM D 2487): _____

3679

GeoSyntec Consultants

FLUOR FERNALD, INC.

FIELD SAND CONE DENSITY TEST (ASTM D 1556)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

TEST NO.: _____

SPECIFICATION REQUIREMENTS:

MATERIAL TYPE: (CIRLCLE ONE) FILL / SUBGRADE / SUBBASE / CLAY / OTHER: _____

% COMPACTION: _____ MOISTURE CONTENT RANGE: _____

TEST LOCATION: _____ TEST NO.: _____

FIELD TEST DATA - ASTM D 1556 QA ID: _____

A	BULK UNIT WT. OF SAND (USE CALIBARTION FORM)	(pcf)		H	WT. OF WET SOIL & TARE FROM HOLE	(lbs)	
B	INITIAL WT. OF SAND & JAR	(lbs)		I	WT. OF TARE NO.: _____	(lbs)	
C	FINAL WT. OF SAND & JAR	(lbs)		J	WT. OF WET SOIL FROM HOLE = H-I	(lbs)	
D	WT. OF SAND IN FUNNEL & HOLE = B-C	(lbs)		K	WET UNIT WT. = J/G	(pcf)	
E	WT. OF SAND IN FUNNEL (1)	(lbs)		M	DRY UNIT WT. = K/[1+(T/100)]	(pcf)	
F	WT. OF SAND IN HOLE = D-E	(lbs)		N	PERCENT COMPACTION = M/L	(%)	
G	VOLUME OF HOLE = F/A	(ft^3)					

NOTE: THE WEIGHT OF SAND IN FUNNEL (E) IS OBTAINED BY WEIGHING THE SAND, A MINIMUM OF THREE TIMES, IN THE APPARATUS BEFORE AND AFTER THE APPARATUS HAS BEEN TURNED OVER ON THE BASE PLATE ALONG A FLAT SURFACE WITH THE SAND BEING EXPENDED.

FIELD MOISTURE CONTENT - ASTM D 2216 QA ID: _____

O	WT. OF TARE NO. _____	(grams)		R	WT. OF WATER = P-Q	(grams)	
P	WT. OF WET SOIL & TARE	(grams)		S	WT. OF DRY SOIL = Q-O	(grams)	
Q	WT. OF DRY SOIL & TARE	(grams)		T	MOISTURE CONTENT = (R/S)X100	(%)	

PROCTOR TEST DATA _____ [L] MAXIMUM DRY UNIT WT. (pcf) _____ OPTIMUM MOISTURE CONTENT (%) _____

COMPARISON WITH NUCLEAR GAUGE - ASTM D 2922 AND D 3017 QA ID: _____

	TEST NO.			U	MOISTURE CONTENT	(%)	
	WET UNIT WT.	(pcf)		V	DRY UNIT WT.	(pcf)	
	DELTA DRY UNIT WT. = M - V				DELTA MOISTURE CONTENT = T - U		

COMMENTS: _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

DETERMINATION OF DENSITY (DRIVE CYLINDER) (ASTM D 2937)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:_____ TASK NO.:_____

DESCRIPTION:_____ DATE: _____ day _____ month _____ year

TEST NO.:_____

SPECIFICATION REQUIREMENTS:

MATERIAL TYPE: (CIRLCLE ONE) FILL / SUBGRADE / SUBBASE / CLAY / OTHER:_____

% COMPACTION:_____ MOISTURE CONTENT RANGE:_____

FDT LOCATION:_____ FDT TEST NO.:_____

FIELD TEST DATA - ASTM D 2937 QA ID:_____

A	CYLINDER NO._____ VOLUME[1] (cf)		E	WET UNIT WEIGHT = D/A (lbs)	
B	WEIGHT OF SAMPLE & CYLINDER (lbs)		F	DRY UNIT WEIGHT = E/[1+(T/100)] (pcf)	
C	WEIGHT OF CYLINDER (lbs)		G	PERCENT COMPACTION = F\L (%)	
D	WEIGHT OF WET SAMPLE = B-C (lbs)			PASS\FAIL	

NOTE: DRIVE CYLINDER VOLUME IS OBTAINED BY MEASURING THE HEIGHT AND DIAMETER, OF FOUR EQUALLY SPACED POINTS, TO AN ACCURACY OF 0.01-in., AND CALCULATING VOLUME USING AVERAGE HEIGHT AND DIAMETER.

FIELD MOISTURE CONTENT - ASTM D 2216 QA ID:_____

O	WT. OF TARE NO. _____ (grams)		R	WT. OF WATER = P-Q (grams)	
P	WT. OF WET SOIL & TARE (grams)		S	WT. OF DRY SOIL = Q-O (grams)	
Q	WT. OF DRY SOIL & TARE (grams)		T	MOISTURE CONTENT = (R/S)X100 (%)	

PROCTOR TEST DATA: [L] MAXIMUM DRY UNIT WT._____(pcf) OPTIMUM MOISTURE CONTENT_____(%)

COMPARISON WITH NUCLEAR GAUGE - ASTM D 2922 AND D 3017 QA ID:_____

DELTA MOISTURE CONTENT = T - U			U	FDT MOISTURE CONTENT (%)	
FDT WET UNIT WT. (pcf)			V	FDT DRY UNIT WT. (pcf)	
DELTA DRY UNIT WT. = F - V					

COMMENTS:

 FILE NO. 2-18-DDC CHECKED BY:_____ SHEET NO. _____ OF _____

3679

GeoSyntec Consultants

FLUOR FERNALD, INC.

NUCLEAR GAUGE STANDARD COUNT LOG (ASTM D 2922 & ASTM D 3017)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

NUCLEAR GAUGE MODEL: _____ SERIAL NO.: _____

DATE ARRIVED ON SITE: _____ DATE DEPART SITE: _____

DATE OF MOST RECENT LEAK TEST: _____

DATE (day/mo)	MOISTURE COUNT (≤2%)	DENSITY COUNT (≤1%)	PASS/ FAIL	QA ID

DATE (day/mo)	MOISTURE COUNT (≤2%)	DENSITY COUNT (≤1%)	PASS/ FAIL	QA ID

000219

NOTE: A COPY OF THIS FORM SHOULD ACCOMPANY GAUGE WHEN SHIPPED FROM SITE.

GeoSyntec Consultants

FLUOR FERNALD, INC.

FIELD NUCLEAR MOISTURE/DENSITY TEST LOG

(ASTM D 3017 AND ASTM D 2922)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:_____ TASK NO.:_____

DESCRIPTION: _____ DATE: ___ day _____ month _____ year

SPECIFICATION REQUIREMENTS: ASTM D 698 / ASTM D 1557___ % COMPACTION / MOISTURE RANGE: ____ LIFT THICKNESS (LOOSE/COMPACTED): ____

MATERIAL SOURCE: _____ MATERIAL TYPE: (CIRCLE ONE) FILL / SUBGRADE / SUBBASE / CLAY / OTHER: _____

NUCLEAR GAUGE TYPE: _____ GAUGE SERIAL NO. _____ CORRECTION FACTOR Y = _____ QA ID:_____

TEST NO.	TEST LOCATION	PROBE DEPTH/ LIFT NO.	LAB RESULTS			FIELD TEST RESULTS						RETEST NO.	RETEST	
			SAMPLE NO.	OMC (%)	MAX DRY UNIT WT (PCF)	FMC (1) (%)	WET UNIT WT (PCF)	DRY UNIT WT (PCF)	PERCENT COMPACT (%)	PASS	FAIL		PASS	FAIL

000220

COMMENTS: (1) FIELD MOISTURE CONTENT (FMC) = GAUGE READING/CORRECTED MOISTURE (Y)_____

GeoSyntec Consultants

FLUOR FERNALD, INC.

LABORATORY TEST SUMMARY

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

MATERIAL TYPE: _____ MATERIAL SOURCE(S): _____ QA ID: _____

SITE SAMPLE NO.	OFF-SITE LAB SAMPLE NO.	MOISTURE CONTENT ASTM D 2216/ D 4643 (%)	GRAIN SIZE			ATTERBERG LIMITS ASTM D 4318			SOIL CLASS. ASTM D 2487	LOI	CARBO CONT.	COMPACTION ASTM D 698 (or) ASTM D 1557		PERMEABILITY ASTM D 2434[1] (or) ASTM D 5084[2]			PASS/ FAIL	CUMUL. QUANT. PLACED (APPROX)
			PASSING NO. 200 SIEVE ASTM D 1140 (%)	ASTM D 422 SIEVE	ASTM D 422 HYDR.	LL (%)	PL (%)	PI		ASTM C311 (%)	ASTM D3042 (%)	MAX. DRY UNIT WT. (pcf)	OPT. MOIST. CONT. (%)	DRY UNIT WT. (pcf)	MOIST. CONT. ASTM D 2216 (%)	HYDRAULIC COND'VITY (cm/sec)		(yd^3)

000221

3679

COMMENTS: _____

NOTES: (1) HYDRAULIC CONDUCTIVITY DETERMINED AT A HYDRAULIC GRADIENT OF ____.

(2) HYDRAULIC CONDUCTIVITY DETERMINED AT AN EFFECTIVE CONFINING STRESS OF ____.

 FILE NO. 2-22-LTS

GeoSyntec Consultants

LABORATORY TEST REQUEST

PROJECT: _____ PROJECT NO.: _____ TASK NO. _____

SOURCE: _____ APPLICATION: _____ LAB SAMPLE NO.: _____

SHIPPER: _____ REQUESTED BY: _____ DATE: _____ SITE SAMPLE ID.: _____

TASK	AS RECEIVED MOISTURE CONTEST ASTM D 2216 (%)	PERCENT PASSING NO. 200 ASTM D 1140 (%)	GRAIN SIZE ASTM D 422: SIEVE	GRAIN SIZE ASTM D 422: HYDROMETER	ATTEBERG LIMITS ASTM D 4318: LL (%)	ATTEBERG LIMITS ASTM D 4318: PL (%)	ATTEBERG LIMITS ASTM D 4318: PI ( )	SOIL CLASSIFICATION ASTM D 2487	LOI ASTM C 311 (%)	CARBO CONT. ASTM D3042 (%)	COMPACTION ASTM D 698 ☐ ASTM D 1557 ☐ A B C D ASTM D 4710: MAX DRY UNIT WT. (pcf)	COMPACTION: OPT. MOIST. CONT. (%)	HYDRAULIC CONDUCTIVITY ASTM D 5084 ☐ ASTM D 2434 ☐ TUBE SAMPLE ☐ REMOLDED SAMPLE ☐ REL.COMP= ____% W=W_{opt} ____(%) γ_d= ____ (pcf); W= ____(%): DRY UNIT WT. (pcf)	HYDRAULIC CONDUCTIVITY: MOIST. CONT. (%)	HYDRAULIC CONDUCTIVITY: K (cm/sec) at σ'_c = ____(psi) I= ____	
DEADLINE																

REMARKS: PERFORMANCE TEST ☐ CONFORMANCE TEST ☐

000222

DISTRIBUTE RESULTS TO: _____ CLIENT _____ SITE _____ OFFICE

 FILE NO. 2-23-LTR

3679

GeoSyntec Consultants

FLUOR FERNALD, INC.

DYNAMIC CONE PENETRATION TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ DAY _____ MONTH _____ YEAR: _____

CONTRACTOR: _____

TEST DESCRIPTION: _____

PASS/FAIL CRITERION: _____

TEST LOCATION: _____

LOCATION	DEPTH	SOIL CLASSIFICATION	BLOW COUNT	"N" VALUE	BEARING CAPACITY (PCF)	PASS/FAIL	QA ID

000223

COPY TO: _____ PER: _____

GeoSyntec Consultants

BORING LOG

Status: (check one)
☐ Well Installed
☐ Plugged & Abbdnd
☐ _____

Borenoie Location
(Indicate distances to permanent features)

Site: _____ Proj. No.: _____ Task _____

Drilling Co: _____ Rig: _____

Method & Tools: _____ Logger: _____

Driller: _____ Supervisor: _____

☐ Surveyed

Boring: _____ Bit Diameter: _____ Ground Elev.: _____ ☐ Estimated

Top (Depth) ☐ Feet ☐ Meters	Lithology Log	Graphic Log	Depth Scale	Well	Std. Penetr'n Test Blows/6"	Run	Rec.	Drilling Log

000224

Project No. _____

Page: 1 of _____

Boring: _____

GeoSyntec Consultants

WELL CONSTRUCTION DIAGRAM

Status: (check one)
☐ Well Installed
☐ Plugged & Abbdnd
☐

Monitoring Well Location
(indicate distances to permanent features)

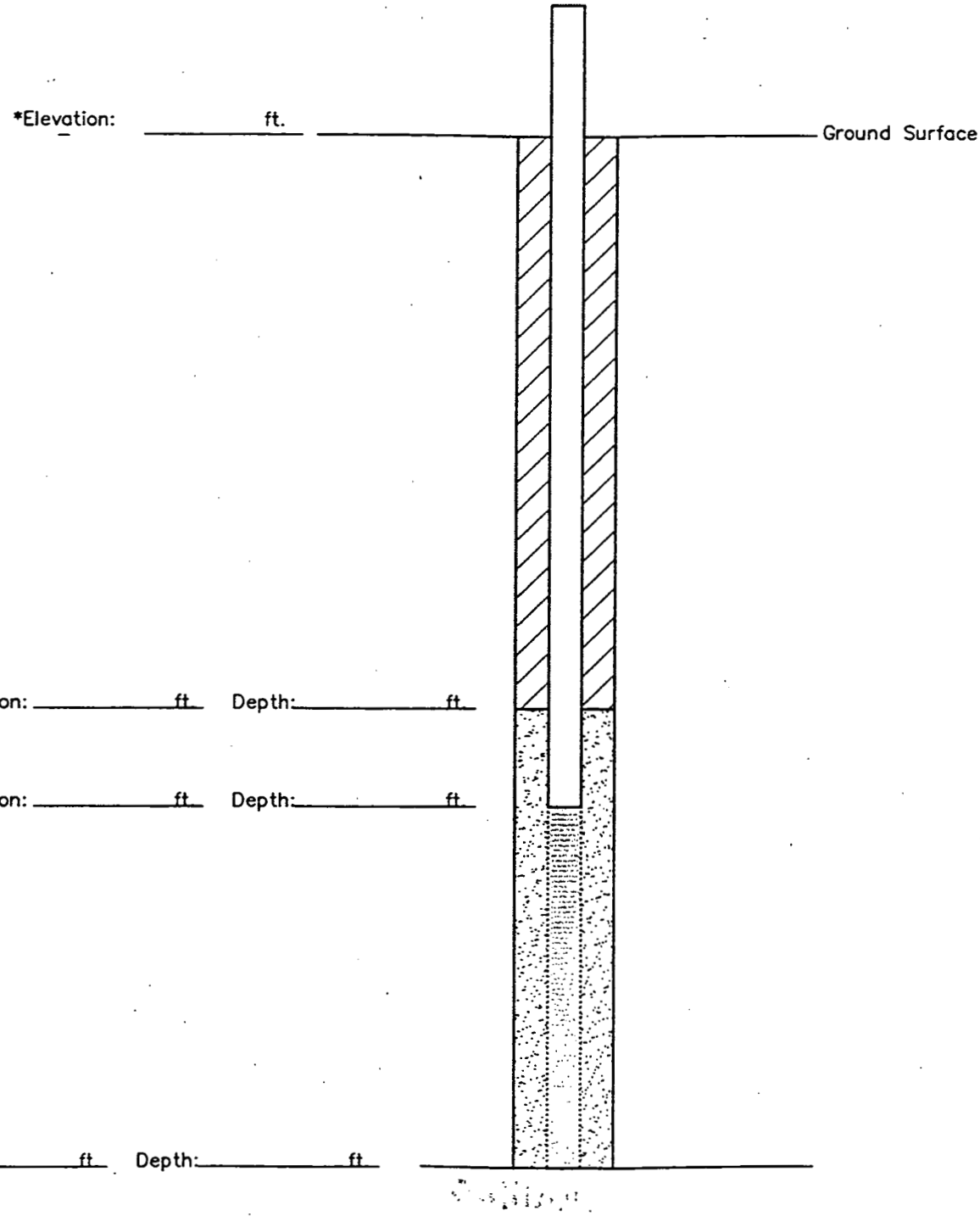
3679

Site: _____ Proj. No.: _____ Task _____

Drilling Co: _____

Well No.: _____ Logger _____ Date: _____

Northing: _____ Easting: _____ Ground Elev.: _____ ☐ Surveyed ☐ Estimated



Project No.: _____

Page: 1 of _____

Well No. _____

Notes: (1)* indicates vertically surveyed elevation; (2) drawing has no scale; (3) depths and heights are relative to above or below ground surface (AGS/BGS)

000225

GeoSyntec Consultants

FLUOR FERNALD, INC.

MATERIAL INVENTORY

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

MATERIAL TYPE: _____ MANUFACTURER: _____

INVENTORY			Q.A. CONFORMANCE				Q.C. DOCUMENTS			
DATE (day/mo)	BATCH / ROLL NO. -	QA ID	DATE SAMPLED (day/mo)	SAMPLE NO.	PASS/ FAIL	QA ID	DATE RECEIVED (day/mo)	DATE CHECKED (day/mo)	PASS/ FAIL	QA ID

AVG. ROLL WIDTH: _____ (ft) AVG. ROLL LENGTH: _____ (ft)

NUMBER OF ROLLS ABOVE: _____ CUMULATIVE NUMBER OF ROLLS: _____

CUMULATIVE AREA: _____ (ft^2) NO. OF CONFORMANCE TESTS (page/total): ____/____

COMMENTS: _____

000226

GeoSyntec Consultants

FLUOR FERNALD, INC.

GEOSYNTHETIC CLAY LINER TEST REQUEST FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:____ TASK NO.:____

DESCRIPTION: ____ YEAR:____

SAMPLED:____ day____mo SAMPLER ID:____ SHIPPED:____ day____mo SHIPPER ID:____ RECEIVED:____ day____mo LAB ID:____

MANUFACTURED BY: ____ SAMPLE SHIPPED VIA: ____

SITE CONTACT: ____ SITE PHONE:____ SITE FAX:____

SAMPLE NO. GCL-	BATCH NO./ ROLL NO.	MASS PER UNIT WEIGHT ASTM D5261 D5993	MOISTURE CONTENT ASTM D2216	FREE SWELL ASTM D5890 GRI-GCL-1	HYDRAULIC CONDUCTIVITY ASTM D5084 GRI-GCL-2	INDEX FLUX ASTM D5887	FLUID LOSS ASTM D5891	PEEL STRENGTH ASTM D4632 mod.	OTHER

22000

REINFORCED OR NONREINFORCED MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

GeoSyntec Consultants

FLUOR FERNALD, INC.

REPAIR SUMMARY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ _____ INSTALLER: _____

DATE (day/mo)	LOCATION				REPAIR NO./ CODE (1)	REPAIR TYPE (2)	SIZE			WELDER ID		QA ID	NON-DESTRUCTIVE TESTING				
	SEAM	PANEL	DIST. (ft)	OFFSET (ft)			LENGTH (ft)	WIDTH (ft)	DIA (ft)	MACH NO.	OPER ID		DATE (day/mo)	OPER ID	PASS/ FAIL	ACTION	QA ID

000228

NOTES: (1) REPAIR NO.: REPAIRS SHOULD BE NUMBERED SEQUENTIALLY.
(1) REPAIR CODES: P = PATCH, C = CAP, S= ANCHOR TRENCH EXTENSION (SKIRT), DS = DESTRUCTIVE SAMPLE, G = GRIND & WELD, T = TOPPING ALONG FUSION SEAM, R = RECONSTRUCTION
(2) REPAIR TYPES: E = EXTRUSION, F = FUSION

GeoSyntec Consultants

FLUOR FERNALD, INC.

DESTRUCTIVE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

CONTRACTOR: _____ TEST REQUIREMENTS: _____

PRIMARY: ☐ SECONDARY: ☐ RE-TEST: ☐ OTHER: ☐ _____

SAMPLE DISTRIBUTION: LABORATORY: ☐ ARCHIVE: ☐ INSTALLER: ☐ OTHER: _____

SAMPLE DATA							FIELD DATA						LABORATORY DATA							
D.S. NO.	TRACK (1)		LOCATION		MACH NO.	OPER ID	AVG PEEL (PPI/PSI)		AVG SHEAR (PPI/PSI)	PASS/ FAIL	DATE SAMPLED/ SHIPPED (day/mo)	QA ID	DATE OF RESULTS (day/mo)	AVG PEEL (PPI/PSI)		AVG SHEAR (PPI/PSI)	PASS/ FAIL	RE-TEST	QA ID
	SINGLE	DOUBLE	SEAM	DISTANCE (ft)			INSIDE	OUTSIDE						INSIDE	OUTSIDE				

625000
0022

NOTES: (1) TRACK TYPES: E = EXTRUSION F = FUSION _____

_____

_____

GeoSyntec Consultants

FLUOR FERNALD, INC.

SEAM AND PANEL REPAIR LOCATION LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

CONTRACTOR: _____

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ PRODUCT TYPE: _____

NORTH

NOTE:
SEE OTHER SIDE FOR SYMBOLS

QA ID: _____

000230

SYMBOLS

S11/P12 — SECONDARY/PRIMARY GEOMEMBRANE PANEL NUMBER

NDT = NONDESTRUCTIVE TEST

VT = VACUUM TEST

AT = AIR TEST

X——X——X — LEACHATE COLLECTION PIPE

— · — · — · — TOE OF SLOPE

—— ——— —— CREST OF SLOPE

xxxxxxxxxxxxxxxxxxxxxxx ANCHOR TRENCH

GEOSYNTHETIC CLAY LINER (GCL)

GEOGRID

GEONET

GEOTEXTILE

GEONET COMPOSITE LAYER

CAPPED SEAM (FUSION) — NDT TESTED

DESTRUCTIVE SAMPLE (DS) LOCATION P=PRIMARY S=SECONDARY — (FAILED); (PASSED); NDT TESTED

EXTRUSION WELD REPAIR — NDT TESTED

COUPON SAMPLE LOCATION — NDT TESTED

PATCH REPAIR LOCATION (EXTRUSION) — NDT TESTED

PIPE PENETRATION

SUMP AREA

60 — THICKNESS MEASUREMENT

ADJACENT PANEL REFERENCE

000231

GeoSyntec Consultants

FLUOR FERNALD, INC.

TRIAL SEAM LOG - FUSION

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: ______ TASK NO.: ______

DESCRIPTION: ______ YEAR: ______

SPECIFICATIONS: ______ TENSIOMETER DESCRIPTION: ______

TRIAL SEAM NO.	DATE (day/mo)	TIME	MACHINE NO.	OPER ID	(1) MATERIAL DESCRIPTION	FUSION		TEST RESULTS				QA ID
						WEDGE (SET/°C/°F)	MEASURED SPEED (°C/°F)	PEEL (ppi/psi)	SHEAR (ppi/psi)	PASS	FAIL	

000232

NOTE: (1) MATERIAL DESCRIPTION REFERS TO EITHER SMOOTH/SMOOTH (S/S); SMOOTH/TEXTURED (S/T); OR TEXTURED/TEXTURED (T/T).

GeoSyntec Consultants

FLUOR FERNALD, INC.

PRODUCTION SEAM SUMMARY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ _____ SPECIFICATIONS: AIR PRESSURE (_____ ± _____ psi for 5 min.) VACUUM BOX (_____ sec.)

PRODUCTION SEAM				LOCATION					NONDESTRUCTIVE TEST					
DATE (day/mo)	TIME	MACHINE NO.	OPERATOR ID	SEAM NO.	BEGIN	END	ACTUAL SEAM LENGTH (ft)	QA ID	LOCATION (ft)	TEST DETAILS	OPERATOR ID	PASS/ FAIL	ACTION	QA ID

000233

TOTALS: FUSION _____ (ft) CUMULATED: _____ (ft)

EXTRUSION _____ (ft) CUMULATED: _____ (ft)

COMMENTS: _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

PANEL PLACEMENT LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

PRIMARY: ☐ SECONDARY: ☐ OTHER: _____ PRODUCT TYPE: _____

PANEL NO.	BATCH / ROLL NO.	DATE (day/mo)	TIME	PLACEMENT LOCATION COMMENTS	APPROX WIDTH (ft)	APPROX LENGTH (ft)	QA ID
				TOTALS:(1)			

000234

NOTE: (1) APPROXIMATE AREA: THIS PAGE: _____ (ft^2) ACCUMULATED: _____ (ft^2)

NOTES: _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

TRIAL SEAM LOG – EXTRUSION

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: ______ TASK NO.: ______

DESCRIPTION: ______ YEAR: ______

SPECIFICATIONS: ______ TENSIOMETER DESCRIPTION: ______

TRIAL SEAM NO.	DATE (day/mo)	TIME	MACHINE NO.	OPER ID	(1) MATERIAL DESCRIPTION	EXTRUSION		TEST RESULTS				RE-TEST NO.	QA ID
						PREHEAT (SET/°C/°F)	BARREL (°C/°F)	PEEL (ppi/psi)	SHEAR (ppi/psi)	PASS	FAIL		

NOTE: (1) MATERIAL DESCRIPTION REFERS TO EITHER SMOOTH/SMOOTH (S/S); SMOOTH/TEXTURED (S/T); OR TEXTURED/TEXTURED (T/T).

GeoSyntec Consultants

FLUOR FERNALD, INC.

GEOCOMPOSITE TEST REQUEST FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

SAMPLED: _____ day _____ mo SAMPLER ID: _____ SHIPPED: _____ day _____ mo SHIPPER ID: _____ RECEIVED: _____ day _____ mo LAB ID: _____

MANUFACTURED BY: _____ SAMPLE SHIPPED VIA: _____

SITE CONTACT: _____ SITE PHONE: _____ SITE FAX: _____

SAMPLE NO. GDL-	BATCH NO./ ROLL NO.	GEOCOMPOSITE					GEONET					GEOTEXTILE				
		PEEL STRENGTH ASTM D413 F904	MASS PER UNIT AREA ASTM D3776 D5261	THICKNESS ASTM D5199	TRANS-MISSIVITY ASTM 4716	OTHER	CARBON BLACK CONTENT ASTM D1603	MASS PER AREA ASTM D3776 D5261	CARBON DISPERSION ASTM D3015 D5596	THICKNESS ASTM D751 D1593 D5199	OTHER	MASS PER UNIT AREA ASTM D3776 D5261	TENSILE ASTM D638 D4632	APPARENT OPENING SIZE ASTM D4751	PERMITTIVITY ASTM D4491	OTHER

DOUBLE SIDED OR SINGLE SIDED MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

CERTIFICATE OF ACCEPTANCE
SUBGRADE SURFACE

INSTALLER	PROJECT
NAME: _____	NAME: _____
ADDRESS: _____	_____
_____	LOCATION: _____
_____	_____
INSTALLER AUTHORIZED REPRESENTATIVE: _____	_____
	OWNER: _____

I, The undersigned, duly authorized representive of _____ do hereby accept the surface on which the geosynthetics will be installed and shall be responsible for maintaining the suitability of this surface, in accordance with the project specifications. (i.e., The contractor shall not install the geosynthetics until the subgrade surface is acceptable. Installation of the geosynthetics will be considered acceptance of the subgrade.)

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ _____

DATE	PANEL NOS.	SIGNATURE

000237

GeoSyntec Consultants

FLUOR FERNALD, INC.

GEONET TEST REQUEST FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:_____ TASK NO.:_____

DESCRIPTION: _____ YEAR:_____

SAMPLED:_____ day_____mo SAMPLER ID:_____ SHIPPED:_____ day_____mo SHIPPER ID:_____ RECEIVED:_____ day_____mo LAB ID:_____

MANUFACTURED BY: _____ SAMPLE SHIPPED VIA: _____

SITE CONTACT: _____ SITE PHONE:_____ SITE FAX:_____

SAMPLE NO. GN-	BATCH NO./ ROLL NO.	MASS PER AREA ASTM D3776 D5261	THICKNESS ASTM D751 D1593 D5199	SPG DENSITY ASTM D792	WIDE-WIDTH TENSILE ASTM D4533	CARBON CONTENT ASTM D1603	CARBON DISPERSION ASTM D3015 D5596	MELT INDEX ASTM D1238	COM-PRESSION GRI-GN1	TRANS-MISSIVITY ASTM D4716	TENSILE STRENGTH ASTM D5035	OTHER

000238

GEONET OR GEONET COMPOSITE MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

3629

GeoSyntec Consultants

FLUOR FERNALD, INC.

GEOTEXTILE TEST SUMMARY REQUEST FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

SAMPLED: _____ day _____ mo SAMPLER ID: _____ SHIPPED: _____ day _____ mo SHIPPER ID: _____ RECEIVED: _____ day _____ mo LAB ID: _____

MANUFACTURED BY: _____ SAMPLE SHIPPED VIA: _____

SITE CONTACT: _____ SITE PHONE: _____ SITE FAX: _____

SAMPLE NO. GT-	ROLL NO./ BATCH NO.	MASS/ AREA ASTM D3776 D5261	THICKNESS ASTM D1777 D5199	GRAB TENSILE ASTM D4632	TRAP TEAR ASTM D4533	MULLEN BURST ASTM D3786	AOS ASTM D4751	PERMITIVITY ASTM D4491	WIDE-WIDTH TENSILE ASTM D4595	WIDE-STRIP SEAM ASTM D4884	STRIP TENSILE ASTM D1682 D5035	PUNCTURE ASTM D4833	OTHER

WOVEN OR NONWOVEN MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

 FILE NO.: 3-02E-TRF

SHEET NO. _____ OF _____

GeoSyntec Consultants

FLUOR FERNALD, INC.

GEOMEMBRANE TEST REQUEST FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO

DESCRIPTION: _____ PROJECT NO.: _____ TASK NO.: _____

SAMPLED: _____ day _____ mo SAMPLER ID: _____ SHIPPED: _____ day _____ mo SHIPPER ID: _____ RECEIVED: _____ day _____ mo LAB ID: _____ YEAR: _____

MANUFACTURED BY: _____

SITE CONTACT: _____ SITE PHONE: _____ SITE FAX: _____

SAMPLE NO. GM-	BATCH NO./ ROLL NO.	SPECIFIC GRAVITY									
		TENSILE ASTM D638	DENSITY ASTM D792 D1505	MELT INDEX ASTM D1238	THICKNESS ASTM D5199/D751 D5193 D5994	CARBON BLACK CONTENT ASTM D1603	CARBON DISP. ASTM D3015 D5596	TEAR RESISTANCE ASTM D1004C	PUNCTURE RESISTANCE FTMS 101C METHOD 2065	ESCR/NCTL SINGLE POINT ASTM D5397 D1693 GRI-GM5	OTHER

SMOOTH OR TEXTURED MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

©GeoSyntec Consultants FILE NO.: 3-02B-TRF

SHEET NO. _____ OF _____

000240

3679

GeoSyntec Consultants

FLUOR FERNALD, INC.

GEOGRID TEST REQUEST FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.:_____ TASK NO.:_____

DESCRIPTION: _____ YEAR:_____

SAMPLED:_____day_____mo SAMPLER ID:_____ SHIPPED:_____day_____mo SHIPPER ID:_____ RECEIVED:_____day_____mo LAB ID:_____

MANUFACTURED BY: _____

SITE CONTACT: _____ SITE PHONE:_____ SITE FAX:_____

SAMPLE NO. GG-	BATCH NO./ ROLL NO.	SPG DENSITY ASTM D792	RIB THICK ASTM D1777	PUNCT THICKNESS (JUNCTION) ASTM D1777	RIB TENSILE GRI-GG1	JUNCTION STRENGTH GRI-GG2	MASS PER AREA ASTM D3776	MELT INDEX ASTM D1238	APERTURE SIZE	CARBON CONTENT ASTM D1603	CARBON DISPERSION ASTM D5596	WIDE-WIDTH TENSILE ASTM D4595	PERCENT OPEN AREA	OTHER

000241

UNIAXIAL OR BIAXIAL MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items