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FINAL DESIGN
OSDF SUPPORT PLANS
ON-SITE DISPOSAL FACILITY

REVISION 0
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INFORMATION ONLY

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

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OSDF

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PERMITTING PLAN AND SUBSTANTIVE REQUIREMENTS FOR THE ON-SITE DISPOSAL FACILITY

20100-PL-001

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ACRONYMS

ACOE	Army Corps of Engineers
ARAR	applicable or relevant and appropriate requirements
AWWT	Advanced Waste Water Treatment
CAMU	corrective action management unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/s	centimeter per second
DCP	Design Criteria Package
DOE	United States Department of Energy
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FHBM	Flood Hazard Boundary Map
FIRM	Flood Insurance Rate Map
FS	Feasibility Study
LDR	land disposal restriction
MCL	maximum contaminant level
MTR	minimum technology requirement
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NWP	nationwide permit
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ORC	Ohio Revised Code
OSDF	On-Site Disposal Facility
PCB	polychlorinated biphenyl
°PTI	permit to install
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	record of decision
TSD	treatment, storage, and disposal
μm	micrometer
USC	United States Code
USCS	Unified Soil Classification System
yd^3	cubic yard

1.0 INTRODUCTION

The Operable Unit 2, Operable Unit 3, and Operable Unit 5 Records of Decision (RODs) established on-site disposal as the selected remedy and established the applicable or relevant and appropriate requirements (ARARs) for the remediation. This Permitting Plan takes into account all waste that will be disposed in the on-site disposal facility (OSDF) from Operable Units 2, 3, and 5. ARARs for these three operable units are consistent with each other; the only variations are based on different waste types that will be generated during remediation. The remedial actions performed at the Fernald Environmental Management Project (FEMP) are regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. Section 121(e)(1) of CERCLA states that no Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on site, where such remedial action is selected and carried out in compliance with Section 121. While an on-site action is exempted from complying with the administrative requirements associated with a permit (e.g., administrative reviews, reporting and recordkeeping requirements, etc.), it is not exempt from complying with the substantive requirements that would have been imposed by each permit.

To determine if a permit is required for a remedial action, an evaluation must be made as to whether the action is "conducted entirely on site," as stated in Section 121(e)(1) of CERCLA. Discussions with United States Environmental Protection Agency (EPA) and Ohio Environmental Protection Agency (OEPA) have established a consensual strategy for permitting activities at the FEMP. This strategy determined that air releases, fill/dredging of wetlands, and construction and operation of the OSDF would be considered "on-site activities" and not subject to the administrative requirements of a permit. It was further decided that waste water and storm water discharges to the Great Miami River and Paddys Run would be considered "off-site" activities subject to both the administrative and substantive requirements of the National Pollutant Discharge Elimination System (NPDES) Permit.

Paragraph XIII.B of the Amended Consent Agreement requires that the following information be compiled for the remedial action:

- identification of each permit that would have been required in the absence of the CERCLA 121(e) permitting exemption;
- identification of the standards, requirements, criteria, or limitations that would have had to have been met to obtain the permits; and
- explanation of how the remedial action will meet the substantive requirements, criteria, or limitations identified above.

Paragraph XI.A of the Amended Consent Agreement also requires that a "plan for satisfaction of permitting requirements" be prepared.

This Permitting Plan will provide the information required by the Amended Consent Agreement in accordance with the decisions made with EPA and OEPA. This document will identify the administrative and substantive requirements for the NPDES Permit and the substantive requirements for all of the operable units' on-site disposal needs for the following permits:

- Wetlands Nationwide Permit
- Resource Conservation and Recovery Act (RCRA) Permit
- Ohio Solid Waste Permit to Install (PTI)

Additionally, this Permitting Plan will discuss how the requirements relate to the OSDF, present the plan for compliance with the requirements, and discuss additional ARARs that are not related to the issuance of a specific permit. Appendix A and Appendix B present a detailed listing of the substantive requirements and ARARs, respectively. These tables will be used throughout the remedial design as a checklist to ensure that the requirements are being met. As the project continues through the design process and additional documentation is completed, the details regarding specific implementation of the substantive requirements will be revised or updated, as needed. When the design is completed, the tables will be finalized to clearly show how the substantive requirements and ARARs are met.

2.0 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

2.1 Permit Information

Section 402 of the Clean Water Act establishes the NPDES program. This program is implemented by 40 Code of Federal Regulations (CFR) Part 122 and regulates the discharge of waste water to waters of the United States through the issuance of an NPDES permit which specifies discharge limitations necessary to comply with applicable technology-based effluent standards and/or water quality-based standards. This permit will also include monitoring requirements and additional conditions regulating the discharge. Discharges of storm water from specific types of activities (e.g., RCRA Subtitle C and D landfills; construction activities including clearing, grading, and excavation activities) have also been included under the NPDES permit program. Authority for administering the NPDES permit program has been delegated to the State of Ohio.

2.2 Applicability to the OSDF

During the active life of the OSDF (i.e., construction, waste placement, and closure activities), construction water, impacted storm water, and leachate will be generated. After placement of a stable vegetative layer on the top of the cap system and closure of the OSDF, only leachate will continue to be generated.

All leachate will be collected in a leachate collection system and transmitted to the Advanced Waste Water Treatment (AWWT) facility for treatment. Storm water from the active portions of the OSDF (those areas where waste placement is occurring) will also be collected and transmitted to the AWWT. Following treatment, the leachate and contaminated storm water will be discharged to the Great Miami River via a permitted outfall. Uncontaminated construction water (i.e., perched water encountered during excavation and storm water contacting uncontaminated disturbed areas) generated during the construction of the liner system and the cover system (but prior to the placement of the vegetative layer) will be conveyed to a permitted storm water outfall at Paddys Run. Appropriate erosion control measures will be designed and installed to mitigate sediment loading to Paddys Run.

2.3 Permit Requirements

The FEMP currently has a NPDES permit for storm water and waste water discharges to Paddys Run and the Great Miami River (OEPA Permit Number 1IO00004*ED). The permit contains effluent limitations and monitoring requirements for six separate outfalls from the FEMP to receiving waters. The FEMP NPDES Permit contains conditions which require OEPA notification of any significant change in the character of the discharge, or of any facility expansion or process

modifications resulting in new, different, or increased levels of pollutants. This notification may trigger NPDES Permit modifications.

The storm water discharges from the OSDF are considered to be already covered under NPDES Permit 1IO00004*ED through the implementation of the permit-required Site Storm Water Pollution Prevention Plan. However, the leachate from the OSDF will constitute a new and different source of waste water and, as such, will require OEPA notification.

3.0 WETLANDS

3.1 Permit Information

Pursuant to Section 404 of the Clean Water Act, any activity that results in the discharge of dredged or fill material into wetlands or waters of the United States requires permit authority from the United States Army Corps of Engineers (ACOE). The ACOE authorizes dredging and filling activities in wetlands and waters of the United States through the issuance of three types of permits: Nationwide permits (NWPs), regional general permits, and individual permits. NWPs are promulgated in Appendix A to 33 CFR Part 330 and are "designed to regulate with little, if any, delay or paperwork certain activities having minimal impacts." [33 CFR §330.1(b)] The ACOE has established NWPs and conditions for 40 distinct activities associated with dredging and filling wetlands and waters of the United States. An activity is authorized under a NWP only if the activity meets all the conditions established for that particular NWP. Activities that do not qualify for a NWP may seek a regional general permit or an individual permit from the ACOE.

In addition to Section 404 permitting requirements, activities resulting in the discharge of dredged or fill material to wetlands or waters of the United States are also required to obtain authorization under a Section 401 State Water Quality Certification. In Ohio, the Section 401 certification process is administered by the OEPA pursuant to Chapter 3745-32 of the Ohio Administrative Code (OAC).

3.2 Applicability to the OSDF

Construction of the OSDF will dredge and/or fill less than one acre of wetlands. This activity will be regulated under Section 404 of the Clean Water Act and, because the activity will be conducted entirely on site, must meet the substantive requirements of the ACOE's permit program. Based upon review of the NWPs promulgated by the ACOE in Appendix A to 33 CFR Part 330, United States Department of Energy (DOE) has determined that the impact from construction of the OSDF is authorized under NWP 26, Headwaters and Isolated Waters Discharge. NWP 26 is applicable because the wetland area that will be impacted by the OSDF drains to Paddys Run (via the Storm Sewer Outfall Ditch), within the headwater area of the stream. Under this NWP, discharges of dredged or fill material into headwaters and isolated waters are allowed if the following conditions are met:

- The discharge does not cause the loss of more than 10 acres of waters of the United States;
- The permittee notifies the district engineer if the discharge would cause the loss of waters of the United States greater than one acre. For discharges in wetlands, the

notification must also include a delineation of affected special aquatic sites, including wetlands; and

- The discharge, including all attendant features, both temporary and permanent, is part of a single and complete project. [Section (B)(26) of Appendix A to 33 CFR Part 330]

In addition to the specific requirements of a particular NWP, the activity must also comply with a series of general NWP conditions, including erosion and siltation controls, protection of endangered species, and notification requirements [Section (C) of Appendix A to 33 CFR Part 330]. The general conditions also require that, if applicable, an individual state water quality certification must be obtained or waived. The Director of the OEPA granted State Water Quality Certification on January 17, 1992 for a series of NWPs, including NWP 26, in a letter to the Chief of the ACOE. In this letter, OEPA specified additional general and specific requirements that must be met in order for an activity to be authorized under a NWP.

The substantive requirements specified in Appendix A to 33 CFR Part 330 will be demonstrated in the following documents:

- Operable Unit 2 Feasibility Study Report;
- Natural Resources Restoration Plan (which will be part of the Sitewide Excavation Plan); and
- Map of FEMP Jurisdictional Wetlands and Waters of the United States.

The substantive requirements associated with NWP 26 are presented Table A-1 of Appendix A. As the project continues through the design process and additional documentation is completed, Table A-1 will be revised or updated, as needed.

3.3 Wetland Mitigation

Wetland impacts associated with the construction of the OSDF were considered during the remedial investigation/feasibility study (RI/FS) process and have been avoided/minimized to the maximum extent practicable. The unavoidable impact that will result from the construction of the OSDF will be conducted in accordance with the substantive requirements of NWP 26 and its corresponding Section 401 State Water Quality Certification. To ensure a consistent approach to mitigation, wetland impacts will be mitigated on a site-wide basis. The wetland mitigation strategy will be addressed by the Site-Wide Excavation Plan which will be submitted to EPA and OEPA in March 1997.

3.4 Additional ARARs

The Operable Unit 2, Operable Unit 3, and Operable Unit 5 RODs identify additional location-specific ARARs related to the protection of wetland and floodplain areas during the construction and operation of the OSDF. These include National Environmental Policy Act (NEPA) and DOE requirements to avoid, to the extent practicable, adverse impacts to wetland and floodplain areas and Ohio requirements associated with the placement of solid waste in or near wetlands or floodplains. Table B-1 of Appendix B lists these ARARs from the RODs. As the project continues through the design process and additional documentation is completed, Table B-1 will be revised or updated, as needed.

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4.0 RESOURCE CONSERVATION AND RECOVERY ACT

4.1 Permit Information

Subtitle C of RCRA requires all facilities that treat, store, or dispose of hazardous waste (TSD facilities) to have a permit. The permit consists of two parts (Part A and Part B) and must be obtained before construction of a TSD facility begins. Part A includes basic information about the facility, such as name, location, and type of activities performed. Part B requires detailed information about the facility, such as types of waste to be handled, groundwater monitoring plans, and design of the facility. These permit requirements are established in 40 CFR Part 270 and reflect the requirements of 40 CFR Part 264. The State of Ohio has been authorized by the EPA to administer the RCRA program. The general RCRA permit requirements are equivalent to the Federal requirements and have been promulgated in OAC 3745-50.

4.2 Applicability to the OSDF

Because the OSDF will contain hazardous waste, design and construction of the OSDF must comply with the substantive requirements of the RCRA permit. The FEMP submitted a RCRA Part B Permit Application (this includes the information required under the RCRA Part A Permit) to OEPA in October 1991 in accordance with the Consent Decree with OEPA and its stipulated amendment. Therefore, the design and construction of the OSDF must address the substantive requirements that were not included in the site RCRA permit application, namely the requirements for landfills [40 CFR §270.21 or OAC 3745-50-44(C)(7)]. Compliance with the RCRA substantive requirements will be demonstrated in the following documents:

- Operable Unit 5 Feasibility Study Report:
- Operable Unit 5 Record of Decision;
- OSDF Design Package; and
- OSDF Remedial Action Work Plan and Support Documents.

Some of these documents have been approved and finalized; others are being prepared for future submittals to the regulatory agencies. The substantive requirements for the OSDF associated with the RCRA permit are presented in Table A-2 of Appendix A. As the project continues through the design process and additional documentation is completed, Table A-2 will be revised or updated, as needed.

The OSDF at the FEMP is designated as a Corrective Action Management Unit (CAMU) in the approved Operable Unit 3 and Operable Unit 5 RODs. The CAMU designation may be considered as a substantive permitting requirement because this designation information is typically

included in a RCRA permit. Designation information would include a description of compliance with the seven CAMU criteria, alternate standards for the land disposal restrictions (LDRs), and minimum technology requirements (MTRs).

The LDRs for Operable Units 3 and 5 will not be invoked with consolidation of remediation waste into the OSDF. The MTRs for a CAMU are also not invoked, although the design standards of the OSDF exceed the MTRs. The CAMU is designated in the Operable Unit 3 and Operable Unit 5 RODs based on site-specific risk-based concentration standards. These standards were used to establish 1) final remediation levels in soil and water, and 2) waste acceptance criteria of the OSDF for consolidation of those remediation wastes which are to be managed on-property. These site-specific remedial action objectives and cleanup levels are defined for the selected remedy in Section 9.2 of the Operable Unit 5 ROD.

4.3 Additional ARARs

The Operable Unit 3 and Operable Unit 5 RODs identify additional ARARs associated with hazardous waste disposal in the OSDF. These include design requirements, protection of groundwater, and landfill closure standards. Table B-2 of Appendix B presents these ARARs from the RODs. As the design of the OSDF proceeds and additional documentation is completed, Table B-2 will be revised or updated, as needed.

5.0 OHIO SOLID WASTE DISPOSAL REGULATIONS

5.1 Permit Information

Under the Ohio Solid Waste Disposal Regulations, a PTI is required before constructing a new solid waste disposal facility (OAC 3745-27-06). The PTI application must provide all information specified in OAC 3745-27-06, including detailed information on the following topics:

- conditions surrounding the proposed location (e.g., topography, wetlands, floodplains, water supply wells, buildings, etc.);
- the proposed configuration of the solid waste landfill;
- geology and hydrogeology of the site;
- construction and operational plans;
- design of the solid waste landfill; and
- monitoring plans for surface water, groundwater, and leachate.

If the facility will impact wetlands, additional information on mitigation and restoration must be provided.

5.2 Applicability to the OSDF

Because the OSDF will contain solid waste, an Ohio PTI would have been required. However, because the OSDF will be located entirely on site, the design and construction must only comply with the substantive requirements of the permit, not the administrative requirements. The substantive requirements specified in OAC 3745-27-06 will be demonstrated in the following documents:

- Operable Unit 2 Feasibility Study Report;
- Operable Unit 3 Remedial Investigation/Feasibility Study Report;
- Operable Unit 5 Feasibility Study Report;
- Operable Unit 2 Record of Decision;
- Operable Unit 3 Record of Decision;
- Operable Unit 5 Record of Decision;

- FEMP Sitewide CERCLA Quality Assurance Project Plan;
- Project Specific Plan for Phase I and II of Operable Unit 2 Predesign Field Investigation;
- Predesign Investigation and Site Selection Report for the On-Site Disposal Facility;
- Addendum to the OSDF Predesign Investigation Report
- OSDF Design Package;
- Leachate/Liner Compatibility Study Final Report;
- OSDF Remedial Action Work Plan and Support Plans;
- Design of Haul Road and Rerouted North Entrance Road;
- FEMP Stormwater Pollution Prevention Plan; and
- Soil Remediation Project Area 1, Phase I Remedial Action Work Plan.

Some of these documents have been approved and finalized; others are being prepared for future submittals to the regulatory agencies. The substantive requirements associated with the Ohio Solid Waste PTI are presented in Table A-3 of Appendix A. As the project continues through the design process and additional documentation is completed, Table A-3 will be revised or updated, as needed.

5.3 Additional ARARs

The Operable Unit 2, Operable Unit 3, and Operable Unit 5 RODs identify additional ARARs associated with solid waste disposal in the OSDF. These include siting criteria and design requirements. Table B-3 of Appendix B lists these ARARs from the RODs. As the design of the OSDF proceeds and additional documentation is completed, Table B-3 will be revised or updated, as needed.

A CERCLA waiver from an Ohio solid waste disposal facility siting criteria was granted in the Operable Unit 2, Operable Unit 3, and Operable Unit 5 RODs. This waiver allows construction of the OSDF over a high-yield, sole-source aquifer although it is prohibited in the Ohio Solid Waste Disposal Regulations [OAC 3745-27-07(H)(2)(c) and (H)(2)(d)]. This waiver is based on the condition that the OSDF be located in the area of the FEMP which exhibits the best hydrogeologic conditions to ensure protection of human health and the environment.

APPENDIX A

SUBSTANTIVE REQUIREMENTS

TABLE A-1
WETLANDS SUBSTANTIVE REQUIREMENTS

Citation	Requirement	Remarks	Cross-Reference
	General Conditions for a Nationwide Permit		
33 CFR §330.4 (c)(1) OAC 3745-32	State 401 water quality certification pursuant to section 401 of the Clean Water Act, or waiver thereof, is required prior to the issuance or reissuance of individual or nationwide permits authorizing activities which may result in a discharge into waters of the United States.	This requirement will be addressed in the Natural Resources Restoration Plan (which will be part of the Sitewide Excavation Plan).	Letter from T. Schneider (OEPA) to the Chief of Engineers (ACOE) "401 Certification - Grant," January 17, 1992.
Appendix A to 33 CFR Part 330, Section C	Factors that the District Engineer will consider when determining the acceptability of appropriate and practicable mitigation include, but are not limited to: • To be practicable the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of overall project purposes; • To the extent appropriate, permittees should consider mitigation banking and other forms of mitigation including contributions to wetland trust funds, which contribute to the restoration, creation, replacement, enhancement, or preservation of wetlands. • Furthermore, examples of mitigation that may be appropriate and practicable include but are not limited to: reducing the size of the project; establishing buffer zones to protect aquatic resource values; and replacing the loss of aquatic resource values by creating, restoring, and enhancing similar functions and values. In addition, mitigation must address impacts and cannot be used to offset the acreage of wetland losses that would occur in order to meet the acreage limits of some of the nationwide permits.	These requirements will be addressed in the Natural Resources Restoration Plan (which will be part of the Sitewide Excavation Plan).	

TABLE A-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
	Specific Conditions for Nationwide Permit Number 26		
Appendix A to 33 CFR Part 330, Section B(26)	Discharges of dredged or fill material into headwaters and isolated waters [are approved] provided:		
	• the discharge does not cause the loss of more than 10 acres of waters of the United States. • the permittee notifies the district engineer if the discharge would cause the loss of waters of the United States greater than one acre. • for discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands.	These requirements will be addressed in the Natural Resources Restoration Plan (which will be part of the Sitewide Excavation Plan).	1993 Jurisdictional Wetlands & Waters of the U.S. (FEMP Map)
	• the discharge, including all attendant features, both temporary and permanent, is part of a single and complete project.	This requirement will be addressed in the Natural Resources Restoration Plan (which will be part of the Sitewide Excavation Plan).	
	Section 404 Only Conditions		
Appendix A to 33 CFR Part 330, Section C	In addition to the General Conditions, the following conditions apply only to activities that involve the discharge of dredged or fill material and must be followed in order for authorization by the nationwide permits to be valid:		
	• No discharge of dredged or fill material may consist of unsuitable material (e.g., trash, debris, car bodies, etc.) And material discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).	This requirement will be addressed in the Natural Resources Restoration Plan (which will be part of the Sitewide Excavation Plan).	

TABLE A-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
Appendix A to 33 CFR Part 330, Section C (continued)	• Discharges of dredged or fill material into waters of the United States must be minimized or avoided to the maximum extent practicable at the project site, unless the DE has approved a compensation mitigation plan for the specific regulated activity.	This requirement will be addressed in the Natural Resources Restoration Plan (which will be part of the Sitewide Excavation Plan).	Appendix H of Operable Unit 2 FS.
	• To the maximum extent practicable, discharges must not permanently restrict or impede the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound waters).	This requirement will be addressed in the Natural Resources Restoration Plan (which will be part of the Sitewide Excavation Plan).	

TABLE A-2
RCRA SUBSTANTIVE REQUIREMENTS

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-50-44 (B)	The following additional information regarding protection of groundwater is required from owners or operators of hazardous waste facilities containing a regulated unit except as provided in paragraph (B) of rule 3745-54-90 of the Administrative Code:		
	• Identification of the uppermost aquifer and aquifers hydraulically interconnected beneath the facility property, including ground water flow direction and rate, and the basis for such identification (i.e., the information obtained from hydrogeologic investigations of the facility area).		Section A.2.2 of Appendix A of Operable Unit 5 FS
	• On the topographic map required under paragraph (A)(19) of this rule, a delineation of the waste management area, the property boundary, the proposed point of compliance as defined under rule 3745-54-95 of the Administrative Code, the proposed location of ground water monitoring wells as required under rule 3745-54-97 of the Administrative Code and, to the extent possible, the information required in paragraph (B)(2) of this rule. • Detailed plans and an engineering report describing the proposed ground water monitoring program to be implemented to meet the requirements of rule 3745-54-97 of the Administrative Code. • If the presence of hazardous constituents has not been detected in the ground water at the time of permit application, the owner or operator must submit sufficient information, supporting data, and analyses to establish a detection monitoring program which meets the requirements of rule 3745-54-98 of the Administrative Code. This submission must address the following items as specified under rule 3745-54-98 of the Administrative Code. - A proposed list of indicator parameters, waste constituents, or reaction products that can provide a reliable indication of the presence of hazardous constituents in the ground water;		OSDF Groundwater/Leak Detection and Leachate Monitoring Plan

TABLE A-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-50-44 (B) (continued)	- A proposed ground water monitoring system; - Background values for each proposed monitoring parameter or constituent, or procedures to calculate such values; and - A description of proposed sampling, analysis and statistical comparison procedures to be utilized in evaluating ground water monitoring data.		
OAC 3745-50-44 (C)(7)	Except as otherwise provided in rule 3745-57-02 of the Administrative Code, owners and operators of facilities that dispose of hazardous waste in landfills must provide the following additional information:		
	• A list of the hazardous wastes placed or to be placed in each landfill or landfill cell;		Section 9.2 of Operable Unit 5 ROD
	• Detailed plans and an engineering report describing how the landfill is or will be designed, constructed, operated, and maintained to comply with the requirements of rule 3745-57-03 of the Administrative Code. This submission must address the following items as specified in rule 3745-57-03 of the Administrative Code:		
	- The liner system and leachate collection and removal system (except for an existing portion of a landfill).		**Liner system** - Section 2.4 of OSDF DCP, Drawings G-22 and G-25 of OSDF Design **Leachate system** - Section 2.5 of OSDF DCP, Drawings M-2, M-4 through M-6, M-9, S-1, S-3, E-4, and E-7 of OSDF Design

TABLE A-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-50-44 (C)(7) (continued)	- Control of run-on; - Control of run-off; - Management of collection and holding facilities associated with run-on and run-off control systems; and		Sections 2.8.3 and 2.8.4 of OSDF DCP, Section 02270 of OSDF Specification Package, and Drawings G-30 through G-32 of OSDF Design
	- Control of wind dispersal of particulate matter, where applicable.		Section 2.11.1 of OSDF DCP and Section 13040 of OSDF Specification Package
	• When required, detailed plans and an engineering report describing and explaining the design of a double liner system between the liners and a leachate collection and removal system above the liners;		Sections 2.4 and 2.5 of OSDF DCP and Drawings G-22 and G-24 of OSDF Design
	• A description of how each landfill, including the liner and cover systems, will be inspected in order to meet the requirements of paragraphs (A) and (B) of rule 3745-57-05 of the Administrative Code. This information should be included in the inspection plan submitted under paragraph (A)(5) of this rule;		Sections 6.0 through 10.0 of OSDF Construction Quality Assurance Plan and Sections 3.0 and 4.0 of OSDF Systems Plan
	• Detailed plans and an engineering report describing the final cover which will be applied to each landfill or landfill cell at closure in accordance with paragraph (A) of rule 3745-57-10 of the Administrative Code, and a description of how each landfill will be maintained and monitored after closure in accordance with paragraph (B) of rule 3745-57-10 of the Administrative Code. This information should be included in the closure and post-closure plans submitted under paragraph (A)(13) of this rule.		Section 2.6 of OSDF DCP, Drawings G-11 and G-26 through G-29 of OSDF Design, Section 4.0 of OSDF Systems Plan, Sections 5.0 through 10.0 of OSDF Post-Closure Care and Inspection Plan, OSDF Groundwater/Leak Detection and Leachate Monitoring Plan

TABLE A-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-66-18 (A)&(C)	The owner of a hazardous waste disposal unit shall have a written post-closure plan, which shall identify the activities that will be carried on after closure of each unit and the frequency of those activities, and include at least:		
	• A description of the planned monitoring activities and frequencies at which they will be performed;		Sections 5.0, 7.0, and 8.0 of OSDF Post-Closure Care and Inspection Plan
	• A description of the planned maintenance activities and frequencies at which they will be performed to ensure the integrity of the cap and final cover or other containment systems and to ensure the function of the monitoring equipment; and		Section 9.0 of OSDF Post-Closure Care and Inspection Plan
	• The name, address, and telephone number of the person or office to contact about the hazardous waste disposal unit or facility during the post-closure period.		Section 4.2 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-66-16	The owner shall submit - to the local zoning authority with jurisdiction over local land use, and to the Director - a survey plat, prepared and certified by a professional land surveyor, indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed, which states the owner's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with OAC 3745-66-17(C).		Section 4.5 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-66-18 (D)	The owner may amend the post-closure plan any time during the active life of the facility or during the post-closure period.		Section 12.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-66-18 (G)	The post-closure plan and length of the post-closure care period may be modified any time prior to the end of the post-closure care period. A modification of the post-closure plan may include, where appropriate, the temporary suspension rather than permanent deletion of one or more post-closure care requirements. At the end of the specified period of suspension, the Director would then determine whether the requirements should be permanently discontinued or reinstated to prevent threats to human health and the environment.		Section 12.0 of OSDF Post-Closure Care and Inspection Plan

TABLE A-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-66-19(A)	The owner shall submit - to the local zoning authority, or the authority with jurisdiction over local land use, and to the Director - a record of the type, location, and quantity of hazardous wastes disposed of within each cell or disposal unit of the facility.		Section 4.5 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-66-19(B)	The owner shall record, in accordance with state law, a notation on the deed of the facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity the potential purchasers of the property that: • The land has been used to manage hazardous wastes; • Its use is restricted under the Ohio Administrative Code closure and post-closure rules; and • The survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or hazardous waste unit of the facility as required by OAC 3745-66-16 and 3745-66-19(A) have been filed with the local zoning authority or the authority with jurisdiction over local land use and with the Director.		Section 4.5 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-66-19(C)	If the owner or any subsequent owner of the land upon which a hazardous waste disposal unit was located wishes to remove hazardous wastes and hazardous waste residues in satisfaction of the criteria in OAC 3745-66-17(C), the owner may request that the Director approve either: • The removal of the notation on the deed to the facility property or other instrument normally examined during title search; or • The addition of a notation to the deed or instrument indicating the removal of the hazardous waste.		Section 4.5 of OSDF Post-Closure Care and Inspection Plan

TABLE A-3
OHIO SOLID WASTE PERMIT TO INSTALL SUBSTANTIVE REQUIREMENTS

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(2)	Plan drawings shall show the following items located within the facility boundary or within 1,000 feet of the limits of solid waste placement or as otherwise specified in this paragraph. A scale of one inch equals no greater than 200 feet shall be used.		
	• the property lines of all land owned or leased for the sanitary landfill facility as determined by a property survey conducted by a professional skilled in the appropriate discipline		Drawing X-4 of OSDF Design
	• the limits of solid waste placement		Drawing X-4 of OSDF Design
	• all public roads, railroads, and occupied structures		Drawing X-6 of OSDF Design
	• existing topography showing vegetation, streams, lakes, springs, and other surface waters, with a contour interval no greater than five feet		Section 1.5 of Operable Unit 2 FS
	• the north arrow		Drawing X-6 of OSDF Design
	• the location of all benchmarks		Drawing X-4 of OSDF Design
	• wetlands located within the limits of waste placement and within 200 feet of the limits of waste placement		See Table B-1 within Appendix B of this plan
	• the unit(s) of the sanitary landfill facility		Drawings G-2 and G-5 of OSDF Design
	• all existing land uses, zoning classifications, property owners, political subdivisions, and communities		Section 1.0 of Operable Unit 5 ROD and Drawing X-6 of OSDF Design
	• all man-made potential explosive gas migration pathways, including underground utilities (sewers, water lines, electric cables), field tiles, french drains, pipelines, and all other potential sources of explosive gas, including oil wells and other landfills		Drawing X-6 of OSDF Design

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(2) (continued)	• the limits of a regulatory floodplain		Drawing X-6 of OSDF Design
	• all public and private water supply wells within 2,000 feet of the limits of solid waste placement (use a scale insert if necessary) and the current status of each, including depth, use, and, where applicable, abandonment date, based on publicly available data		Drawing X-6 of OSDF Design
OAC 3745-27-06(B)(3)	Plan drawings shall show the following items located within the facility boundary or within 300 feet of the limits of solid waste placement. A scale of one inch equals no greater than 200 feet shall be used.		
	• the locations of all existing or proposed maintenance buildings, weighing facilities, storage buildings, other occupied structures, and salvaging areas		Drawing G-2 of OSDF Design
	• the location of existing or proposed utilities, including water, sewerage and sewage treatment, electricity, gas, and telephone or other means of communication; and any utility company easement bordering or within the proposed facility boundaries		Drawing X-6 of OSDF Design
	• the location of all fencing, gates, and natural or other screening on the site (may be shown on an aerial photograph)		Drawing X-3 and X-4 of OSDF Design
	• the location of all borings and hydrogeologic study test pits, and all proposed ground water monitoring wells		Section 2.0 of OSDF Predesign Investigation Report, Drawings X-7 and X-12 of OSDF Design, and Figure 4-2 of OSDF Groundwater/Leak Detection and Leachate Monitoring Plan
	• potentiometric maps of the uppermost aquifer and all significant zones of saturation above the uppermost aquifer (more than one map sheet may be used)		Drawings X-8 and X-9 of OSDF Design

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(3) (continued)	• the location of any ground water control structures	This requirement is not applicable to the design of the OSDF.	
	• the location of explosive gas probes and test stations, and proposed explosive gas control/extraction structures	This requirement is not applicable to the design of the OSDF.	
	• the general phasing diagram for the systematic construction and development of the unit(s) of the sanitary landfill facility (more than one plan sheet may be used)		Drawing G-2 of the OSDF Design
OAC 3745-27-06(B)(4)	Plan drawings for the entire sanitary landfill facility shall show the boundaries and elevations of the following items. The scale on these drawings shall be one inch equals no greater than 200 feet and contour intervals shall be no greater than 5 feet.		
	• the horizontal and vertical limits of excavation proposed in the permit to install application		Drawing G-5 of OSDF Design
	• the horizontal limits and top and bottom elevations of the recompacted soil liner proposed in the permit to install application		Drawings G-5 and G-6 of OSDF Design
	• the top elevation of the drainage layer, pipe inverts, and layout of the leachate management system(s) proposed in the permit to install application		Drawing G-8 of OSDF Design
	• the horizontal limits and top and bottom elevations of all emplaced waste and areas proposed for waste placement in the permit to install application		Drawings X-4 and G-15 through G-18 of OSDF Design
	• the horizontal limits and top and bottom elevations of the cap system and surface drainage structures proposed in the permit to install application		Drawings G-11, G-15, and G-18 of OSDF Design
OAC 3745-27-06(B)(5)	Cross sections shall show the following items and shall clearly show the horizontal and vertical scale used:		

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(5) (continued)	• the sanitary landfill facility showing, at and interval no greater than every 300 feet of length and width: - existing topography - the horizontal and vertical limits of excavation proposed in the permit to install application - the horizontal limits and top and bottom elevations of all emplaced waste and all areas of waste placement proposed in the permit to install application - the horizontal limits and top and bottom elevations of the cap system proposed in the permit to install application		Drawings G-1 and G-15 through G-18 of OSDF Design
	• the hydrogeology of the site intercepting the borings and showing the following:		
	- geologic stratigraphy and significant zones of saturation corresponding to site-boring information		Sections 2.3 through 2.6, 3.2, 4.2, and 4.3 of OSDF Predesign Investigation Report and Drawings X-13 through X-15 of OSDF Design
	- the uppermost aquifer and all saturated strata above the uppermost aquifer		Section 1.5.2.3 of *Operable Unit 2 FS* and Drawings X-13 through X-15 of OSDF Design
	- all well logs of the borings intercepted by the cross section		Appendix F of OSDF Predesign Investigation Report

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(5) (continued)	- ground water flow patterns for the uppermost aquifer and all significant zones of saturation above the uppermost aquifer		Section 3.0 of OSDF Predesign Investigation Report and Sections 2.3 and 3.3 of Addendum to the OSDF Predesign Investigation Report
	- limits of excavation		Drawings G-5 and G-15 through G-18 of OSDF Design
	- any permanent ground water control structures	This requirement is not applicable to the design of the OSDF.	
	• the perimeter of the property showing all man-made and natural potential explosive gas migration pathways	This requirement is not applicable to the design of the OSDF.	
OAC 3745-27-06(B)(6)	Detailed construction and operational plans outlining the systematic development of each phase of the unit(s) of the sanitary landfill facility shall show the following:		
	• phase preparation		Drawing G-2 of OSDF Design
	• location of any on-site borrow areas and storage areas for the recompacted soil liner material, recompacted soil barrier material for the cap system, and cover material		Drawings X-4, G-12, and G-19 of OSDF Design
	• direction of prevailing winds during each season		Drawing X-3 of OSDF Design
	• anticipated direction that the working face will proceed		Drawing G-2 of OSDF Design and Section 6.7 of OSDF Impacted Material Placement Plan

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(6) (continued)	• areas of operation during inclement weather		Section 6.6.2 of OSDF Impacted Material Placement Plan
	• traffic patterns		Drawing G-2 of OSDF Design
	• direction of flow and points of concentration of all surface waters on the site; measures to be utilized to control surface water run-on and run-off, sediment discharge, erosion, and ground water infiltration		Drawings X-4, G-2, G-30, and G-31 of OSDF Design
	• grades of the completed phase		Drawing G-11 of OSDF Design
OAC 3745-27-06(B)(7)	The following information shall be on detailed plan drawings:		
	• recompacted soil liner, flexible membrane liner, and geosynthetic clay liner (if applicable), including the interface between phases		Drawings G-22 and G-24 of OSDF Design
	• final cap system		Drawing G-26 of OSDF Design
	• key systems for the final cap system, leachate management system, and recompacted soil liner, flexible membrane liner, and geosynthetic clay liner (if applicable)		Drawings G-22, G-24, G-26, and M-2, M-4, M-5, and M-9 of OSDF Design
	• all leachate management system elements		Drawings M-2, M-4, M-5, and M-9 of OSDF Design
	• permanent ground water control structures, if any	This requirement is not applicable to the design of the OSDF.	
	• ground water monitoring well construction		Section 5.2 of FEMP Sitewide CERCLA Quality Assurance Project Plan

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(7) (continued)	• explosive gas control and extraction system elements, if any • explosive gas monitoring probe construction	These requirements are not applicable to the design of the OSDF.	
	• earthen structures, if any		Drawings G-20, G-24, G-26, G-30, and G-31 of OSDF Design
	• on-site roads with vertical profiles of the roads showing maximum grades		Drawings G0005-G0009 of Haul Road Design and Drawings G0005-G0011 of Rerouted North Access Road Design
	• sedimentation pond and discharge structures and surface water run-on and runoff control structures with vertical profiles of the ditches showing minimum and maximum grades		Drawings G-30 and G-31 of OSDF Design
OAC 3745-27-06(C)(2)	A hydrogeologic site investigation report shall be presented, which shall at a minimum include:		
	• sufficient hydrogeologic information to allow the director to:		
	- determine the suitability of the site for solid waste disposal		Sections 4.2 and 4.3 of OSDF Predesign Investigation Report
	- identify and characterize the hydrogeology of the uppermost aquifer system and all geologic strata that exist above the uppermost aquifer system		Sections 2.0 and 3.0 of OSDF Predesign Investigation Report
	- sufficiently characterize the site geology to allow for the evaluation of the proposed design of the sanitary landfill facility and to ensure that it will be in compliance with the requirements of this chapter		Sections 2.5, 3.2, and 4.2 of OSDF Predesign Investigation Report

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	• a description, based on publicly available information of the regional hydrogeology of the proposed sanitary landfill facility. This shall include, but may not be limited to:		
	- the identification of the regional aquifer(s)		Section A.2.2 of Appendix A of Operable Unit 5 FS
	- the well logs of public and private water supply wells within one mile of the proposed sanitary landfill facility - the average yield of water supply wells within one mile of the sanitary landfill facility	These requirements are not applicable to the design of the OSDF.	
	- the direction of the groundwater flow in the regional aquifer - the identification of recharge and discharge areas of the regional aquifer(s)		Section A.2.2 of Appendix A of Operable Unit 5 FS
	- the identification of any public water supply wells within 10 miles of the sanitary landfill facility	This requirement is not applicable to the design of the OSDF.	
	- regional stratigraphy - the structural geology, including a description of local and regional structural features - a description of the regional geomorphology, including the location of surface water bodies, floodplains, etc. This description shall include an analysis of any topographic features that may influence the ground water flow system.		Section A.2.2 of Appendix A of Operable Unit 5 FS
	• a detailed description of the hydrogeology under the proposed sanitary landfill facility. This description shall be based on data collected from boreholes, piezometers, and test pits. The description shall include but may not be limited to:		

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	- a description of the consolidated and unconsolidated stratigraphic units from the ground surface down to the base of the uppermost aquifer system, including: • sedimentary composition, including, for unconsolidated formations, textural classification "Unified Soil Classification System" (USCS), Atterberg limits, grain size distribution, and hydraulic conductivity • thickness • lateral extent		Sections 2.2 through 2.4, 3.2, 4.2, and 4.3 of OSDF Predesign Investigation Report
	- a description of the geomorphology at the proposed sanitary landfill facility - a description of the structural geology under the proposed sanitary landfill facility		Section A.2.2 of Appendix A of Operable Unit 5 FS
	- a description of the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. This description shall include the depth to, and lateral and vertical extent of, the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. This description shall include but not be limited to:		Sections 2.3 through 2.6, 4.2, and Appendices B and C of OSDF Predesign Investigation Report
	• temporal fluctuations in ground water levels and the effects on ground water flow directions		Sections 2.6 and Appendices B and C of OSDF Predesign Investigation Report

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	• an interpretation of the ground water flow system, including rate of flow, direction of flow, vertical and lateral components of flow, and interconnections between and within the uppermost aquifer system and any significant zones of saturation above the uppermost aquifer system. This interpretation shall be described in both narrative and map form	This requirement will also be addressed in the .	Sections 2.0 and 3.0 of OSDF Predesign Investigation Report, Section A.2.2 of Appendix A of Operable Unit 5 FS, Sections 2.3 and 3.3 of Addendum to the OSDF Predesign Investigation Report, and Section 2.3 of OSDF Groundwater/Leak Detection and Leachate Monitoring Plan
	• identification and characterization of recharge and discharge areas within the boundaries of the proposed sanitary landfill facility. This shall include any relationships of ground water with seeps, springs, streams, and other surface water features		Sections 2.0 and 3.0 of OSDF Predesign Investigation Report, Section A.2.2 of Appendix A of Operable Unit 5 FS, and Sections 2.5 and 3.4 of Addendum to the OSDF Predesign Investigation Report
	• a quantification of the vertical and horizontal hydraulic conductivity of the uppermost aquifer system and all strata within the zone of saturation above the uppermost aquifer system. This shall include at least three measurements of hydraulic conductivity per stratum measured		Section 3.0 of OSDF Predesign Investigation Report, Sections 2.2 and 3.2 of Addendum to the OSDF Predesign Investigation Report, Section A.2.2 of Appendix A of Operable Unit 5 FS, and Section 2.3 of OSDF Groundwater/Leak Detection and Leachate Monitoring Plan

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	• a description and quantification of the ground water quality of the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. The description and quantification of ground water quality shall describe and quantify the rate, extent, and concentration of any ground water contamination located under the site. This description shall include data gathered by sampling and analyzing the ground water from the uppermost aquifer system an all significant zones of saturation above the uppermost aquifer system. These samples shall, at a minimum, be analyzed for compounds 1 to 79 listed in Appendix I of rule 3745-27-10 of the Administrative Code and the following parameters: - total organic carbon - turbidity - phosphorus - cyanide		Sections 2.3, 2.4, and 2.6 of OSDF Predesign Investigation Report, Sections 2.6, 3.5, and 3.6 of Addendum to the OSDF Predesign Investigation Report, and Section A.2.2 of Appendix A of Operable Unit 5 FS
	• a detailed description of the drilling and soil sampling methods used in characterizing the soil and hydrogeologic properties of the proposed sanitary landfill facility • a detailed description of the analytical procedures and methodology used to characterize the soil and rock materials obtained from test pits and borings		Section 2.0 of OSDF Predesign Investigation Report and Sections 7.0 and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	• a detailed description of the methodology, equipment, and procedures used to define the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system including the well and piezometer construction specifications, and water level measurement procedures		Sections 2.3, 2.4, and 2.6 of OSDF Predesign Investigation Report and Sections 7.0 and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	• a detailed description of the methodology, equipment, and procedures used to determine the groundwater quality in the uppermost aquifer system and any significant zones of saturation above the uppermost aquifer system including:		
	- detection of immiscible layers	This requirement is not applicable to the design of the OSDF.	
	- collection of groundwater samples, including well evacuation, sample withdrawal, sample containers and handling, and sample preservation		Sections 2.3, 2.4, and 2.6 of OSDF Predesign Investigation Report and Sections 7.0 and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	- performance of field analysis including procedures and forms for recording data and the exact location, time, and facility-specific considerations associated with the data acquisition, and calibration of field devices.		Sections 7.0 and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	- decontamination of equipment		Sections 7.0 and 8.44 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	- analysis of ground water samples		Sections 2.3 and 2.4 of OSDF Predesign Investigation Report and Sections 7.0 and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	- chain of custody control including standardized field tracking reporting forms to record sample custody in the field prior to and during shipment, and preprepared sample labels containing all information necessary for effective sample tracking		Section 8.0 and Attachment IV of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	- field and laboratory quality assurance and quality control including collection of replicate samples, submission of field-bias blanks, and potential interferences		Sections 6.0, 7.0, and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	- all boring logs, test pit logs, ground water quality data, soil analytical data, and any other data generated while preparing this report		Appendices A through L of OSDF Predesign Investigation Report
OAC 3745-27-06(C)(3)	Detail the measures and operations to control and manage the following:		
	• leachate production and migration		Section 3.0 of OSDF Systems Plan
	• ground water infiltration	This requirement is not applicable to the design of the OSDF.	
	• explosive gas migration • fires, dust, scavenging, vectors, erosion, blowing litter, and birds	Except for erosion, these requirements are not applicable to the operation of the OSDF.	Sections 2.8.3 and 2.8.4 of OSDF DCP, Sections 12.0 and 13.0 of OSDF Calculation Package, and Section 5.0 of OSDF Surface Water Management and Erosion Control Plan

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(3) (continued)	• surface water run-on and runoff and sediment discharge		Sections 5.0 and 6.0 of Surface Water Management and Erosion Control Plan
OAC 3745-27-06(C)(4)	The following design calculations with reference to equations used, showing site specific input and assumptions:		
	• calculations showing volume of the sanitary landfill facility in cubic yards and anticipated life in years, and the volume in cubic yards and anticipated life in years of each unit of the sanitary landfill facility		Section 2.0 of OSDF Calculation Package
	• liner thickness calculations, from appendix I of rule 3745-27-08 of the Administrative Code, if any	This requirement is not applicable to the design of the OSDF.	
	• calculations for hydrostatic forces on the recompacted soil liner		Section 6.1 of OSDF Calculations Package
	• calculations for leachate generation before and after final closure		Section 7.1 of OSDF Calculations Package
	• leachate management system calculations		Sections 8.0, 9.0, and 10.0 of OSDF Calculations Package
	• pump size calculations		Section 10.0 of OSDF Calculations Package
	• pipe strength and pipe deflection calculations for the leachate management system		Section 8.0 of OSDF Calculations Package
	• calculations demonstrating that the landfill as designed will resist the earth movement in unstable areas		Section 4.0 of OSDF Calculations Package
	• calculations demonstrating that the landfill as designed will resist the maximum horizontal acceleration in lithified material at the site		Section 4.0 of OSDF Calculations Package

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(4) (continued)	• slope stability analysis		Section 3.0 of OSDF Calculations Package
	• calculations to determine the volume of soil necessary to construct and operate the sanitary landfill facility, and calculations to estimate the volume of soil available on site for each intended construction and operational use		Section 15.0 of OSDF Calculations Package
	• soil erosion calculations		Section 11.3 of OSDF Calculations Package
	• surface water control structure calculations		Sections 12.0 and 13.0 of OSDF Calculations Package
	• sedimentation basin calculations		Section 12.2 of OSDF Calculations Package
	• calculations for the explosive gas threshold limit for each station and/or probe	This requirement is not applicable to the design of the OSDF.	
	• other relevant calculations		Volumes 1 through 4 of OSDF Calculations Package
OAC 3745-27-06(C)(5)	Discussion of the following construction information as illustrated in the detail engineering plans:		
	• site preparation • sequence of construction activities		Section 2.6 of OSDF RAWP
	• installation of the items specified in rules 3745-27-08 and 3745-27-10 of the Administrative Code	See Table B-3 of Appendix B for each of these rules.	Division 2 of OSDF Specifications Package
	• seaming and bonding methods to be used for the geosynthetic materials		Section 02772 of OSDF Specification Package

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(5) (continued)	• chemical compatibility testing as required in paragraph (D) of rule 3745-27-08 of the Administrative Code and demonstration of physical and chemical resistance as required in paragraph (E) of rule 3745-27-08 of the Administrative Code		Leachate/Liner Compatibility Study Final Report
OAC 3745-27-06(C)(6)	Discussion of the following operational information:		
	• authorized maximum daily waste receipt as defined in paragraph (A) of rule 3745-27-01 of the Administrative Code requested for the sanitary landfill facility • sources of [daily] cover material; and from each source, anticipated material quantity, characteristics, and intended use	These requirements are not applicable to the design of the OSDF.	
	• methods to be used to handle solid waste, including methods to be used to handle bulky materials and dusty materials		Sections 6.0 through 8.0 of OSDF Impacted Material Placement Plan
	• whether acceptance of asbestos or asbestos containing waste that is subject to the provisions of NESHAP, 40 CFR Part 61, subpart M is anticipated and if permitted, a description of how these materials will be managed		Sections 4.3 and 8.6 of OSDF Impacted Material Placement Plan
	• equipment to be used to construct, operate, and maintain the sanitary landfill facility		OSDF Specification Package
	• schedule of leachate management system inspections		Sections 3.4 and 3.6 of OSDF Systems Plan
	• inclement weather operation procedures		Section 5.0 of OSDF Systems Plan and Section 6.6.2 of OSDF Impacted Materials Placement Plan
	• salvaging operation procedures, if any • use of those portions of the sanitary landfill facility where solid waste is not to be deposited during the operating life of the facility	These requirements are not applicable to the design of the OSDF.	

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(7)	The following plans:		
	• ground water detection monitoring plan as required in rule 3745-27-10 of the Administrative Code, and if applicable the ground water quality assessment plan and/or corrective measures plan required pursuant to rule 3745-27-10 of the Administrative Code		OSDF Groundwater/Leak Detection and Leachate Monitoring Plan
	• surface water monitoring plan if required by the Director to ensure compliance with paragraph (J)(5) of rule 3745-27-19 of the Administrative Code	This plan is not applicable to the operation of the OSDF.	
	• leachate monitoring plan to ensure compliance with paragraph (M)(4) of rule 3745-27-19 of the Administrative Code		Section 3.0 of OSDF Systems Plan and Section 4.0 of OSDF Groundwater/Leak Detection and Leachate Monitoring Plan
	• leachate contingency plan as required in paragraph (K)(6) of rule 3745-27-19 of the Administrative Code		Section 6.0 of OSDF Post-Closure Care and Inspection Plan
	• explosive gas monitoring plan as required in rule 3745-27-12 of the Administrative Code	This plan is not applicable to the operation of the OSDF.	
	• the quality assurance/quality control plan specified in paragraph (F) of rule 3745-27-08 of the Administrative Code		OSDF Construction Quality Assurance Plan
	• the final closure/post-closure plan as detailed in paragraph (B) of rule 3745-27-11 of the Administrative Code		OSDF Post-Closure Care and Inspection Plan
	• the final closure and post-closure care financial assurance instruments required by rules 3745-27-15 and 3745-27-16 of the Administrative Code, respectively, and if applicable the corrective measures financial assurance instrument required by rule 3745-27-18 of the Administrative Code	This requirement is not applicable to the operation of the OSDF.	

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(7) (continued)	• the PCB and hazardous waste prevention and detection program required in paragraph (L) of rule 3745-27-19 of the Administrative Code	This requirement is not applicable to the operation of the OSDF.	
OAC 3745-27-06(C)(8)	Contingency plans detailing emergency equipment, procedures, notification, and remediation for the following:		
	• discovery of unauthorized liquid waste, and waste that is burning or at a temperature likely to cause fire	This requirement is not applicable to the operation of the OSDF.	
	• escape of asbestos, if any is accepted • fire, explosion, and spills • erosion, leachate outbreaks, and differential settling • equipment failure		Section 7.2 of OSDF RAWP and Sections 9.0, 10.0, and 11.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-06(C)(10)	Applications which propose to locate unit(s) of the sanitary landfill facility in wetlands, as defined in paragraph (B) of rule 3745-27-01 of the Administrative Code, shall include the following demonstrations:		
	• where applicable under section 404 of the Clean Water Act or applicable state wetlands laws, the presumption that practicable alternatives to the proposed unit(s) are available which do not involve wetlands is clearly rebutted		Appendix H of Operable Unit 2 FS
	• the construction and operation of the unit(s) of the sanitary landfill facility will not:		
	- cause or contribute to violations of any applicable state water quality standard - violate any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act	These requirements will be addressed in the Sitewide Excavation Plan.	OSDF Surface Water Management and Erosion Control Plan and FEMP Stormwater Pollution Prevention Plan

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(10) (continued)	- jeopardize the continued existence of endangered or threatened species or result in the destruction of a critical habitat, protected under the Endangered Species Act of 1973		Section 10.6 of Operable Unit 2 ROD, Section 9.6 of Operable Unit 3 ROD, Section 10.6 of Operable Unit 5 ROD, and Appendix D of Soil Remediation Project Area 1, Phase I Remedial Action Work Plan
	• the unit(s) of the sanitary landfill facility will not cause or contribute to significant degradation of wetlands. The owner or operator must demonstrate the integrity of the unit(s) of the sanitary landfill facility and their ability to protect ecological resources by addressing the following factors:		
	- erosion, stability, and migration potential of native wetland soils, muds, and deposits used to support the unit(s) of the sanitary landfill facility - erosion, stability, and migration potential of dredged and fill materials used to support the unit(s) of the sanitary landfill facility	The OSDF will not be located over any wetlands or fill or dredged material. Therefore, this requirement is not applicable to the construction of the OSDF.	
	- the volume and chemical nature of the waste managed in the unit(s) of the sanitary landfill facility		The Operable Unit 2, 3, and 5 FS Reports, and Section 4.0 of OSDF Impacted Material Placement Plan
	- impacts on fish, wildlife, and other aquatic resources and their habitat from release of the solid waste - the potential effects of catastrophic release of waste to the wetland and the resulting impacts on the environment - any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(10) (continued)	• to the extent required under section 404 of the Clean Water Act or applicable state wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent practicable as required by paragraph (C)(10)(a) of this rule, then minimizing unavoidable impacts to the maximum extent practicable, and finally offsetting wetland impacts through all appropriate and practicable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands)		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
	• sufficient information is available to make a reasonable determination with respect to these demonstrations	The above-referenced documents provide sufficient information to make a determination with respect to the required demonstrations.	
OAC 3745-27-11(H)(5)(a)	The owner shall file - with the board of health having jurisdiction, with the county recorder of the county in which the facility is located, and with the Director - a plat of the unit(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume, and nature of the solid waste deposited in the unit(s) of the sanitary landfill facility.		Section 4.5 of OSDF Post-Closure Care and Inspection Plan

APPENDIX B

ADDITIONAL ARARs

TABLE B-1
WETLANDS/FLOODPLAINS ARARs

Citation	Requirement	Remarks	Cross-Reference
40 CFR §6.302(a) [Executive Order 11990]	Federal agencies conducting certain activities must avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands when a practicable alternative exists.	This requirement will be addressed in the Natutal Resources Resoration Plan (which will be part of the Sitewide Excavation Plan).	Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
40 CFR §6.302(b) [Executive Order 11988]	Federal agencies must evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.	This requirement is not applicable to the design of the OSDF.	
33 U.S.C. §1344 40 CFR §230.10	No discharge of dredged or fill material shall be permitted: • if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as, the alternative does not have other significant adverse environmental consequences. • unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem. • causes or contributes, after consideration of disposal site dilution and dispersion, to violations of any applicable state water quality standard. • violates any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act. • jeopardizes the continued existence of species listed as endangered or threatened under the Endangered Species Act of 1973, as amended, or results in likelihood of the destruction or adverse modification or a habitat which is determined to be a critical habitat under the Endangered Species Act of 1973, as amended.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS

TABLE B-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
33 CFR §323.3	Permits will be required for the discharge of dredged or fill material into waters of the United States including wetlands. Certain discharges specified in 33 CFR Part 330 are permitted by that regulation (nationwide permits).	This requirement will be addressed in the Natutal Resources Resoration Plan (which will be part of the Sitewide Excavation Plan).	
	If a discharge of dredged or fill material is not permitted by 33 CFR Part 330 (Nationwide Permits), an individual section 404 permit will be required for the discharge of dredged or fill material into waters of the United States.	This requirement is not applicable to the construction of the OSDF.	
	Discharges of dredged or fill material into waters of the United States done by or on behalf of any Federal agency, other than the Corps of Engineers, are subject to the authorization procedures of these regulations.	This requirement will be addressed in the Natutal Resources Resoration Plan (which will be part of the Sitewide Excavation Plan).	
33 U.S.C. §1341(a)(1),(d) 33 CFR §330.1 (c)	An activity is authorized under an NWP only if that activity and the permittee satisfy all of the following NWPs terms and conditions. Potentially applicable NWPs include:		
	• Nationwide Permit #38 - Cleanup of Hazardous and Toxic Waste - This permit authorizes specific activities required to effect the containments, stabilization or removal of hazardous or toxic waste materials that are performed ordered, or sponsored by a government agency with established legal or regulatory authority provided the permittee notifies the district engineer. - For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands. - This nationwide permit does not authorize the establishment of new disposal sites or the expansion of existing sites used for the disposal of hazardous or toxic waste.	These requirements are not applicable to the design of the OSDF.	

TABLE B-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
10 CFR §1022.3(a), (b)(1),(2),(3),(5),(6),(c), (d),(e)	DOE shall exercise leadership and take action to: • avoid to the extent possible the long- and short-term adverse impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands, and avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative. • incorporate floodplain management goals and wetlands protection considerations into its planning, regulatory, and decision-making processes and shall to the extent practicable: - reduce the hazard and risk of flood loss. - minimize the impact of floods on human safety, health, and welfare. - restore and preserve natural and beneficial values served by the floodplains. - minimize the destruction, loss, or degradation of wetlands. - preserve and enhance the natural and beneficial values of wetlands. • undertake a careful evaluation of the potential effects of any DOE action taken in a floodplain and any new construction undertaken by DOE in wetlands not located in a floodplain • identify, evaluate, and as appropriate, implement alternative actions which may avoid or mitigate adverse floodplain/wetlands impacts	These requirements will be addressed in the Natutal Resources Resoration Plan (which will be part of the Sitewide Excavation Plan).	Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
	• provide opportunity for early public review of any plans or proposals for actions in floodplains and new construction in wetlands		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS

TABLE B-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
10 CFR §1022.5(b),(h)	This part shall apply to all proposed floodplain/wetlands actions, including those sponsored jointly with other agencies, where practicable alternatives to the proposed actions are still available. The policies and procedures of this part which are applicable to floodplain actions shall apply to all proposed actions which occur in a wetlands located in a floodplain.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
10 CFR §1022.11(a),(b),(c)	Concurrent with its review of a proposed action to determine appropriate NEPA requirements, DOE shall determine applicability of the floodplain management and wetlands protection requirements of this part. In making a floodplain determination, DOE shall utilize the Flood Insurance Rate Maps (FIRMs) or the Flood Hazard Boundary Maps (FHBMs) prepared by the Federal Insurance Administration of the Department of Housing and Urban Development to determine if a proposed action is located in the base or critical action floodplain, as appropriate. For a proposed action in an area of predominantly Federal or State land holdings where FIRM or FHBM maps are not available, information shall be sought from the land administering agency (e.g., Bureau of Land Management, Soil Conservation Service, etc.) or from agencies with floodplain analysis expertise.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
10 CFR §1022.12(a)	If DOE determines, pursuant to 10 CFR §§ 1022.5 and 1022.11, that this part is applicable to the proposed action, DOE shall prepare a floodplain/wetlands assessment, according to the requirements in this section (10 CFR §1022.12).		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
10 CFR §1022.15(a)	If DOE finds that no practicable alternative to locating in the floodplain/wetlands is available, consistent with the policy set forth in Executive Order 11988, DOE shall, prior to taking action, design, or modify its action in order to minimize potential harm to or within the floodplain/wetlands.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS

TABLE B-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-20 (C)(2)	The limits of solid waste placement and the leachate management system cannot be located in a regulatory floodplain, unless deemed acceptable by the Director.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
OAC 3745-27-07 (G)(15)	A solid waste disposal facility may not be located in a floodway.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
OAC 3745-27-07 (H)(4)(d)	The limits of waste placement cannot be located within 200 feet of a stream, lake, or wetland, unless deemed acceptable by the Director.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
40 CFR §258.12	New municipal solid waste landfill units must not be located in wetlands unless Ohio approves otherwise.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS

TABLE B-2
RCRA ARARs

Citation	Requirement	Remarks	Cross-Reference
OAC 3745.05 (D)(6)(c) [ORC 3734.05 (D)(6)(c)]	A hazardous waste facility installation and operation permit shall not be approved unless it is proven that the facility represents the minimum adverse environmental impact, considering the state of available technology, the nature and economics of various alternatives and other pertinent considerations.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
OAC 3745.05 (D)(6)(d) [ORC 3734.05 (D)(6)(d)]	A hazardous waste facility installation and operation permit shall not be approved unless it is proven that the facility represents the minimum risk of all the following:		
	• contamination of groundwater and surface water; • fires or explosions from treatment, storage, or disposal methods; • accidents during transportation; • impact to public health and safety;		Operable Unit 2, Operable Unit 3, and Operable Unit 5 FS Reports and RODs
	• air pollution; and		Section 6.0 of Integrated Environmental Monitoring Plan
	• soil contamination.		Operable Unit 2, Operable Unit 3, and Operable Unit 5 FS Reports and RODs
ORC 3734.02(I)	No owner or operator of a hazardous waste facility, in the operation of the facility, shall cause, permit, or allow the emission therefrom of any particulate matter, dust, fumes, gas, mist, smoke, vapor, or odorous substance that, in the opinion of the Director, unreasonably interferes with the comfortable enjoyment of life or property by persons living or working in the vicinity of the facility, or that is injurious to public health.		Section 2.11.1 of OSDF DCP and Section 13040 of OSDF Specification Package
40 CFR §264.552 Subpart S	Corrective action management unit or CAMU means an area within a facility that is designated by the Regional Administrator under part 264 Subpart S, for the purpose of implementing corrective action requirements under Section 264.101 and RCRA Section 3008(h). A CAMU shall only be used for the management of remediation wastes pursuant to implementing such corrective action requirements at the facility.		Section 9.1.8 of Operable Unit 5 ROD

TABLE B-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §264.552 Subpart S (continued)	For the purpose of implementing corrective action for solid waste management units, the Regional Administrator may designate an area at the facility as a corrective action management unit (CAMU). One or more CAMU's may be designated at a facility. • Placement of remediation wastes into or within a CAMU does not constitute land disposal of hazardous wastes. • Consolidation or placement of remediation wastes into or within a CAMU does not constitute creation of a unit subject to minimum technology requirements. • The CAMU shall facilitate the implementation of reliable, effective, protective, and cost-effective remedies. • Waste management activities associated with the CAMU shall not create unacceptable risks to humans or to the environment resulting from exposure to wastes. • The CAMU shall include uncontaminated areas of the facility only if including such areas for the purpose of managing remediation waste is more protective than management of such wastes at contaminated areas of the facility. • Areas within the CAMU, where wastes remain in place after closure of the CAMU, shall be managed and contained so as to minimize future releases, to the extent practicable. • The CAMU shall expedite the timing of remedial activity implementation, when appropriate and applicable. • The CAMU shall enable the use, when appropriate, of treatment technologies (including innovative technologies) to enhance the long-term effectiveness of remedial actions by reducing the toxicity, mobility, or volume of wastes that will remain in place after closure of the CAMU. • The CAMU shall, to the extent practicable, minimize the land area of the facility upon which wastes will remain in place after closure of the CAMU.		

TABLE B-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §264.552 Subpart S (continued)	The owner/operator shall provide sufficient information to enable the Regional Administrator to designate a CAMU in accordance with the criteria in Section 264.552.		
40 CFR §265.301(a) OAC 3745-68-011	Construction of a landfill must include 2 or more liners and a leachate collection and removal system above and between such liners.		Section 2.4.1 of OSDF DCP and Drawings G-22 and G-24 of OSDF Design
40 CFR §265.90 Subpart F OAC 3745-65-90	The owner or operator of a surface impoundment, landfill, or land treatment facility which is used to manage hazardous waste must implement a groundwater monitoring program capable of determining the facility's impact on the quality of groundwater in the uppermost aquifer underlying the facility.		OSDF Groundwater/Leak Detection and Leachate Monitoring Plan
40 CFR §264.92-.100 Subpart F OAC 3745-54-92 to -100	The owner or operator must ensure that hazardous constituents detected in the groundwater from a regulated unit do not exceed the concentration limits for MCLs in the uppermost aquifer underlying the waste management are beyond the point of compliance during the compliance period.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
	The groundwater monitoring requirements include procedures for detection, compliance, and corrective action monitoring programs.		OSDF Groundwater/Leak Detection and Leachate Monitoring Plan
40 CFR §265.111 Subpart G OAC 3745-66-11	The owner or operator must close a facility in a manner that: • Minimizes the need for further maintenance; • Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and • Complies with these closure requirements.		Section 2.6 of OSDF DCP
40 CFR §265.310 Subpart N OAC 3745-68-10	At final closure of the landfill or upon closure of any cell, the owner or operator must cover the landfill or cell with a final cover designed and constructed to: • provide long-term minimization of migration of liquids through the closed landfill;		Section 2.6.1 of OSDF DCP and Drawing G-26 of OSDF Design

TABLE B-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §265.310 Subpart N OAC 3745-68-10 (continued)	• function with minimum maintenance; • promote drainage and minimize erosion or abrasion of the cover; • accommodate settling and subsidence so that the cover's integrity is maintained; and • have a permeability less than or equal to the permeability of any bottom liner system or natural subsoil present.		
	After final closure, the owner or operator must comply with all postclosure requirements, including maintenance and monitoring throughout the postclosure care period. The owner or operator must:		
	• maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events;		Section 4.0 of OSDF Systems Plan and Section 9.0 of OSDF Post-Closure Care and Inspection Plan
	• continue to operate the leachate collection and removal system until leachate is no longer detected; • maintain and monitor the leak detection system;		Section 6.0 of OSDF Post-Closure Care and Inspection Plan
	• maintain and monitor the groundwater monitoring system;		Section 5.3 of OSDF Post-Closure Care and Inspection Plan and Section 4.0 of OSDF Groundwater/Leak Detection and Leachate Monitoring Plan
	• prevent run-on and run-off from eroding or otherwise damaging the final cover;		Section 4.0 of OSDF Systems Plan and Section 9.3 of OSDF Post-Closure Care and Inspection Plan
	• protect and maintain surveyed benchmarks; and • restrict access to the landfill as appropriate for its post-closure use.		Sections 4.4, 7.0, and 9.3.2 of OSDF Post-Closure Care and Inspection Plan

TABLE B-3
SOLID WASTE ARARs

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-05 (A)	Solid waste shall be disposed of only by the following methods: • sanitary landfill • incineration • composting Methods not mentioned above and not prohibited by this chapter, OAC 3745-27, may be used provided that such methods are demonstrated to the satisfaction of the Director to be capable of disposing of solid waste without creating a nuisance or a health hazard, without causing water pollution, and without violating these regulations and any regulation adopted by the Director pursuant to Ohio Revised Code Chapter 3704 (Air Pollution Control).		Section 9.0 of Operable Unit 2 ROD, Section 8.0 of Operable Unit 3 ROD, and Section 9.0 of Operable Unit 5 ROD
OAC 3745-400-04(A)	Construction and demolition debris shall be disposed of by landfilling or by other methods demonstrated to the satisfaction of the licensing authority.		Section 8.0 of Operable Unit 3 ROD
40 CFR §257.3-7	The solid waste disposal facility or practice shall not engage in open burning of residential, commercial, institutional, or industrial solid waste. This requirement does not apply to land-clearing debris, diseased trees, debris from emergency clean-up operations, and ordnance.		Section 9.0 of Operable Unit 2 ROD, Section 8.0 of Operable Unit 3 ROD, and Section 9.0 of Operable Unit 5 ROD
ORC 3734.03	No person shall dispose of solid wastes by open burning or open dumping, except as authorized by the Director. No person shall dispose of treated or untreated infectious wastes by open burning or open dumping.		Section 9.0 of Operable Unit 2 ROD, Section 8.0 of Operable Unit 3 ROD, and Section 9.0 of Operable Unit 5 ROD

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §257.3-3	A solid waste disposal facility shall not cause a discharge of pollutants into waters of the United States that is in violation of the requirements of the NPDES under section 402 of the Clean Water Act, as amended. A solid waste disposal facility shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under section 404 of the Clean Water Act, as amended. A solid waste disposal facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an area-wide or Statewide water quality management plan that has been approved by the Administrator under section 208 of the Clean Water Act, as amended.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, Appendix J of Operable Unit 5 FS, OSDF Surface Water Management and Erosion Control Plan, and the FEMP NPDES Permit
40 CFR §257.3-4	A solid waste disposal facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
40 CFR §241.200	In consultation with the responsible agencies the owner/operator shall determine what wastes shall be accepted and shall identify any special handling required.		Sections 4.0 and 8.0 of OSDF Impacted Material Placement Plan
40 CFR §241.201	Using information supplied by the waste generator/owner, the responsible agency and the disposal site owner/operator shall jointly determine specific wastes to be excluded and shall identify them in the plans.		Section 4.4 of OSDF Impacted Material Placement Plan
40 CFR §241.202	Site selection and utilization shall be consistent with public health and welfare, and air and water quality standards and adaptable to appropriate land-use plan.		OSDF Predesign Investigation Report
40 CFR §241.203	Plans for the design, construction, and operation of new sites or modifications to existing sites shall be prepared or approved by a professional engineer.		OSDF Drawings

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §241.204	The location, design, construction, and operation of the land disposal site shall conform to the most stringent of applicable water quality standards established in accordance with or effective under the provisions of the Federal Water Pollution Control Act, as amended.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 FS, and Appendix J of Operable Unit 5 FS
40 CFR §241.205	The design, construction, and operation of the land disposal site shall conform to applicable ambient air quality standards and source control regulations established under the authority of the Clean Air Act, as amended, or State or local standards effective under that Act, if the latter are more stringent.		Section 9.3 of OSDF Impacted Material Placement Plan
40 CFR §241.206	Decomposition gases generated within the land disposal site shall be controlled on site, as necessary, to avoid posing a hazard to occupants of adjacent property.	This requirement is not applicable to the design of the OSDF.	
40 CFR §241.207	Conditions shall be maintained that are unfavorable for the harboring, feeding, and breeding of vectors.	This requirement is not applicable to the design of the OSDF.	
40 CFR §241.208	The land disposal site shall be designed and operated at all times in an aesthetically acceptable manner.		Section 2.2 of OSDF DCP
40 CFR §241.209	Cover material shall be applied as necessary to minimize fire hazards, infiltration of precipitation, odors, and blowing litter; control gas venting and vectors; discourage scavenging; and provide a pleasing appearance.	This requirement is not applicable to the design of the OSDF.	
40 CFR §241.210	In order to conserve land disposal site capacity, thereby preserving land resources, and to minimize moisture infiltration and settlement, municipal solid waste and cover material shall be compacted to the smallest practicable volume.		Sections 6.8, 7.0, and 8.0 of OSDF Impacted Material Placement Plan
40 CFR §241.211	The land disposal site shall be designed, constructed, and operated in such a manner as to protect the health and safety of personnel associated with the operation.		FEMP Site Health and Safety Procedures and OSDF Project-Specific Health and Safety Requirements Matrix

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9)	The following layers must be installed in the construction of a sanitary landfill (from bottom to top):		
	Recompacted Soil Liner		Section 02225 of OSDF Specification Package
	The recompacted soil liner shall be:		
	• constructed using loose lifts 8 inches thick with a maximum permeability of 1 x 10^{-7} cm/s.		Sections 2.4.1 and 2.4.3 of OSDF DCP
	• constructed of a soil with a maximum clod size of 3 inches or half the lift thickness, whichever is less.		Section 2.4.3 of OSDF DCP
	• constructed of soil with:		
	- 100% of the particles having a maximum dimension not greater than 2 inches. - not more than 10% of the particles, by weight, having a dimension greater than 0.75 inches. - not less than 50% of the particles, by weight, passing through the 200-mesh sieve.		Section 02225 of OSDF Specification Package
	- not less than 25% of the particles, by weight, having a maximum dimension not greater than 0.002 millimeters.	An alternative to this requirement has been approved by OEPA in a letter from T. Schneider to J. Reising dated January 26, 1996, "Hamilton County Comments: Clay Liner Paper."	Section 2.4.3 of OSDF DCP
	• compacted to at least 95% of the maximum "Standard Proctor Density" using ASTM D-698 or at least 90% of the maximum "Modified Proctor Density" using ASTM D-1557. • compacted at a moisture content at or wet of optimum.		Section 2.4.3 of OSDF DCP

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Alternatives for the above requirements may be used if it is demonstrated to the satisfaction of the Director that the materials and techniques will result in each lift having a maximum permeability of 1 x 10^{-7} cm/s.		Letter from T. Schneider to J. Reising dated January 26, 1996, "Hamilton County Comments: Clay Liner Paper"
	Additionally, the recompacted soil liner shall:		
	• not comprised of solid waste.		Section 2.4.3 of OSDF DCP and Sections 6.0 and 9.0 of OSDF Test Pad Program Final Report
	• be constructed using the same number of passes and lift thickness, and the same or similar type and weight of compaction equipment established by testing (as defined in this table).		
	• be placed on the bottom and exterior excavated sides of the landfill and have a minimum bottom slope of 2% and a maximum slope based on:		Section 2.4.3 of OSDF DCP and Drawing G-6 of OSDF Design
	- compaction equipment limitations;		Section 9.4 of OSDF Test Pad Program Final Report
	- slope stability;		Section 3.1 of OSDF Calculation Package
	- maximum friction angle between any soil-geosynthetic interface and between any geosynthetic-geosynthetic interface; and		Section 3.2 of OSDF Calculation Package and Section 5.0 of OSDF Soil-Geosynthetic Interface Direct Shear Testing Report
	- resistance of geosynthetics and geosynthetic seams to tensile forces.		Section 3.2 of OSDF Calculation Package
	• constructed on a prepared surface that shall:		
	- be free of debris, foreign material, and deleterious material;		Section 2.4.3 of OSDF DCP

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	- be able to bear the weight of the landfill and its construction operations without causing or allowing a failure of the liner to occur through settling; and		Section 2.4.3 of OSDF DCP and Section 5.1 of OSDF Calculation Package
	- not have any abrupt changes in grade that may result in damage to geosynthetics.		Section 2.4.3 of OSDF DCP and Drawing G-5 of OSDF Design
	• be at least 5 feet thick, although the Director may approve an alternate thickness, to be no less than 3 feet, based upon the result of calculations or on a design that is no less protective of human health and the environment.	This requirement is not applicable to the design of the OSDF (see next requirement).	
	• be at least 3 feet thick with a geosynthetic clay liner that meets the specifications in paragraph (C)(3) of this rule although the Director may approve an alternate thickness to be no less than 1½ feet, based upon the results of calculations or on a design that is no less protective of human health and the environment.		Section 2.4.1 of OSDF DCP and Drawings G-22 through G-25 of OSDF Design
	• have a factor of safety for hydrostatic uplift not less than 1.4.		Section 2.4.2 of OSDF DCP and Section 6.1 of OSDF Calculation Package
	• be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction and operation.		Section 2.4.3 of OSDF DCP and Section 02240 of OSDF Specification Package
	Flexible Membrane Liner		Section 02770 of OSDF Specification Package
	The flexible membrane liner shall be:		
	• placed on the recompacted soil liner.		Section 2.4.5 of OSDF DCP and Drawings G-22 through G-25 of OSDF Design
	• sixty mil high density polyethylene (HDPE).		Section 2.4.5 of OSDF DCP

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	• be protected from the drainage layer by a cushion layer, as required by the Director		Section 2.4.5 of OSDF DCP and Drawings G-22 through G-25 of OSDF Design
	Other materials or thicknesses may be used if, at a minimum, the flexible membrane liner meets all the following: • negligibly permeable to fluid migration. • physically and chemically resistant to chemical attack by the solid waste, leachate, or other materials which may come in contact with the flexible membrane liner. • seamed to allow no more than negligible amounts of leakage with seaming material that is physically and chemically resistant to chemical attack by the solid waste, leachate, or other materials which may come in contact with the seams. • have properties for its installation and use which are acceptable to the Director. • protected from the drainage layer by a cushion layer, as required by the Director. • have a minimum thickness of 40 mils.	DOE does not presently anticipate utilizing these alternative provisions.	
	Geosynthetic Clay Liner The geosynthetic clay liner used in lieu of part of the recompacted soil liner shall be:		Section 02772 of OSDF Specification Package
	• negligibly permeable to fluid migration. • be installed to allow no more than negligible amounts of leakage by a minimum overlap of 6 inches, or, for end of panel seams, a minimum over of 12 inches. 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 1 pound per square foot.		Section 2.4.4 of OSDF DCP

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	• be installed in accordance with the manufacturers specifications in regards to handling, overlap, and the use of granular or powdered bentonite to enhance bonding at the seams.		
	• be constructed above the recompacted soil liner.		Section 2.4.4 of OSDF DCP and Drawings G-22 through G-25 of OSDF Design
	Leachate Management System		
	The leachate management system shall:		
	• be designed to prevent clogging and crushing of the system and to limit the level of leachate in areas other than lift stations to a maximum of 1 foot.		Section 2.5.1 of OSDF DCP and Section 8.0 of OSDF Calculation Package
	• include a drainage layer placed on top of the flexible membrane liner composed of granular material that must:		Section 2.5.1 of OSDF DCP and Drawings G-22 through G-25 of OSDF Design
	- have a minimum permeability of 1 x 10^{-3} cm/s; - have a minimum thickness of 1 foot; - have a negligible amount of fines; and - not contain carbonate material.		Section 2.5.1 of OSDF DCP and Section 02710 of OSDF Specification Package
	An alternate material and/or thickness may be used if it is demonstrated to the satisfaction of the Director that the material meets the requirements.	DOE does not presently anticipate utilizing these alternative provisions.	
	• include leachate collection pipes to remove leachate from the bottom of the landfill. The pipes must:		
	- be imbedded in the drainage layer; - have a minimum slope of 0.5%; - have lengths and configuration which shall not exceed the capabilities of clean-out devices;		Section 2.5.1 of OSDF DCP and Drawing G-22 through G-25 of OSDF Design

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	- be provided with access for clean-out devices which shall be protected from differential settling;		Section 2.5.1 of OSDF DCP
	- have joints sealed to prevent separation; and		Section 2.5.1 of OSDF DCP and Section 02605 of OSDF Specification Package
	- be physically and chemically resistant to attack by the solid waste, leachate, or other materials that they may come in contact with. Sealing material and means of access for clean-out devices shall also be physically and chemically resistant to attack by the solid waste, leachate, or other materials that they may come in contact with.		Section 2.5.1 of OSDF DCP and Leachate/ Liner Compatibility Study Final Report
	An alternate means for leachate removal may be used if it is demonstrated to the satisfaction of the Director that the means for leachate removal meets the requirements.	DOE does not presently anticipate utilizing these alternative provisions.	
	• include a filter layer to prevent clogging of the leachate collection system.		Section 2.5.1 of OSDF DCP, Section 02712 of OSDF Specification Package, and Drawings G-22 through G-25 of OSDF Design
	• include a protective layer to protect the recompacted soil liner, flexible membrane liner, geosynthetic clay liner (if applicable), and leachate collection system from the intrusion of objects during construction and operation.		Section 2.5.1 of OSDF DCP, Section 02240 of OSDF Specification Package, and Drawings G-22 through G-25 of OSDF Design
	• include lift stations which are to be protected from adverse effects from leachate and differential settling. If manholes are used as lift stations, they must be equipped with automatic high level alarms located no greater than 6 feet above the invert of the leachate inlet pipe. Lift station pipes should be of adequate capacity and shall automatically commence pumping before the leachate elevation activates the high level alarm.		Section 2.5.3 of OSDF DCP, Sections 10.3 and 10.4 of OSDF Calculation Package, and Drawings M-2, M-4, M-5, and M-9 of OSDF Design

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Leachate Collection and Storage		
	Any leachate conveyance and storage structures located outside the limits of solid waste placement shall be no less protective of the environment than the landfill facility, as determined by the Director, and:		
	• The structures must be monitored, as required by the Director.		Section 2.5.3 of OSDF DCP, Section 3.6 of the OSDF Systems Plan, Section 6.0 of OSDF Post-Closure Care and Inspection Plan, and Section 5.0 of OSDF Groundwater/Leak Detection and Leachate Monitoring Plan
	• Storage tanks must be provided with spill containment • Leachate lines must be double-cased		Section 2.5.3 of OSDF DCP
	• Storage structures must have a minimum of 1 week of storage capacity using design assumptions simulating final closure.		Section 2.5.3 of OSDF DCP and Section 7.2 of OSDF Calculation Package
	• If at any time leachate is evaluated to be hazardous in accordance with rule 3745-52-11 of the OAC, it shall be managed in accordance with Chapters 3745-50 to 3745-69 of the OAC, and the generator standards for storage shall apply in accordance with Chapter 3745-52 of the OAC.	This requirement is not applicable to the design of the OSDF.	
	Surface Water Control		
	• Any permanent or temporary surface water control structures shall be designed to accommodate, by non-mechanical means, the peak flow from the 25-year/24-hour storm event.		Section 2.8.3 of OSDF DCP and Sections 12.1 and 13.1 of OSDF Calculation Package

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	• Surface water control structures shall be designed to minimize silting and scouring.		Section 2.8.3 of OSDF DCP
	• If sedimentation ponds are used, they shall be designed and constructed according to OAC 3745-27-08 (C)(6)(b).		Section 2.8.3 of OSDF DCP and Section 12.2 of OSDF Calculation Package
	Benchmarks		
	• At least 3 permanent third order benchmarks on separate sides of the landfill facility shall be within easy access to the limits of solid waste placement and shall be constructed in accordance with OAC 3745-27-08(C)(7)(a)-(c).		Drawing X-4 of OSDF Design
	Groundwater Control	DOE does not presently anticipate utilizing permanent groundwater control structures.	
	• Any permanent groundwater control structures shall adequately control groundwater infiltration through the use of non-mechanical means such as impermeable barriers or permeable drainage structures. • No permanent groundwater control structures may be used to dewater an aquifer system, except if the recharge and discharge zone of the aquifer system are located entirely within the boundary of the landfill facility.		
40 CFR §258.40	The liner and leachate system shall be designed and constructed to maintain less than a 30-cm depth of leachate over the liner.		Section 2.5.1 of OSDF DCP and Section 8.1 of OSDF Calculation Package
	The geomembrane must be at least 30-mil thick.		Section 2.4.5 of OSDF DCP and Section 02770 of OSDF Specification Package

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §258.26	The landfill shall have: • a run-on control system to prevent flow onto the active portion of the landfill during the peak discharge from a 25-year storm. • a run-off control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm.		Section 2.8.3 of OSDF DCP and Sections 12.1 and 13.1 of OSDF Calculation Package
OAC 3745-27-08 (D) and (E)	Prior to being used in the construction of the recompacted soil liner and drainage layer of the sanitary landfill or the landfill cap, the following characteristics of the earthen materials must be determined to show that the material is suitable for use in construction of the landfill.		Test Pad Program and Geotechnical Sampling and Testing Work Plans
	Soil Material Specifications		
	The following tests shall be performed on representative samples at least once for every 1,500 yd^3 of soil except the recompacted permeability test, which shall be performed at least once for every 10,000 yd^3 of soil. • recompacted permeability at construction specifications; • moisture content and density using an approved ASTM method; • grain size distribution using ASTM D-422 for sieve and hydrometer methods; and • Atterberg limits using ASTM D-4318.		Section 2.4.3 of OSDF DCP and Section 6.0 of the OSDF Construction Quality Assurance Plan
	Granular Drainage Material Specifications		
	The following tests shall be performed at least once for every 3,000 yd^3 of material. • permeability; • grain size distribution using ASTM D-422 for the sieve method; and		Section 2.5.1 of OSDF DCP and Section 6.0 of the OSDF Construction Quality Assurance Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (D) and (E) (continued)	• chemical compatibility testing may be required by the Director.	This requirement is not applicable to the design of the OSDF.	
	Geosynthetic Material Specifications		
	Geosynthetics, other synthetic materials, and joint sealing compounds used in the construction of the flexible membrane liner, geosynthetic clay liner, and leachate management system for a sanitary landfill facility or a sanitary landfill cap system shall be shown to: • be physically and chemically resistant to attack by the solid waste, leachate, or other materials that they may come in contact with using USEPA Method 9090 or other documented data. • have properties acceptable for installation and use.		Leachate/Liner Compatibility Study Final Report, Section 2.4.9 of OSDF DCP, and Section 02772 of the OSDF Specification Package
OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g)	The following activities must be performed to ensure that the components of the sanitary landfill facility meet the specifications of this rule.		
	Test Pads		
	The recompacted soil liner and the recompacted soil barrier layer in the cap system shall be modeled by the construction of test pads. The test pads shall:		
	• be designed such that the proposed tests are appropriate and their results are valid.		Section 2.7.1 of OSDF DCP and Sections 2.2 and 5.1 of OSDF Test Pad Work Plan
	• be constructed to establish the construction details which are necessary to obtain sufficient compaction to satisfy the permeability requirement. The construction details include: - lift thickness; - water content necessary to achieve the desired compaction; and		Section 2.7.1 of OSDF DCP and Section 2.2 of OSDF Test Pad Work Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g) (continued)	- type, weight, and number of passes of construction equipment. • be constructed prior to the construction of the sanitary landfill component which the test pad will model.		
	• be constructed whenever there is a significant change in soil material properties.		Section 2.7.3 of OSDF DCP and Section 2.1 of OSDF Test Pad Work Plan
	• have a minimum width three times the width of the compaction equipment, and a minimum length two times the length of compaction equipment, including power equipment and any attachments.		Section 2.7.3 of OSDF DCP and Section 5.1 of OSDF Test Pad Work Plan
	• be comprised of at least four lifts.		Section 2.7.3 of OSDF DCP and Sections 2.3.4 and 5.1 of OSDF Test Pad Work Plan
	• be tested for field permeability, following the completion of test pad construction. For each lift a minimum of 3 tests for moisture content and density shall be performed.		Section 2.7.3 of OSDF DCP and Sections 2.3.5, 7.0, and 8.0 of OSDF Test Pad Work Plan
	• be reconstructed as many times as necessary to meet the permeability requirement. Any amended construction details shall be noted.		Section 2.7.3 of OSDF DCP
	An alternative to test pads may be used if it is demonstrated to the satisfaction of the Director that the alternative meets the requirements.	DOE does not currently anticipate utilizing this alternative provision.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g) (continued)	Moisture Content and Density Testing		
	Moisture content and density testing of the recompacted soil liner and recompacted soil barrier in the cap system shall be performed at a frequency of no less than 5 tests per acre per lift. Any penetrations shall be repaired using methods acceptable to the Director.		Section 2.4.3 of OSDF DCP, Section 02225 of OSDF Specification Package, and Section 6.0 of OSDF Construction Quality Assurance Plan
	Flexible Membrane Liner Testing		
	• For the purpose of testing every seaming apparatus in use each day, peel and shear tests shall be performed on scrap pieces of flexible membrane liner at the beginning of the seaming period and every four hours thereafter. • Nondestructive testing shall be performed on 100% of the flexible membrane liner seams. • Destructive testing for peel and shear shall be performed at least once for every 500 feet of seam length. An alternate means may be used if it is demonstrated to the satisfaction of the Director that the alternate means meets the requirements.		Section 2.4.5 of OSDF DCP, Section 02770 of OSDF Specification Package, and Section 7.0 of OSDF Construction Quality Assurance Plan
OAC 3745-27-08 (G)	All tests failing to meet the specifications outlined above must be investigated and the areas reconstructed to meet specifications.		Sections 6.12, 7.9, 8.8, and 9.7 of OSDF Construction Quality Assurance Plan
OAC 3745-27-08 (F)	The following testing procedures shall be included in a Quality Assurance/Quality Control Plan: • sampling and testing procedures to be used in the field and in the laboratory; • testing frequency; • parameters and sample locations;		OSDF Construction Quality Assurance Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (F) (continued)	• procedures to be followed if a test fails; • the management structure and the experience and training of the testing personnel; and • contingency plan for anticipated construction difficulties. The following components shall be included in a Quality Assurance/Quality Control Plan: • in-situ foundation preparation; • recompacted soil and/or geosynthetic clay liner system; • flexible membrane liner; • leachate management system; • cap system; • permanent ground water control structures; and • explosive gas control/extraction systems.		
OAC 3745-27-19 (E)(19)	To demonstrate that the solid wastes to be received at the landfill facility will not compromise the integrity of any material used to construct the landfill facility, the Director may require chemical compatibility testing to be performed.		Leachate/Liner Compatibility Study Final Report
OAC 3745-27-19 (E)(26)	The integrity of the engineered components of the landfill facility shall be maintained and any damage to, or failure or, the components shall be repaired.		OSDF Systems Plan and Sections 6.0 through 10.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-19 (E)(30)	The owner or operator shall not accept for disposal or dispose of: • whole scrap tires at a sanitary landfill facility • shredded whole scrap tires at a sanitary landfill facility.		Section 4.4 of OSDF Impacted Material Placement Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-19 (J)(1),(4)	Surface water shall be diverted from areas where solid waste is being, or has been, deposited. The facility shall be designed, constructed, maintained, and provided with surface water control structures, as necessary, to control run-on and run-off of surface water to ensure minimal infiltration of water through the cover material and cap system, and minimal erosion of the cover material and cap system. If ponding or erosion occurs on areas of the landfill facility where solid waste is being, or has been, deposited, action will be taken to correct the conditions causing the ponding or erosion.		Sections 2.8.3 and 2.8.4 of OSDF DCP, Sections 12.0 and 13.0 of OSDF Calculation Package, and Section 5.0 of OSDF Surface Water Management and Erosion Control Plan
OAC 3745-27-19 (K)(1)	If leachate is detected on the surface of the landfill facility, then the outbreak(s) shall be repaired and: • leachate shall be contained and properly managed at the sanitary landfill facility. • if necessary, leachate shall be collected and disposed in accordance with paragraph (K)(5) and (K)(6) of OAC 3745-27-19. • actions shall be taken to minimize, control, or eliminate the conditions which contribute to the production of leachate.		Section 3.0 of OSDF Systems Plan and Sections 6.0 and 10.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-19 (K)(2)	At least one lift station back-up pump shall be kept at the sanitary waste landfill facility at all times.		Section 2.5.3 of OSDF DCP
OAC 3745-27-19 (K)(3)	The collection pipe network of the leachate management system shall be inspected after placement of the initial lift of waste to ensure that crushing has not occurred and shall be inspected annually thereafter to ensure that clogging has not occurred.		Section 3.4 of OSDF Systems Plan and Section 6.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-19 (K)(4)	If authorized by the Director, leachate may be temporarily stored within the limits of solid waste placement until the leachate can be treated and disposed.		Section 2.5.3 of OSDF DCP
OAC 3745-27-19 (K)(5)	The owner shall treat and dispose of collected leachate in accordance with the following: • Treat and dispose of collected leachate on site at the sanitary landfill facility; • Pre-treat collected leachate on site and dispose of collected leachate off site of the sanitary landfill facility; or		Section 9.1.5 of Operable Unit 5 ROD

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-19 (K)(5) (continued)	• Treat and dispose of collected leachate off site of the sanitary landfill facility.		
OAC 3745-27-19 (K)(6)	The owner or operator shall prepare a contingency plan for the storage and disposal of leachate and place a copy in the operating record. The plan shall describe the immediate and long-term steps, including the setting aside of land for the construction and operation of an on-site treatment facility, to be taken for leachate management in the event that collected leachate cannot be managed in accordance with the management option selected in paragraph (K)(5) of this rule.		Section 6.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-19 (M)(4),(5)	The owner annually shall report: • A summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year; • Location of leachate treatment and/or disposal; • Verification that the leachate management system is operating in accordance with this rule; and • Results of analytical testing of an annual grab sample from the leachate management system.		Section 6.0 of OSDF Post-Closure Care and Inspection Plan and Section 5.0 of OSDF Groundwater/Leak Detection and Leachate Monitoring Plan
OAC 3745-27-10	The groundwater monitoring system for detection monitoring, assessment monitoring, or corrective measures shall consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from both the uppermost aquifer system and any significant zones of saturation that exist above the uppermost aquifer system that: • represent the quality of the background groundwater that has not been affected by past or present operations; and • represent the quality of the groundwater passing directly downgradient of the limits of solid waste placement.		Section 4.0 of OSDF Groundwater/Leak Detection and Leachate Monitoring Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-10 (continued)	The groundwater monitoring program shall include consistent sampling and analysis procedures and statistical methods that are protective of human health and the environment and that are designed to ensure monitoring results that provide an accurate presentation of groundwater quality at the background and downgradient well. If contamination from the landfill is discovered, corrective measures shall be taken.		
OAC 3745-27-11 (A), (B), (G)(1)-(3), (G)(7)	It is the responsibility of the permittee to complete final closure of the solid waste landfill facility in a manner that minimizes the need for further maintenance and minimizes postclosure formation and release of leachate and explosive gases to air, soil, groundwater, or surface water to the extent necessary to protect human health and the environment. The adequacy of closure methods must be approved by OEPA for cap design, soil barrier layer, granular drainage layer, and vegetative cover.		Section 2.6 of OSDF DCP
OAC 3745-27-11 (H)	At final closure of a landfill facility:		
	• all land surfaces shall be graded to prevent ponding of water where solid waste has been placed. Drainage facilities shall be provided to direct surface water from the landfill facility.		Drawings G-11, G-30, and G-31 of OSDF Design and Section 5.0 of OSDF Surface Water Management and Erosion Control Plan
	• a groundwater monitoring system shall be designed and installed in accordance with OAC 3745-27-10, if a system is not already in place.		OSDF Groundwater/Leak Detection and Leachate Monitoring Plan
OAC 3745-27-11 (O)	Closure of the sanitary landfill facility must be completed in a manner that minimizes the need for further maintenance and minimizes post-closure formation and release of leachate and explosive gases to air, soil, groundwater, or surface water to the extent necessary to protect human health and the environment.		Section 2.6 of OSDF DCP

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(15)	A composite cap system which shall minimize infiltration, must be constructed in all areas of solid waste placement:		
	• The cap system shall have a slope of between 5% and 25% or some greater slope based on stability analyses.		Section 2.6.9 of OSDF DCP and Drawing G-11 of OSDF Design
	• The cap system shall have a maximum projected erosion rate of 5 tons/acre/year.		Section 2.6.3 of OSDf DCP and Section 11.3 of OSDF Calculation Package
	• Any penetrations into the cap system shall be sealed so that the integrity of the soil barrier layer is maintained.		Section 2.6.9 of OSDF DCP and Section 02225 of OSDF Specification Package
	The cap system shall, at a minimum, consist of the following (from bottom to top):		
	Recompacted Soil Barrier Layer		
	The recompacted soil barrier layer of the cap shall be:		
	• a minimum of 18 inches thick and constructed in accordance with the specifications outlined above for construction of the recompacted soil liner for a landfill facility ((C)(1)(a) to (C)(1)(g) and (C)(1)(m) to (C)(1)(o) of OAC 3745-27-08) with the exception that the maximum permeability of the recompacted soil barrier shall be $1x10^{-6}$ cm/sec; OR		Section 2.6.9 of OSDF DCP, Drawings G-22 through G-25 of OSDF Design, and Section 02225 of OSDF Specification Package
	• a geosynthetic clay liner of equal or less permeability as the recompacted soil barrier layer, with an engineered subgrade constructed in accordance with the following requirements:		Section 2.6.9 of OSDF DCP and Section 02772 of OSDF Specification Package
	- The thickness of the subgrade shall be sufficient to achieve an evenly graded surface and shall be a minimum of 12 inches. - Be constructed of a soil with 100% of the particles have a maximum dimension not greater than 2 inches and with not more than 10% of the particles, by weight, having a dimension greater than 0.75 inches.		Section 2.6.9 of OSDF DCP and Section 02200 of OSDF Specification Package

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(15) (continued)	- Be compacted to at least 95% of the maximum "Standard Proctor Density" using ASTM D-698 or at least 90% of the maximum "Modified Proctor Density" using ASTM D-1557. - After being smooth-rolled, the surface shall not have sharp edged or protruding particles.		
	- The particle size and proctor density required shall be verified by tests performed on representative samples based on the variability and homogeneity of the material, but no less than a minimum of once for every 5,000 cubic yards of material used in the engineered subgrade. - Field density testing shall be performed at a frequency not less than 5 tests per acre. Any penetrations in the subgrade as a result of the testing must be repaired using bentonite or a bentonite-soil mixture.		Section 2.6.9 of OSDF DCP and Section 6.0 of OSDF Construction Quality Assurance Plan
	Flexible Membrane Liner		
	The flexible membrane liner for the cap system shall be constructed on top of the soil barrier layer or geosynthetic clay liner in accordance with the specifications listed above for a flexible membrane liner for a landfill facility [OAC 3745-27-08 (C)(2)].		Section 2.6.9 of OSDF DCP, Section 02770 of OSDF Specification Package, and Drawings G-26 through G-29 of OSDF Design
	Drainage Layer		
	The drainage layer shall be:		
	• a minimum of 1 foot of granular material; <u>OR</u>		Section 2.6.7 of OSDF DCP and Drawings G-26 through G-29 of OSDF Design
	• a drainage net that has equivalent performance capabilities as the granular material.	DOE does not currently anticipate utilizing these alternative provisions.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(15) (continued)	• constructed on top of the flexible membrane liner in accordance with the specifications outlined above for the drainage layer included in the leachate management system of a sanitary landfill facility ((C)(4)(a) of 3745-27-08 of the OAC).		Section 2.6.7 of OSDF DCP and Drawings G-26 through G-29 of OSDF Design
	Frost Protection Layer		
	The frost protection layer shall be: • placed on top of the drainage layer. • a minimum of 30 inches thick. If the drainage layer is constructed with granular material instead of a drainage net, the drainage layer may be used as part of the frost protection layer.		Section 11.4 of OSDF Calculation Package
	Soil Vegetative Layer		
	The soil vegetative layer shall: • consist of soil and vegetation placed on top of the frost protection layer. • have soil of sufficient thickness and fertility to support its vegetation and to protect the recompacted soil barrier layer and flexible membrane liner from damage due to root penetration. • have healthy grasses or other vegetation that form a complete and dense vegetative cover. Soil from the frost protection layer may be used as a part of the vegetative layer.		Sections 2.6.3 and 2.6.4 of OSDF DCP, Drawings G-26 through G-29 of OSDF Design, and Sections 02250, 02920, and 02930 of OSDF Specification Package
	Comparable materials and/or thicknesses for the soil barrier layer, the granular drainage layer, and the soil vegetative layer may be used if approved by the Director.	DOE does not currently anticipate utilizing these alternative provisions.	
OAC 3745-20-06	Each owner or operator of an active asbestos waste disposal site shall cause or permit no visible emissions to the outside air; or shall comply with the following requirements. Rather than meet the no visible emissions requirement above, each owner or operator of an active asbestos waste disposal site shall comply with the following:		Section 8.6 of OSDF Impacted Material Placement Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-20-06 (continued)	• There shall be no visible emissions from asbestos-containing waste materials during the on-site transportation, transfer, deposition, or compacting operations. • Deposition and burial operations shall be conducted in a manner which prevents handling by equipment or persons that causes asbestos-containing waste materials to be broken-up or dispersed before the materials are buried. • As soon as practicable after deposition of the asbestos-containing waste materials but no later than at the end of each operating day, the asbestos-containing waste material deposited at the site during the operating day shall be buried with at least 12 inches of compacted nonasbestos-containing material. • During the unloading, deposition, burial, and initial compaction of asbestos-containing waste materials, the owner or operator of the active waste disposal site shall establish a restricted area adequate to deter the unauthorized entry of the general public and any unauthorized personnel from any location within 100 feet of operations.		
OAC 3745-20-07(A), (C)	Prohibits visible emissions from asbestos-containing materials from an inactive asbestos waste disposal site, and requires at least 6 inches of cover of compacted non-asbestos containing material over that asbestos-containing material and growth and maintenance of a cover of vegetation on an area adequate to prevent exposure of the asbestos-containing waste material, or at least 2 feet of cover of compacted non-asbestos containing material, and maintenance of that cover to prevent exposure to the asbestos-containing waste material.		Section 8.6 of OSDF Impacted Material Placement Plan
OAC 3745-27-11 (H)(5)(b)	A notation must be recorded on the deed to the sanitary landfill facility property, or on some other instrument which is normally examined during title search, that will in perpetuity notify any potential purchaser of the property that the land has been used as a sanitary landfill facility. The notation shall include information describing acreage, exact location, depth, volume, and nature of the solid waste deposited in the sanitary landfill facility.		Section 4.5 of OSDF Post-Closure Care and Inspection Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-14 (A)(1),(2)	Following completion of final closure activities in accordance with rule 3745-27-11 of the OAC, post-closure care activities shall be conducted at the sanitary landfill facility for a minimum of 30 years.		Section 1.1 of OSDF Post-Closure Care and Inspection Plan
	Post-closure care activities for all sanitary landfill facilities shall include, but are not limited to:		
	• continuing operation and maintenance of the leachate management system, the surface water management system, any explosive gas extraction and/or control system, any explosive gas monitoring system, and the groundwater monitoring system		Sections 5.0, 6.0, and 9.0 of OSDF Post-Closure Care and Inspection Plan
	• maintaining the integrity and effectiveness of the cap system, including making repairs to the cap system as necessary to correct the effects of settling, dead vegetation, subsidence, erosion, leachate outbreaks, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cap system		Section 4.0 of OSDF Systems Plan and Section 9.3.2 of Post-Closure Care and Inspection Plan
40 CFR §258.61	The Director of Ohio EPA may allow the owner or operator to stop managing leachate if the owner or operator demonstrates that leachate no longer poses a threat to human health and the environment.		Section 6.0 of OSDF Post-Closure Care and Inspection Plan
40 CFR §257.3-2	Solid waste disposal facilities or practices shall not cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife. Solid waste disposal facilities or practices shall not result in the destruction or adverse modification of the critical habitat of endangered or threatened species as identified in 50 CFR Part 17.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
OAC 3745-27-20 (C)(2)	The limits of solid waste placement and the leachate management system cannot be located in a regulatory floodplain, unless deemed acceptable by the Director.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(4)(d)	The limits of waste placement cannot be located within 200 feet of a stream, lake, or wetland, unless deemed acceptable by the Director.	See Table B-1 of Appendix B of this plan.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(3)(a)	A sanitary landfill facility may not be located within the surface and subsurface areas surrounding a public water supply well through which contaminants may move toward and may reach the public water supply well within a period of 5 years.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OEPA GD202.105	The minimum distance to a public water supply will be considered by application of this criteria: • The five-year time of travel shall be calculated between the boundary of the solid waste landfill facility and the closest public water supply. A period of no less than five years will be required before groundwater flowing in a downgradient direction from the facility can intersect with a public water supply well screen. To be considered for an exemption from this rule, the following will need to be demonstrated: • that there is at least 50 feet of separation between the bottom of the solid waste landfill facility liner and the aquifer system in which the public water supply well is screened; • that any release of leachate will be detected before reaching the aquifer system in which the public water supply well is screened; and • that once leachate is released below the liner, the leachate will not reach the aquifer system in which the public water supply will is screened within a time span of 100 years plus the anticipated life of the solid waste landfill facility, which shall include the 30-year postclosure care period.	DOE does not currently anticipate utilizing this exemption.	
OAC 3745-27-07 (H)(2)(c)	A sanitary landfill facility cannot be located above an aquifer declared by the federal government under the Safe Drinking Water Act to be a sole source aquifer.	A waiver from this requirement has been granted by U.S. EPA.	Section 2.1.2 of OSDF DCP, Section 7.5.4 of Operable Unit 2 ROD, Sections 9.2.1 and 9.2.2 of Operable Unit 3 ROD, and Sections 10.2.1. and 10.2.2 of Operable Unit 5 ROD
OEPA GD202.101	The Director may grant an exemption to the prohibition of siting a solid waste landfill facility over a sole-source aquifer under ORC 3743.02(G). In order to grant an exemption, the Director needs to determine that no adverse impact to human health or safety or the environment will occur due to granting the exemption. The decision to grant an exemption from this rule is made on a site-by-site basis.	DOE does not currently anticipate utilizing this exemption.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OEPA GD202.101 (continued)	Among the items that should be considered when determining if a waiver will be granted are whether a significant thickness of low permeable material exists between the landfill facility liner and the sole-source aquifer and whether there is an interconnection between the sole-source aquifer and any significant saturated zones which exist above the sole-source aquifer.		
OAC 3745-27-07 (H)(2)(d)	A sanitary landfill facility cannot be located above an unconsolidated aquifer capable of sustaining a yield of 100 gallons per minute for a 24-hour period to an existing or future water supply well located within 1,000 feet of the limits of solid waste placement, unless deemed acceptable by the Director.	A waiver from this requirement has been granted by U.S. EPA.	Section 2.1.2 of OSDF DCP and Section 7.5.4 of Operable Unit 2 ROD, Sections 9.2.1 and 9.2.2 of Operable Unit 3 ROD, and Sections 10.2.1. and 10.2.2 of Operable Unit 5 ROD
OEPA GD202.102	An exemption to the prohibition of siting a solid waste landfill facility over an unconsolidated aquifer capable of sustaining a yield of 100 gallons per minute for a 24-hour period may be obtained by demonstrating that the thickness and lack of permeability of the sediment that exists between the bottom of the proposed landfill facility liner and the top of the unconsolidated high-yield aquifer from the effects of a release of leachate from the solid waste landfill facility. The sediment should prevent leachate from migrating from the bottom of the facility liner to the high-yield aquifer in a time period equal to the active life of the facility, including the postclosure care period.	DOE does not currently anticipate utilizing this exemption.	
OAC 3745-27-07 (H)(3)(c)	The limits of solid waste placement cannot be located within 1,000 feet of an existing water supply well or developed spring unless it is deemed acceptable by the Director or it is: • controlled by the applicant, is needed as a source of nonpotable water, no other reasonable alternate water source is available, and the well is constructed to prevent contamination of the groundwater, OR • located at least 500 feet hydrogeologically up-gradient from the limits of solid waste placement, OR	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-07 (H)(3)(c) (continued)	• separated from the limits of solid waste placement by a hydrogeologic barrier, OR • constructed and used solely for monitoring groundwater quality		
OEPA GD202.103	This guidance clarifies when exceptions to the required 1000-foot isolation distance from water supply wells and developed springs apply and when a situation contrary to the rule can be deemed acceptable to the Director of OEPA.	DOE does not currently anticipate utilizing this exemption.	
OAC 3745-27-07 (H)(2)(e)	The isolation distance between the uppermost aquifer system and the bottom of the recompacted soil liner of a sanitary landfill system cannot be less than 15 feet of in situ or added geologic material deemed acceptable by the Director.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP, Section 4.2.1 of OSDF Predesign Investigation Report, and Drawings X-13 through X-15 of OSDF Design
OEPA GD202.104	For geologic material to be deemed acceptable to the Director as added fill under OAC Rule 3745-27-07 (B)(15), it must be able to meet the following criteria: • the geologic material must be impermeable enough so it will not store, transmit or yield a significant amount of water to a well or spring • the geologic material must be able to impede both physically and chemically, the flow of leachate constituents through it In order to meet both criteria listed above, the added geologic material should: • be classified as CL, SC, GC, CL-ML, or CH under the Unified Soil Classification System (USCS) • be composed of particles of which at least 25% by dry weight will pass through a No. 200 (75 μm) sieve • be composed of no more than 25% by dry weight particles which will not pass through a No. 4 sieve • no particle should be greater than 8 inches in diameter	DOE does not currently anticipate utilizing these alternative provisions.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OEPA GD202.104 (continued)	• have a final permeability of no more than $1x10^{-8}$ cm/sec • be recompacted in a manner that when the landfill is constructed on it, no damage to the landfill liner will occur due to settling of the added material		
OAC 3745-27-07 (H)(1)	The limits of solid waste placement cannot be located in any of the following areas: • national park or recreation area; • candidate area for potential inclusion in the national park system; • tate park or established state park purchase area; or • any property that lies within the boundaries of a national park or recreation area but that has not been acquired or in not administered by the secretary of the United States Department of the Interior.	The location of the OSDF fulfills these requirements.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(2)(a)	The solid waste disposal facility cannot be located in a sand or gravel pit where the sand or gravel deposit has not been completely removed.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(2)(b)	The solid waste disposal facility cannot be located in a limestone quarry or sandstone quarry, unless deemed acceptable by the Director.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(3)(b)	The solid waste landfill cannot be located within an area of potential subsidence due to an underground mine.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(4)(a)	The limits of solid waste placement cannot be located within 1,000 feet of the following: • areas designated by the Ohio Department of Natural Resources as either a state nature preserve, a state wildlife area, or a state scenic river; • areas designated, owned, and managed by the Ohio Historical Society as a nature preserve; • areas designated by the United States Department of the Interior as either a national wildlife refuge or a national scenic river;	The location of the OSDF fulfills these requirements.	Section 2.1.2 of OSDF DCP

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-07 (H)(4)(a) (continued)	• areas designated by the United States Forest Service as either a special interest area or a research natural area in the Wayne National Forest; or • stream segments designated by Ohio EPA as either a state resource water, a coldwater habitat, or an exceptional warmwater habitat.		
OAC 3745-27-07 (H)(4)(b)	The limits of waste placement cannot be located within 300 feet of the sanitary landfill facility's property line, unless deemed acceptable by the Director.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP and Drawing X-4 of OSDF Design
OAC 3745-27-07 (H)(4)(c)	The limits of solid waste placement cannot be located within 1,000 feet of an existing domicile whose owner has not consented in writing to the location of the sanitary landfill facility.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
OAC 3745-27-20 (C)(3)	The limits of solid waste placement cannot be located within 200 feet of a fault that has had displacement in Holocene time unless the owner or operator can demonstrate that a distance less than 200 feet will prevent damage to the structural integrity of the solid.waste landfill.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
ORC 3734.02(A)	The director of environmental protection shall adopt and may modify, suspend, or repeal rules for all solid waste facilities in order to ensure that the facilities will be located, maintained, and operated, and will undergo closure and post-closure care, in a sanitary manner so as not to create a nuisance, cause or contribute to water pollution, create a health hazard, or violate 40 CFR § 257.3-2 or 257.3-8.	The design of the OSDF fulfills this requirement.	
OAC 3745-27-19(N)	The permittee shall submit to the Director of the OEPA, upon every 10th anniversary of the effective date of a permit to install that approved the initial construction of the facility, an analysis demonstrating that the design, construction, and final closure plan of the solid waste landfill facility continue to constitute the best available technology.	This requirement will be met through the CERCLA five-year review process.	Section 9.1 of Operable Unit 2 ROD, Section 9.0 of Operable Unit 3 ROD, and Section 10.0 of Operable Unit 5 ROD

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-19(N) (continued)	If the Director of the OEPA determines that the design is no longer consistent with best available technology as being applied to the solid waste landfill industry in the State of Ohio, the permittee may be required to submit a permit to install application for necessary modifications to the landfill facilities. If a permit to install is required, the Director of the OEPA shall not apply the siting criteria outlined in paragraph (H) of OAC 3745-27-07 when considering the permit to install application.		

BORROW AREA MANAGEMENT AND RESTORATION PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-003
REVISION 0
MAY 1997

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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APPENDIX A: GEOTECHNICAL DATA SUMMARY

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1.0 INTRODUCTION

1.1 Overview

This Borrow Area Management and Restoration (BAMR) Plan describes the management and restoration activities that will be undertaken for obtaining on-site borrow soils for construction, filling, and closure of the Fernald Environmental Management Project (FEMP) On-Site Disposal Facility (OSDF), Fernald, Ohio. These activities are conducted primarily at the East Field Borrow Area (borrow area) located south of the OSDF and east of the South Entrance Road. Borrow activities conducted within the footprint of the OSDF are also briefly described.

This plan addresses management and restoration activities at the borrow area throughout construction, impacted material placement, and closure of the OSDF, as prescribed in the *"Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)"* [DOE, 1995a]. The plan does not address maintenance activities beyond final restoration of the borrow area.

1.2 Project Description

The OSDF will be constructed to permanently contain impacted materials derived from remediation of the operable units at the FEMP. All material destined for OSDF disposal will be required to meet OSDF waste acceptance criteria (WAC). The estimated total volume of material destined for OSDF disposal is 2.5 million cubic yards (1.9 million cubic meters) bank/unbulked. Approximately 80 percent of this material is impacted soil, with the remainder consisting of building demolition rubble, fly ash, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials.

The design approach for the OSDF is presented in the document, *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2"* [DOE, 1995b]. The design of the OSDF, as currently developed, is presented in the *"Final Design Package, On-Site Disposal Facility"* [GeoSyntec, 1997a]. The design of the OSDF includes a liner system, impacted material

placement, final cover system, leachate management system, surface-water management system, and other ancillary features.

The construction, impacted material placement, and closure of the OSDF is currently scheduled to occur over a period of approximately 7 years, as described in the Accelerated Remediation Plan. However, due to the potential for variations in the pace of remedial action activities, the OSDF has been designed to be constructed, filled, and closed in phases.

1.3 Plan Scope

The scope of this BAMR Plan is to identify the development, management, and restoration activities that the Subcontractor shall follow to ensure proper development of the borrow area in accordance with the design. Activities to be undertaken by the contractor before, during, and after borrow excavation occurs are discussed in this plan.

1.4 Plan Organization

The remainder of this BAMR Plan is organized as follows:

- the design requirements applicable to this work plan are presented in Section 2;
- a description of the borrow area is presented in Section 3.0;
- borrow area operations are described in Section 4.0;
- the borrow area sequence of development is contained in Section 5.0 and;
- borrow activities at the OSDF footprint are described in Section 6.0.

1.5 Related Plans

Several other implementation plans have been prepared for the OSDF that contain information relevant to this BAMR Plan. Other plans of direct relevance to this BAMR Plan are listed below along with a brief statement of the relationship of the work plan to this plan:

- *OSDF Surface-Water Management and Erosion Control (SWMEC) Plan [GeoSyntec, 1997b]:* provides details of temporary and permanent erosion and sediment controls and surface-water controls for the borrow area;

- *Final Design Package, On-Site Disposal Facility [GeoSyntec, 1997a]:* provides project drawings and specifications that shall be followed during construction and;

- *OSDF Construction Quality Assurance (CQA) Plan [GeoSyntec, 1997c]:* provides soil testing standards and frequencies that will be implemented to evaluate soils from the borrow area.

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2.0 APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to the BAMR Plan are contained in the Design Criteria Package (DCP) for the OSDF. The DCP is contained within the overall OSDF Final Design Package [GeoSyntec, 1997a]. These requirements take the form of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) as determined in by the record of decision for each of the various FEMP operable units, functional requirements, and general design criteria. There are no ARARs, TBCs, or functional requirements for the development of the borrow area. The general design criteria applicable to the BAMR Plan were obtained from the DCP.

2.2 General Design Criteria

The DCP identifies a number of general design criteria for the OSDF. The general design criteria that the Subcontractor shall meet in developing the borrow area:

- The borrow area should be laid out in a manner that provides easy ingress and egress.
- The borrow area shall be developed in a manner that requires minimal additional earthwork after borrow activities are complete to achieve the required restoration grades.
- Restoration shall be performed progressively as work is completed in portions of the borrow area.
- Erosion and sediment controls shall be implemented in the borrow area during construction and restoration.

- The borrow area shall be developed in a manner that produces consistent materials for construction of the OSDF and effectively utilizes the existing topography to control stormwater runoff and runon.

- Processing of borrow area soils shall be in accordance with the applicable requirements of the project specifications. Such processing includes moisture conditioning and screening.

- Before the start of construction in the borrow area, the following activities shall be performed:

  - establishment of temporary surface water management and erosion and sediment controls for the borrow area, including sediment basins;
  - establishment of soil processing facilities (if any are needed).

3.0 BORROW AREA DESCRIPTION

3.1 Existing Conditions

The borrow area is located in the southeast portion of the FEMP south of the OSDF. It is bounded to the north by the relocated North Entrance Road, to the west by the South Entrance Road, to the south by Willey Road, and to the east by an oil pipe line easement. The total plan area of the borrow area is approximately 50 acres (20 hectares).

The existing topography at the borrow area is relatively flat with surface elevations ranging from 606 ft. to 575 ft. Surface water flows generally from east to west along slopes ranging from approximately one to eight percent. Surface water runoff crosses the South Entrance Road via three reinforced concrete pipe culverts and discharges ultimately to Paddys Run.

Perched ground-water potentiometric surfaces in the borrow area range from approximately 5 ft. to 15 ft. (1.5 m to 4.6 m) below the existing ground surface. Perched ground water potentiometric levels may locally approach the ground surface after periods of heavy precipitation. Perched ground water is expected to be present in sand and gravel lenses below this potentiometric surface and to extend from these depths to below the proposed finished grades of the borrow area.

The existing vegetative cover at the borrow area consists of long grasses in good condition.

3.2 On-Site Borrow Material

3.2.1 Uses for Borrow Soils

Material excavated from the borrow area will be used to construct several components of the OSDF liner and final cover system as well as compacted fill used in construction of

temporary and permanent roads and other site work applications. The components of the liner and final cover system to be constructed from borrow area materials are (from bottom to top):

- compacted clay liner;
- compacted clay cap; and
- vegetative support layer.

The topsoil layer will be stripped from the borrow area and used for topsoil for the OSDF final cover system.

If needed, material from the borrow area will also be used to construct compacted fill, seasonal cover, the non-granular protective layer in the lining system and the contouring layer above the impacted materials, should sufficient volume of suitable impacted materials not be available for the construction of these components.

3.2.2 Description of Borrow Area Soils

The soil profile at the borrow area consists of a clay-loam topsoil layer overlying a 10- to 18-foot (3-m to 5.5-m) thick brown till layer, overlying a 10- to 20-ft. (3-6 m) thick gray till layer. Brown till will be used to construct the earthwork components of the OSDF discussed in the previous section. The brown till layer is a lean clay to sandy lean clay with the following properties and characteristics:

- plasticity index (PI): 8 to 30
- clay content: 12 to 48 percent
- moisture content (in-situ): 10 to 28 percent

- percent saturation: 86 to 100 percent
- dry unit weight (in-situ): 102 to 130 lbs/ft^3

The plasticity index, clay content, and moisture content of the brown till tend to decrease with depth. The percent saturation and dry unit weight of the brown till tend to increase with depth. Geotechnical data obtained from previous field investigations conducted at both the borrow area and the OSDF are summarized in Appendix A.

Additional information on the geotechnical characteristics of the brown fill from the borrow area can be found in Parsons [1996].

It is anticipated that not all of the borrow area soils will be suitable for construction of the clay liner and/or clay cap. These unsuitable materials shall be separated as described in a later section of this plan and used in the construction of the other OSDF and cover system components or general site work construction previously described.

3.2.3 Borrow Soils

Prior to constructing any OSDF cells, brown till at the OSDF footprint shall be excavated to the required grade in accordance with Section 02200 of the technical Specifications. The depth of excavation to subgrade at the OSDF footprint ranges from zero to 15 ft. A small portion of this excavated material will be impacted material requiring disposal in the OSDF. The remaining portion of this material will be used for construction of the compacted clay liner, if suitable, or other applicable components of the OSDF. Although the OSDF footprint is not within the limits of the borrow area, the procedures for removing and handling the material is similar to those procedures for materials excavated from the borrow area. Borrow activities associated with the OSDF footprint are, therefore, discussed in this plan (Section 6).

This BAMR assumes that impacted soil is removed from within the OSDF footprint prior to the start of excavation by the Subcontractor. If it is decided that impacted material will be removed concurrently with cell construction, this BAMR Plan shall be amended to reflect changes or additional work necessitated by the concurrent activities.

4.0 BORROW AREA OPERATIONS

4.1 General

Borrow area operations include activities that occur prior to, during, and after excavation of the borrow materials. These activities are presented in detail in the following sections. At the time this BAMR Plan was prepared, no impacted areas have been identified in the borrow area; thus, impacted material removal is not discussed in this plan. Should impacted material be identified in the borrow area, this BAMR Plan will either be amended to reflect changes or additional work necessitated by the presence of the impacted material.

4.2 Erosion and Sediment Controls

Erosion and sediment controls that shall be implemented at the borrow area include silt fence, straw bale barriers, sediment basin, drainage channels, and vegetation. These controls shall be implemented as required by Section 6 of the Specifications and the *OSDF SWMEC Plan*. The erosion and sediment controls shall be implemented as required to effectively divert surface water runon from active borrow sites within the borrow area, minimize sedimentation and erosion within the active borrow site, and collect and contain construction water within the area of active borrow. Erosion and sediment controls shall be established in the vicinity of each borrow site prior to the commencement of any soil disturbance in the borrow area.

The OSDF Subcontractor shall maintain the erosion and sediment controls in accordance with the Specifications and the *OSDF SWMEC Plan*.

4.3 Borrow Area Haul Road

The layout for the haul roads within the borrow area shall be planned prior to commencement of borrow activities. The Subcontractor may establish haul road layouts within the borrow area limits suitable for planned excavation sequence and for transportation of materials to the OSDF. Temporary drainage structures such as culverts and or drainage channels

shall be established as necessary so that surface water is not impounded in anyway by the haul road. Any temporary drainage structure utilized by the Subcontractor shall be in accordance with the Specifications and the *OSDF SWMEC Plan*.

The subcontractor shall maintain the haul roads within the borrow area and haul road to the OSDF cell construction. Once established, the borrow area haul roads shall be watered regularly for fugitive emissions control.

4.4 Clearing and Grubbing

Clearing and grubbing shall take place in areas that will be stripped for borrow activities. Clearing and grubbing shall be performed in accordance with Section 02110 of the technical Specifications. Disposal, stockpiling, or reuse of cleared and grubbed material shall also be in accordance with Section 02110.

4.5 Topsoil Removal and Stockpiling

Topsoil shall be stripped from the borrow area from an area no larger than 10 acres (4 ha). The stripped topsoil shall be stockpiled at the Subcontractor's work area at a location designated by the Construction Manager (CM) that is easily accessible by the Subcontractor for maintenance. Topsoil stockpiling and stripping shall be in accordance with Section 02110 of the technical Specifications. The stockpiled topsoil shall either be temporarily seeded in accordance with Section 02930 of the technical Specifications or covered with a tarp. If a tarp is used, it shall be sufficiently anchored with sandbags or tires to resist uplift.

4.6 Borrow Activities

Borrow activities shall begin in the vicinity of the sediment basin and proceed upgradient. Material shall be excavated from the borrow area and transported to either the point of construction or the Subcontractor's soil stockpile area. Suitability of borrow material for clay liner and clay cap will be established by the CM with the CQC Consultant performing

conformance testing. It is the responsibility of the Subcontractor to establish the suitability of all other borrow material for the proposed end use. The CQC Consultant will monitor and test soil used in construction for conformance with the Specifications based on the end use selected by the Subcontractor. Monitoring and testing by the CQC Consultant will be in accordance with the *OSDF CQA Plan*. The Subcontractor shall manage borrow materials in two separate stockpiles: one stockpile containing borrow material suitable for use as clay liner and clay cap, and one stockpile containing all other borrow material.

4.7 Borrow Area Restoration

As borrow activities continue, progressive restoration of the borrow area shall be implemented. As any active portion of the borrow area reaches final grade, it shall be permanently revegetated in accordance with Section 02930 of the Specifications. The maximum area of bare soil that may be exposed at any one time in the borrow area is 10 acres (4 ha). Once all portions of the borrow area within the contributory drainage area of a sediment basin are restored (*i.e.*, have established permanent vegetation), the sediment basin shall be decommissioned by removing the riser structure and 36-inch diameter portion of the culvert. The remaining 48-inch diameter culvert will remain as a permanent drainage structure. Decommissioning of the sediment basin shall be in accordance with the *OSDF SWMEC Plan*. Progressive restoration of the borrow area is discussed further in Section 5.0. Refer to Figure 5-1 for the approximate limits of the borrow area stages.

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5.0 SEQUENCE OF DEVELOPMENT

5.1 General

The borrow area shall be developed in two major stages in a manner that effectively utilizes the existing topography to control stormwater runoff and runon (see Figure 5-1). The dividing line between the two stages is an existing swale that crosses the borrow area in the east west direction located in the northern half of the borrow area. The area north of the existing swale represents the early stage of the borrow area and the area south of the existing swale represents the late stage of the borrow area. The development of these two stages are discussed further below.

5.2 Early Stage Development

The plan area of the early stage is approximately 21 acres (8 ha). The existing swale to the south of the early stage will intercept runon before it enters the early stage area and direct it to the existing 30-inch (0.8-m) diameter culvert at the South Entrance Road. The sequence of development for the early stage of the borrow area shall be as presented below.

1. Erosion and sediment controls shall be implemented in the vicinity of sediment basin and to the west of the South Entrance Road where a drainage channel in the borrow area will be constructed.

2. Clearing, grubbing and topsoil stripping operations shall take place in the vicinity of the sediment basin. These materials shall be handled as described in Section 4.4 (clearing and grubbing), or Section 4.5 (topsoil), as appropriate.

3. Construction of sediment basin shall begin. Construction activities include: (i) excavating for the sediment basin and removing the excavated materials as described in Section 4; (ii) excavating the culvert trench beneath the South Entrance Road (iii) seeding the base and side slopes of the sediment basin.

4. Concurrently with the construction of the sediment basin, an area suitable for establishing a soil processing operation, if needed, shall be established as described in Section 4.7.

5. The layout of the borrow area haul roads shall be planned and erosion and sediment controls shall be implemented in the vicinity of the haul roads and location of the first borrow site [not to exceed 10 acres (4 ha)] within the early stage of the borrow area.

6. Clearing, grubbing, and topsoil stripping of the borrow site shall occur as described in Section 4.4 (clearing and grubbing), or Section 4.5 (topsoil), as appropriate.

7. Borrow operations shall begin. Excavated material shall be hauled and stockpiled as described in Section 4.6. Excavation grades shall be established such that positive drainage to the sediment basin is maintained.

8. Throughout excavation operations, the Subcontractor shall maintain erosion and sediment controls.

9. As final grades are reached within the active borrow site, the finished areas shall be promptly revegetated. Topsoil need not be placed over finished grades in cut areas but the finished subgrade shall be prepared in accordance Section 02930 of the Specifications.

10. As final grades are approached throughout the first active borrow site, and vegetation has been established over much of the site, the next borrow site within the early stage shall be planned, and Step Nos. 7 through 11 above shall be implemented for each subsequent borrow site within the early stage of the borrow area.

5.3 Late Stage Development

The plan area of the late stage is approximately 29 acres (12 ha). The finished grades of the early stage developed previously will direct stormwater runoff from the early stage away from the later stage. The sequence of development for the late stage of the borrow area shall be as presented below.

1. The layout of the borrow area haul roads shall be planned and erosion and sediment controls shall be implemented in the vicinity of the haul road and location of the first borrow site [not to exceed 10 acres (4 ha)] within the late stage of the borrow area. The Subcontractor shall minimize erosion and/or sedimentation in the completed early stage of the borrow area.

2. Clearing, grubbing, and topsoil stripping of the borrow site shall occur as described in Section 4.4 (clearing and grubbing), or Section 4.5 (topsoil), as appropriate.

3. Borrow operations shall begin. Excavated material shall be hauled and stockpiled as described in Section 4.6. Excavation grades shall be established such that positive drainage to relevant erosion and sediment controls is maintained.

4. Throughout excavation operations, the Subcontractor shall maintain erosion and sediment controls.

5. As final grades are reached within the active borrow site, the finished areas shall be promptly revegetated. Topsoil need not be placed over finished grades in cut areas, but the finished subgrade shall be prepared in accordance with Section 02930 of the Specifications.

6. As final grades are approached throughout the first active borrow site, and vegetation has been established over much of the site, the next borrow site within

the late stage shall be planned, and Step Nos. 2 through 10 above shall be implemented for each subsequent borrow site within the late stage of the borrow area.

7. Once final grades are obtained throughout the late stage of the borrow area, and vegetation has been established over the entire late stage. The sediment basin shall be decommissioned in accordance with the *OSDF SWMEC Plan*.

6.0 BORROW ACTIVITIES AT THE OSDF FOOTPRINT

As discussed in Section 3.2.3, zero to 15 feet (0 to 4.6 m) of material will generally be removed from the OSDF foot print during excavation to OSDF cell subgrade elevation. The excavated material shall be used for construction of the compacted clay liner, if suitable, or other applicable components of the OSDF. The construction activities associated with this excavation are similar to those within the borrow area and are briefly described below.

Erosion and sediment controls, including sediment basins, shall be implemented in accordance with Section 02270 of the Specifications and the *OSDF SWMEC Plan*. Excavated materials shall be hauled to the point of construction or the soil stockpile area. Borrow activities shall be as described in Section 4.6 of this plan. It is anticipated that the Subcontractor will, to the extent possible, use excavated material from the OSDF footprint to construct compacted fill and compacted clay liner prior to obtaining material from the borrow area.

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7.0 REFERENCES

GeoSyntec Consultants, *"Final Design Package,"* Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1997a.

GeoSyntec Consultants, *"OSDF Surface-Water Management and Erosion Control Plan,"* Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1997b.

GeoSyntec Consultants, *"OSDF Construction Quality Assurance Plan,"* Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1997c.

Parsons, *"Geotechnical Investigation Report, On-Site Disposal Facility, Operable Unit 2, Project Order 140, Revision 0,"* prepared for FERMCO for the Fernald Environmental Management Project, Subcontract No. 2-21487, December, 1995.

Parsons, *"Preliminary Results of Borrow Area Sampling and Testing Program."*

U.S. Department of Energy (DOE), *"Final Record of Decision for Remedial Actions at Operable Unit 2,"* Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995a.

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APPENDIX A

GEOTECHNICAL DATA

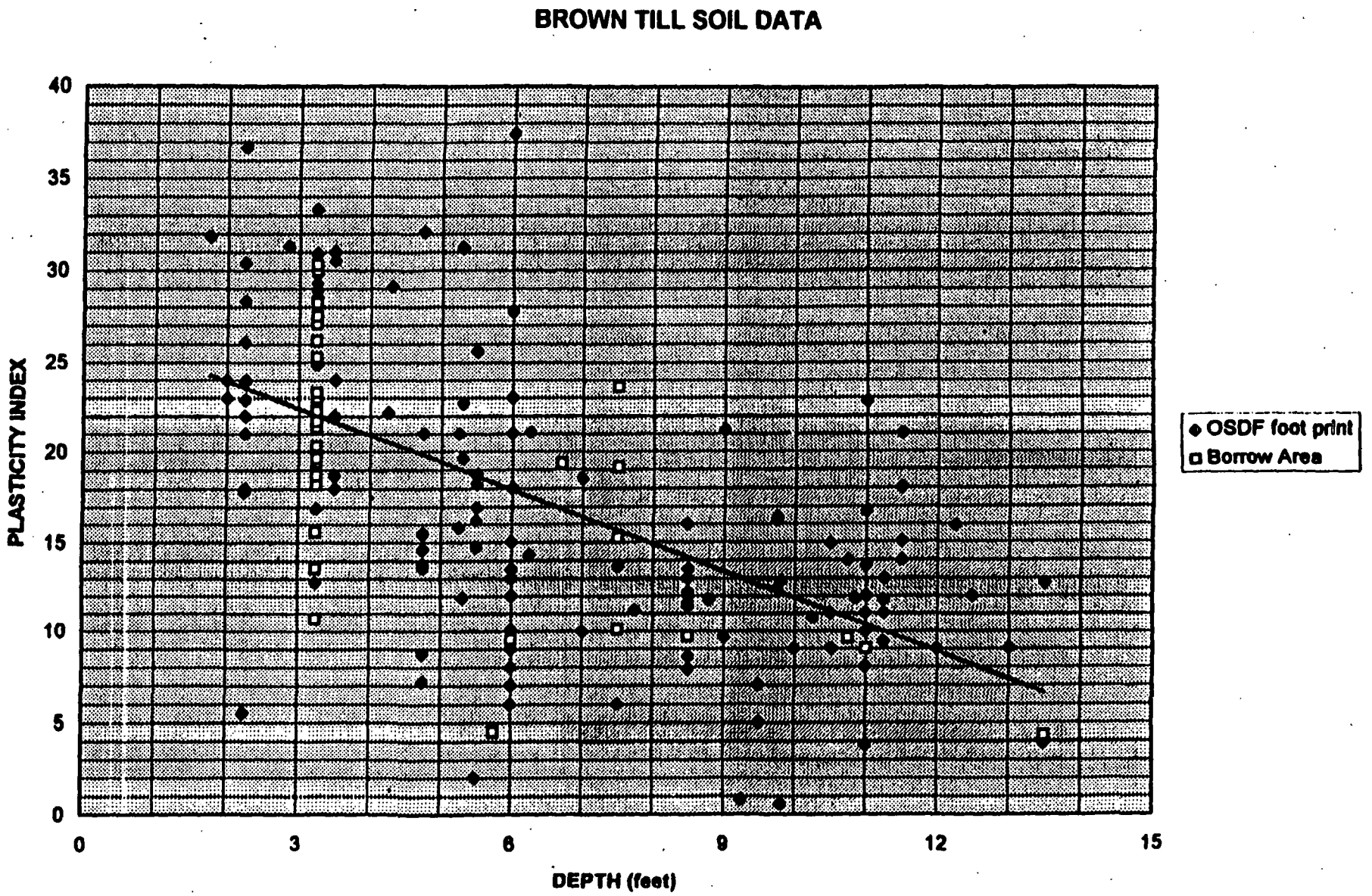


Figure 1. Brown [illegible] Plasticity Index Data

[data obtained from Parso[illegible] and 1996]

001109

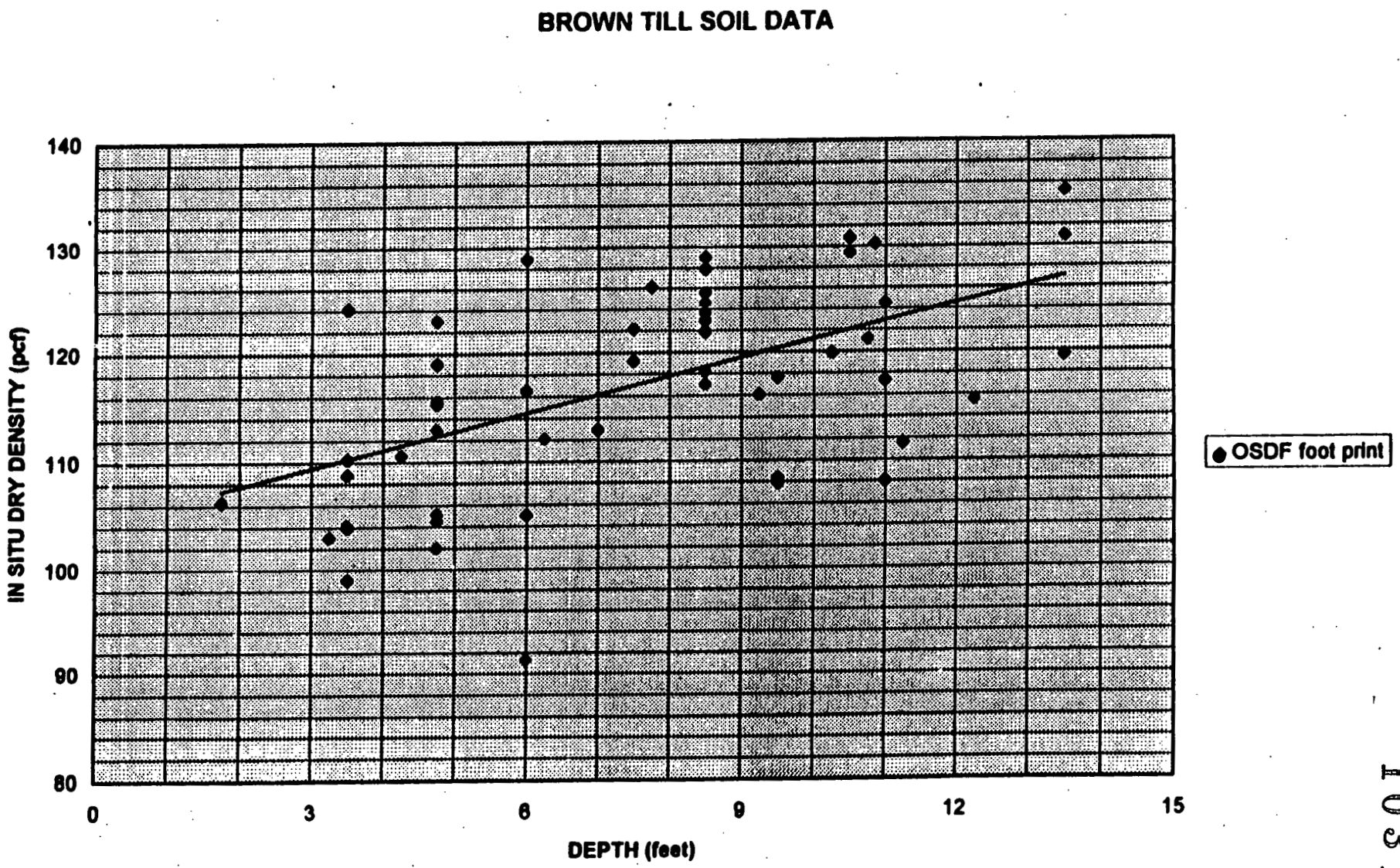


Figure 5. Brown Till In Situ Dry Density Data

[data obtained from Parsons, 1995]

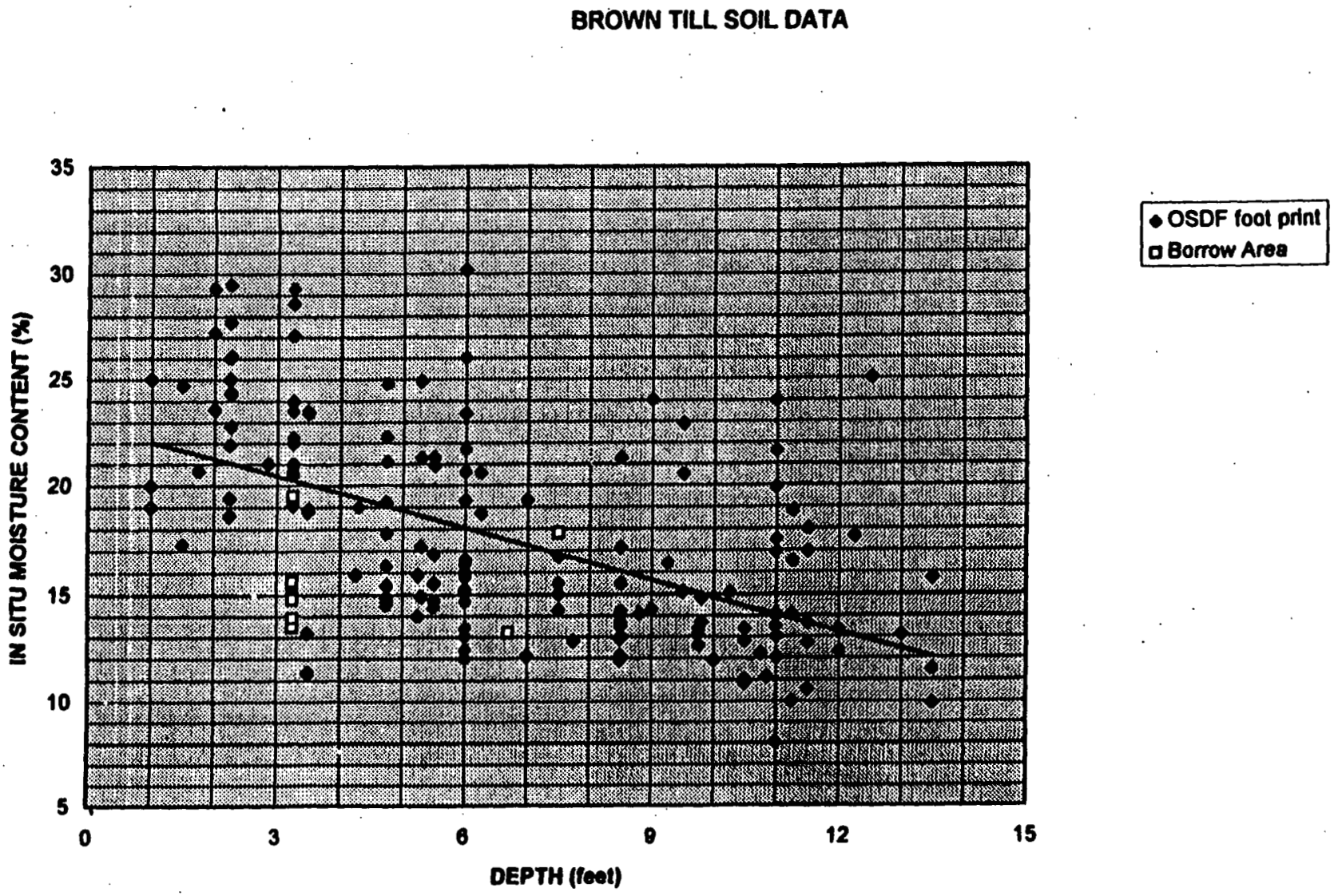
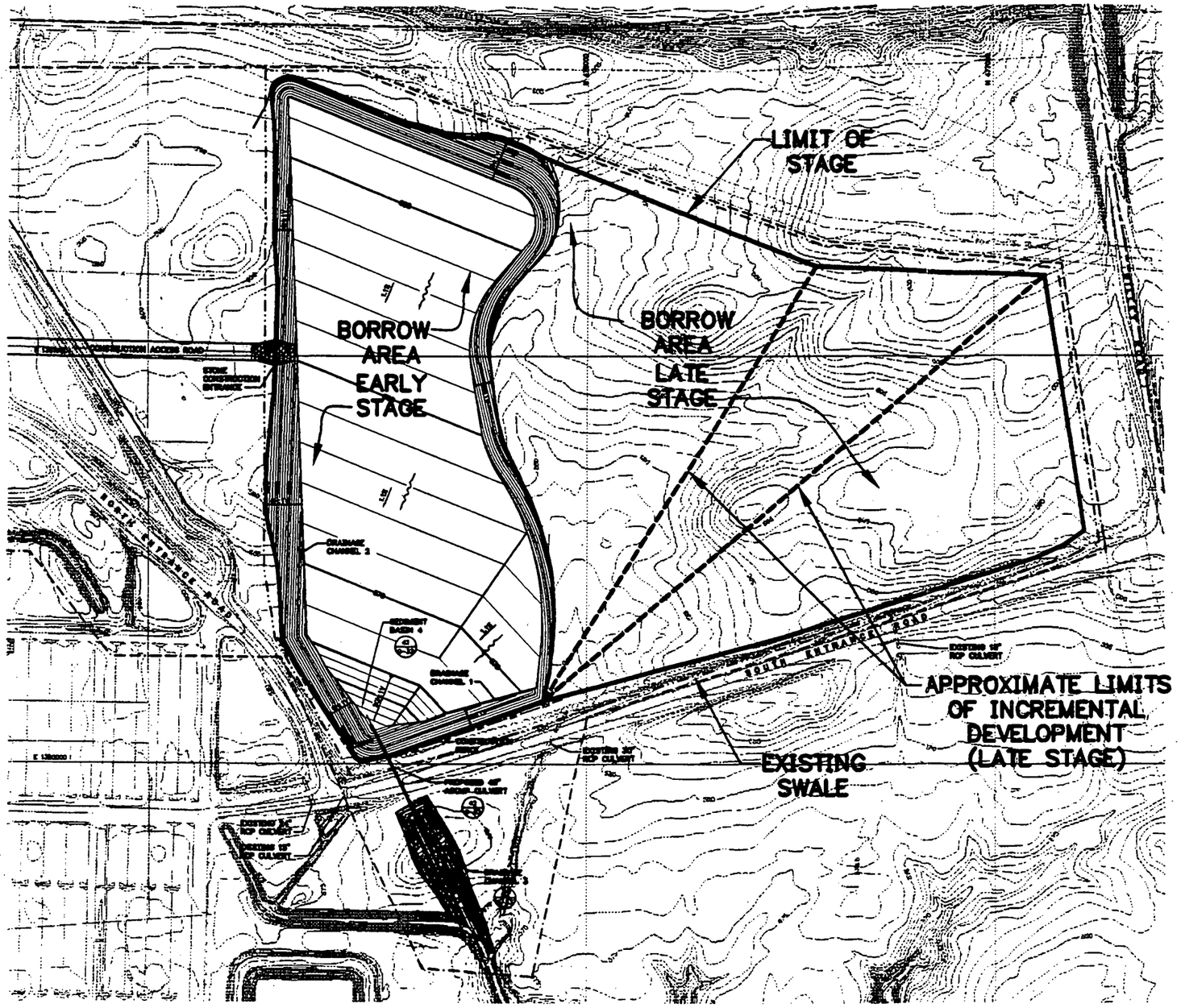


Figure 3. Brown [illegible] Situ Moisture Content Data [data obtained from [illegible] 1995 and 1996]

000111



LEGEND

600	EXISTING GROUND ELEVATION (FEET)
570	FINISHED GRADE ELEVATION (FEET)
	BATTERY LIMIT
	FEMP PROPERTY LINE
	DRAINAGE FLOW DIRECTION
	DRAINAGE CHANNEL
	LIMIT OF BORROW AREA

0 300
SCALE IN FEET

NOTES:

1. SEQUENCE OF CONSTRUCTION FOR BORROW AREA EARLY STAGE IS PRESENTED IN BORROW AREA MANAGEMENT AND RESTORATION (BAMR) PLAN.
2. DEVELOP BORROW AREA SO THAT, TO THE EXTENT POSSIBLE, RUNOFF FROM THE AREAS BEING DEVELOPED DRAINS TO SEDIMENT BASIN 4 AND RUNOFF FROM AREAS TO BE TO BE DEVELOPED IN THE FUTURE DRAINS TO THE EXISTING SWALE ON THE WEST SIDE OF THE SOUTH ENTRANCE ROAD.

GEOSYNTEC CONSULTANTS
ATLANTA, GA

PROJECT NO.	GE3900	FIGURE NO.	5-1
DOCUMENT NO.		FILE NO.	F96-G010

SURFACE-WATER MANAGEMENT AND EROSION CONTROL PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-004
Revision 0
May 1997

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

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Subcontract 95PS005028

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ACRONYM LIST

ARAR	Applicable or Relevant and Appropriate Requirement
BSL	Biodenitrification Surge Lagoon
CFR	Code of Federal Regulations
CQA	Construction Quality Assurance
DCP	Design Criteria Package
DOE	United States Department of Energy
E&S	Erosion and Sediment
FEMP	Fernald Environmental Management Project
LCS	Leachate Collection System
LTS	Leachate Transmission System
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ODNR	Ohio Department of Natural Resources
OSDF	On-Site Disposal Facility
OU2	Operable Unit 2
OU5	Operable Unit 5
ROD	Record of Decision
SWMEC	Surface Water Management and Erosion Control

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1.0 INTRODUCTION

1.1 Overview

This Surface-Water Management and Erosion Control (SWMEC) Plan describes the surface-water management and erosion control practices to be followed within the battery limit of the Fernald Environmental Management Project (FEMP) On-Site Disposal Facility (OSDF), Fernald, Ohio. The guidance provided in this document applies to the use of engineered features designed to manage surface water, minimize erosion, and control off-site sedimentation.

This plan addresses surface-water management and erosion control practices throughout the construction, impacted material placement, and closure of the OSDF. This plan does not address surface-water management and erosion control practices during or beyond the 30-year post-closure period prescribed in the *"Final Record of Decision for Remedial Actions at Operable Unit 2" (OU2 ROD)* [DOE, 1995a]. Those activities are addressed in the *OSDF Post-Closure Care and Inspection Plan*.

1.2 Project Description

The construction, impacted material placement, and closure of the OSDF is currently scheduled to occur over a period of approximately 7 years, as described in the Accelerated Remediation Plan. However, due to the potential for variations in the pace of remedial action activities, the OSDF has been designed to be constructed, impacted material placed, and closed in phases.

The design approach for the OSDF is presented in the document, *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2"* [DOE, 1995b]. The design of the OSDF as currently developed, is presented in the *"Final Design Package,*

On-Site Disposal Facility" [GeoSyntec, 1997c]. The *"Final OSDF Design Criteria Package" (DCP)* [GeoSyntec, 1997e] for the OSDF requires preparation of a SWMEC Plan to address the work scope identified in Section 1.3 of this plan. This SWMEC Plan also satisfies the applicable requirements identified in Section 2.0 of this plan.

1.3 Plan Scope

This SWMEC Plan establishes the surface-water management, erosion minimization, and sediment control practices that the Subcontractor shall follow to maintain the proper performance of the OSDF, and to minimize impacts to surrounding areas and stormwater conveyances from excessive sediment loading. The scope of this SWMEC Plan includes a description of the engineered features that will handle:

- stormwater runon from outside the battery limit into the OSDF battery limit;
- stormwater runoff from areas within the battery limit that will be discharged through the temporary and permanent drainage system of the OSDF; and
- wastewater, which includes all waters that must be contained, collected, and ultimately discharged to the Biodenitrification Surge Lagoon (BSL).

Wastewater generated as a result of development of the OSDF area includes:

- leachate from impacted material within each cell of the OSDF — leachate is defined to mean stormwater that percolates into the leachate collection system (LCS), and is discharged to the OSDF leachate transmission system (LTS); impacted material runoff retained within the OSDF cells may be pumped to the FEMP former production area storm drainage control system;

- runoff from impacted-material staging areas within the OSDF battery limits; these wastewaters will be contained, collected, and discharged to the FEMP former production area storm drainage control system;

- runoff from impacted-material haul roads within the OSDF battery limits; these wastewaters will be contained, collected, and discharged dependent on location of collection to the FEMP former production area storm drainage control system; and

- perched ground water that seeps into excavations within the OSDF battery limits; these wastewaters will be contained, collected, and transferred to the FEMP former production area storm drainage control system.

The engineered features are described in Sections 4.0, 5.0 and 6.0 of this plan, in the Construction Drawings, and in the Technical Specifications.

1.4 Plan Organization

The remainder of this SWMEC Plan is organized as follows.

- A description of the plans related to this SWMEC Plan is presented in the remainder of Section 1.0.

- The requirements from the OSDF DCP applicable to this SWMEC Plan are described in Section 2.0.

- General information regarding the development of the OSDF as it relates to this SWMEC Plan is presented in Section 3.0.

- Soil stabilization controls are described in Section 4.0.
- Runon/runoff controls are described in Section 5.0.
- Sediment controls are described in Section 6.0.
- References are presented in Section 7.0.

1.5 Related Plans

Several other support plans have been prepared for the OSDF remedial action project and should be used in conjunction with this SWMEC Plan. The other plans containing information relevant to this SWMEC Plan are listed below with a brief statement of the relationship to this plan.

- *OSDF Impacted Materials Placement (IMP) Plan* [GeoSyntec, 1997b]. The *IMP Plan* contains the procedures that the Subcontractor shall use to place the impacted materials into the OSDF.
- *OSDF Borrow Area Management and Restoration (BAMR) Plan* [GeoSyntec, 1997c]. The *BAMR Plan* contains the procedures that the Subcontractor shall use to develop, manage, and restore the on-site borrow area.
- *OSDF Systems Plan.* The *Systems Plan* contains the procedures that the Subcontractor shall use to inspect and maintain the OSDF during construction, impacted material placement, and closure.

- *Final Design Package, On-Site Disposal Facility* [GeoSyntec, 1997a]. This document provides project drawings and specifications that the Subcontractor shall follow during construction.

- *OSDF Construction Quality Assurance (CQA) Plan* [GeoSyntec, 1997d]. The *CQA Plan* contains procedures to evaluate soils compaction and other features of the OSDF liner and final cover system.

- *OSDF Post-Closure Care and Inspection (PCCI) Plan.* The *PCCI Plan* addresses inspection and maintenance of the surface-water management and erosion control features during the post-closure period.

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2.0 APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to this SWMEC Plan are contained in the OSDF Design Criteria Package *(DCP)* [GeoSyntec, 1997e]. These requirements take the form of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) as determined by the record of decision for each of the various FEMP operable units, functional requirements, and general design criteria. The following requirements applicable to the SWMEC Plan were obtained from the *DCP*.

2.2 Applicable or Relevant and Appropriate Requirements

General ARARs that should be addressed by the Subcontractor are provided here.

No.	Title	Requirement
1.	Waste Storage Piles OAC 3745-56-51, 54 & 58, and 40 CFR §264.251 through .259	Collection and holding facilities associated with a runon and runoff control system must be inspected weekly and be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system.
2.	Ohio Solid Waste Disposal Regulations OAC 3745-27-19(E)(26)	The integrity of the engineered components of the landfill facility shall be maintained and any damage to, or failure of, the components shall be repaired.

No.	Title	Requirement
3.	Ohio Solid Waste Disposal Regulations OAC 3745-27-19(J)(1),(4)	Surface water shall be diverted from areas where solid waste is being, or has been, deposited. The facility shall be designed, constructed, maintained, and provided with surface water control structures, as necessary, to control runon and runoff of surface water to ensure minimal infiltration of water through the cover material and cap system, and minimal erosion of the cover material and cap system. If ponding or erosion occurs on areas of the landfill facility where solid waste is being, or has been, deposited, action will be taken to correct the conditions causing the ponding or erosion.
4.	Ohio Solid Waste Disposal Regulations OAC 3745-27-11(H)	At final closure of a landfill facility, all land surfaces shall be graded to prevent ponding of water where solid waste has been placed. Drainage facilities shall be provided to direct surface water from the landfill facility.
5.	Ohio Solid Waste Disposal Regulations OAC 3745-27-11(O)	Closure of the sanitary landfill facility must be completed in a manner that minimizes the need for further maintenance and minimizes post-closure formation and release of leachate and explosive gases to surface water to the extent necessary to protect human health and the environment.

2.3 Functional Requirements

The *DCP* contains a variety of functional requirements that have been established for the OSDF. The functional requirements that the Subcontractor shall meet applicable to the SWMEC Plan are:

- route surface water to designated locations where it can be appropriately managed;

- protect the OSDF from damage caused by precipitation and stormwater runon and runoff; and

- discharge surface water to existing watercourses in accordance with applicable regulatory and DOE requirements.

The Subcontractor shall develop a surface water management system that performs in a manner that meets the project requirements for both temporary conditions (*i.e.*, during construction, impacted material placement, and closure of the OSDF) and long-term conditions (*i.e.*, after closure of the OSDF). The system shall prevent stormwater runon to the OSDF and uncontrolled stormwater and wastewater runoff from the OSDF. Features of the long-term surface-water management system shall be constructed to require minimal monitoring and maintenance. The system shall be integrated, to the extent possible, with existing topography, features, and facilities.

2.4 Design Criteria

The *DCP* also identifies a number of design criteria for the OSDF. The Subcontractor shall incorporate these criteria in its plan to manage stormwater and control erosion. The applicable design criteria are:

- temporary erosion and sediment (E&S) control features for the OSDF shall be designed for the 25-year, 24-hour storm event [ARARs: 40 CFR §258.26 and OAC 3745-27-08(C)(6)(a) and (b)];

- temporary E & S control features shall be designed to minimize silting and scouring [ARAR: OAC 3745-27-08(C)(6)(c)];

- temporary sediment ponds or basins, if used, shall be designed following the criteria of OEPA [ARAR: OAC 3745-27-08(C)(6)(d)];

- long-term E&S control features for the OSDF shall be designed for the 2,000-year, 24-hour storm event (design criterion for assumption of a DOE Performance Category 2 facility); and

- long-term runon/runoff control structures for the OSDF shall be designed to limit interruption and damage (*i.e.*, washout) of the OSDF in the 2,000-year, 24-hour storm event (design criterion for assumption of a DOE Performance Category 2 facility); runon should be controlled and diverted away from and around the OSDF using swales, channels, or diversion berms.

2.5 Other Requirements

In addition to the requirements contained in the DCP, the Subcontractor shall incorporate the following other requirements into the plan to manage stormwater and control erosion:

- disturbed areas shall be stabilized (*i.e.*, vegetated) after the area has been constructed to final grade;

- general practices for construction, inspection, and maintenance of erosion and sediment control features shall be as recommended by the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation document entitled *"Rainwater and Land Development"* [ODNR, 1996]; and

- temporary sediment basins shall be cleaned out to the design capacity when the sediment retained in the basin has reduced one-half of the basin's original storage depth [ODNR, 1996].

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3.0 OSDF DEVELOPMENT RELATED TO SURFACE-WATER MANAGEMENT AND EROSION CONTROL

3.1 Introduction

The OSDF is anticipated to be developed in stages (*e.g.*, early, middle, and final). In general, each stage consists of the construction of disposal cells, placement of impacted material in the disposal cells, and closure of the disposal cells. For the purposes of managing surface water and controlling erosion, each development stage is sub-divided as follows:

- preconstruction period;
- cell construction period;
- impacted material placement period; and
- closure period.

In addition, surface-water management and erosion control is anticipated to be maintained throughout the OSDF post-closure period; however, as stated previously in Section 1.1 of this plan, post-closure activities are outside the scope of this plan and will be addressed in a separate forthcoming plan.

In the remainder of the section, a description of the surface-water management and erosion control features needed for each of the aforementioned development periods is presented. The construction, inspection, and maintenance activities for the surface-water management and erosion control features are presented in the remaining sections of this plan.

3.2 Preconstruction Period

The preconstruction period is defined as the period of time prior to all construction. During this period, disturbed areas shall be kept to a minimum. Erosion prevention and sediment control deemed necessary by the Subcontractor shall be provided prior to earth disturbance. The first line of defense in minimizing soil erosion and sedimentation is the establishment of soil stabilization features. The following soil stabilization features shall be implemented during the pre-construction period:

- in disturbed areas where additional grading or reworking is not scheduled for more than 45 days, temporary seeding and mulching will be applied to exposed soils within 7 days to stabilize soil and minimize erosion;

- where additional grading or reworking is not scheduled for a year or more, disturbed areas will be permanently seeded and mulched as soon as possible to stabilize soil and reduce erosion; and

- riprap will be applied within and along watercourses to prevent soil erosion under the design flow conditions.

Stormwater runon/runoff control measures shall be established to minimize erosion and off-site sedimentation. These features shall also be used to divert stormwater away from contaminated areas, thus maintaining separation between clean and potentially contaminated water. Runon to areas under construction shall be prevented by constructing runon diversion dikes and channels to route water to a natural watercourse. The location of these features shall be selected by the Subcontractor based on the sequence of construction activities.

The following runon/runoff control features may be used during the pre-construction period:

- temporary sediment basins;
- temporary drainage channels;
- check dams;
- temporary diversions;
- silt fence; and
- culverts.

Runoff from undisturbed areas shall be diverted from running on to the disturbed areas using temporary drainage channels, culverts, and temporary diversions.

Runoff from disturbed areas shall be diverted to a temporary sediment basin using temporary drainage channels, culverts, and temporary diversions.

3.3 Cell Construction Period

The cell construction period will include the excavation and construction of the OSDF disposal cells. The soil stabilization, runon/runoff control, and off-site sedimentation features used during this period will be the same as those used for the pre-construction period. The location of these features shall be selected by the Subcontractor based on the sequence of construction activities.

Wastewater encountered during the cell construction period will be limited to perched ground water. Perched ground water that enters the OSDF excavation shall be collected in a toe drain, or other suitable sump, and pumped or otherwise transferred to the FEMP former production area storm drainage control system.

3.4 Impacted Material Placement Period

The impacted material placement period includes placing impacted material in the cells. Features to manage surface water and control erosion and offsite sedimentation will be the same as those features used during the construction of the OSDF. The locations of these features shall be selected by the Subcontractor based on the sequence of construction activities.

In addition to these features, the leachate management system will be employed to contain leachate and impacted material runoff within the cells of the OSDF. These wastewaters shall percolate into the LCS and shall be discharged to the LTS or pumped to the FEMP former production area storm drainage control system. Specifically, wastewaters that will be encountered in the cell filling period of the OSDF should be managed as follows.

- *Leachate*. All precipitation or other water that falls into an active (*i.e.*, in the process of having impacted material placed in accordance with the *IMP Plan*) OSDF cell and percolates into the cell LCS will be considered leachate. Placement of impacted material in OSDF cells shall be performed such that runoff from active and open portions of a cell can be managed within the cell. Runoff from the impacted material retained within the OSDF cells may be pumped to the FEMP former production area storm drainage control system.

- *Impacted Runoff*. Runoff from impacted material staging areas and haul roads should drain to sumps or impacted runoff sediment control structures. Runoff from the staging area shall be discharged to the FEMP former production area storm drainage control system. Runoff from impacted material haul roads within the battery limit

should be contained, and allowed to flow by gravity, to the FEMP former production area storm drainage control system.

3.5 Closure Period

The closure period includes construction of the OSDF final cover system and the long-term surface-water management system. Features of the final cover system that may discharge stormwater to the permanent drainage structures includes the drainage layer and final cover surface.

The permanent drainage channels, which are located at the perimeter of the OSDF, are shown on the Construction Drawings.

During construction of the final cover system, the surface-water management and erosion and sediment control measures used during the cell construction period will remain in place as much as feasible.

3.6 Post-Closure Period

As stated previously in Section 1.1, this plan does not address surface-water management and erosion control practices during or beyond the post-closure period as they are outside the scope of this plan; those activities are addressed in the *OSDF Post-Closure Care and Inspection Plan*.

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4.0 SOIL STABILIZATION

4.1 Introduction

A description of the construction, inspection, and maintenance of the soil stabilization features for both temporary and long-term conditions are presented in this section. These features include:

- temporary seeding and mulching;
- permanent seeding and mulching; and
- riprap.

The construction, inspection, and maintenance of these control features shall be based on standard engineering and soil conservation practices. The methods presented in this section are taken from the ODNR document entitled *"Rainwater and Land Development"* [ODNR, 1996]. The Subcontractor shall be prepared to implement other methods to control erosion of sediment at the site as deemed necessary by the Construction Manager.

4.2 Temporary Seeding and Mulching

4.2.1 Definition

Temporary seeding and mulching are common soil stabilization measures that serve to hold soil in place until permanent cover is provided at the time of final grading. Temporary seeding establishes a temporary vegetative cover on disturbed areas by seeding with the appropriate rapid growing plants and is essential to preserve the integrity of earthen structures used to control sediment, such as temporary diversion dikes and the banks and dams of sediment basins. Mulching involves the application of plant residues and other suitable materials to the soil surface and protects against rain, wind, and sun while seeds are germinating and helps to ensure a vegetative stand.

4.2.2 Purpose

The Subcontractor shall apply temporary seeding to:

- reduce the erosion and sedimentation by stabilizing disturbed areas that will not be brought to final grade for a year or less;
- reduce problems associated with mud or dust from bare soil surfaces during construction; and
- reduce sediment runoff to downstream areas and improve the visual aspects of the construction area.

The Subcontractor shall apply mulch to:

- inhibit erosion by protecting the soil surface from raindrop impact and reducing the velocity of overland flow; and
- foster the growth of vegetation by increasing available moisture and providing insulation against extreme heat and cold.

4.2.3 Application

The Subcontractor shall apply temporary seed and mulch to soil surfaces where additional grading or reworking is not scheduled for a period of 45 days to less than one year.

Temporary seeding and mulching shall be applied in accordance with Section 02930 of the Project Specifications.

4.2.4 Maintenance

Where seeding does not establish as expected, the Subcontractor shall reseed and mulch the area within 3 weeks. The cause of the failure should be ascertained and corrected by the Subcontractor before reseeding. Physical conditions such as soil conditions may be unfavorable, resulting in the failure, and may require an alternative approach and/or type of cover. Areas requiring reseeding shall be prepared in the same manner as the original installation. Once established, a regular maintenance program will be performed.

The Subcontractor shall inspect applied mulch periodically, particularly after rainstorms, to check for rill erosion. Where erosion is observed, the Subcontractor shall apply additional mulch. Nets used to anchor mulch shall also be inspected after rainstorms for dislocation or failure. If washouts or breakage occur, reinstall nets as necessary after repairing damage to the slope. Inspections should take place until grasses are firmly established.

Additional temporary seeding and mulching planning considerations and design criteria are provided in *"Rainwater and Land Development"* [ODNR, 1996].

4.3 Permanent Seeding and Mulching

4.3.1 Definition

Permanent seeding and mulching shall be applied to establish permanent vegetation when an area has been brought to final grade and will not be subjected to disturbance for a year or more.

4.3.2 Purpose

The Subcontractor shall apply seeding and mulching to:

- reduce erosion and decrease sediment yield from overland flow;

- permanently stabilize disturbed areas in a manner that is economical, adaptable to site conditions, and allows selection of the most appropriate plant materials; and

- stabilize drainage channels where concentrated flow occurs.

4.3.3 Application

The Subcontractor shall apply permanent seeding and mulching to:

- disturbed areas where permanent, long-lived vegetative cover is needed to stabilize the soil; and

- rough graded areas which will not be brought to final grade for a year or more.

Permanent seeding and mulching shall be applied in accordance with Section 02930 of the Project Specifications.

4.3.4 Maintenance

Maintenance for permanent seeding and mulching shall be performed in accordance with Section 4.2.4.

4.4 Riprap

4.4.1 Definition

Riprap is an erosion-resistant ground cover consisting of large, loose, angular stone installed wherever soil conditions, water turbulence and velocity, expected vegetative cover, etc., are such that soil may erode under design flow conditions.

4.4.2 Purpose

The Subcontractor shall place riprap to:

- protect the soil surface from the erosive forces of concentrated runoff;
- slow the velocity of concentrated runoff while enhancing the potential for infiltration; and
- stabilize slopes with seepage problems and/or erosive soils.

The Subcontractor shall calculate the size and areal extent of the riprap based on surface-water calculations performed in accordance with Section 2.0 of the SWMEC Plan.

4.4.3 Application

The Subcontractor shall place riprap at soil-water interfaces where the soil conditions, water turbulence and velocity and, expected vegetative cover are such that the soil may erode under the design peak flow conditions. Typical uses of riprap may be at storm drain outlets, on channel banks and/or bottoms, within drainage channels, or at the toe of slopes.

The Subcontractor shall place riprap in accordance with the following minimum guidelines:

- Riprap used at channel transitions shall extend upstream and downstream of the transition a distance of five times the downstream channel depth; the minimum extension should be 15 ft (4.5 m).

- Riprap used at culvert exits shall have a minimum width of 4 ft. wider than the pipe diameter and a minimum width based on calculated peak flow velocities using Figure 2-3 of ODNR [1996].

- Geotextiles shall be used to control piping and erosion beneath riprap in temporary facilities. Geotextiles shall meet the requirements of Section 02714 of the Project Specifications.

"Rainwater and Land Development" [ODNR, 1996] should be consulted for additional design criteria and planning considerations.

4.4.4 Maintenance

Once riprap has been installed it should require little maintenance though the Subcontractor shall periodically inspect riprapped areas to determine if high flows have caused scour beneath the riprap or dislodged any of the stone. If repairs are needed, the Subcontractor shall accomplish such repairs within the same work day.

4.5 Construction Entrance

4.5.1 Definition

A construction entrance is a stabilized pad of aggregate over a geotextile base and is used to reduce the amount of mud tracked off-site with construction traffic.

4.5.2 Purpose

The Subcontractor shall use a construction entrance:

- where construction vehicles leave active construction areas;

- at all points of egress to public roads; and
- where frequent vehicle and equipment ingress/egress is expected.

4.5.3 Application

The Subcontractor shall build construction entrances in accordance with ODNR [1996, page 158].

4.5.4 Maintenance

The Subcontractor shall inspect the construction entrances on a weekly basis, and after rainstorms. The Subcontractor shall follow the maintenance guidelines provided in ODNR [1996, page 158].

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5.0 RUNON/RUNOFF CONTROLS

5.1 Introduction

A description of the construction, inspection, and maintenance of the runon/runoff control features for both temporary and long-term conditions are presented in this section. These features include:

- temporary diversions;
- temporary drainage channels;
- permanent drainage channels;
- check dams; and
- culverts.

The construction, inspection, and maintenance of these control features shall be based on standard engineering and soil conservation practices. The methods presented in this section are taken from the ODNR document entitled *"Rainwater and Land Development"* [ODNR, 1996]. The Subcontractor shall be prepared to implement other methods to control erosion of sediment at the site as deemed necessary by the Construction Manager.

5.2 Temporary Diversions

5.2.1 Definition

Temporary diversions consist of an earth channel constructed across the slope. Adjoining the channel and on the lower side of the slope, a berm is constructed from material taken from the channel to help divert and contain flow in the channel. A detail of a temporary diversion is illustrated in ODNR [1996, page 156].

5.2.2 Purpose

In general, temporary diversions are intended to prevent erosion. This is accomplished by diverting water (overland sheet flow) from areas where the water may cause erosion to areas where the water can be used or disposed safely.

The Subcontractor shall use temporary diversions to:

- divert stormwater runon away from contaminated areas of the OSDF;
- divert stormwater runoff away from unprotected slopes to a stabilized outlet;
- divert sediment-laden runoff from a disturbed area to a temporary sediment basin; and
- shorten the flow length within a long sloping drainage area.

5.2.3 Application

The Subcontractor shall construct temporary diversions in areas where runoff from higher-lying areas have the potential to damage or is damaging: (i) lower-lying areas; (ii) cut or fill slopes or steeply sloping land; (iii) critical sediment source areas; and (iv) active gullies or other erodible areas.

Temporary diversions shall have stable outlets. The Subcontractor shall stabilize the diversions throughout its planned life. Guidelines for stability are provided in ODNR [1996, page 156]. Diversions are not recommended below high sediment-producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment, are installed with or before the diversions. The Subcontractor shall locate the temporary diversions according to outlet condition, topography, land use, soil type, and length of slope. Temporary diversions

must be located so that water will empty on established water disposal areas, a stable watercourse, waterway, or structure.

5.2.4 Maintenance

The Subcontractor shall regularly inspect and maintain temporary diversions as follows:

- check for points of scour or bank failure, rubbish or channel obstruction, rodent holes, breaching or settling of the berm, excessive wear from pedestrian or construction traffic;
- repair damage and remove deposits or sediment from the diversion; and
- restabilize as needed.

If no sediment protection is provided, the Subcontractor shall periodically clean out accumulated sediment.

5.3 Temporary Drainage Channels

5.3.1 Definition

A temporary drainage channel is a natural or constructed channel or outlet shaped or graded to convey runon and runoff. The channel may have a protective lining of vegetation or erosion-resistant materials such as concrete, riprap, erosion mat, or grass.

All temporary drainage channels shall have stable outlets with adequate capacity for the designed peak flow. The outlet must discharge in such a manner as not to cause erosion. Outlets should be constructed and stabilized prior to the operation of the temporary drainage channels.

5.3.2 Purpose

The Subcontractor shall construct temporary drainage channels to provide for the conveyance of excess surface water from diversions and other erosion and sediment control measures, or natural concentrations of flow without causing erosion or flooding.

5.3.3 Application

The Subcontractor shall construct temporary drainage channels as needed to manage runon and runoff and to control erosion resulting from concentrated runoff. Temporary drainage channels shall be designed based on surface water calculations performed in accordance with Section 2.0 of the SWMEC Plan. Whenever possible, temporary drainage channels shall be used in such a way that preserves the existing and permanent drainage systems. Temporary drainage channels shall generally be located in existing and permanent drainageways where water can drain in from all sides. In all situations, channels shall be located so that they do not make sharp, unnatural changes in direction of flow.

The proposed locations for temporary drainage channels shall be selected by the Subcontractor based on its sequence of construction activities. Supplemental measures, such as check dams may be used in conjunction with temporary drainage channels.

5.3.4 Maintenance

The Subcontractor shall inspect and maintain the temporary drainage channels in accordance with the following:

- Inspection shall be frequent and repairs shall be made promptly as needed.

- All temporary drainage channels shall be inspected immediately (*i.e.*, that work day, or the first work day) after each rainfall event and at least once each work day

during prolonged rainfall. Necessary repairs to channels shall be made promptly.

- Temporary drainage channels shall be kept clear of debris at all times.

- The protective lining vegetation or erosion-resistant materials shall be maintained as built to prevent undermining, scour, or deterioration.

5.4 Permanent Drainage Channels

5.4.1 Definition

Permanent drainage channels consist of a series of channels designed for conveying runon and runoff away from the OSDF. Details of the permanent drainage channels are shown on the Construction Drawings. The Construction Drawings also show the proposed location of the permanent drainage channels for the OSDF.

5.4.2 Purpose

The permanent drainage channels shall be used to prevent stormwater runon and runoff from damaging the OSDF final cover system.

5.4.3 Application

The Subcontractor shall construct the permanent drainage channels at the perimeter of the OSDF as shown on the Construction Drawings. The permanent drainage system shall divert runoff from abutting land north and east of the facility and rejoin the existing drainage channels north and south of the FEMP former production area. The permanent drainage system shall be installed in phases as the OSDF is constructed and closed.

5.4.4 Maintenance

The Subcontractor shall inspect and maintain permanent drainage channels in accordance with the following:

- Inspection shall occur periodically to ensure that the channels are free-flowing and not clogged with sediment or debris.
- Permanent drainage channels shall be kept clear of debris at all times.
- The protective lining of vegetation or erosion-resistant materials shall be maintained as built to prevent undermining, scour, or deterioration.

5.5 Check Dams

5.5.1 Definitions

Check dams consist of a section of rocks placed at the inlet, along the length, or at the outlet of a drainage feature. A detail illustrating a constructed check dam is provided in ODNR [1996, page 133].

5.5.2 Purpose

Check dams may be installed in temporary diversions and temporary and permanent drainage channels to reduce erosion.

5.5.3 Application

The Subcontractor shall install check dams in accordance with ODNR [1996, page 133].

5.5.4 Maintenance

The Subcontractor shall inspect and maintain check dams in accordance with the following:

- Inspection shall occur periodically to ensure that the structures have not been damaged by high energy flows. Repairs shall be made promptly, as needed.

- All check dams shall be inspected immediately (*i.e.*, that work day, or the first work day) after each rainfall event and at least once each work day during prolonged rainfall. Necessary repairs shall be made promptly.

- Check dams shall be maintained as built.

5.6 Culverts

5.6.1 Definition

Culverts are temporary or permanent structures used to convey stormwater beneath a road or other embankment.

5.6.2 Purpose

The Subcontractor shall install culverts to provide:

- Temporary means to convey stormwater under construction and operation-related roads; and

- Permanent means to convey stormwater under OSDF access roads.

5.6.3 Application

The Subcontractor shall install temporary culverts as needed to manage runon and runoff. The Subcontractor shall design temporary culverts based on surface water calculations performed in accordance with Section 2.0 of the SWMEC Plan. Temporary culverts shall also be designed to withstand construction traffic loading. The size and locations of permanent culverts are shown on the Construction Drawings.

5.6.4 Maintenance

The Subcontractor shall inspect and maintain the culverts as follows:

- Periodic inspection shall be performed to ensure that the culverts are clear and not damaged.

- Maintenance shall be performed as needed in a timely manner to ensure that culverts are functioning as designed. This shall include removal and disposal of any trapped sediment or debris.

6.0 SEDIMENT CONTROL

6.1 Introduction

A description of the construction, inspection, and maintenance of the sediment control features for both temporary and long-term conditions are presented in this section. These features are:

- silt fences; and
- temporary sediment basins.

The construction, inspection, and maintenance of these control features should be based on standard engineering and soil conservation practices. The methods presented in this section are taken from the ODNR document entitled *"Rainwater and Land Development"* [ODNR, 1996]. The Subcontractor shall be prepared to implement other methods to control erosion of sediment at the site as deemed necessary by the Construction Manager.

6.2 Silt Fences

6.2.1 Definition

A silt fence is a temporary sediment barrier constructed of posts and filter fabric. The filter fabric is stretched across and attached to the supporting posts and is entrenched. The silt fence is placed on the level contour of the land near the toe of a slope. It can also be placed in a minor drainage way to intercept and detain sediment and decrease flow velocities from drainage areas of limited size.

6.2.2 Purpose

The Subcontractor shall use silt fences to:

- intercept and detain small amounts of sediment from disturbed areas during construction operations in order to prevent sediment from leaving the site; and

- decrease the velocity of sheet flows and low-to-moderate level channel flows.

6.2.3 Application

The Subcontractor shall install silt fences on the downslope side of areas to be disturbed until permanent drainage and erosion control structures are established. The silt fence shall be placed on the level contour of the land near the toe of the slope. A silt fence should not be placed directly at the toe of the slope if it is at all possible to place it several (preferably at least five feet horizontal distance) away. Criteria for establishing silt fence locations is provided on ODNR [1996, page 119].

Under no circumstances shall the Subcontractor install silt fences in streams or in channels where flows are likely to exceed 1 cubic foot per second (cfs).

6.2.4 Maintenance

The Subcontractor shall inspect and maintain all silt fences in accordance with the following.

- Daily inspection of the silt fence to identify areas that require repair or removal of accumulated sediment.

- Silt fences shall be inspected immediately (*i.e.*, that work day, or the first work day) after each rainfall and at

leastonce each work day during prolonged rainfall. Any required repairs shall be made within the same work day.

- Accumulated silt and debris shall be removed from behind the face of the silt fence when the silt fence deposits reach approximately one-half the height of the fence.

- If runoff overtops the silt fence, flows under or around the ends, or in any other way becomes a concentrated flow, one of the following shall be performed as appropriate: (a) change the layout of the silt fence, (b) remove the accumulated sediment, or (c) install a different erosion and sediment control measure.

- Sediment deposits should be removed after each rainfall event (*i.e.*, that work day, or the first work day after the rainfall event).

- The expected usable life of a silt fence is 6 months. Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the fence is still necessary, the fabric shall be replaced promptly.

- Any sediment deposits remaining in place after the silt fence is no longer required shall be dressed to conform with the existing grade, prepared, and seeded.

6.3 Temporary Sediment Basins

6.3.1 Definition

A temporary sediment basin is a structure designed to catch and store sediment and other waterborne debris.

6.3.2 Purpose

Temporary sediment basins are constructed downgradient of construction activities. Sediment basins are not 100 percent effective in trapping sediment which flows into them. Therefore, they should be used in conjunction with erosion control measures such as temporary seeding, mulching, diversions, etc. to reduce the amount of sediment flowing into the basin. Temporary sediment basins shall receive only stormwater runoff, not wastewater.

6.3.3 Application

The Subcontractor shall construct temporary sediment basins in accordance with plans and specifications to be provided by the Construction Manager. Temporary sediment basins will be located to intercept the largest possible amount of runoff from the disturbed areas. Temporary sediment basins shall be removed within 36 months after its construction or after the exposed areas are adequately protected against erosion by vegetative or mechanical means as directed by the Construction Manager.

Removal of a temporary sediment basin shall consist of:

- draining the sediment basin of all water;
- removing the sediments from the basin;
- removing primary and emergency spillways and appurtenances;

- grading the sediment basin to the lines and grades provided by the Construction Manager; and

- revegetating disturbed areas.

6.3.4 Maintenance

The Subcontractor shall inspect and maintain the temporary sediment basins. Inspections shall be performed following rainstorms. Regular maintenance shall include repair of eroded areas, replacement of vegetation or riprap around the basins, repair of damaged or clogged spillways in the basins, and removal of sediment from the basins. Sediment shall be removed from the basins when the sediment has filled one-half the basin's original depth.

6.4 Final Cover System

6.4.1 Definition

The final cover system of the OSDF shall consist of a layered combination of natural material (soil/rock) and synthetic components. A detail of the final cover system is shown in the Construction Drawings. The surface of the impacted materials shall be shaped/prepared for placement of the capping system. This system will include a composite cap overlain by the following layers:

- drainage layer — placed above the composite cap to collect and convey water infiltrating the capping system with direct discharge to the permanent drainage system;

- biointrusion layer — a biointursion barrier placed above the drainage layer to provide long-term protection from burrowing animals and vegetative root intrusion;

- granular filter layer — placed above the biointrusion layer to separate the vegetative zone from the biointrusion layer and prevent loss of the soil from the vegetative zone into the biointrusion layer;

- vegetative soil layer — consisting of a minimum of 6 in. of topsoil overlaying a minimum of 12 in. of soil suitable to support vegetative growth of sufficient thickness to maintain proper moisture control within the plant root zone; and

- topsoil — surface cover/vegetation to provide, to the extent feasible, protection against erosion.

6.4.2 Purpose

The final cover system has been designed to satisfy the following general conditions:

- isolate impacted material in the OSDF;
- protect the OSDF from inadvertent intrusion;
- promote vegetative growth;
- limit infiltration into the facility after closure; and
- minimize requirements for long-term inspection, maintenance, and repair.

6.4.3 Application

The final cover system shall be constructed when the waste in the OSDF has reached its design elevation. The exterior side slopes will be closed as soon as possible after the planned vertical extent of waste is achieved for each phase of placement activities.

In anticipation of a "seasonal" shutdown (*e.g.*, winter weather), the facility will be graded to promote proper drainage. Exposed surfaces will be covered with a layer of soil. An extended shutdown of the facility (greater than one year) may necessitate partial closures. In the event of an extended shutdown, a partial closure will be implemented, thus creating a cell within the overall OSDF. All slopes will be graded in compliance with applicable standards, then capped with the barrier layer, drainage layer, and vegetative zone.

6.4.4 Maintenance

The OSDF final cover system shall be maintained in accordance with the *OSDF Systems Plan*.

7.0 REFERENCES

GeoSyntec Consultants, *"Final Design Package, On-Site Disposal Facility, Fernald Environmental Management Project"*, GeoSyntec Consultants, Atlanta, GA, 1997a.

GeoSyntec Consultants, *"OSDF Impacted Materials Placement (IMP) Plan"*, GeoSyntec Consultants, Atlanta, GA, 1997b.

GeoSyntec Consultants, *"OSDF Borrow Area Management and Restoration (BAMR) Plan"*, GeoSyntec Consultants, Atlanta, GA, 1997c.

GeoSyntec Consultants, *"OSDF Construction Quality Assurance (CQA) Plan"*, GeoSyntec Consultants (GeoSyntec), Atlanta, GA, 1997d.

GeoSyntec Consultants, *"OSDF Design Criteria Package (DCP) Plan"*, GeoSyntec Consultants, Atlanta, GA, 1997e.

Ohio Department of Natural Resources (ODNR), *"Rainwater and Land Development: Ohio's Standards for Stormwater Management, Land Development and Urban Stream Protection, Second Edition"*, ODNR Division of Soil and Water Conservation, Columbus, Ohio, 1996 [FORMERLY U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS), *"Water Management and Sediment Control in Urbanizing Areas"*, U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., 1987].

U.S. Department of Energy (DOE), *"Final Record of Decision for Remedial Actions at Operable Unit 2"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995a.

U.S. Department of Energy (DOE), *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995b.

CULTURAL RESOURCE UNEXPECTED DISCOVERY PLAN

ON-SITE DISPOSAL FACILITY PROJECT

20100-PL-005

Revision 0

May 1997

Prepared By:

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United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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ACRONYM LIST

CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
FDF	Fluor Daniel Fernald
FEMP	Fernald Environmental Management Project
NAGPRA	Native American Graves Protection and Repatriation Act
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
OHPO	Ohio Historic Preservation Office
OSDF	On-Site Disposal Facility

1.0 PURPOSE/SCOPE

The United States Department of Energy (DOE) recognizes its stewardship responsibilities for managing cultural resources at the Fernald Environmental Management Project (FEMP) site and on other lands that are impacted by the FEMP site. In recognizing that responsibility, DOE and its contractors are taking a proactive approach to acknowledge the cultural and scientific value of cultural resources at the FEMP site, and identifying, avoiding if possible, and mitigating when necessary, any cultural resources affected by actions at the FEMP site.

This plan provides a method to ensure compliance with the National Historic Preservation Act (NHPA), Native American Graves Protection and Repatriation Act (NAGPRA), and other applicable cultural resource regulations in the event Fluor Daniel Fernald (FDF) personnel, sub-contractor personnel and/or any other persons working or assisting with the conduct of a project (performing any ground disturbing activity) discover a cultural resource/historic property[1].

2.0 BACKGROUND

The FEMP site and surrounding area are located within a 4.8 kilometer- (3 mile-) wide subterranean valley formed as a result of Pleistocene glaciation. The remaining glacial outreach made the valley's soil rich for farming. The FEMP site and surrounding area are also located near the Great Miami River, which provided a source of water for early residents. Historically, these combined factors made the FEMP site and surrounding area desirable as a settlement place. As a result of this desirability, the area is rich with diverse cultural resources.

Cultural resource investigations (Phase I and II) were conducted in the area of the On-Site Disposal Facility (OSDF) and its support operations prior to any ground disturbing activities. During the Phase I investigations, twenty-three (23) archeological sites were identified. Nineteen of the sites (33Ha646 through 33Ha664) were located in Hamilton County; the remaining four sites (33Bu487 through 33Bu490) were located in Butler County. Three of the sites were designated as historic, and 20 were prehistoric. Two of the historic sites (33Ha654 and 33Bu487), and four of the prehistoric sites (33Ha646, 33Ha647, 33Ha650, and 33Ha662) were recommended as potentially eligible for

[1] cultural resource, or historic property means any prehistoric or historic district, site, building, or object included in, or eligible for inclusion in the National Register of Historic Places; term includes things such as artifacts, records, and human remains which are related to such district, site, building, structure, or object. Appropriate subcontractors will be trained to recognize if a cultural resource has been encountered during excavation activities (Section 5.0 of this plan).

inclusion in the National Register of Historic Places (NRHP). The other 17 were not recommended as eligible.

A Phase II investigation was conducted on the six sites that were recommended as potentially eligible for the NRHP. The investigation involved shovel testing and test unit excavations. A subsurface feature at each of the two sites (33Ha646 and 33Ha662) was sectioned and proved to be prehistoric hearths. Some additional historic features were also identified at sites 33Bu487 and 33Ha654.

Based on the findings of the Phase II investigation, it was determined that 33Bu487, 33Ha647, and 33Ha648 were not eligible for the NRHP. However, sites 33Ha646, 33Ha654 and 33Ha662 retain the integrity and possess the scientific value capable of yielding data important to either the prehistory or history of the region. These three sites were designated as sites requiring Phase III or data recovery to ensure the safe removal and/or recording of the cultural resources identified. The Phase III activities will be completed prior to any construction activities in the area of these sites designated as potentially eligible for the NRHP.

3.0 PROCEDURAL RESPONSIBILITIES

In the event that a remedial action affects an unidentified cultural resource, project staff will ensure safe handling of any cultural resource by isolating the affected area until an emergency on-call (within 4 hours) contractor can perform data recovery as necessary; a contract is in place for this potential event and has been utilized during installation of the public water supply. The DOE will consult with the appropriate parties (e.g., Ohio Historic Preservation Office) pursuant to 36 Code of Federal Regulations (CFR) Part 800 to determine an appropriate course of action as necessary. DOE will avoid and minimize any adverse impacts to the extent practicable. The following discussion of is an overview of responsibilities if such an event occurs (refer to EP-0003, "Unexpected Discovery of Cultural Resources, Rev. 1").

3.1 RESPONSIBILITIES

3.1.1 Responsible Field Representative

- Stops work upon discovery of a cultural resource (see Section 5.0)
- Notifies FDF Cultural Resource Coordinator upon discovery of a cultural resource

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- Completes and signs Unexpected Cultural Resource Discovery Form (with assistance from the FDF Cultural Resource Coordinator)

3.1.2 FDF Cultural Resource Coordinator

- Notifies FDF Natural Resource Department Manager of unexpected cultural resource discovery
- Completes and signs Prehistoric/Historic Assessment Report
- Assists in completion and signs Unexpected Cultural Resource Discovery Form
- Coordinates mitigation

3.1.3 FDF Natural Resource Management Department Manager

- Notifies DOE-FEMP of unexpected cultural resource discovery
- Coordinates mitigation
- Completes documentation (Prehistoric/Historic Assessment Report)

3.1.4 DOE-Fernald Cultural Resource Point of Contact

- Notifies the Ohio Historic Preservation Office (OHPO) of unexpected cultural resource discovery
- Negotiates mitigation
- Notifies FDF of authorization to proceed with work

3.2 NAGPRA

In the event that a human remain or associated funerary object, unassociated funerary object, sacred object, or object of cultural patrimony is discovered during ground disturbing activity (e.g., excavation of a disposal cell), the appropriate Native American tribes would be consulted in order to expedite removal of the remains and/or objects. While this consultation would be taking place, the DOE must cease activity in the immediate area and make a reasonable effort to secure the remains and/or objects. Work stoppage in the immediate area could last up to 30 days.

4.0 APPLICABLE DOCUMENTS

4.1 DRIVERS

- National Historic Preservation Act
- Native American Graves and Repatriation Act
- Archeological Resources Protection Act of 1979
- American Indian Religious Freedom Act
- 36 CFR Part 800
- 43 CFR Part 10

4.2 REFERENCES

- Unexpected Discovery of Cultural Resources, EP-0003, Rev. 1
- NAGPRA (25 U.S.C. Section 3000)

5.0 TRAINING

Subcontractors will be trained (e.g., how to recognize a cultural resource), as needed, to this plan. Additionally, this plan will be included in any pertinent procurement packages in order for the subcontractor to accurately estimate potential down time.

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CONSTRUCTION QUALITY ASSURANCE PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-006
REVISION 0
MAY 1997

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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Under

Fluor Daniel Fernald
Subcontract 95PS005028

ACRONYM LIST

ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society of Testing and Materials
BAMR	Borrow Area Management and Restoration
CCM	Construction Manager
COE	Corps of Engineers
CQC	Construction Quality Assurance
CQC	Construction Quality Control
CS	Confirmatory Sampling
CSS	Construction Safety and Security
DCP	Design Criteria Package
DOE	United States Department of Energy
DOT	Department of Transportation
FDF	Fluor Daniel Fernald
FEMP	Fernald Environmental Management Project
FTMS	Federal Testing Method Standards
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

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QC	Quality Control
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SWMEC	Surface Water Management and Erosion Control
TPP	Test Pad Program
USEPA	United States Environmental Protection Agency
WAC	Waste Acceptance Criteria

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1. INTRODUCTION

1.1 Overview

This Construction Quality Assurance (CQA) Plan describes the quality assurance and construction quality control (CQC) activities that will be undertaken 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 procedures necessary to achieve a high level of quality in the OSDF and assure that OSDF components are constructed in compliance with the approved Construction Drawings and Technical Specifications. This plan addresses the CQA and CQC activities to be performed during construction of the OSDF.

The OSDF CQA plan will address the following elements of the OSDF construction:

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

The quality assurance and quality control monitoring and testing procedures, along with the required frequency of tests, are provided. Also detailed in this plan are the organization and minimum qualifications 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 assure 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, as currently developed, 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; and
- general site work including installation of various appurtenances such as general earthwork, mechanical and electrical systems, and concrete.

This CQA Plan presented in this document 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.

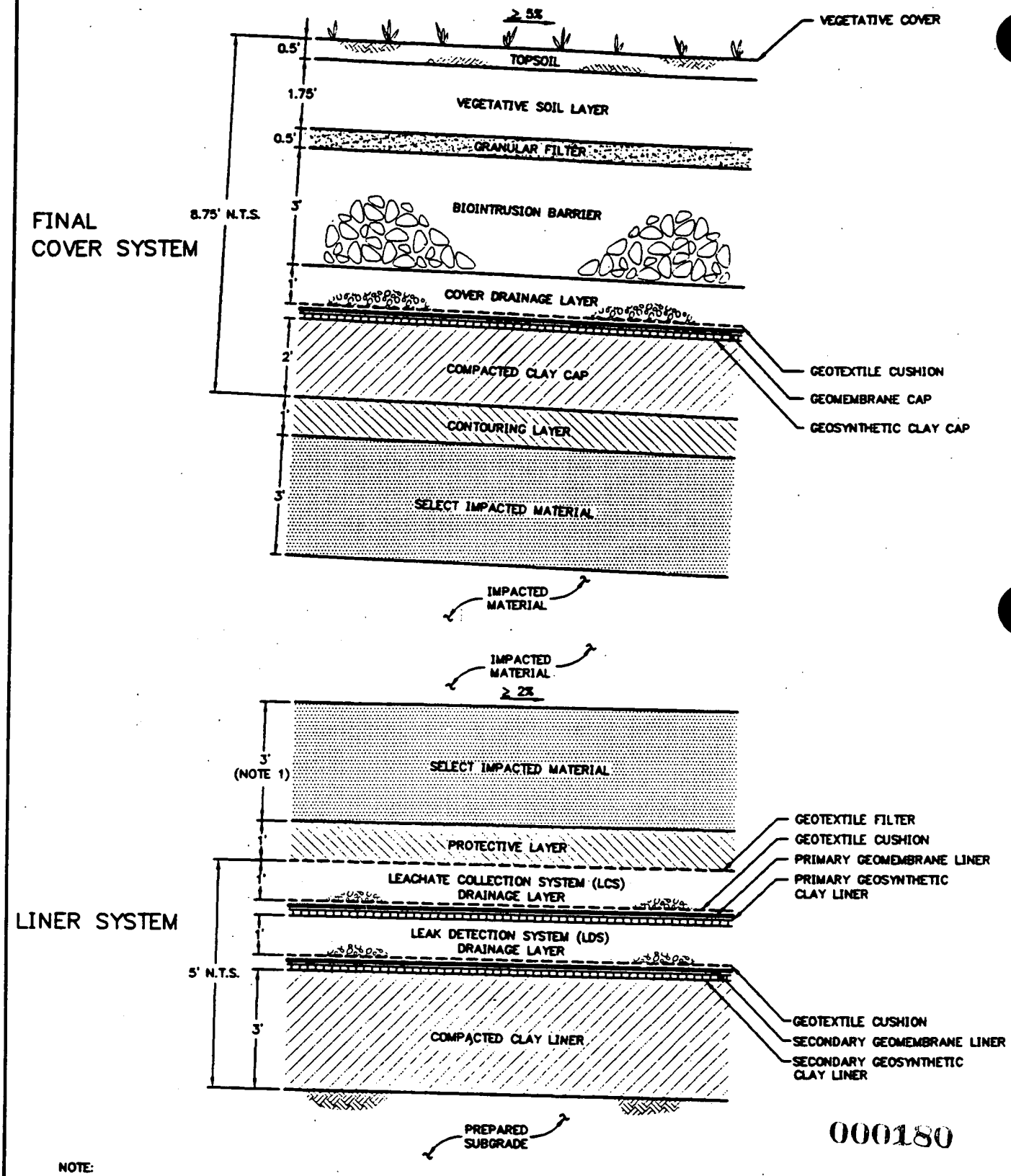
- *Liner and Final Cover Systems.* The liner and final cover systems will be constructed using both soil and geosynthetic components (refer to Figure 1-1). The liner system consists of a double-composite liner that will have a leachate collection system (LCS) above the primary liner and a leakage detection 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, detection and collection manholes, double-walled gravity transmission pipe, 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 stormwater runon and runoff, perched ground water, other construction waters, and wastewaters from various sources such as the equipment decontamination facility.

- *Support Elements and Utilities.* Both permanent and temporary support elements are included in the OSDF design. Permanent support elements include survey benchmarks, a perimeter access corridor, and a facility access road. Temporary support elements include construction security fencing, administrative support facilities, equipment decontamination facility, impacted material staging areas, temporary haul roads and construction materials stockpile areas. Utilities include electrical, water, telephone, and wastewater lines for the administrative support areas. The administrative support offices are also provided with parking, security fencing, and all-weather ingress and egress.

LINER AND COVER SYSTEM DESIGN
ON-SITE DISPOSAL FACILTY



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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 SOIL OR RELATIVELY SMALL SIZE DEBRIS THAT CAN BE PLACED IN CONTROLLED LIFTS.

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	1-1
PROJECT NO.	GE3900-16.4
DOCUMENT NO.	F9650002.CDO
FILE NO.	F95C001.DWG

1.4 CQA Plan Scope

The CQA Plan establishes the quality assurance and quality control procedures and monitoring requirements to be implemented during construction of the OSDF. The CQA Plan was developed to conform the Ohio Environmental Protection Agency (OEPA) requirements (ARAR: 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 lining and cover system components;
- establishing procedures for construction documentation; and
- providing the means for assuring 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 Subcontractor during the construction of the OSDF and to supplement the specifications of the OSDF Construction Subcontract. This plan is part of the construction subcontract. In the case of any conflicts between the CQA procedures described in this plan and the requirements of the project specifications, the specifications will govern.

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

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

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 lining and final cover systems and general earthwork are presented in Section 6;
- the CQC activities for geomembranes, geosynthetic clay liner, and geotextiles are presented in Sections 7 through 9 respectively;
- the CQC activities for the installation of HDPE manholes, pipes, fittings, and valves 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.

2. APPLICABLE 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 derived from 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 overlying a geosynthetic clay liner; in addition, the 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 1×10^{-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 1×10^{-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)).

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 are 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 all laboratory and field hydraulic conductivity test results from the program, are presented in a report entitled *Test Pad Program Final Report*. This report specifies construction equipment types and construction procedures that result in a compacted clay liner satisfying the hydraulic conductivity performance criterion of OAC 3745-27-08(C)(1). The report is available for reference by the Subcontractor and should be consulted for the information contained therein.

During construction of the OSDF liner system, a detailed CQA program must be implemented in accordance with OAC 3745-27-08(F). The CQA 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 verify 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 assurance will be provided 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 soil, except for the hydraulic conductivity testing, which shall be performed at a frequency not less than one test per 10,000 yd^3:

- hydraulic conductivity on specimens compacted to achieve the conditions described in the construction specifications;

- moisture content and dry density using an approved ASTM method;

- grain 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 a 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 constructed above the compacted clay liner.

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 component 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 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, filter layer. biointrusion barrier, cover drainage layer, composite cap, and impacted-material contouring layer.

2.2.4.1 Topsoil

A vegetated topsoil layer will form the uppermost component of the OSDF final cover system. 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)). The topsoil shall satisfy the requirements of 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 protect the geomembrane and compacted clay components of the geocomposite 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 support 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 specifications and consist of durable cobbles (possibly with gravel and boulder size fractions) 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. thickness of granular drainage material, with the 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 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 granular filter 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 liquid 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 1×10^{-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.

- *Construction Quality Control (CQC)* - Those actions which provide a means to measure and regulate the characteristics of an item or service in relation to contractual and regulatory requirements.

In the context of this document:

- CQA refers to means and actions employed by FDF to assure conformity of the lining and final cover system component production and installation with this CQA plan, the Construction Drawings and Technical Specifications.

- CQC refers to those actions taken by the CQC Consultant, Subcontractor, Manufacturers, or Installers to ensure 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 all synthetic materials used in geotechnical engineering applications; the term includes geotextiles, geogrids, geonets, geomembranes, geosynthetic clay liners (GCLs) and geocomposites. There are four types of geosynthetic products referenced in this CQA Plan which are included in the OSDF lining and final cover systems. These geosynthetics include (i) textured HDPE geomembranes used in the composite liner and cap; (ii) GCL's used in the composite liner and cap; (iii) geotextiles used as filters or cushions; and (iv) high density polyethylene manholes and pipes used to collect and convey leachate.

3.3 CQA Lines of Communications

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

4. PROJECT ORGANIZATION AND PERSONNEL

The OSDF construction organization chart is shown in Figure 4-1. Day-to-day construction activities at the OSDF will be managed though the direct interaction of several parties below FDF Project Manager level including but not limited to the Construction Manager, Resident Engineer, Subcontractor, 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 and CQC of the OSDF are described below.

4.1 Construction Manager

4.1.1 Definition

The Construction Manager shall be an individual responsible for site operations and overall management of the construction. In this CQA plan the term "Construction Manager" shall refer specifically to an authorized representative of the Department of Energy for the OSDF at the FEMP.

4.1.2 Qualifications

The Construction Manager will hold a baccalaureate degree in construction management, engineering, or related field or have 10 years of construction management experience. The Construction Manager will also have 3 years of environmental restoration plus 1 year of government experience.

4.1.3 Responsibilities

The Construction Manager shall be responsible for coordination and oversight of all construction activities including: (i) subcontract administration; (ii) construction

Figure 4-1

OSDF Construction Organization Chart

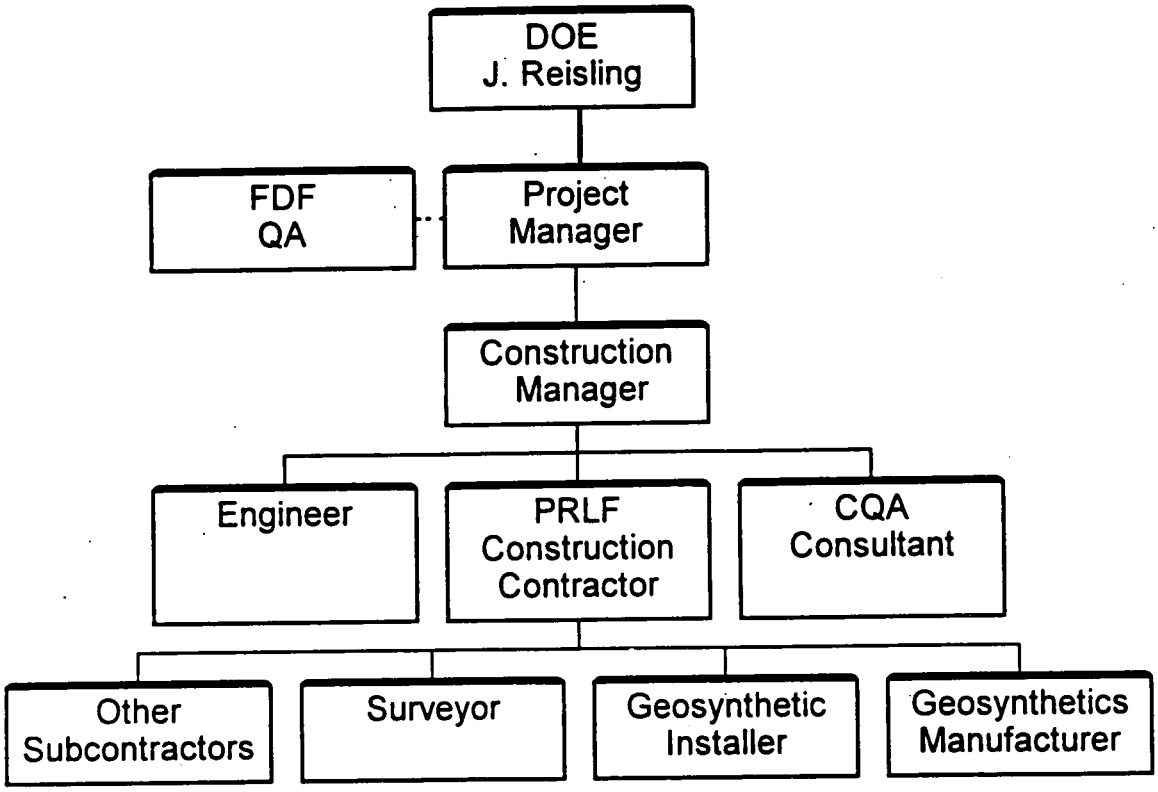
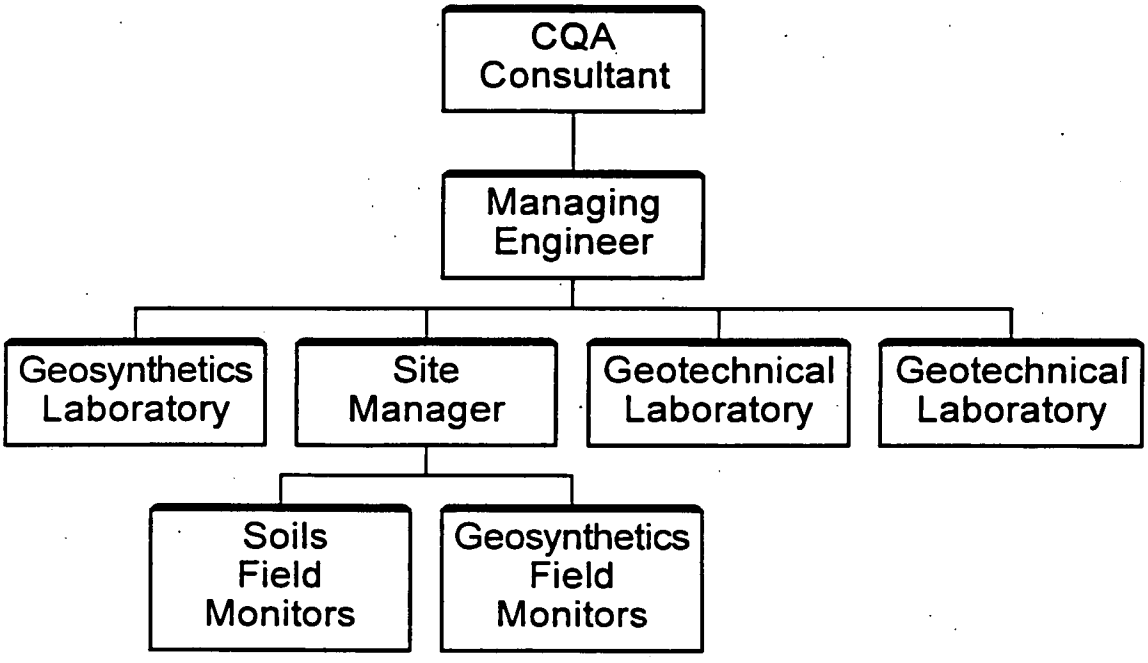


Figure 4-2

OSDF CQA
Organization Chart



management; (iii) review and approval of any modifications or changes to the subcontract documents; and (iv) final approval authority for subcontract submittals.

4.2 Resident Engineer

4.2.1 Definition

The Resident Engineer is the individual representing the firm having responsibility for OSDF design.

4.2.2 Qualifications

The Resident Engineer will hold a minimum of a baccalaureate degree in engineering and be registered as a Professional Engineer and have 10 years experience in construction management, engineering, or related fields. The Resident Engineer shall have expertise which demonstrates significant familiarity with geosynthetics and soils, as appropriate, including design and construction experience related to lining and cover systems.

4.2.3 Responsibilities

The Resident Engineer is responsible for approving all design and specification changes, and making design clarifications which may be required during construction of the OSDF. The Resident Engineer shall assist the Construction Manager in reviewing and approving the Subcontractor'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 all elements of the OSDF design. The Resident Engineer shall have the authority to recommend changes or modifications to the Construction Drawings and Technical Specifications for approval by the Construction Manager.

4.3 Subcontractor

4.3.1 Definition

The Subcontractor is the firm or corporation having a legally binding agreement to construct the OSDF. The Subcontractor is represented on-site by a qualified individual who is authorized to act on behalf of the Subcontract in all matters pertaining to the construction of the OSDF.

4.3.2 Qualifications

The Subcontractor shall be qualified as required by the subcontract to perform all aspects of work required to successfully construct the project. The Subcontractor shall be registered in accordance with applicable local, state, and federal requirements and shall demonstrate significant prior related experience. The Subcontractor's field representative shall be qualified individual who is able to perform all tasks associated with OSDF construction activities. The Subcontractor's field representative shall demonstrate prior and experience similar to the Construction Manager. The Subcontractor's field representative shall have the authority to direct and instruct the Subcontractor's crews and its lower tier Subcontractors.

4.3.3 Responsibilities

The Subcontractor is responsible for all construction materials and activities. The Subcontractor is also responsible for scheduling and coordination of the required work with its lower-tier Subcontractors to complete the project within the construction schedule approved by the Construction Manager. The Subcontractor shall provide an experienced supervisory representative at all times during any construction activity on site. The Subcontractor is responsible for furnishing as-built record drawings and a copy of all documentation required during the construction of the OSDF. The

Subcontractor is also responsible for updating all construction drawings for any deviations from the original plans and specifications on a daily basis.

The Subcontractor's field representative is responsible for coordinating and supervising the work of all Subcontractors on site. At a minimum, the Subcontractor's field representative will be responsible for the following:

- informing the Construction Manager of any discrepancies between the plans and specifications and the field conditions;
- distributing all documentation required by the Construction Drawings and Technical Specifications in a timely manner;
- attending all project coordination meetings held on site;
- scheduling all phases of the construction;
- maintaining a daily log of all construction activities on site;
- implementing and verifying all QC procedures required of the Subcontractor and/or lower-tier Subcontractors; and
- submitting proposed alternative materials or construction methods to the Construction Manager for approval prior to acquisition and use.

4.4 CQC Consultant

4.4.1 Definition

The CQC Consultant is the party, independent from the Construction Manager and the Subcontractor, responsible for observing, testing, and documenting activities related

to the CQC of the soil and geosynthetic components of the OSDF lining and final cover systems and other activities related to the construction and closure of the OSDF.

4.4.2 Qualifications

The CQC Consultant shall be a well-established firm specializing in liner and final cover system design, construction management, and CQC. The CQC Consultant shall possess the equipment, personnel, and licenses necessary to conduct the monitoring and testing activities required by the OSDF Construction Drawings and Technical Specifications. The CQC Consultant shall also be experienced in the installation and CQC of soil and geosynthetic materials similar to those materials to be used for the lining and final cover system. The CQC Consultant will be experienced in the preparation of CQC documentation including CQC plans, field documentation, field testing procedures, laboratory testing procedures, construction specifications for lining and cover systems, construction plans, and certification reports. The CQC Consultant shall provide qualified staff for the project.

In addition, the CQC Consultant shall provide the following, in writing, 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 services for the installation of the corresponding geosynthetic material; 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 geosynthetic material installed; and
- telephone number of person familiar with the project.

- résumés of CQC personnel to be involved in the project including the CQC, Managing Engineer, CQC Site Manager, and CQC Field Monitors; and

- proof of Professional Engineering registration (or ability to be registered) for the engineer to be the designated CQC Managing Engineer.

The CQC Consultant's personnel shall include:

- the CQC Managing Engineer, who operates from the office of the CQC Consultant and who conducts periodic visits to the site as required;

- the CQC Site Manager, who is located at the site; and

- the CQC Field Monitors, who will be located at the site.

The CQC Consultant organization will be led by the CQC Managing Engineer, who will hold a baccalaureate degree in engineering and be registered as a Professional Engineer. The CQA Site Manager will be the representative of the CQC Consultant on site and will have a minimum of 10 years experience in similar construction and be specifically familiar with the construction of soil and geosynthetic liner and closure system components.

At a minimum, the lead geosynthetics Field Monitor shall have performed CQC activities for the installation of at least 5,000,000 ft^2 of HDPE geomembrane and hold current certification by the National Institute for the Certification of Engineering Technicians (NICET) for the Installation Inspection of Geosynthetic Materials. The lead soils Field Monitor shall have performed CQC activities for the installation of at least 2,500,000 ft^2 of low-permeability clay liner and cover systems. Other Field Monitors will be personnel who are specifically trained in the CQC of geosynthetics and low permeability clays and have documented CQC monitoring experience.

The CQC Consultant shall establish an on-site soils laboratory having qualifications as specified in Section 4.5.2 of this CQA Plan.

4.4.3 Responsibilities

The CQC Consultant shall be responsible for monitoring and documenting the activities of the Subcontractor relative to the installation of the liner and cover system components as well as various appurtenances related to the construction of the OSDF. The CQC Consultant will be responsible for monitoring the compliance of construction materials delivered to the site with the submittals and/or shop drawings previously reviewed by the Construction Manager. The CQC Consultant shall assure that the Subcontractors construction methods and workmanship are performed in accordance with the Construction Drawings and Technical Specifications. The CQC Consultant shall be responsible for obtaining samples of the various construction materials in accordance with the testing frequencies identified in this plan. The CQC Consultant shall also be responsible for obtaining, labeling, and shipping samples for off-site laboratory testing in accordance with the requirements of this plan and appropriate specifications.

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

The on-site soils laboratory shall 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 shall also be responsible for conducting routine field tests during construction of the OSDF liner and final cover systems which shall include:

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

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 shall be maintained in the CQC Consultant's on-site project file. All tests will be conducted in accordance with ASTM or other applicable state or federal standards. Test results shall be submitted to the Construction Manager within a time frame which will not impede or delay construction of the liner and cover systems.

The duties of the CQC Personnel are discussed in the following subsections.

4.4.3.1 CQC Managing Engineer

The CQC Managing Engineer:

- reviews the liner and cover systems construction plans and Construction Drawings and Technical Specifications;
- reviews liner and cover system soils and geosynthetics-related documents (such reviews are for familiarization and for evaluation of constructibility only);
- attends project meetings related to construction quality activities;
- administers the CQC program (i.e., assigns and manages all on-site CQC personnel, reviews all field reports, and provides engineering review of all CQC related activities);
- provides quality control of CQC documentation;
- reviews changes to the liner and cover system design, Construction Drawings, and Technical Specifications; and
- with the CQC Site Manager, prepares the final report.

4.4.3.2 CQC Site Manager

The CQC Site Manager:

- acts as the on-site representative of the CQC Consultant;
- familiarizes all CQC Field Monitors with the site, project documents, and the CQC requirements;

- manages the daily activities of the CQC Field Monitors;
- attends regularly-scheduled CQC-related meetings on-site;
- reviews the ongoing preparation of the construction record drawings;
- reviews test results provided by the Subcontractor;
- verifies the calibration and condition of on-site testing equipment;
- reviews the CQC Field Monitors' daily reports and logs;
- reports to the Construction Manager, and documents in a daily report any reported relevant observations by the CQC Field Monitors;
- prepares a daily report for the project;
- oversees the collection and shipping of all laboratory test samples;
- reviews results of laboratory testing and makes appropriate recommendations;
- reports any unresolved deviations from the CQA Plan, construction plans, and Construction Drawings and Technical Specifications to the Construction Manager;
- assists with the preparation of the final report;
- reviews appropriate certifications and documentation from the Subcontractor and the Geosynthetics Manufacturer and Installer, and makes appropriate recommendations;
- reviews the Geosynthetics Manufacturer's QC documentation;

- reviews the Geosynthetics Installer's personnel qualifications for conformance with those pre-approved for work on site; and

- performs duties of CQC Field Monitor as needed.

4.4.3.3 CQC Field Monitors

The duties of the CQC Field Monitors are monitoring and documenting construction of all soils and geosynthetics components of the liner and cover systems and other OSDF appurtenances, as assigned by the CQC Site Manager.

The duties of the Field Monitors may include:

- monitoring material stockpiles for any deterioration of materials;

- monitoring surface-water drainage in the areas of soil and geosynthetic material stockpiles;

- preparing daily field reports;

- recording CQC activities on field logs;

- reporting problems to the CQC Site Manager;

- assisting with collection of samples from the constructed soil components in accordance with the CQA Plan;

- monitoring soil placement and compaction operations;

- monitoring the unloading and on-site handling and storage of the geosynthetics;

- monitoring geosynthetic repair operations;
- monitoring geosynthetic material deployment and installation operations; and
- collecting conformance samples for testing by CQA laboratories.

In addition to these specific duties, all CQC Field Monitors will document any on-site activities that could result in damage to the soils or geosynthetic components of the liner and cover systems. This is particularly true during the placement and compaction of the initial lift of soil on top of the underlying geosynthetic material. Any observations so noted by the CQC Field Monitors shall be reported immediately to the CQC Site Manager.

4.5 Soils CQC Laboratory

4.5.1 Definition

The Soils CQC Laboratory is the party, independent from the Construction Manager and Subcontractor, responsible for conducting geotechnical laboratory tests in accordance with standards referenced in the Construction Drawings and Technical Specifications and this CQA Plan. The testing results generated by the Soils CQC Laboratory shall be used by the CQC Consultant to verify compliance of the soils construction materials with the plans and specifications and submittals previously approved by the Construction Manager.

It is anticipated that the Soils CQC Laboratory will be required to perform the conformance evaluation testing of the various soils components of the OSDF and more sensitive performance testing required during construction such as hydraulic conductivity testing which require tightly controlled laboratory conditions.

4.5.2 Qualifications

The Soils CQC Laboratory will be experienced 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 Soils 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 Soils CQC Laboratory, if different from the CQC Consultant, shall submit their qualifications and QA/QC procedures to the Construction Manager for review and approval. The qualifications presented by the Soils CQC Laboratory shall, as a minimum, include:

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

4.5.3 Responsibilities

The Soils CQC Laboratory will be responsible for testing various soils components of the OSDF liner and final cover systems. These tests shall include, but not be limited to, material qualification (conformance) tests and material construction quality control (performance) tests as described in Construction Drawings and Technical Specifications. The CQC Consultant will be responsible for coordinating the Soils CQC Laboratory testing.

4.6 Geosynthetics CQC Laboratory

4.6.1 Definition

The Geosynthetics CQC Laboratory is the party, independent from the Construction Manager, Subcontractor, and Geosynthetics Manufacturer and Installer, responsible for conducting tests on samples of geosynthetic materials used in construction of the OSDF liner and cover systems in accordance with standards referenced in the Construction Drawings and Technical Specifications and this CQA Plan. The testing results generated by the Geosynthetics CQC Laboratory shall be used by the CQC Consultant to verify compliance of the geosynthetic materials with plans and specifications and submittals previously approved by the Construction Manager.

It is anticipated that the Geosynthetics CQC Laboratory will be required to perform the conformance evaluation testing of the various geosynthetic components of the OSDF and the performance testing required during construction such as destructive seam testing.

4.6.2 Qualifications

The Geosynthetics CQC Laboratory shall hold current accreditation by Geosynthetic Research Institute (GRI) and have experience in testing geosynthetics similar to those proposed for use during construction of the OSDF. The Geosynthetics CQC Laboratory shall be familiar with ASTM and other applicable geosynthetic test standards. 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, if different from the CQC Consultant, shall submit their qualifications to the Construction Manager for review and approval. The qualifications presented by the Geosynthetics CQC Laboratory shall, as a minimum, include:

- corporate background and statement of qualifications;
- listing 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.

4.6.3 Responsibilities

The Geosynthetics CQC Laboratory will be responsible for testing various geosynthetic components of the liner and cover systems. These tests shall include, but not be limited to, geosynthetic conformance tests and destructive testing of the geomembrane field seams as described in the Construction Drawings and Technical Specifications. The CQC Consultant will be responsible for coordinating the Geosynthetics CQC Laboratory testing.

4.7 Geosynthetics Manufacturers

4.7.1 Definition

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

4.7.2 Qualifications

The Geosynthetics Manufacturers shall be able to provide sufficient production capacity and qualified personnel to meet the demands of the project schedule. Prior to shipment of any material to the site, each Geosynthetics Manufacturer shall be pre-qualified and approved by the Construction Manager. The geotextile, geomembrane, and GCL manufacturers shall meet the qualifications outlined in Sections 02714, 02770, and 02772 of the Technical Specifications, respectively.

4.7.3 Responsibilities

Each Geosynthetics Manufacturer is responsible for the production and quality control of its respective geosynthetic product. In addition each Geosynthetics Manufacturer is responsible for the condition of the geosynthetic until the material is accepted by the Subcontractor. Each Geosynthetics Manufacturer shall produce a consistent high quality product which shall meet all the requirements of the specifications. Each Geosynthetics Manufacturer shall submit quality control documentation to the Construction Manager for its respective products as required by the Technical Specifications.

4.8 Geosynthetics Installer

4.8.1 Definition

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 Subcontractor to the Construction Manager as required by the Technical Specifications.

4.8.2 Qualifications

The Geosynthetics Installer shall meet the qualifications outlined in Section 02770 of the Technical Specifications.

The Geosynthetics Installer will designate one representative as its supervisor, who will be responsible for acting as the Geosynthetics Installer's spokesman on site. The Geosynthetics Installer will provide the Construction Manager with a list of proposed seaming personnel and their qualifications. This document will be reviewed by the CQC Consultant. Final approval of the Geosynthetic Installers seaming personnel will be the responsibility of the Construction Manager. Any proposed seaming personnel deemed insufficiently experienced will not be accepted. The most experienced seamer, the "master seamer", shall provide direct supervision, as required, over less experienced seamers. No field seaming shall take place without the master seamer being present.

4.8.3 Responsibilities

The Geosynthetics Installer's supervisor will be responsible for handling installation of the geosynthetics used in construction of the OSDF and for providing supervision and guidance to the installation crew. The Geosynthetics Installer's supervisor is also responsible for the following: (i) obtaining samples, as required by the CQA Plan and the specifications; (ii) field testing; (iii) documenting quality control testing activities; and (iv) coordinating the geosynthetics installation activities with the Construction Manager. The Geosynthetics Installer's supervisor will be responsible for documenting the geosynthetics installation activities, including, but not limited to, on-site personnel, material inventories, production figures, test results, installation deficiencies, and resolution of construction problems.

4.9 Surveyor

4.9.1 Definition

The Surveyor is responsible for lines and grades required for control of the work on an ongoing basis during all phases of the OSDF construction. Close interaction between the Surveyor, Subcontractor, and the CQC Consultant is essential to ensure that construction of the OSDF is completed in accordance with the Construction Drawings and Technical Specifications.

4.9.2 Qualifications

The project Surveyor shall be a licensed Professional Land Surveyor who shall sign and seal all construction survey record drawings. All surveying personnel shall be experienced in the provision of surveying services, including detailed accurate documentation as required in Section 02100 of the Technical Specifications.

4.9.3 Responsibilities

The Surveyor is responsible for all surveying activities and products in accordance with Section 02100 of the Technical Specifications.

5. DOCUMENTATION

An effective CQA Plan depends largely on recognition of all construction activities that should be monitored and the assignment of responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance and quality control activities. The CQC Consultant shall be responsible for assuring that the Subcontractor's quality control requirements have been addressed and satisfied.

The CQC Site Manager shall make available to the Construction Manager descriptive daily field reports, data sheets, and logs which document that monitoring activities have been carried out. The CQC Site Manager will submit weekly reports to the Construction Manager covering significant activities and observations during the preceding week. Examples of some of the forms which will be used to document CQC activities are included in Appendix A. The CQC Site Manager shall also maintain at the job site a complete file of Construction Drawings and Technical Specifications, this CQA Plan, the Subcontractor's Quality Control Plan(s), checklists, test procedures, daily logs, and other pertinent construction and CQC documents.

5.1 Daily Recordkeeping

The CQC Consultant's daily reporting procedures shall include: (i) daily summary report; (ii) monitoring logs; (iii) testing data sheets; and (iv) when appropriate, problem identification and corrective measures reports.

5.1.1 Daily Summary Reports

The CQC Consultant's daily summary reports shall 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;
- data on weather conditions;
- summary on meetings held and their results;
- process description(s) and location(s) of construction underway during the time frame of report;
- descriptions and specific locations of areas, or units, of work being tested and/or observed 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 problem reporting and corrective measures reports used to substantiate the decisions described above;
- signature of the respective CQC Site Manager and/or the CQC Field Monitor; and
- any corrections to the Daily Summary Reports shall be single line crossed out, initialed by the correcting personnel, and dated.

5.1.2 CQA Monitoring Logs and Test Data Sheets

Monitoring observations, sampling information, and test results shall be recorded on an appropriate monitoring logs and test data sheets. The CQC Consultant shall use the monitoring logs and test data sheets to ensure completeness of the required CQC activities. Any corrections to the monitoring logs and test data sheets shall be single line crossed out, initialed by the CQC personnel responsible for the correction and dated. Examples of relevant monitoring logs are presented in Appendix A.

The CQC Consultant's monitoring logs and test data sheets shall include the following information as applicable:

- project specific information such as project name, location;
- the date the CQC activity was performed;
- a unique identifying sheet number for cross-referencing and document control;
- description or title of the CQC activity or test procedure;
- location of the CQC activity or location from which the sample increment was obtained;
- type of CQC activity or procedure used (reference to standard method when appropriate);
- recorded observation or test data, 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 CQC inspection 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, logs, or test data sheets where the nonconformance was identified. The reports should 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 measure;
- documentation of correction (reference to inspection data sheets);
- final results;
- suggested methods to prevent similar problems; and
- signature of the appropriate CQC Field Monitor and concurrence by the CQC Site Manager.

In some cases, not all of the above information will be available or obtainable. However, when available, such efforts to document nonconformances could help to

avoid similar nonconformances in the future. The CQC Site Manager shall distribute copies of the report to the Construction Manager for further actions.

5.2 Photographic Documentation

The Construction Manager will be responsible for obtaining photographic documentation of the Subcontractor's activities, materials installation methods, and testing procedures. Photographs will serve as a pictorial record of work progress, problems, and corrective measures. Photographic reporting data sheets should be utilized to organize and document photographs taken during construction of the OSDF also may prove useful. Such data sheets could be cross-referenced or appended to summary reports, CQC monitoring logs, or test data sheets and/or problem identification and corrective measures reports. At a minimum, photographic reporting data sheets 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 shall be organized chronologically and kept in a permanent protective file. Negatives shall be stored in a separate protective file.

5.3 Design and/or Specifications Changes

Design and/or specifications changes may be required during construction. In such cases, the Subcontractor must submit written requests for such changes to the Construction Manager. The Resident Engineer shall review and respond to these requests in a timely manner. Design and/or specifications changes will be made only

with the approval of the Construction Manager. Such changes will take the form of a design change notice (DCN) to the Subcontract.

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 Subcontractor 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 any revision to procedures or specifications must be approved by the Construction Manager.

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 has 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 logs and testing data sheets 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 Managing Engineer.

The Subcontractor's record 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, etc.), and a geomembrane panel record drawings prepared by the CQC Consultant and 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 and upon issuance of the final certification report, the CQC document originals will be organized and submitted to the Construction Manager. Records shall be filed in accordance with the subject file index and shall be retained for 30 years after closure of the OSDF. Required records shall 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 shall be performed during installation of the various soil liner and cover system and other earthwork components. Criteria to be used for determination of acceptability of the various soil layers are identified in the Construction Drawings and Technical Specifications and this CQA Plan.

6.2 Soil Components

There are several soil components included in OSDF liner and cover systems. The soil components or layers of the OSDF liner system include the following, from top to bottom:

- a 1-ft thick granular LCS layer and corridor having a hydraulic conductivity of 1×10^{-1} cm/s or greater and 10 cm/s respectively;
- a 1-ft thick granular LDS layer and corridor having a hydraulic conductivity of 1×10^{-1} cm/s or greater and 10 cm/s respectively; and
- a 3-ft thick compacted clay layer having a hydraulic conductivity of 1×10^{-7} cm/s or less.

The soil layers of the OSDF final cover system include the following, from top to bottom:

- a 0.5-ft thick topsoil layer;
- a 1.75-ft thick vegetative soil layer;

- a 0.5-ft thick granular filter layer;
- a 3-ft thick biointrusion barrier;
- a 1-ft thick cover drainage layer having a hydraulic conductivity of 1×10^{-1} cm/s or greater; and
- a 2-ft thick compacted clay cap having a hydraulic conductivity of 1×10^{-7} cm/s or less.

The prepared subgrade soils which will support the OSDF liner system will require preparation in the form of grading, placement, and compaction prior to the installation of the liner system materials. The prepared soil subgrade layer will generally be comprised of in situ materials or borrow area fill materials which must also be monitored and tested in accordance with the Construction Drawings and Technical Specifications and this CQA Plan.

Trench backfilling and the miscellaneous soil construction is also included in this section of the CQA Plan.

6.3 Record Drawings and As-Built Surveys

During construction of the soil components of OSDF, the CQC Consultant shall routinely review record drawings submitted by the Subcontractor. The drawings are used to verify location of work, percent of work completed, layer thickness, or final grades. Prior to the placement of successive soil or geosynthetic layers the CQC Consultant shall review certified as-built surveys which indicate compliance of the preceding layer thickness, lines, and grades. Once an as-built survey has been reviewed by the CQC Consultant it will be the responsibility of the Construction Manager to review the information in a timely manner and notify the Subcontractor of any noncompliance.

6.4 Related Construction Drawings and Technical Specifications

Several sections of the Technical Specifications should be referenced by the CQC Consultant for pertinent soil materials physical properties and construction requirements. Related specifications include the following:

- Section 02100 - Surveying;
- Section 02200 - Earthwork;
- Section 02215 - Trenching and Backfilling;
- Section 02225 - Compacted Clay Liner and Cap;
- Section 02250 - Vegetative Soil Layer;
- Section 02710 - Granular Drainage Layer;
- Section 02712 - Granular Filter; and
- Section 02920 - Topsoil.

6.5 Earthwork

Prior to the start of earthwork operations, the CQC Consultant shall review the information required by Section 02200 of the Technical Specifications. Compliance of the submittals with the Technical Specifications shall be determined by the Construction Manager.

During construction, conformance and performance testing of the subgrade soil materials shall be performed by the CQC Consultant. The CQC Consultant shall monitor proofrolling of areas that are cut to achieve grade. Material placed to achieve

grades indicated on the Construction Drawings shall be tested by the CQC Consultant in accordance with the tests methods and frequencies shown in Table 6-1 and 6-3, to verify that the compacted fill material used by the Subcontractor complies with the Technical Specifications. Areas of proofrolling or compacted fill that do not meet the Technical Specifications will be delineated and reported to the Construction Manager. The areas will be retested after any reworking by the Subcontractor. This process will be repeated until passing results are achieved.

The CQC Consultant shall monitor the repair and rework of subgrade which is damaged by excess moisture (causing softening) and insufficient moisture (causing desiccation and shrinkage), or by freezing. If such conditions are found to exist, the CQC Consultant shall evaluate the suitability of the subgrade by the following methods as applicable:

- moisture/density testing;
- continuous visual inspection during proof-rolling;
- checking the consistency of cohesive soils using a penetrometer, hand-held vane shear device, or other suitable field expedient measurement device in suspect weak soil areas; and/or
- other tests identified in Tables 6-1 through 6-4.

6.6 Conformance Testing

It will be necessary for the CQC Consultant to observe and test the soil components of the OSDF liner and cover systems to ensure they are uniform and conform to the requirements of the Technical Specifications. For soil materials obtained from the on-site borrow area, visual inspections and conformance tests shall be performed by the CQC Consultant prior to the materials being excavated. If soil materials are obtained from off site borrow sources, visual inspection and conformance

tests shall be performed at the source location or as the materials arrive at the OSDF site. Borrow area inspections may also be utilized by the CQC Consultant to ensure that only suitable soil materials are transported to the OSDF site. For both on-site and off-site borrow areas containing non-uniform materials, it shall be necessary for the Subcontractor and the CQC personnel to coordinate excavation and monitoring of the segregation of substandard materials. All materials failing to comply with conformance standards shall be reported to the Construction Manager.

Initial evaluation of various soil types by CQC personnel during construction shall be largely visual; therefore, the CQC personnel must be experienced with visual-manual soil classification procedures. CQC personnel shall be aware that changes in color or texture can be indicative of a change in soil type. CQC personnel shall observe soils for deleterious materials (e.g., roots, stumps, glass, and large objects). When necessary, the visual-manual procedure for the description and identification of soils shall be conducted by the CQC Consultant in accordance with test method ASTM D 2488.

6.6.1 Test Methods

Conformance tests used to evaluate the suitability of soil materials during construction shall be performed in accordance with the current ASTM or other applicable test procedures indicated in Tables 6-1 and 6-2. Documentation and reporting of the test results shall be the responsibility of the CQC Consultant.

The Standard Proctor Test (ASTM D 698) shall 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) shall be used for in-situ field testing. The sand cone test method (ASTM D 1556) shall 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. Any conflict regarding acceptance of test results shall be resolved by the Construction Manager.

6.6.2 Test Frequency

The frequency of conformance tests shall conform to the minimum frequencies presented in Tables 6-1 and 6-2. The frequency of testing may be increased at the discretion of the Construction Manager or if variability of the materials is observed. The testing frequencies described herein for compacted fill shall also apply to materials used by the Subcontractor in areas outside the limits of the final cover system of the OSDF.

6.7 Construction Monitoring

During installation of the various soil components, the CQC Consultant shall visually observe and document the Subcontractor's earthwork activities for the following:

- changes in the soil consistency;
- the thickness of lifts as loosely placed and as compacted;
- soil liner 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.

6.8 Hydraulic Conductivity Testing Evaluations

As shown in Tables 6-1 and 6-2, hydraulic conductivity (permeability) tests shall be conducted on materials proposed for use as the soil component of the compacted clay liner and cap as well as the soil materials which shall comprise the LDS, LCS, and cover drainage layers. Permeability testing of compacted clay liner and cap materials shall be accomplished in accordance with ASTM 5084 at a confining stress of 5 psi. Permeability testing of the LDS, LCS, and cover drainage layers shall be performed in accordance with ASTM D 2434. Laboratory remolded samples shall be used for conformance evaluation of the clay liner and cap materials prior to construction. The CQC Consultant shall be responsible for documenting pertinent sampling information including the date the sample was obtained, sample identification number, and location.

6.9 Performance Testing

During construction, the CQC Consultant shall observe and test the soil components of the OSDF liner and cover systems to ensure they are installed in accordance with the requirements of the Construction Drawings and Technical Specifications. The CQC Consultant shall also evaluate the procedures, methods, and equipment used by the Subcontractor to install the various soil components.

6.9.1 Test Methods

All performance testing shall be conducted in accordance with the Technical Specifications or as directed by the Construction Manager. The CQC field testing methods, used to evaluate the suitability of soils during their installation, shall be performed by the CQC Consultant in accordance with current ASTM test procedures indicated in Tables 6-3 and 6-4. Test results shall be documented and reported to the Construction Manager.

6.9.2 Test Frequency

Performance testing shall be conducted during the course of the work. The minimum construction performance testing frequencies are presented in Tables 6-3, and 6-4. 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 shall be selected by the CQC Consultant. If necessary, the location of routine in-place density tests shall be determined using a non-biased sampling approach.

A special testing frequency shall be used at the discretion of the Construction Manager when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas shall be considered when:

- rollers slip during rolling operation;
- lift thickness is greater than specified;
- earthfill is at improper 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;
- 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:

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

6.10 Clay Liner and Cap Perforations

Perforations that must be filled shall include, but not be limited to, the following:

- in-place density test probe locations;
- sand cone or drive 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, shall be filled in accordance with the requirements of Section 02225 of the Technical Specifications and this CQA Plan. Additional density and moisture testing of these areas, if required, shall be conducted at the discretion of the Construction Manager.

6.11 Field Equipment Decontamination

The CQC Consultant shall 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. 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.

6.12 Deficiencies

If a defect is discovered in the soils construction, the CQC Consultant shall immediately determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQC Consultant shall determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQC Consultant deems appropriate. If the defect is related to adverse site conditions, such as overly wet soils or surface desiccation, the CQC Consultant shall define the limits and nature of the defect.

6.12.1 Notification

As soon as possible, after determining the extent and nature of substandard materials, noncompliant construction practice, or other such deficiency in materials or workmanship which cannot be immediately resolved on-the-spot, the CQC Consultant shall notify the Construction Manager and Subcontractor and schedule appropriate retests when the work deficiency is to be corrected.

6.12.2 Repairs and Retesting

The CQC Consultant shall verify that the Subcontractor has corrected all noted deficiencies to the satisfaction of the Construction Manager. If a specified criterion cannot be met, or unusual weather conditions hinder work, the Subcontractor shall submit suggested solutions or alternatives 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. Alternatively, at the Construction Manager's option, undisturbed samples of in-place material shall be obtained for hydraulic conductivity or other appropriate testing. All retests performed by the CQC Consultant must verify that the deficiency has been corrected before any additional work is performed by the Subcontractor in the area of the deficiency.

6.13 Documentation

The documentation of soils CQC testing activities is an important factor in assuring the successful construction, performance, and approval of the OSDF soil liner and closure system components. The CQC monitoring observations, sample location descriptions, field test results, and on-site laboratory test results shall be documented by the CQC Consultant on forms similar to the examples included in Appendix A. Reports and forms shall be provided to the Construction Manager as requested. Weekly reports shall be regularly submitted to the Construction Manager.

TABLE 6-1
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS

TEST NAME/TEST METHOD	SOIL TYPE			
	COMPACTED FILL	COMPACTED CLAY LINER	GRANULAR DRAINAGE MATERIAL	EMBEDMENT FILL
SPECIFICATION SECTION	02200	02225	02710	02215
Particle Size Analysis/ASTM D 422 (sieve only)	1 test per 5,000 yd^3	1 test per 1,500 yd^3 (1)	N/A	N/A
Particle Size Analysis/ASTM C 136	N/A	N/A	1 test per 3,000 yd^3	1 test per 1,000 yd^3
Atterberg Limits/ASTM D 4318	1 test per 5,000 yd^3	1 test per 1,500 yd^3	N/A	N/A
Moisture Content/ASTM D 2216 or ASTM D 4643	1 test per 5,000 yd^3	1 test per 1,500 yd^3	N/A	
Soil Classification/ASTM D 2487	1 test per 5,000 yd^3	1 test per 1,500 yd^3	1 test per 3,000 yd^3	1 test per 1,000 yd^3
Standard Proctor/ASTM D 698	1 test per 5,000 yd^3	1 test per 1,500 yd^3	N/A	N/A
Hydraulic Conductivity/ASTM D 5084	N/A	1 test per 10,000 yd^3 (remold sample)(3)	N/A	N/A
Hydraulic Conductivity/ASTM D 2434	N/A	N/A	1 test per 3,000 yd^3	N/A
Carbonate Content/ASTM D 3042(2)	N/A	N/A	1 test per 5,000 yd^3	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. For Phase I, the frequency shall be 1 test per 1,500 yd^3. This frequency shall be evaluated for modification during later phases.

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TABLE 6-2
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR OSDF COVER SYSTEM COMPONENTS

TEST NAME/TEST METHOD	SOIL TYPE						
	COMPACTED CLAY CAP	COVER DRAINAGE LAYER	BIOINTRUSION BARRIER		GRANULAR FILTER	VEGETATIVE SOIL LAYER	TOPSOIL
			PRIMARY BIOINTRUSION BARRIER	CHOKE STONE			
SPECIFICATION SECTION	02225	02710	02280	02280	02712	02250	02920
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)
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
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
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
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
Hydraulic Conductivity/ASTM D 5084	1 test per 1,500 yd^3 (remold)	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
Carbonate Content/ASTM D 3042 (2)	N/A	1 test per 5,000 yd^3				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 = Not Applicable

NOTE: 1. Also, perform hydrometer analysis once every tenth test.

2. Sample to be tested at pH of 4.

3. Perform hydrometer analysis for each test.

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TABLE 6-3
PERFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS

TEST NAME/TEST METHOD	COMPACTED FILL	TRENCH BACKFILL	ANCHOR TRENCH BACKFILL	COMPACTED CLAY LINER	GRANULAR DRAINAGE MATERIALS
SPECIFICATION SECTION	02200	02215	02215	02225	02710
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	5 tests per acre per lift[1]	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	5 tests per acre per lift[1]	N/A
Sand Cone/ASTM D 1556	1 test per 25 nuclear tests	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

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TABLE 6-4
MINIMUM PERFORMANCE TESTING FREQUENCIES FOR OSDF COVER SYSTEM COMPONENTS

TEST NAME/TEST METHOD	SOIL TYPE						
			BIOINTRUSION BARRIER				
	COMPACTED CLAY CAP	COVER DRAINAGE LAYER	PRIMARY BIOINTRUSION BARRIER	CHOKE STONE	GRANULAR FILTER	VEGETATIVE SOIL LAYER	TOPSOIL
SPECIFICATION SECTION	02225	02710	02280	02280	02712	02250	02920
In-situ Moisture/ASTM D 3017	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	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	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

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7. GEOMEMBRANE LINER AND COVER

7.1 Introduction

The CQC Consultant shall perform conformance testing and shall 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 shall be carried out by the CQC Consultant in accordance with the current versions of the ASTM or other applicable test procedure indicated in Tables 7-1 and 7-2.

7.2 Related Construction Drawings and Technical Specifications

The Subcontractor shall comply with Section 02770 of the Technical Specifications. This specification shall be referenced for the various physical properties, manufacturing quality control, and installation requirements of the geomembrane materials.

7.3 Manufacturing Plant Visit

The Construction Manager, or authorized representative (i.e., the CQC Consultant), shall visit the plant of the Geomembrane Manufacturer for the purpose of verifying manufacturing quality control procedures are in conformance with Section 02770 of the Technical Specifications. If possible, such a visit shall be performed prior to or during the manufacturing of the geomembrane rolls for the OSDF project. The Construction Manager shall review the manufacturing process, quality control procedures, laboratory facilities, and testing procedures.

During the project specific plant visit, the Construction Manager shall:

- verify that properties guaranteed by the Geosynthetics Manufacturer meet all specifications;
- verify that the measurements of properties by the Geosynthetics Manufacturer are properly documented and test methods used are acceptable;
- spot inspect the rolls and verify that they are free of holes, blisters, or any sign of contamination by foreign matter;
- review packaging and transportation procedures to verify that these procedures are not damaging the geomembrane;
- verify that all rolls are properly labeled; and
- verify 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 shall be completed by the Construction Manager.

7.4 Transportation, Handling and Storage

The CQC Consultant shall monitor the transportation, handling, and storage of the geomembrane on-site. The Construction Manager shall designate a geomembrane storage location. It will be the responsibility of the Subcontractor to protect the geomembrane stored on site from theft, vandalism, and damage.

Upon delivery at the site, the Subcontractor, Geosynthetics Installer, and CQC Consultant shall conduct an inspection of the rolls for defects and damage. This

inspection shall be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant shall 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 shall 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 Procedures

Upon delivery of the geomembrane rolls to the OSDF, the CQC Consultant shall ensure that representative geomembrane conformance samples are obtained at the specified frequency and forwarded to the Geosynthetics CQC Laboratory for testing. Geomembrane conformance samples shall be taken across the entire width of the roll and shall not include the first 3 ft of material. Unless otherwise directed by the Construction Manager, samples shall be 3 ft long by the roll width. The required minimum geomembrane conformance sampling frequencies are provided in Table 7-1. The CQC Consultant shall 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 Procedures

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

7.5.3 Test Results

All conformance test results shall be reviewed, accepted, and reported by the CQC Consultant before deployment of the geomembrane. Any nonconformance of the material's physical properties with the requirements of the Technical Specifications shall be reported to the Construction Manager. In all cases, the test results shall meet, or exceed, the property values listed in Appendix B.

7.5.4 Conformance Test Failure

In the case of failing test results, the Subcontractor 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 procedure. If the retest fails or if the option to retest is not exercised, then two isolation conformance samples shall be obtained by the CQC Consultant. These isolation samples shall 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 fail numerically between the passing roll numbers shall be rejected by the Construction Manager. The CQC Consultant will verify that the Subcontractor has replaced all rejected rolls. The CQC Consultant shall document all actions taken in conjunction with geomembrane conformance failures.

7.6 Anchorage Trench

The CQC Consultant shall verify and document that the anchor trench has been constructed according to Construction Drawings. The amount of anchor trench open at any time shall be limited to one day of geomembrane installation capacity. The anchor trench shall be constructed with proper drainage to prevent ponding.

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 shall 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 shall verify 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 shall assure 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 shall document the correspondence between roll numbers, factory panels, and field panel identification codes. The field panel identification code shall be used for all quality assurance/quality control records.

7.7.2 Field Panel Placement

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

Geomembrane placement shall not proceed at an ambient temperature below 40°F or above 104°F 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 shall monitor that the above conditions are fulfilled and that the supporting soil has not been damaged by adverse weather conditions.

The CQC Consultant shall 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;
- any geosynthetic elements immediately underlying the geomembrane are clean and free of foreign objects or debris;
- all 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., sand bags, tires), not likely to damage the geomembrane, has been placed to prevent uplift by wind (in case of high winds, continuous loading, e.g., by adjacent sand bags, is recommended along edges of panels to minimize risk of wind flow under 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 shall observe the geomembrane panels, after placement and prior to seaming, for damage. The CQC Site Manager shall advise the Construction

Manager which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected shall 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 shall 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 should 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 should be less than 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. All 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 giving the temperature in the apparatus and at the nozzle. The CQC Consultant shall verify that the extrudate is comprised of the same resin as the geomembrane sheeting. The CQC Consultant shall monitor temperatures, extrudate temperatures, ambient temperatures, and geomembrane surface temperatures at appropriate intervals.

The CQC Consultant shall 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 on a smooth base such that no damage occurs 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 shall monitor ambient temperatures, and apparatus temperatures.

The CQC Consultant shall 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 on a smooth base such that no damage occurs to the geomembrane;
- for cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to welding;
- 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 shall 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 Geomembrane Manufacturer's instructions or Section 02770 of the

Technical Specifications, whichever is the more stringent, 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:

- Unless authorized in writing by the Construction Manager, no seaming shall be attempted at an ambient temperature below 40°F or above 104°F.
- Between ambient temperatures of 40°F and 50°F, 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 50°F resulting from wind.
- In all cases, the geomembrane seam areas shall be dry and protected from wind.

The CQC Consultant shall verify that methods used by the Subcontractor for seaming at ambient temperatures below 40°F or above 104°F will produce seams which are entirely equivalent to seams produced at ambient temperatures between 40°F and 104°F and protect the overall quality of the geomembrane. The CQC Consultant shall 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 shall 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 procedure 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 shall verify that the Geosynthetics Installer performs trial seam tests in accordance with Section 02770 of the Technical Specifications. The CQC Consultant shall observe and document the Geosynthetic Installers trial seam testing procedures. The trial seam samples shall be assigned an identification number and marked accordingly by the CQC Consultant. Each sample shall 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 Subcontractor until a passing destructive test is achieved on seam represented by the trial seam sample.

7.8.7 General Seaming Procedures

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

- For fusion welding, a movable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be seamed. This is to prevent any moisture build-up between the sheets to be welded.

- If required, a firm substrate shall be provided by using a flat board, 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 Subcontractor to the satisfaction of the Construction Manager.

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

7.8.8 Nondestructive Seam Continuity Testing

The CQC Consultant shall monitor that the Geosynthetics Installer shall nondestructively test all 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 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. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming. The CQC Consultant shall:

- monitor nondestructive testing;
- document the results of the nondestructive testing; and
- inform the Subcontractor and Construction Manager of any noncompliance.

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

- observe the repair procedures;
- observe the retesting procedures; 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 shall be recorded by the CQC Consultant.

7.8.9 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.

7.8.9.1 Location and Frequency

The CQC Consultant shall select all destructive seam test sample locations. Sample locations shall 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 shall be determined during seaming at the CQC Consultants 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 shall not be informed in advance of the locations where the seam samples will be taken.

7.8.9.2 Sampling Procedures

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

- observe sample cutting;

- assign a number to each sample, and mark it accordingly; and

- record sample location on layout drawing.

All holes in the geomembrane resulting from destructive seam test sampling shall be immediately repaired in accordance with repair procedures 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 7.9.8.

7.8.9.3 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 should 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 shall 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 shall 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.

7.8.9.4 Field Testing

The test strips shall be tested in the field, for peel adhesion, using a gauged tensiometer. In addition to meeting the strength requirements outlined in Appendix B, all 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 shall witness all field tests and mark all samples and portions with their number. The CQC Consultant shall also log the date, number of seaming unit, seaming technician identification, destructive sampling, and pass or fail description.

7.8.9.5 Geosynthetics CQC Laboratory Testing

Destructive test samples shall be tested by the Geosynthetics CQC Laboratory. Testing shall include "Bonded Seam Strength" and "Peel Adhesion" (ASTM D 4437). The minimum acceptable values to be obtained in these tests are presented in Appendix B. At least five specimens shall be tested for each test method. Specimens shall 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 shall be tested for peel adhesion. A passing test shall meet the minimum required values in at least four out of five specimens.

The Geosynthetics CQC Laboratory shall provide test results no more than 24 hours after they receive the samples. The CQC Site Manager shall review laboratory test results as soon as they become available, and make appropriate recommendations to the Construction Manager.

7.8.9.6 Procedures for Destructive Test Failure

The following procedures shall 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 an 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.

All failed seams must 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 shall document all actions taken in conjunction with destructive test failures.

7.9 Defects and Repairs

7.9.1 Identification

All seams and non-seam areas of the geomembrane shall 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 shall be clean at the time of examination. The Construction Manager shall require the geomembrane surface to be broomed or washed by the Subcontractor if the amount of dust or mud inhibits examination.

7.9.2 Repair Procedures

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 procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Subcontractor and Construction Manager.

In addition, the following conditions shall 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;
- all surfaces must be clean and dry at the time of the repair;
- all seaming equipment used in repairing procedures must be approved:
- the repair procedures, materials, and techniques shall be approved by the Construction Manager in advance of the specific repair;
- 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.

7.9.3 Verification of Repairs

Each repair shall be numbered and logged. Each repair shall be non-destructively tested using approved methods. Repairs which 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 shall observe all non-destructive testing of repairs and shall record the number of each repair, date, and test outcome.

7.10 Liner and Cover System Acceptance

The Subcontractor shall retain all responsibility for the geosynthetics until acceptance by the Construction Manager. The terms for liner system acceptance are described in Section 02770 of the Technical Specifications.

7.11 Materials in Contact with the Geomembrane

The procedures outlined in this section are intended to assure that the installation of materials in contact with the geomembrane do not cause damage. Additional quality assurance and quality control procedures are necessary to assure that systems built with these materials will be constructed in such a way to ensure proper performance.

7.11.1 Soils

The CQC Consultant shall monitor that the Subcontractor takes all necessary precautions to ensure that the geomembrane is not damaged during its installation or during the installation of other components of the liner or cover system or by other construction activities. The CQC Consultant shall monitor the following:

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

- soil placement operations above the geomembrane which shall be made by the Subcontractor to minimize wrinkles in the geomembrane;

- equipment used for placing soil shall not be driven directly on the geomembrane;
- a minimum soil thickness of 1 ft is used between a light track-mounted dozer (e.g., having a maximum ground pressure of 5 psi) and the geomembrane;
- a minimum thickness of 3 ft of soil is used between rubber-tired vehicles and the geomembrane; and
- soil thickness shall be greater than 3 ft in heavily trafficked areas such as access ramps.

7.11.2 Appurtenances

The CQC Consultant shall 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]
Specific Gravity	ASTM D792 Method A or ASTM D1505	1 test per 100,000 ft^2
Thickness	ASTM D 519 or GRI-GM8	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 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 4354.

TABLE 7-2:

GEOMEMBRANE SEAM TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY
Peel Adhesion	ASTM D44371[1,3]	1 test every 500 ft of seam length
Bonded Seam Strength	ASTM D4437[2,3]	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

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.

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8. GEOSYNTHETIC CLAY LINER AND CAP

8.1 Introduction

The CQC Consultant shall perform conformance testing and shall 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 shall 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.

8.2 Related Construction Drawings and Technical Specifications

The Subcontractor shall comply with Section 02772 of the Technical Specifications. This specification shall be referenced for the various physical properties, manufacturing quality control, and installation requirements of the GCL and GCC materials.

8.3 Transportation, Handling, and Storage

The CQC Consultant shall 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. Any protective wrapping that is damaged or stripped off the rolls shall be repaired immediately to the satisfaction of the Construction Manager. During transportation, handling, and storage the GCL and GCC rolls will be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

Upon delivery at the site, the Subcontractor, Geosynthetics Installer, and CQC Consultant shall conduct an inspection of the rolls for defects and damage. This inspection shall be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant shall 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 shall 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.

8.4 Conformance Testing

8.4.1 Sampling Procedures

Upon delivery of the rolls of GCL and GCC, the CQC Consultant will assure that samples are removed and forwarded to the Geosynthetic CQC Laboratory for testing of conformance to both the design specifications and the list of guaranteed properties provided by the manufacturer. Unless otherwise directed by the Construction Manager, conformance samples will be 3 ft long by the roll width. The CQC Consultant will mark the machine direction on the samples with a waterproof maker and tap or otherwise secure the cut edges of the sample to eliminate the loss of the granular bentonite. The required minimum 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 shall 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.

8.4.2 Testing Procedure

Conformance testing of the GCL and GCC materials delivered to the site will be conducted to ensure compliance with both the Technical Specifications and the manufacturer's list of minimum average roll values. As a minimum, the GCL and GCC conformance test procedures listed in Table 8-1 shall be performed by the Geosynthetics CQC laboratory.

8.4.3 Test Results

The CQC Consultant will examine all results from laboratory conformance testing and will report any nonconformance to the Construction Manager. The GCL and GCC conformance test result shall meet or exceed the minimum physical property values presented in Appendix C.

8.4.4 Conformance Test Failure

In the case of failing test results, the Subcontractor 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 procedure. If the retest

fails or if the option to retest is not exercised, then two isolation conformance samples shall be obtained by the CQC Consultant. These isolation samples shall 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 fail numerically between the passing roll numbers shall be rejected by the Construction Manager. The CQC Consultant will verify that the Subcontractor has replaced all rejected rolls. The CQC Consultant shall document all actions taken in conjunction with GCL and GCC conformance failures.

8.5 Surface Preparation

The GCL and GCC shall not be placed on surfaces which are softened due to high water content or cracked due to desiccation. 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 Subcontractor shall comply with the compacted clay liner surface preparation and acceptance requirements identified in Section 02225 of the Technical Specifications. Additionally, the surface shall contain no loose stones and no ruts greater than 1/2-in. depth. The CQC Consultant shall 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.

8.6 Placement

The CQC Consultant shall verify that the Geosynthetics Installer has taken all necessary precautions to protect the underlying subgrade during GCL and GCC deployment operations. The CQC Consultant shall verify that all GCL and GCC are handled in such a manner as to ensure they are not damaged in any way, 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, all GCL and GCC are weighted with sandbags or the equivalent;

- 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 other 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 assure that damaged areas, if any, are identified and repaired; and

- if a white colored GCL and GCC is used, precautions are taken against "snowblindness" of personnel.

8.7 Overlaps

The CQC Consultant shall monitor and verify the GCL and GCC overlapping procedures conform to the requirements of Section 02772 of the Technical Specifications. GCL and GCC panels shall be overlapped at a minimum of 6 inches along panel sides and a minimum of 12 inches along panel ends. Dry bentonite powder

shall be applied, at a minimum rate of one pound per lineal foot, around pipe penetrations or other perforations of GCL and GCC which may be required.

8.8 Repair

The CQC Consultant shall monitor the repair of any holes or tears in the GCL and GCC or the geotextile backing. Repairs shall be made by placing a patch made from the same type GCL and GCC over the damaged area. On slopes greater than 5 percent, the patch shall overlap the edges of the hole or tear by a minimum of 2 ft in all directions. On slopes, 5 percent or flatter, the patch shall overlap the edges of the hole or tear by a minimum of 1 ft in all directions. The patch shall be secured to the satisfaction of the Construction Manager to avoid shifting during backplacing with soil or covering with another geosynthetic.

TABLE 8-1:

GCL AND GCC CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[1]
Direct Shear[2]	ASTM D 5321	1 test per 100,000 ft^2
Hydraulic Conductivity	GRI GCL-2	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 shall be tested for the following: (i) internal shear strength; (ii) interface shear strength of geosynthetic clay liner and the geomembrane liner and the geosynthetic clay cap and the geomembrane cap; and (iii) the interface shear strength of the geosynthetic clay liner and compacted clay liner and the geosynthetic clay cap and the compacted clay cap.

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9. GEOTEXTILES

9.1 Introduction

The CQC Consultant shall perform conformance testing and shall monitor the installation of geotextile filter, cushions, and separators 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 shall be performed by the CQC Consultant in accordance with the current versions of the ASTM or other applicable test procedure indicated in Tables 9-1 and 9-2.

9.2 Related Construction Drawings and Technical Specifications

The Subcontractor shall comply with Section 02714 of the Technical Specifications. This specification shall be referenced for specific details of the geotextile material properties, manufacturing quality control, and installation requirements of the geotextiles.

9.3 Transportation, Handling and Storage

The CQC Consultant shall monitor the transportation, handling, and storage of the geotextile on-site. The Construction Manager shall 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 competent 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 or to the point where accessibility can cause damage in handling.

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, unless otherwise specified 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 water from ponding.

Upon delivery at the site, the Subcontractor, Geosynthetics Installer, and CQC Consultant shall conduct an inspection of the rolls for defects and damage. This inspection shall be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant shall 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 shall 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.

9.4 Conformance Testing

9.4.1 Sampling Procedures

Samples shall be taken across the entire width of the roll and shall not include the first 3 feet. Unless otherwise specified, samples shall 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 shall 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 which are sampled shall be immediately rewrapped in their protective coverings to the satisfaction of the Construction Manager.

9.4.2 Testing Procedure

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

9.4.3 Test Results

The CQC Consultant shall review all laboratory conformance test results and verify compliance of the test results with the specification shown in Appendix D prior to deployment of the geotextiles. Any nonconformance shall be reported to the Construction Manager.

9.4.4 Conformance Test Failure

In the case of failing test results, the Subcontractor 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 procedure. If the retest fails or if the option to retest is not exercised, then two isolation conformance samples shall be obtained by the CQC Consultant. These isolation samples shall 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 fail numerically between the passing roll numbers shall be rejected by the Construction Manager. The CQC Consultant will verify that the Subcontractor has replaced all rejected rolls. The CQC Consultant shall document all actions taken in conjunction with geotextile conformance failures.

9.5 Placement

The CQC Consultant shall monitor the placement of all geotextiles to assure 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, all 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 a upward cutting hook blade. Special care must be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.

- The CQC Consultant shall 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.

9.6 Seams and Overlaps

All geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). Geotextiles shall be overlapped 6 in. prior to seaming. No horizontal seams shall be allowed on side slopes that are steeper than 10 horizontal to 1 vertical (i.e. seams shall be along, not across, the slope), except as part of a patch.

Any sewing shall be done using polymeric thread with chemical and ultraviolet resistance properties equal to or exceeding those of the geotextile. The seams shall be sewn using a single row type "401" two-thread chainstich. The CQC Consultant shall

monitor the geotextile seaming procedures to verify that seams and overlaps are in accordance with Section 02714 of the Technical Specifications.

9.7 Repair

The CQC Consultant shall monitor that any holes or tears in the geotextile are repaired as follows:

- On slopes: A patch made from the same geotextile is double seamed into place (with each seam 1/4 in. to 3/4 in. apart and no closer than 1 in. from any edge) with a minimum 12-in. overlap. Should any tear exceed 50 percent of the width of the roll, that roll shall be removed from the slope and replaced.

- Non-slopes: A patch made from the same geotextile is sewn in place with a minimum of 12 in. overlap in all directions away from the repair area.

Care shall be taken to remove any soil or other material which may have penetrated the torn geotextile. The CQC Consultant shall observe all repairs and assure that any noncompliance with the above requirements is corrected.

9.8 Placement of Soil Materials

The CQC Consultant shall monitor the Subcontractor's placement of all 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; 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 or as otherwise directed by the Construction Manager. On side slopes soil backfill shall be placed over the geotextile from the bottom of the slope upward.

TABLE 9-1:

GEOTEXTILE FILTER CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY1[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 4354.

TABLE 9-2:

GEOTEXTILE CUSHIONS 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 4354.

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10. HDPE MANHOLES, PIPES, FITTINGS AND VALVES

10.1 Introduction

The CQC Consultant shall monitor the installation of ancillary materials such as manholes, pipes, fittings, and valves for leachate collection and transmission as required by Section 02605 of the Technical Specifications and this CQA Plan.

10.2 Butt-Fusion Welding Process

The CQC Consultant shall monitor the assembling of lengths of HDPE pipe into suitable installation lengths by the butt-fusion process. 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 welding of the HDPE pipes and fittings shall be performed by the Subcontractor in accordance with the pipe manufacturer's recommendations as to equipment and technique.

10.3 Transportation, Handling and Storage

The pipe is to be placed on wooden pallets and bundled together with plastic straps for bulk handling and shipment. The packing shall be such that either fork lifts or cranes equipped with slings can be used for safety handling. The pipe shall be segregated by wall thickness and diameter.

The CQC Consultant shall monitor the offloading of the palletized pipe to assure that handling of the pallets is done in a competent manner and that the pallets are not placed in areas where water can accumulate. The pallets shall not be stacked more then three high or in such a manner that could cause damage to the pipe. Furthermore, the pipe shall be stacked in such a manner that access for conformance sampling is possible. Outdoor storage should be no longer than 12 months. For outdoor storage

periods longer than 12 months a temporary covering shall be placed over the pipes, or they shall be moved to within an enclosed facility.

10.4 Installation

Care will be taken during installation of the HDPE manholes and pipe such that they will not be cut, kinked, or otherwise damaged. Ropes, fabric, or rubber-protected slings and straps shall be used by the Subcontractor when installing manholes and pipes. The use of chains, cables, or hooks inserted into the pipe ends shall not be approved by the Construction Manager.

The Subcontractor shall install the manholes, pipe fittings, and values in such a manner that the materials are not damaged. Slings for handling the pipeline shall not be positioned at butt-fused joints. Sections of the pipes with deep cuts and/or gouges shall 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.

11. MECHANICAL AND ELECTRICAL

11.1 Introduction

The CQC Consultant shall monitor the materials used in and installation of all mechanical and electrical systems to assure compliance with Division 15 and Division 16 of the Technical Specifications. The mechanical and electrical systems include, but are not limited to, the following:

- permanent lift station electrically actuated isolation valve, lift station control panel, associated instrumentation, alarm light and siren, and all other work;
- leak detection manholes control panels and associated instrumentation, alarm lights, and all other work;
- leachate collection manholes manual valves and all other work;
- decontamination facility pumps, and electrical and potable water service;
- overhead power distribution system, power wiring, including power circuit connections for pump motors, and equipment mounting boards; and
- temporary support facilities electric, water, and sanitary sewer services.

11.2 Related Construction Drawings and Technical Specifications

The mechanical work performed by the Subcontractor shall comply with Division 15 of the Technical Specifications. These specifications shall be referenced for specific details of the mechanical equipment requirements and installation. The electrical work performed by the Subcontractor shall comply with Construction Drawings and Technical Specifications. These specifications shall be referenced for specific details of the electrical requirements and installation.

11.3 Codes, Rules, Inspections, and Workmanship

The CQC Consultant shall monitor the work of the Subcontractor 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 shall observe and document construction acceptance testing procedures performed by the Subcontractor. The CQC Consultant shall also observe and document operational all construction acceptance testing procedures performed by the Subcontractor.

11.4 Record Drawings

The CQC Consultant shall monitor the maintenance by the Subcontractor of a set of prints 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 progress prints shall be inspected by the Resident Engineer and Construction Manager and used to determine the progress of mechanical and electrical work.

At the completion each phase of the work, the CQC Consultant shall obtain from the Subcontractor a set of record drawings of the work to include marked-up prints showing the dimensioned location of all underground systems.

12. CONCRETE

12.1 Introduction

This CQC Consultant shall monitor the construction and perform conformance testing of all concrete materials and finished products to assure compliance with Construction Drawings and Technical Specifications.

12.2 Inspections

The CQC Consultant shall monitor concrete workmanship to assure that the Subcontractor 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 Subcontractor 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 shall be the responsibility of the CQC Consultant. The concrete test program shall 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 the first 5 cubic yards and every 25 cubic yards of concrete or any portion of thereafter for each structure. 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 four standard cylinders. Each set of test specimens will be tested for 7-day and 28-day compressive strength.

- Compressive strengths shall 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 shall be determined with no less frequency than that of casting strength specimen sets. Air content and slump shall be determined in accordance with ASTM C 231 and ASTM C 143, respectively.

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

13. ROAD CONSTRUCTION

13.1 Introduction

The CQC Consultant shall 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) shall be performed by the CQC Consultant for all compacted fill materials. Fill placement and compaction shall be conducted in accordance with Section 02200 of the Construction Drawings and Technical Specifications. For road subgrades, nuclear moisture/density tests shall be performed at a minimum frequency of 1 test per 500 lineal ft per lift. The CQC Consultant shall monitor the Subcontractor's proofrolling of cut sections.

13.3 Geotextile Conformance Testing and Placement

Conformance testing of the geotextile separator shall be in accordance with the Section 02714 of the Technical Specifications. The CQC Consultant shall monitor the Subcontractor's geotextile installation methods and procedures. The CQC Consultant shall monitor the overlapping and sewing of the geotextile seams. All holes in the geotextile shall be patched in accordance with Section 02714 of the Technical Specifications. The CQC Consultant shall monitor that the minimum overlap between adjacent geotextile panels is maintained during placement of overlying materials.

13.4 Subbase Layer

The CQC Consultant shall monitor the subbase aggregate to ensure it is constructed to the thickness, grades, and limits shown on the construction drawings. The CQC Consultant shall monitor the test section required in Section 02230 of the Technical Specifications.

13.5 Base Layer

The CQC Consultant shall monitor the subbase aggregate to ensure it is constructed to the thickness, grades, and limits shown on the Construction Drawings. The CQC Consultant shall monitor the test section required in Section 02230 of the Technical Specifications.

13.6 Quality Control Testing

Quality control testing of the materials used in construction of the roads and paved surfaces shall be the responsibility of the CQC Consultant. The frequency of CQC testing for the subbase aggregate and 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 subbase and base aggregates shall be defined during the compaction of a test strip. The test strip for subbase aggregate shall be in accordance with the requirements of Item 310.03 of the Ohio DOT Specifications. The base aggregate shall be compacted in accordance with the requirements of Item 304.04 of the Ohio DOT Specifications.

13.7 Repairs

If a defective area is discovered, the CQC Consultant will evaluate the extent and nature of the defect. After this determination the Subcontractor shall correct the deficiency to the satisfaction of the Construction Manager. The Subcontractor shall not perform additional work in the area until the Construction Manager approves the correction of the defect. In the event of damage, the Subcontractor 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 shall monitor the activities which are to be performed for various general site work items including, but not limited to rip rap, erosion and sediment control, culverts, chain link fences and gates, and vegetation for compliance with Construction Drawings and Technical Specifications.

14.2 Conformance Testing

Conformance testing of materials to ensure compliance with the Construction Drawings and Technical Specifications shall be performed by the CQC Consultant at the discretion of the Construction Manager. If nonconformances or other deficiencies are found by the CQC Consultant in the Subcontractors materials or completed work, the Subcontractor will be required to repair or replace the deficiency at not cost. Any noncompliant items shall be reported to the Construction Manager.

APPENDIX A

EXAMPLES OF CQC FORMS

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

DAILY FIELD REPORT

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: DATE: ____ day ____ month ____ year

CONTRACTOR:

WEATHER:

COPY TO: PER: HRS:

©GEO SYNTEC CONSULTANTS FILE NO. 1-04-DFR

SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

DAILY WEATHER LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 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: AMBIENT TEMPERATURE LOCATIONS TAKEN AT APPROXIMATELY ____ ABOVE GROUND LEVEL.

000294

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

SENIOR PERSONNEL SUMMARY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: YEAR:

NAME	REF ID	COMPANY	POSITION	COMMENTS

©GEO SYNTEC CONSULTANTS FILE NO. 1-02-SPS

SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PERSONNEL/EQUIPMENT DAILY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: WEEK BEGINING:

ITEM	REF ID	COMPANY	MON	TUES	WED	THURS	FRI	SAT	SUN

000294

©GEO SYNTEC CONSULTANTS FILE NO. 1-03-PDL

SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

WEEKLY FIELD REPORT

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: WEEK ENDING:

COPY TO: PER:

©GEO SYNTEC CONSULTANTS FILE NO. 1-05-WFR

SHEET NO. OF

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

FIELD OBSERVATION REPORT

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

WEATHER: _____

AREA:

CONTRACTOR:

EQUIPMENT USED:

WORK PERFORMED:

000296

COPY TO: _____ PER: _____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

TRANSMITTAL LETTER

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

ATTENTION: _____

ADDRESS: _____

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

NO. OF COPIES	DRAWING NUMBER	DESCRIPTION	DATE

REMARKS

000297

COPY TO: _____ FROM: _____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

CHANGE ORDER (CO) REFERENCE NO.: _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

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 CHANGE OR ADDED: .....

REASON FOR CHANGE: .....

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

FINANCIAL AND SCHEDULE CONSIDERATIONS .....

OWNER'S REPRESENTATIVE day/mo/yr

SITE CQA MANAGER 000298 day/mo/yr

PROJECT MANAGER day/mo/yr

COPY TO: _____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

CLARIFICATION FORM REFERENCE NO.: _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

OWNER: _____

REFERENCES:

SPECIFICATION SECTION: CQA PLAN SECTION:

CLARIFICATION:

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

RESPONSE:

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

COPY TO: _____

©GEO SYNTEC CONSULTANTS FILE NO. 1-10-CRF SHEET NO. _____ OF _____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

CHANGE ORDER LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ YEAR: _____

CONTRACTOR: _____

NUMBER	TITLE	DATE SUBMITTED (day/mo)	STATUS		DATE APPROVED/ REJECTED (day/mo)	COMMENTS
			ACCEPTED	REJECTED		

000300

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

SUBMITTAL COVER SHEET

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

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: 000301

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

SUBMITTAL LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.:

DESCRIPTION: YEAR:

CONTRACTOR:

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

000302

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

MEETING SIGN-IN SHEET

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

SUBJECT: _____ REFERENCE NO. _____

NAME	ORGANIZATION	TELEPHONE

000303

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

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PHOTOGRAPHIC LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: YEAR:

REFERENCE NO.	DATE (day/month)	DESCRIPTION

000304

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

SURVEY DATA LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

SURVEYOR: _____ ALLOWABLE TOLERANCE: _____ QA ID: _____

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

000303

1031

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

SITE SAFETY FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

CONTRACTOR: _____

DURING THE COURSE OF PERFORMING OUR DUTIES ON THIS PROJECT, WE HAVE BECOME AWARE OF A POTENTIALLY DANGEROUS SITUATION ON THE SITE. WHILE WE SPECIFICALLY ASSUME NO RESPONSIBILITY FOR JOB SITE SAFETY, WE ARE BRINGING THIS TO YOUR ATTENTION AS A COURTESY TO OUR CLIENT.

THIS POTENTIALLY DANGEROUS SITUATION IS OF THE FOLLOWING NATURE (AS CHECKED):

- [ ] IMPROPERLY BRACED OR SLOPED EXCAVATIONS THAT ARE DEEPER THAN FIVE FEET
- [ ] IMPROPER ENTRY INTO CONFINED SPACE
- [ ] POTENTIAL EXPOSURE OF PERSONNEL TO HAZARDOUS SUBSTANCES OR HAZARDOUS WASTES
- [ ] LACK OF PROPER PROTECTIVE EQUIPMENT
- [ ] OTHER: .....

DESCRIPTION AND LOCATION OF THE WORK AREA:	SKETCH OF THE WORK AREA

SUBMITTED BY:

_____ OF GEOSYNTEC CONSULTANTS _____ DATE

ACKNOWLEDGED BY:

_____ OF _____ DATE

_____ OF _____ DATE

_____ OF _____ DATE

000306

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ YEAR: _____

CONTRACTOR: _____

TEST DESCRIPTION: _____

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

TEST LOCATION: _____

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

VISUAL MONITORING: _____ CONTRACTOR'S REPRESENTATIVE day/mo/yr _____ SITE CQA MANAGER day/mo/yr

000307

FINAL APPROVAL: _____ CONTRACTOR'S REPRESENTATIVE day/mo/yr _____ SITE CQA MANAGER day/mo/yr

COPY TO: _____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

CONCRETE PLACEMENT FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

DESIGN MIX DATA: DESIGN MIX NO.: _____

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

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

LOCATION NOTES: _____

000308

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

COMPRESSIVE STRENGTH TEST OF CONCRETE SPECIMANS

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

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

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): .....

TIME BATCHED: ..... CONCRETE TEMPERATURE (°F/C): .....

DATE SAMPLED: ..... SLUMP (in.): .....

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

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

TESTING LABORATORY: .....

Field Sample No.	Laboratory Sample No.	Age (days)	Total Load	Area (in^2)	Compressive Strength (psi)	Pass/Fail	QA ID

COPY TO: _____ 000309

©GEO SYNTEC CONSULTANTS FILE NO. 1-20-CSF

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

FIELD RELEASE FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: YEAR:

As of .....(day).....(month).....(year), the field services operation 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

SITE CQA MANAGER day/mo/yr

000310

PROJECT MANAGER day/mo/yr

COPY TO:

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

SOIL SAMPLE LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ YEAR: _____

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

NOTES: _____

©GEO SYNTEC CONSULTANTS FILE NO. 2-01-SSL CHECKED BY: _____ SHEET NO. _____ OF _____

1031

000311

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

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

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____

SOIL SAMPLE SIZE ASTM D 1140 SAMPLE NO.: _____

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)×100	(%)	

NOTES:

000312

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOIL

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

OVEN METHOD (ASTM D 2216): Recommended Mass Of Moist Sample Weight 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

	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					

MICROWAVE METHOD (ASTM D 4643): Recommended Mass Of Moist Sample Weight 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%

	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					

000313

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

FIELD LABORATORY COMPACTION TEST (ASTM D 698 METHOD A)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ 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 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	M[illegible]RE CONTENT = (I/J) X 100	(%)					

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

FIELD LABORATORY COMPACTION TEST (ASTM D 698 METHOD B)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ 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 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	(%)					

GEO SYNTEC CONSULTANTS FILE NO. 2-05-FLC CHECKED BY: _____ SHEET NO. _____ OF _____

1031

000345

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

FIELD LABORATORY COMPACTION TEST (ASTM D 698 METHOD C)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ 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 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	[illegible]URE CONTENT = (I/J) X 100	(%)					

000346

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

FIELD LABORATORY COMPACTION TEST (ASTM D 1557 METHOD A)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ 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 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 FILE NO. 2-08-FLC CHECKED BY: _____ SHEET NO. _____ OF _____

1031

000317

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

FIELD LABORATORY COMPACTION TEST (ASTM D 1557 METHODS A, B, AND C)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ 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 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	[illegible]URE CONTENT = (I/J) X 100	(%)					

000318

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

FIELD LABORATORY COMPACTION TEST (ASTM D 1557 METHOD C)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ 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 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	(%)					

1031

000349

GeoSyntec Consultants

FLUOR DANIEL FERNALD

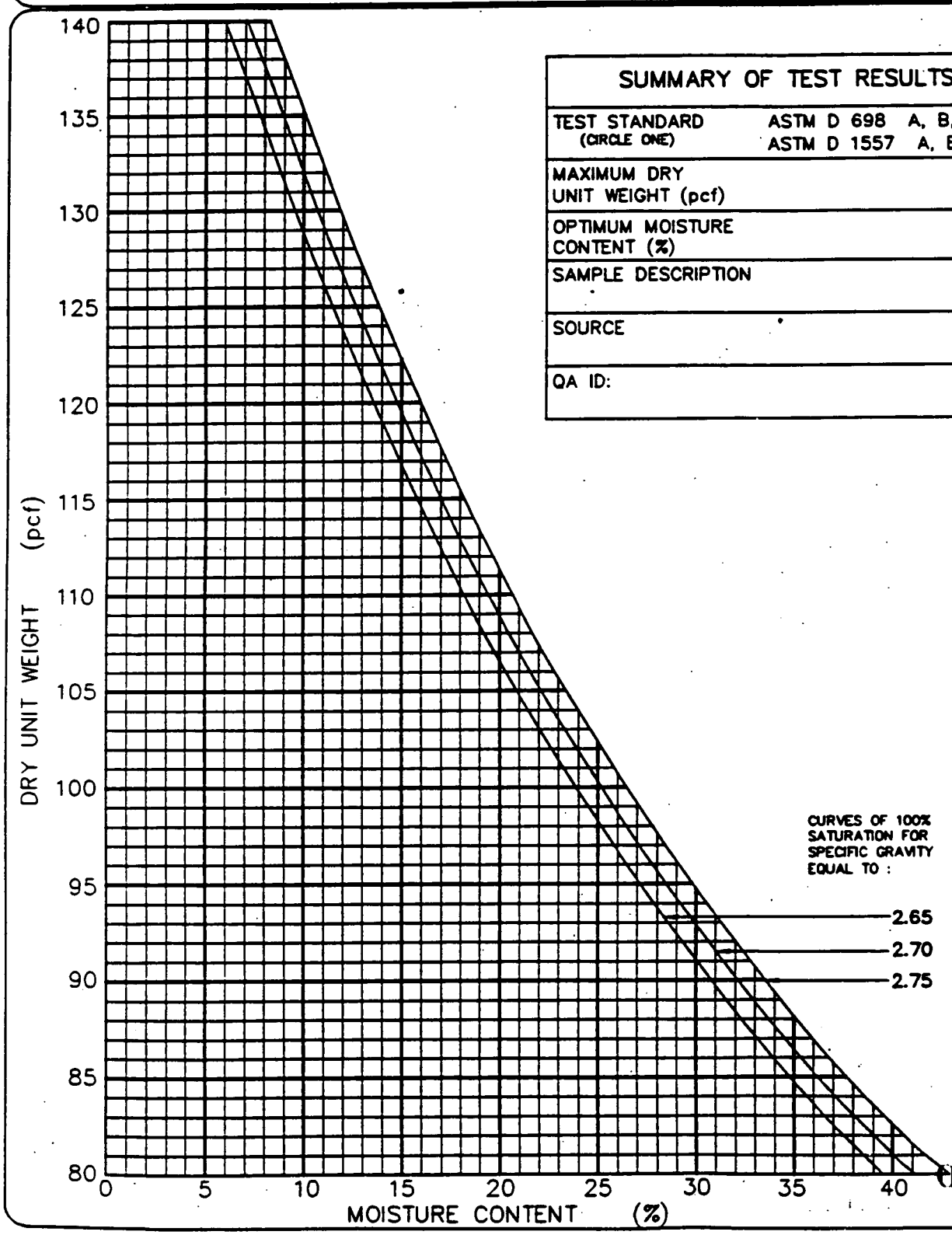
MOISTURE-DENSITY RELATIONSHIP

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: DATE: ____ day ____ month ____ year

MATERIAL TYPE: SAMPLE NO.:



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

000320

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

ATTERBERG LIMITS TEST (ASTM D 4318)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

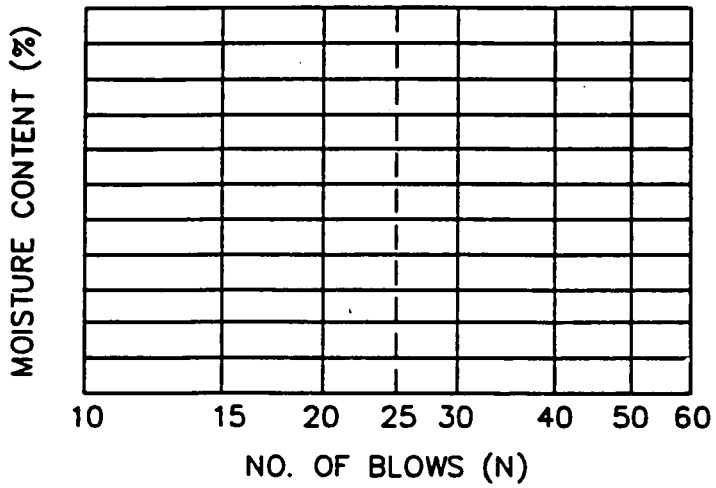
MATERIAL TYPE: _____ SAMPLE NO.: _____

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	(%)				

00032

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

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PARTICLE SIZE ANALYSIS MECHANICAL SIEVE METHOD (ASTM D 422)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: G00166 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

SOIL SAMPLE SIZE

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

000322

%FINER = 100 − Σ% RETAINED

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PARTICLE SIZE ANALYSIS HYDROMETER METHOD (ASTM D 422)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

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

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PARTICLE SIZE DISTRIBUTION AND SOIL CLASSIFICATION TEST RESULTS (ASTM D 422 & ASTM D 2487)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

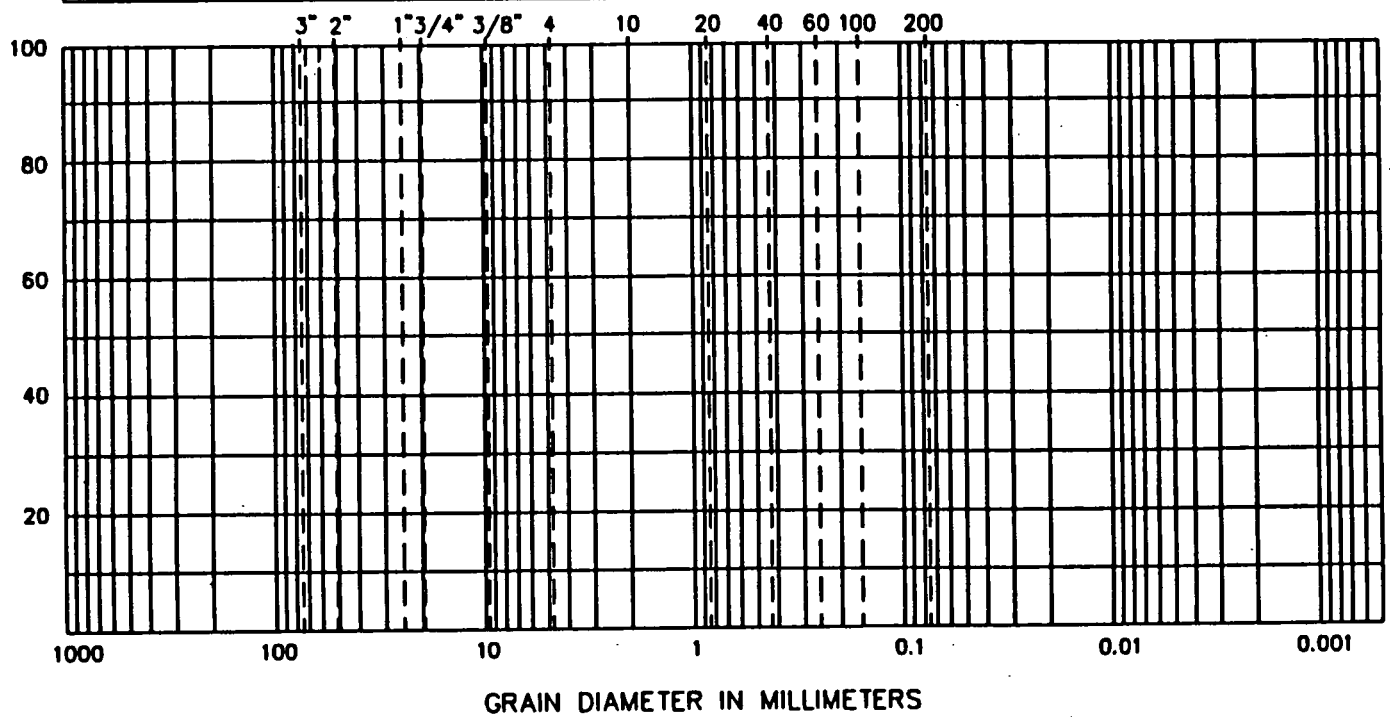
LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

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

CURVE COEFFICIENTS: (C_u) ..... (C_c) .....

BOULDERS	COBBLES	GRAVEL		SAND			FINE	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES
U.S. STANDRARD SIEVE SIZES								



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): _____

©GEOSYNTEC CONSULTANTS FILE NO. 2-16-PSD CHECK _____ SHEET NO. _____ OF _____

000324

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

FIELD SAND CONE DENSITY TEST (ASTM D 1556)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

SOURCE: _____

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 (SEE 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/U	(%)	
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 _____ 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:

000325

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

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

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

SOURCE: _____ QA ID: _____

SPECIFICATION REQUIREMENTS:

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

% COMPACTION: _____ MOISTURE CONTENT RANGE: _____

TEST LOCATION: _____ TEST NO.: _____

FIELD TEST DATA – ASTM D 2937

QA ID: _____

A	CYLINDER NO. _____ VOLUME[1] (cf)		D	WEIGHT OF WET SAMPLE = B–C (lbs)	
B	WEIGHT OF SAMPLE & CYLINDER (lbs)		E	WET UNIT WEIGHT = D/A (lbs)	
C	WEIGHT OF CYLINDER (lbs)		F	DRY UNIT WEIGHT = E/[1+(T/100)] (pcf)	

NOTE: CYLINDER VOLUME IS OBTAINED BY MEASURING THE HEIGHT AND DIAMETER, OF FOUR EQUALLY SPACE POINTS, TO 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–O (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 _____ 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. = F – V				DELTA MOISTURE CONTENT = T – U	

COMMENTS:

000326

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

NUCLEAR GAUGE STANDARD COUNT LOG

(ASTM D 2922 & ASTM D 3017)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

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	DENSITY COUNT	PASS/ FAIL	QA ID	DATE (day/mo)	MOISTURE COUNT	DENSITY COUNT	PASS/ FAIL	QA ID

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

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

FIELD NUCLEAR MOISTURE/DENSITY TEST LOG (ASTM D 3017 AND ASTM D 2922)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

SPECIFICATION REQUIREMENTS

SOURCE: _____ MATERIAL TYPE: FILL / SUBGRADE / SUBBASE / CLAY / OTHER: _____ LIFT THICKNESS (LOOSE/COMPACTED): _____
(CIRCLE ONE)

% COMPACTION: _____ MOISTURE RANGE: _____ ASTM D 698: A B C / ASTM D 1557: A B C _____
(CIRCLE ONE)

NUCLEAR GAUGE TYPE: _____ NUCLEAR GAUGE SERIAL NO. _____ COR. FACTOR: _____ 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 (%)	WET UNIT WT (PCF)	DRY UNIT WT (PCF)	PERCENT COMPACT (%)	PASS	FAIL		PASS	FAIL

COMMENTS: _____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

SUMMARY OF FIELD DENSITY TESTS

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ QA ID: _____

DATE OF TEST (day/mo)	TEST NO.	TEST LOCATION	LAB RESULTS			TYPE OF TEST		FIELD TEST RESULTS				PERCENT COMPACT (%)	PASS	FAIL	RETEST NO.
			SAMPLE NO.	O.M.C. (%)	MAX UNIT WT (pcf)	ASTM D 2922	ASTM D 1556	DEPTH/ ELEV (ft)	FMC (%)	DRY UNIT WT (pcf)	WET UNIT WT (pcf)				

COMMENTS:

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1031

000129

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

LABORATORY TEST SUMMARY REQUEST FORM NO. _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.: _____

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ QA ID: _____

NOTE: Separate forms are required for each material type and source. Strike out nonapplicable tests.

SITE SAMPLE NO.	LAB SAMPLE NO.	MOISTURE CONTENT ASTM D 2216/ D 4643 (%)	GRAIN SIZE			ATTERBERG LIMITS ASTM D 4318			SP. GR. ASTM D 854	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	ACUMUL. QUANT. PLACED (APPROX)
			PASSING NO. 200 SIEVE ASTM D 1140 (%)	ASTM D 422		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)
				SIEVE	HYDR.														

COMMENTS: _____

NOTES: HYDRAULIC CONDUCTIVITY DETERMINED AT A HYDRAULIC GRADIENT OF ____.

HYDRAULIC CONDUCTIVITY DETERMINED AT AN EFFECTIVE CONFINING STRESS OF ____.

000336

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

MATERIAL INVENTORY

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: YEAR:

PRODUCT 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: AVG. ROLL LENGTH:

NUMBER OF ROLLS ABOVE: ACCUMULATIVE NUMBER OF ROLLS: 000331

CUMULATIVE AREA: NO. OF CONFORMANCE TESTS (page/total): /

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

GEOSYNTHETIC CLAY LINER TEST REQUEST FORM NO. _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 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 D3776	MOISTURE CONTENT ASTM D2216	FREE SWELL A.P.I. TEST NO. 1010	HYDRAULIC CONDUCTIVITY ASTM D5084	THICKNESS ASTM D5199	OTHER

REINFORCED OR NONREINFORCED MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

GeoSyntec Consultants
Materials Testing Laboratory

FLUOR DANIEL FERNALD

GEOMEMBRANE TEST REQUEST FORM NO. _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 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. GM-	BATCH NO./ ROLL NO.	ANALYSIS REQUIRED (STRIKE OUT NONAPPLICABLE TESTS)									
		TENSILE ASTM D638	MELT INDEX ASTM D1238	DENSITY ASTM D792	THICKNESS ASTM D5199/D751 D3342/D1593	CARBON BLACK ASTM D1603	PERCENT CARBON BLACK ASTM D1603	TEAR RESISTANCE ASTM D1004	PUNCTURE RESISTANCE FTMS 101C METHOD 2065	ESCR/NCTL SINGLE POINT ASTM D1693 D5397	OTHER

SMOOTH OR TEXTURED MATERIAL (CIRCLE ONE)

COMMENTS/SPECIAL INSTRUCTIONS:

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

GEOGRID TEST REQUEST FORM NO. _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 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 D790	RIB THICK ASTM D1777	PUNCT THICKNESS (JUNCTION) D1777	RIB TENSILE GRI-GG1	JUNCTION STRENGTH GRI-GG1	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

UNIAXIAL OR BIAXIAL MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

000332

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

GEONET TEST REQUEST FORM NO. _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 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	THICKNESS ASTM D374C/ D5199	SPG DENSITY ASTM D792	WIDE-WIDTH TENSILE ASTM D4533	CARBON CONTENT ASTM D1603	CARBON DISPERSION ASTM D5596	MELT INDEX ASTM D1238	CBR GRI-GN1	COM-PRESSION GRI-GN1	TRANS-MISSIVITY ASTM D4716	TENSILE STRENGTH ASTM D5035	OTHER

GEONET OR GEONET COMPOSITE MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

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000335

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

GEOTEXTILE TEST SUMMARY REQUEST FORM NO. _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 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 D4491	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

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

GEOCOMPOSITE TEST REQUEST FORM NO. _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 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	THICKNESS ASTM D374C D5199	TRANS-MISSIVITY ASTM 4716	CARBON BLACK CONTENT ASTM D1603	MASS PER AREA ASTM D3776	CARBON DISPERSION ASTM D3015	THICKNESS ASTM D5199	MASS PER UNIT AREA ASTM D3776	TENSILE ASTM D638	APPARENT OPENING SIZE ASTM D4751	PERMITTIVITY ASTM D4491

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

000338

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

PANEL PLACEMENT LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

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)	000339		

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

NOTES: _____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

TRIAL SEAM LOG - EXTRUSION

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: YEAR:

CONTRACTOR: 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		

000340

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

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

TRIAL SEAM LOG - FUSION

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: YEAR:

CONTRACTOR: TENSIOMETER DESCRIPTION:

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

000341

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

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

SEAM SUMMARY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ YEAR: _____

CONTRACTOR: _____

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

PRODUCTION SEAMING						NONDESTRUCTIVE TESTING						
DATE (day/mo)	SEAM NO.	MACHINE NO.	OPERATOR ID	ACTUAL SEAM LENGTH (ft)	QA ID	DISTANCE (ft)	AIR PRESSURE (__.__psi for 5 min.)	VACUUM BOX (_____sec.)	OPERATOR ID	PASS/ FAIL	ACTION	QA ID
				TOTAL (1)								

000342

NOTE: (1) SEAM LENGTH: THIS PAGE _____ (ft) ACCUMULATED _____ (ft)

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

SEAM AND PANEL REPAIR LOCATION LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0166 TASK NO.: 04

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

CONTRACTOR: _____

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

NORTH

NOTE:
SEE OTHER SIDE FOR SYMBOLS

QA ID: _____

SYMBOLS

S11/P12 — SECONDARY/PRIMARY GEOMEMBRANE PANEL NUMBER

NDT = NONDESTRUCTIVE TEST

VT = VACUUM TEST

AT = AIR TEST

LEACHATE COLLECTION PIPE

TOE OF SLOPE

CREST OF SLOPE

ANCHOR TRENCH

EXTRUSION WELD

GEOGRID

GEONET

GEOTEXTILE

GEOCOMPOSITE 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

000344

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

REPAIR SUMMARY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.:

DESCRIPTION: YEAR:

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ CONTRACTOR:

DATE (day/mo)	REPAIR LOCATION		REPAIR NO. AND CODE (1)	REPAIR TYPE (2)	REPAIR			WELDER ID		QA ID	NON-DESTRUCTIVE TESTING				
	SEAM OR PANEL	MAPPING (DIST FROM 0-FT OR EDGE)			LENGTH (ft)	WIDTH (ft)	DIA (ft)	MACH NO.	OPER ID		DATE (day/mo)	OPER ID	PASS/ FAIL	ACTION	QA ID

(15)

NOTES: (1) REPAIR NO.: REPAIRS CAN BE NUMBERED SEQUENTIALLY, IF NECESSARY.
(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

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000345

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FLUOR DANIEL FERNALD

DESTRUCTIVE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0166 TASK NO.:

DESCRIPTION: YEAR:

CONTRACTOR: TEST REQUIREMENTS:

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

DISTRIBUTION: LABORATORY: ☐ ARCHIVE: ☐ INSTALLER: ☐ OTHER: ☐

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

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(15)

APPENDIX B

TABLE 02770-1
REQUIRED TEXTURED
HDPE GEOMEMBRANE PROPERTIES

TABLE 02770-1

REQUIRED HDPE TEXTURED GEOMEMBRANE PROPERTIES

Properties	Qualifiers	Units[1]	Specified Values		Test Method
			Liner	Cap	
Physical Properties					
Thickness	average	mils	80	60	GRI-GM8
	minimum	mils	76	58	GRI-GM8
Specific Gravity	minimum	N/A	0.940		ASTM D 792 Method A or ASTM D 1505
Carbon Black Content	range	%	2-3		ASTM D 1603
Carbon Black Dispersion	N/A	none	Category 1 or 2		ASTM D 5596
Melt Flow Index	maximum	g/10 min	1.0		ASTM D 1238 (Condition E)
Mechanical Properties					
Tensile Properties (each direction)					
1. Force Per Unit Width at Yield	minimum	lb/in	168	126	ASTM D 638 (Modified by NSF 54 Annex A)
2. Tensile Strength (force per unit width at break)	minimum	lb/in	120	90	ASTM D 638 (Modified by NSF 54 Annex A)
3. Elongation at Yield	minimum	%	12		ASTM D 638 (Modified by NSF 54 Annex A)
4. Elongation at Break	minimum	%	200		ASTM D 638 (Modified by NSF 54 Annex A)
Tear Resistance	minimum	lb	56	42	ASTM D 1004 Die C Puncture

TABLE 02770-1 (continued)

Properties	Qualifiers	Units[1]	Specified Values		Test Method
			Liner	Cap	
Environmental Properties					
Low Temperature Brittleness	maximum	°C	-60		ASTM D 746 Procedure B
Dimensional Stability (each direction)	maximum change	%	±2		ASTM D 1204 212°F, 15 min.
Environmental Stress Crack	minimum	hrs	500[2]		ASTM D 5397

Notes: 1. % = percent
g = grams
min = minutes
lb/in = pounds per inch
lb = pound
°C = degrees celsius
hrs = hours
2. Time-to-failure at a tensile stress of 30 percent of the tensile yield strength.

APPENDIX C

TABLE 02772-1
REQUIRED GEOSYNTHETIC CLAY LINER AND CAP PROPERTY VALUES

TABLE 02772-1

REQUIRED GEOSYNTHETIC CLAY LINER AND CAP PROPERTY VALUES

PROPERTIES	QUALIFIERS	UNITS[6]	SPECIFIED[1] VALUES	TEST METHOD
GCL Properties				
Bentonite Content[2] (GCL)	minimum	lb/ft^2	1.0	ASTM D 5261
Bentonite Moisture Content	maximum	%	25	ASTM D 4643
Bentonite Free Swell	minimum	ml/2g	24	ASTM D 5890
Hydraulic Conductivity (Bentonite only)[3]	minimum	cm/s	5×10^{-9}	GRI GCL-2
Shear Strength (GCL)		See values in Part 2 of this Section.		
Textured HDPE Geomembrane Properties[4]				
Thickness	average minimum	mils mils	40 36	GRI GM 8 GRI GM 8
Specific Gravity	minimum	N/A	0.94	ASTM D 792 or ASTM 1505
Melt Flow Index	maximum	g/10 min	1.0	ASTM D 1238 (Condition E)
Elongation at Yield	minimum	%	13	ASTM D 638
Elongation at Break	minimum	%	100	ASTM D 638
Strength at Yield	minimum	lb/in	95	ASTM D 638
Strength at Break	minimum	lb/in	50	ASTM D 638
Tear Resistance	minimum	lb	12	ASTM D 1004 Die C puncture
Puncture Resistance	minimum	lb	25	ASTM D 4833
Carbon Black Content	range	%	2-3	ASTM D 1603
Carbon Black Dispersion	N/A	none	Category 1 or 2	ASTM D 5596
Geotextile Properties[4]				
Polymer Composition	minimum	%	95 polyester or polypropylene	

TABLE 02772-1 (continued)

Notes:
1. All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).
2. Measured at a moisture content not exceeding 25 percent.
3. For GCL with geomembrane backing, perforate or cut backing to allow unimpeded and uniform flow through the backing.
4. Geosynthetic clay liners and caps not having these components and otherwise satisfying Part 2.01 of this Section, are exempt from meeting the specified values.
5. Not used.
6. lb/ft^2 = pounds per square foot
   cm/s = centimeter per second
   min = minutes
   g = grams
   % = percent
   lb = pound
   lb/in = pounds per inch
   ml/2g = milliliters per two grams

[END OF SECTION]

APPENDIX D

TABLES 02714-1 THROUGH 02714-5 REQUIRED PROPERTY VALUES FOR CUSHIONS GEOTEXTILE FILTER AND SEPARATOR

TABLE 02714-1

REQUIRED PROPERTY VALUES FOR GEOTEXTILE FILTER

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

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values.
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

TABLE 02714-2

REQUIRED PROPERTY VALUES FOR GEOTEXTILE CUSHION IN FINAL COVER SYSTEM

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

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values.
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

TABLE 02714-3

REQUIRED PROPERTY VALUES FOR GEOTEXTILE CUSHION IN LINER SYSTEM

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

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values.
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

TABLE 02714-4

REQUIRED PROPERTY VALUES FOR SUPPLEMENTAL GEOTEXTILE CUSHION IN LINER SYSTEM

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

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values.
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

TABLE 02714-5

REQUIRED PROPERTY VALUES FOR GEOTEXTILE SEPARATOR

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

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

[END OF SECTION]

SYSTEMS PLAN

ON-SITE DISPOSAL FACILITY PROJECT

20100-PL-008

Revision 0

May 1997

Prepared By:

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Fernald, Ohio
Under Contract DE-AC05-92OR21972

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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ATTACHMENTS

ATTACHMENT A: Owner's Manuals for Leachate Management System Equipment (to be provided by the Subcontractor as Part of Construction Acceptance)

ATTACHMENT B: Owner's Manuals for Decontamination Facilities (to be Provided by the Subconstruction Contractor as Part of Construction Acceptance)

1.0 INTRODUCTION

1.1 OVERVIEW

This Systems Plan describes the inspection, monitoring, and maintenance activities that will be undertaken at the Fernald Environmental Management Project (FEMP) On-Site Disposal Facility (OSDF), Fernald, Ohio. These activities apply to the leachate management system, final cover system, temporary facilities, and access roads within the battery limit of the OSDF.

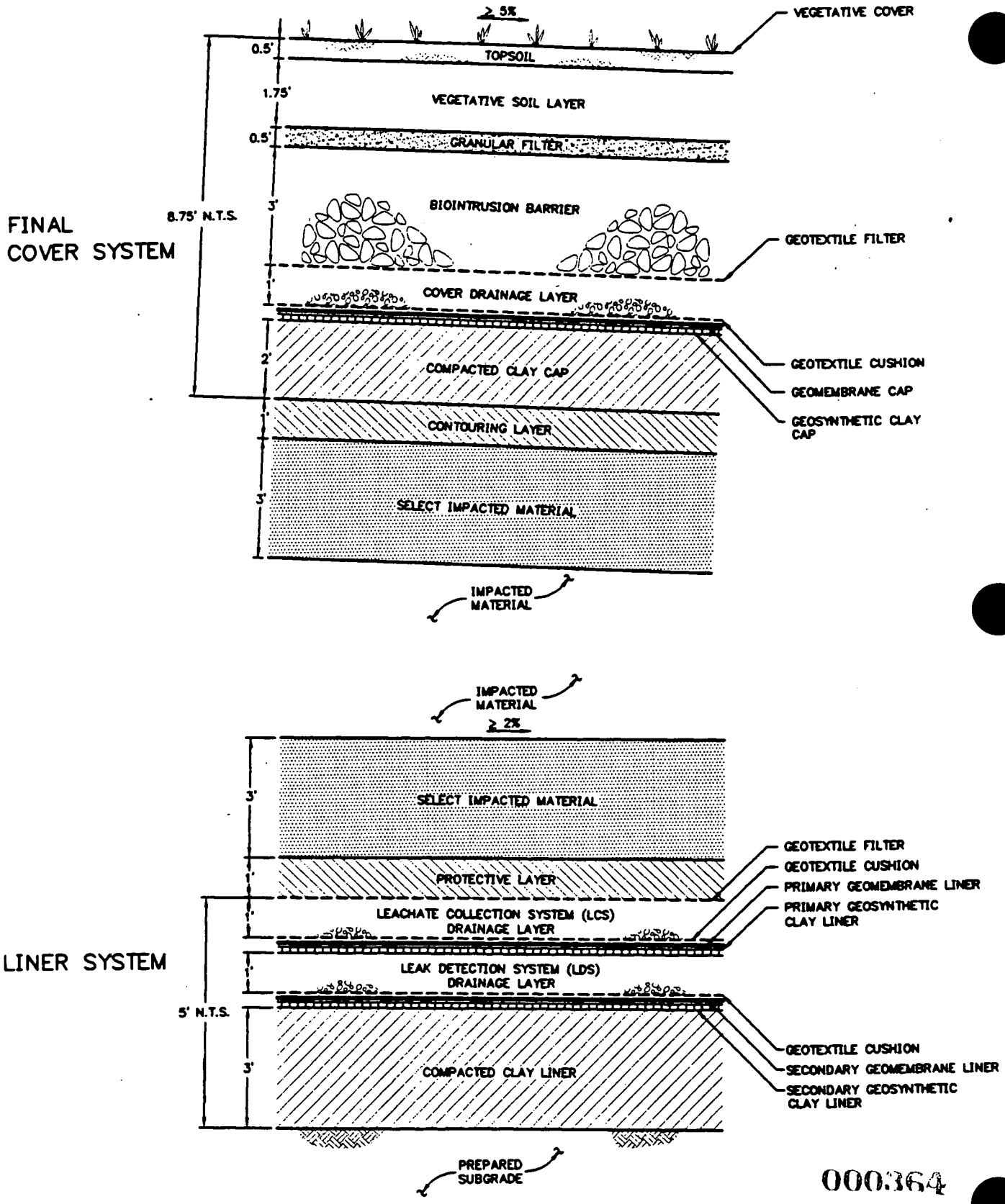
This plan addresses the systems activities to be implemented throughout construction, material placement, and closure of the OSDF. The inspection, monitoring, and maintenance activities for the 30 year post-closure monitoring period prescribed in the *Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)* [DOE, 1995a] will be addressed in the *OSDF Post-Closure Care and Inspection Plan* [FDF, 1997]. Inspection, monitoring, and maintenance activities beyond the 30 year post-closure monitoring period will be addressed through future amendments to this plan and the *OSDF Post-Closure Care and Inspection Plan*.

1.2 PROJECT DESCRIPTION

The OSDF will be constructed to contain impacted materials derived from remediation of the operable units at the FEMP. All material destined for OSDF disposal will be required to meet OSDF waste acceptance criteria (WAC). The OU2 ROD has established an initial WAC for the OSDF of 346 pico Curies/gram (pCi/g) of uranium-238 (U-238) or 1,030 parts per million (ppm) total uranium. The estimated total volume of material destined for OSDF disposal is 2.5 million cubic yards (1.9 million cubic meters) bank/unbulked. Approximately 80 percent of this material is impacted soil, with the remainder consisting of building demolition rubble, fly ash, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials.

The design approach for the OSDF is presented in the document, *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2"* [DOE, 1995b]. The design of the OSDF, as currently developed, is presented in the *"Final Design Package, On-Site Disposal Facility"* [GeoSyntec, 1997a]. The design of the OSDF includes a liner systems, placement of impacted material, final cover systems, leachate management systems, surface-water management systems, and other ancillary features. The liner and final cover systems details for the OSDF are shown in Figure 1-1.

LINER AND COVER SYSTEM DESIGN
ON-SITE DISPOSAL FACILTY



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GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	1-1
PROJECT NO.	GE3900-6.1
DOCUMENT NO.	F9530007.CDG
FILE NO.	F95a001.DWG

1.3 PLAN SCOPE

This OSDF Systems Plan establishes the inspection, monitoring, and maintenance activities necessary to achieve the proper performance of the OSDF. The scope of this plan includes:

- Maintaining the OSDF throughout construction, impacted material placement and closure of the OSDF. (While the Systems Plan also includes procedures to be used to maintain the OSDF in the 30 year post-closure monitoring period, those post closure activities are presented for illustrative purposes only, as post closure activities are addressed in a separate *Post-Closure Care and Inspection Plan*);

- Inspecting, and monitoring, the leachate management system;

- Stabilizing the final cover system surface with grass species that limit the erosion of topsoil, are compatible with local vegetation, and require minimal maintenance;

- Maintaining the OSDF seasonal cover, when in use;

- Monitoring temporary support facilities during construction; and

- Maintaining vehicular access around the OSDF.

This Systems Plan has been prepared for regulatory review. Prior to and during construction of the OSDF, this Systems Plan will be updated to contain equipment manuals and operating and maintenance procedures for the specific equipment and system procured and installed by the Subcontractor. This updated plan will serve as a working document that will be periodically updated during the active life and closure of the OSDF. In no case, however, will the updating result in a reduction in inspection, monitoring, maintenance and operational activities below the levels required by this plan unless approval for such reduction is formally obtained from the DOE and EPA/OEPA.

1.4 PLAN ORGANIZATION

The remainder of this Systems Plan is organized as follows:

- The requirements from the OSDF design criteria package (DCP) applicable to this plan, as well as other general requirements applicable to the plan, are presented in Section 2.0;

- Activities for the OSDF leachate management system are presented in Section 3.0;

- Activities for the OSDF final cover system are contained in Section 4.0;
- Activities for the OSDF seasonal cover are described in Section 5.0;
- Activities for the OSDF temporary support facilities, utilities, and site security fence are addressed in Section 6.0;
- Activities for the permanent access roads are presented in Section 7.0; and
- Recordkeeping requirements are presented in Section 8.0.

1.5 PLAN RESPONSIBILITIES

Implementation responsibilities for this Systems Plan are as follows:

- *Construction Manager (CM):* responsible for ensuring that OSDF maintenance, monitoring, and inspection activities are performed in accordance with this plan, on schedule, and by suitably trained personnel; responsible for receiving and reviewing reports and documentation from the Subcontractor, and requesting involvement of Resident Engineer, as required;
- *Subcontractor:* responsible for construction, impacted material placement, and closure of the OSDF facility. The Subcontractor shall implement this plan until the OSDF is fully closed.

The Subcontractor shall be responsible for preparing the necessary health and safety plan that meets all health and safety requirements identified in the FEMP Project Specific Health and Safety Requirements Matrix (PSHSRM). In addition, the H&S personnel will perform periodic audits of the Subcontractor to ensure compliance; H&S personnel will have stop-work authority (in the event of threat to worker and/or public safety) until the proper corrective action is taken. The H&S Officer assigned to the OSDF project will be the single point of contact for all safety, industrial hygiene, fire protection, and radiological issues or concerns.

The Subcontractor will be required to provide a H&S field representative who will be responsible for the Subcontractor's compliance with all H&S requirements. The Subcontractor H&S representative will be required to report all safety concerns and incidents to the H&S Officer.

Radiological Technicians will also be assigned to the OSDF project. In conjunction with the H&S Officer assigned to the project, the Radiological Technician(s) will help to ensure radiological

compliance throughout the project. Radiological compliance may include the radiological monitoring of equipment, materials, soil, and air during excavation, placement and closure to help ensure proper segregation, storage, or disposition; routine inspection, monitoring, and recording of area radon monitors and/or other radiation detection monitors; and radiological monitoring of personnel. The PSHSRM will be the basis for the required monitoring and will identify the action levels that will ensure personnel safety by limiting exposure.

1.6 RELATED IMPLEMENTATION PLANS

Several other implementation plans have been prepared for the OSDF that contain information relevant to this plan. Other plans of direct relevance to this plan are listed below along with a brief statement of the relationship of the work plan to this plan:

- *OSDF Borrow Area Management and Restoration (BAMR) Plan* [GeoSyntec, 1997b]: provides procedures to strip, develop, maintain, and restore the OSDF soil borrow area;
- *OSDF Construction Quality Assurance (CQA) Plan* [GeoSyntec, 1997c]: provides testing and certification standards which are required for the OSDF construction and materials or equipment which may require replacement or repair during construction activities;
- *OSDF Impacted Materials Placement (IMP) Plan* [GeoSyntec, 1996]: outlines impacted material acceptance criteria (WAC) and provides procedures for impacted materials disposal in the OSDF;
- *OSDF Surface-Water Management and Erosion Control (SWMEC) Plan* [GeoSyntec 1997d]: provides details of temporary and permanent E&S controls for the OSDF (including maintenance requirements for channels and sediment control);
- *OSDF Post-Closure Care and Inspection Plan* [FDF, 1997]: describes post-closure inspection, operation and maintenance activities.

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2.0 APPLICABLE REQUIREMENTS

2.1 OVERVIEW

Regulatory, DOE, and other requirements applicable to this Systems Plan are contained in the Design Criteria Package (DCP) for the OSDF. The DCP is contained with the overall OSDF Design Package [GeoSyntec, 1997a]. These requirements take the form of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) as determined by the record of decision for each of the various FEMP operable units, functional requirements, and general design criteria. The DCP requirements applicable to this Systems Plan are described below.

2.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs that are addressed by this Systems Plan are:

- OAC 3745-27-08(C)(4)(b): Leachate collection systems pipes shall (i) be provided with access for clean-out devices; (ii) be of a length and configuration that do not exceed the capabilities of clean-out devices; and (iii) resist damage caused by differential settlement.

- OAC 3745-27-08(C)(4)(e): Lift stations shall be equipped with automatic high level alarms located no greater than 6 ft (2.0 m) above the invert of the leachate inlet pipe. Lift station pumps shall be of adequate capacity and shall automatically commence pumping before the accumulated leachate activates the high level alarm.

- OAC 3745-27-08(C)(5): Leachate conveyance and storage structures located outside of the limits of disposal shall be no less protective of the environment than the disposal facility, and shall:

  - Be monitored, as required by EPA and OEPA;

  - For storage tanks, be provided with secondary containment;

  - For leachate lines, be provided with double containment; and

  - For storage structures, have a minimum of one week of storage capacity as established by design using assumptions simulating final closure of the facility.

- OAC 3745-27-08(C)(8): Access roads shall allow passage of vehicles during all weather conditions with minimum erosion, dust generation, and with adequate drainage. Grades are not to exceed 12 percent.

Post-closure care activities for all sanitary landfill facilities shall include, but are not limited to:

- Continuing operation and maintenance of the leachate management systems and surface-water management systems; and
- Maintaining the integrity and effectiveness of the cap systems, including making repairs to the cap systems as necessary to correct the effects of settling, dead vegetation, subsidence, erosion, leachate outbreaks, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cap systems.

- OAC 3745-27-19(E)(26): The integrity of the engineered components of the landfill shall be maintained and any damage to, or failure, or the components shall be repaired.
- OAC 3745-27-19(J)(1)(4): If ponding or erosion occurs on areas of the landfill facility where solid waste is being, or has been, deposited, action will be taken to correct the conditions causing the ponding or erosion.
- OAC 3745-27-19(K)(1): If leachate is detected on the surface of the landfill facility, then the outbreak(s) shall be repaired and:
  - Leachate shall be contained and properly managed at the sanitary landfill facility;
  - If necessary, leachate shall be collected and disposed in accordance with paragraph (K)(5) and (K)(6) of OAC 3745-27-19; and
  - Actions shall be taken to minimize, control, or eliminate the conditions which contribute to the production of leachate.
- OAC 3745-27-19(K)(2): At least one lift station back-up pump shall be kept at the disposal facility at all times.
- OAC 3745-27-19(K)(3): The collection pipe network of the leachate management systems shall be inspected after placement of the initial lift of waste to ensure that crushing has not occurred and shall be inspected annually thereafter to ensure that clogging has not occurred.
- OAC 3745-68-10: After final closure, the owner or operator shall comply with all post-closure requirements, including maintenance and monitoring throughout the post-closure care period. The owner or operator shall:

  1) Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events;

2) Continue to operate the leachate collection and removal systems until leachate is no longer detected;

3) Maintain and monitor the leak detection systems;

4) Maintain and monitor the ground-water monitoring systems;

5) Prevent run-on and run-off from eroding or otherwise damaging the final cover; and

6) Protect and maintain surveyed benchmarks.

2.3 FUNCTIONAL REQUIREMENTS AND DESIGN CONSIDERATIONS

The DCP contains a variety of functional requirements and design considerations that have been established for the OSDF. These functional requirements are specific facility design or performance criteria required by DOE. Design considerations represent those other design, construction, or operational criteria identified by the OSDF architect/engineer (A/E) as necessary for the OSDF to successfully fulfill its intended function. Criteria relevant to the OSDF leachate management system are provided in Section 2.5 of the DCP. Criteria relevant to the final cover system are described in Section 2.6. Criteria applicable to the support facilities and utilities are presented in Section 2.9.

2.4 OTHER CRITERIA

Criteria applicable to this plan consist of those industry-standard practices that have proven effective at other waste disposal facilities. Inspection and monitoring requirements from the manufacturers and suppliers of materials and equipment to be installed at the OSDF are also criteria relevant to this plan.

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3.0 LEACHATE MANAGEMENT SYSTEM

3.1 OVERVIEW OF SYSTEM

The double-liner systems of each OSDF cell contains a leachate collection system (LCS) and a leak detection system (LDS) (see Figure 1-1). These systems are designed to convey any liquids that enter the system through pipes (i.e., the LCS pipes and the LDS pipes) to manholes located outside each cell. Liquids that enter the LCS include: (i) leachate generated by infiltration of water through the impacted material into the LCS; and (ii) impacted runoff from active portions of the OSDF which infiltrate into the LCS. Liquid that enters the LDS is primarily precipitation that percolates into the LDS prior to placement of the primary liner. Liquid that collects in the LDS manhole of a cell shall be pumped to the adjacent LCS manhole. In turn, the LCS manholes are connected by a leachate transmission system (LTS) gravity line which conveys leachate from the LCS pipes in the manholes via gravity flow to either a temporary gravity line or a permanent lift station. The temporary lift gravity line is a double-wall pipe which conveys flows to the permanent lift station during earlier stages of OSDF operation. From the permanent lift station, leachate is pumped through a permanent double-wall forcemain to the Biodenitrification Surge Lagoon (BSL)

The locations of the LCS, LDS, and LTS gravity lines manholes, temporary gravity line and permanent lift stations are presented on the Construction Drawings.

This Systems Plan addresses all leachate management systems components up to the LTS gravity line or temporary gravity line discharge point into the permanent lift station.

3.2 BASIC SYSTEM OPERATION

The basic operation of the OSDF leachate management systems is described below.

- The LCS and LDS pipes from the liner system to the LCS and LDS manholes for each cell consist of double-wall HDPE pipes (i.e., inner carrier pipes and outer containment pipes). Each pipe drains by gravity from the OSDF cell and terminates in a LCS or LDS manhole.

- The LDS manhole allows for direct discharge of flow from the LDS carrier pipe into a primary containment vessel located inside the manhole. The LDS manhole serves as a secondary containment structure for the primary containment vessel. The LDS manhole has provisions for the monitoring of liquid in the primary containment vessel component of the manhole. The primary containment vessel has a 2 in. (50 mm) diameter liquid level pipe, a 2 in. (50 mm) diameter suction pipe, and a 2 in. (50 mm) diameter discharge pipe. The discharge pipe is connected to the LTS gravity line in the adjacent LCS manhole. The LDS containment pipe has a monitoring port and fixed end seal

within the LDS manhole to verify the absence of liquid in the annular space between the carrier pipe and containment pipe.

- Each LDS manhole has a cleanout adjacent to the manhole for maintaining the LDS carrier pipe. The LDS manhole also has access provisions to install a sump pump to allow pumping of construction water that drains from the LDS prior to the placement of impacted material in the OSDF.

- The LCS manhole allows for direct discharge of flow from the LCS carrier pipe into the LTS gravity line that passes through the manhole. The LCS carrier pipe has temporary valves for regulating leachate flow into the gravity line during OSDF construction, impacted material placement, and periods of gravity line maintenance, extension, repair, etc. These valves shall be removed (and replaced with a solid-wall HDPE spool) from the LCS carrier pipe prior to final closure of the OSDF (so that, in the long term, there are no obstructions in the pipe). The LCS carrier pipe in each LCS manhole also has a sampling port for obtaining leachate samples. Each LCS manhole has an inlet for a redundant LCS carrier pipe. The redundant carrier pipe has a valve (secured in a closed position) and sampling port (for periodically confirming the absence of liquid in the pipe). The redundant carrier pipe valve is configured so that it can be opened to allow flow to the LTS gravity line at any time in the event of a failure due to clogging of the primary LCS carrier pipe. This valve shall also be removed (and replaced with solid-wall HDPE spool) after final closure of the entire OSDF. Both the primary and redundant LCS containment pipes have monitoring ports and fixed end seals within the LCS manholes to verify the absence of liquid in the annular space between the carrier pipe and the containment pipe.

- LCS manholes are equipped with liquid level alarms, consisting of a submersible liquid level sensor, logic controller, and alarm light. The liquid level sensor shall be calibrated such that the alarm is activated when the liquid level in the LCS manhole exceeds 2 in. (50 mm). The LCS and LDS manholes have pipe supports for the LTS gravity line and the LDS carrier pipe, respectively.

- The LTS gravity line and LCS and LDS manholes will be installed in stages, progressively advancing from north to south in conjunction with the progressive development of the OSDF. Each stage may involve the installation of manholes and LTS gravity line for several cells. At a given stage, the LTS gravity line will run through all of the manholes previously installed and those installed for a given stage to the southernmost manhole installed in that stage. This southernmost manhole serves as a connector point to the temporary gravity line.

- The LTS gravity line consists of a double-wall HDPE pipe with a 6 in. (150 mm) diameter inner carrier pipe and a 10 in. (150 mm) diameter outer containment pipe. The inner carrier pipe of the LTS gravity line will be continuous over its entire length (i.e., from its upgradient to its discharge point). The outer containment pipe will be continuous between the LCS manholes and joined to the manhole walls.

- The LTS gravity line will be equipped with a vent and 4 in. (100 mm) diameter quick-connect hose connection at its northern end. The purpose of the vent is to prevent pressure or vacuum buildup in the systems. The quick-connect hose allows pressure testing of the systems and jetting water in the line to clean it. The gravity line will have cleanouts on the upgradient end of each LCS manhole for maintenance.

- The butterfly valve located in each LCS manhole will be manually adjusted in conjunction with the flow meter to control the rate of flow into the temporary gravity line. The temporary gravity line control systems are designed to allow flow at a rate no greater than the storm design flow rate, which has been established as 200 gallons per minute (gpm) (760 liters per minute (lpm)).

- Unneeded portions of the temporary gravity line are to be taken out of service as part of each subsequent stage of construction. At that time, the LTS gravity line should be extended either to the next temporary gravity line connection location or to the permanent lift station, as appropriate.

- The temporary gravity line between the LTS gravity line and the permanent lift station consists of double-wall HDPE pipe. The inner carrier pipe is 6 in. (150 mm) in diameter and the outer containment pipe is 10 in. (254 mm) in diameter. The temporary gravity line will have a slope of at least 0.25 percent towards the permanent lift station. During winter months, the temporary gravity line must be covered by at least a 3 ft (0.9 m) thick soil cover for frost protection.

- The permanent lift station is provided with secondary containment which is designed so that it can be monitored for the presence of leakage.

- The permanent lift station is capable of storing the quantity of leachate generated during a one-week period using design assumptions simulating final closure of the OSDF.

- Prior to the discharge of liquid into the permanent lift station, the liquid passes through a motor-operated inflow valve which closes automatically in the event of power failure or if liquid levels in the lift station rises above the high level alarm setpoint or any level that would cause an electrical short or damage to equipment in the lift station). The lift station also has a manual means for closing the lift station motor-operated inflow valve. Therefore, this valve can be closed manually, if needed, until appropriate maintenance activities can be implemented.

- The permanent lift station will be equipped with a pumping system to transfer liquids in the lift station to the BSL.

Each major component of the leachate management systems will be identified (i.e., numbered) during installation. The Subcontractor will be required to provide manufacturer's equipment operating and maintenance instructions as part of Construction Acceptance Testing. Construction Acceptance Testing is the performance of all necessary testing to demonstrate that subcontractor

supplied or installed equipment and system are installed satisfactorily and safely in accordance with the Construction Drawings and Specifications.

3.3 LDS AND LCS OPERATION PROCEDURES

The LDS and LCS of each OSDF cell shall be operated by the Subcontractor in conformance with the requirements of this section.

- Systems shall not be accepted for operation until the Subcontractor has completed all the requirements of the Construction Acceptance Testing.
- Prior to the start of active operations of a cell, the Subcontractor shall maintain a sump pump in the primary containment vessel of the LDS manhole and pump accumulated water to the FEMP stormwater management system. The LDS flow rate shall be less than 10 gpm (38 lpm) (due to drainage of construction water from the LDS) prior to the start of cell operation.
- Prior to the start of active operations of a cell, the subcontractor shall obtain a sample of the liquid in the primary containment vessel and test for constituents that are defined by the Construction Manager.
- Prior to the start of active operations of a cell, the Subcontractor shall set the level transmitter for the primary containment vessel of the LDS manholes to activate the alarm *i.e.*, alarm light for a liquid level 6 in. (150 mm) below the top of the vessel.
- Prior to the start of active operations of a cell, the Subcontractor shall set the level transmitter for the secondary containment vessel of the LCS manhole to activate the alarm for a liquid level 2 in. (50 mm) above the bottom of the vessel.
- If an alarm is activated, the Subcontractor personnel shall respond within one hour to assess the reasons for the alarm sounding and to take corrective actions.
- Prior to the start of active operations of a cell, the Subcontractor shall attach an auxiliary cleanout to the LTS gravity line cleanout adjacent to the cell.
- The butterfly valve on the LCS carrier pipe shall be maintained in the closed position until the start of impacted material placement in the cell. The Subcontractor shall manage runoff that falls into the cell prior to the start of impacted material placement as stormwater. This water shall be pumped using a sump pump or other means to the FEMP stormwater management system.
- Prior to start of active operations of a cell the Subcontractor shall verify the absence of liquids in the LCS, redundant LCS, and LDS containment pipes by opening the monitoring ports on each containment pipe and visually observing for collection of any liquid present.

- After impacted material placement begins in a cell, all water in the cell may be discharged to the FEMP stormwater management system. The butterfly valve on the LCS carrier pipe shall be opened to allow discharge to the LTS gravity line, but shall be positioned (throttled) such that flow rate to the permanent lift station does not exceed 200 gpm (760 lpm).

- The impacted runoff catchment area is designed to allow impacted runoff to enter directly into the LCS collection system. If the system becomes inoperable (*e.g.*, clogging of the sacrificial geotextile has occurred) the subcontractor shall remove impacted runoff by pumping from the impacted runoff catchment area to the auxiliary cleanout.

- The valve on the redundant LCS carrier pipe shall be maintained closed at all times, unless overridden by conditions dictated in Section 3.4.

- The butterfly valve on the LCS carrier pipe shall be maintained open at all times during the active life, closure period, and post-closure period of the OSDF, except for those periods where the valve needs to be closed for systems maintenance and repair or in the event of an operational emergency.

- The LCS manholes are designed as a closed system; liquids should not accumulate in these manholes. The level transmitter in the secondary containment in each LCS manhole shall be set to activate the alarm light for a liquid level of more than 2 in. (50 mm) above the floor of the manhole. If the alarm is activated, Subcontractor personnel shall respond within one hour to assess the problem and to take appropriate corrective actions.

- Throughout active operations of the OSDF, the Subcontractor shall daily measure and record the liquid quantity in, and flow rate into, the primary containment vessel of each LDS manhole. A portable suction pump shall be used to pump this liquid through the LDS suction pipe and into the LDS discharge pipe. The LDS primary containment vessel shall be evacuated as often as necessary to prevent overtopping of the vessel.

- The Subcontractor shall provide the CM with whatever equipment or assistance the CM may periodically request in connection with obtaining samples of liquids from the LCS and LDS sampling or monitoring ports.

The Subcontractor shall follow all Occupational Safety and Health Administration (OSHA), DOE, and FEMP site requirements for confined space entry when performing monitoring and inspection activities in the LDS and LCS manholes.

3.4 LDS AND LCS INSPECTION AND MAINTENANCE ACTIVITIES

The LCS and LDS shall be inspected and maintained in accordance with the schedule and activity requirements outlined in Table 3-1, or until leachate is no longer generated and an alternative

TABLE 3-1

LEACHATE COLLECTION AND LEAK DETECTION SYSTEMS INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy
	Active Period	Closure Period		
LDS	Weekly	Weekly for the first three months after cell closure, then monthly for the remainder of the first year	• condition of submersible level transmitter and appurtenances	• check level transmitter operations (e.g., operating temperature range, accuracy, etc.), electrical connections, and alarm light.
			• leakage from primary containment vessel	• check for source of leak; if source identified then take appropriate corrective measures (i.e., spot-seal vessel, replace vessel, etc.)
			• liquid in LDS containment pipe	• keep monitoring port drained; perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects
LCS	Weekly	Weekly for the first three months after cell closure, then monthly for the remainder of the first year	• condition of submersible level transmitter and appurtenances	• check level transmitter operations (e.g., operating temperature range, accuracy, etc.), electrical connections, strobe light, and radio transmission
			• condition of shutoff valve	• check valve operability; correct any deficiencies
			• liquid in LCS containment pipe	• keep monitoring port drained; perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects
			• liquid in redundant LCS carrier pipe	• drain pipe into LTS gravity line
LDS & LCS Pipes	prior to the start of active operations, then annually	Annually	Video inspect for: • crushing of pipe • clogging of pipe	• flush clogged pipe with water or mechanically clean • insert small diameter pipe in crushed pipe, if possible • replace crushed pipe if crushed portion is outside of the cell • utilize redundant LCS pipe

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) Leachate collection and leak detection systems shall be inspected after the occurrence of major earthquakes.

activity schedule has been approved by EPA and OEPA. Specific details of the required inspection and maintenance activities are given below.

According to ARARs (OAC 3745-27-19(k)(3)), the LCS and LDS pipe network shall be inspected after placement of the initial lift of impacted material to ensure that crushing has not occurred, and annually thereafter to ensure that clogging has not occurred. Clogging can occur by deposition of particles within the pipe or by biological growth inside the pipe. The Subcontractor shall inspect this pipe network between the manhole and the first 100 ft (30 m) of subdrain pipe inside the cell. The portion of the pipe beyond this point inside the cell is considered to be redundant because the gradation of the LCS granular drainage material is designed to limit the level of leachate on the geomembrane liner to less than 1 ft (0.3 m) without need for a subdrain pipe.

Access to the LCS and LDS pipes for inspection shall be through HDPE cleanouts located adjacent to the LDS or LCS manholes. Inspections shall be performed using a video camera or other appropriate inspection equipment. The inspection equipment shall have the ability to monitor its location (e.g., distance counter), be sized to fit within the LCS and LDS inner carrier pipes indicated on Construction Drawings and be capable of being pushed the length to be inspected.

If an inspection indicates that a LCS or LDS pipe is obstructed, the pipe shall be flushed by pumping fresh water from a water truck through a hose inserted in the pipe cleanout. If flushing does not remove the obstruction, other methods shall be used to clean the pipe. These other methods may include blowing the obstruction out with air, vacuuming, rodding, or inserting a snake, fish tape, or other suitable device. If air or water pressure is used, the working pressure inside the pipe shall not exceed the rated pressure of the pipe.

The specific pipe maintenance procedures (other than flushing) to use to remove a pipe obstruction should be selected on a case by case basis. Any procedure proposed by the Subcontractor other than flushing with water must be pre-approved by the CM.

In the event that LCS or LDS pipe obstruction cannot be dislodged, or in the very unlikely event that a pipe has undergone partial or total crushing, the following procedures should be considered in the following order:

- For the LCS or LDS, insert a new small diameter pipe within the obstructed or collapsed pipe;
- For the LCS, activate the redundant LCS pipe; and

- For the LCS or LDS pipe, if the obstruction or collapse is outside of the disposal facility containment systems, replace the pipe.

All equipment inserted into the LCS or LDS line for inspection and/or maintenance shall be decontaminated prior to removal from the OSDF battery limits.

In addition to the foregoing requirements, all mechanical and electrical equipment shall be calibrated, operated, maintained, and serviced in accordance with the manufacturer's instructions for that equipment. Manufacturer's instructions are contained in Attachment A of this Systems Plan. These instructions shall be amended to this plan once the equipment is installed by the OSDF Consultant Subcontractor and accepted by the CM.

3.5 LTS OPERATION PROCEDURES

The OSDF LTS shall be operated by the Subcontractor in conformance with the requirements of this section.

- Systems shall not be accepted for operation until the Subcontractor has completed the requirements of the Construction Acceptance Testing.

- Before taking the temporary gravity line out of service, the Subcontractor shall manually turn off the inflow valve in the LCS gravity line and the required temporary portion of the gravity line shall be removed.

3.6 LTS INSPECTION AND MAINTENANCE ACTIVITIES

- The LTS shall be inspected and maintained in accordance with the schedule and activity requirements outlined in Tables 3-2 and 3-3, or until leachate is no longer generated and an alternative activity schedule has been approved by EPA and OEPA. Specific details of the required inspection and maintenance activities are given below.

The manholes, leachate transmission system, valves, connections, sampling ports, monitoring ports, pumps, etc., shall be routinely inspected and maintained to provide for proper OSDF operation. All mechanical and electrical equipment shall be calibrated, operated, maintained, and serviced in accordance with the manufacturer's instructions for that equipment. Manufacturer's instructions are contained in Attachment A of this OSDF Plan. In addition, the inspection and maintenance activities for the LTS shall include the following:

- Confirm that appropriate warning signs are visible (e.g., confined space entry, buried pipe and conduit);

TABLE 3-2

LDS/LCS MANHOLES AND LTS GRAVITY LINE INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy
	Active Period	Closure Period		
LDS Manholes	Weekly	Weekly for the first three months after cell closure, then monthly	• confirm all required signage is visible	• repair and/or replace as necessary
			• cracked, broken manhole cover	• replace manhole cover
			• leaking seal on manhole cover	• replace seal
			• general structural condition of containment vessel	• check for structural integrity; if problems are found, take appropriate measures (i.e., spot seal vessel, replace vessel, etc.) and implement permanent solution
			• odors, bacterial growth (containment vessel)	• flush and/or spray sodium hypochlorite into containment vessel
LCS Gravity Line	Weekly	Monthly	• liquid in LCS gravity line containment pipe	• keep containment pipe drained; performed video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM
			• inspection of pipe for clogging or crushing (annual only)	• flush clogged pipe with water or mechanically clean; repair as necessary
			• butterfly valve in proper position	• adjust valve to limit flow to permanent lift station to 200 gpm
LDS Gravity Line	Weekly	Monthly	• liquid in LDS gravity line containment pipe	• keep containment pipe drained; performed video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM
			• inspection of pipe for clogging or crushing (annual only)	• flush clogged pipe with water or mechanically clean; repair as necessary
LTS Gravity Line	Weekly	Monthly	• liquid in LTS gravity line containment pipe	• keep containment pipe drained; performed video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM
			• inspection of pipe for clogging or crushing (annual only)	• flush clogged pipe with water or mechanically clean; repair as necessary
LCS Manholes	Weekly	Weekly for the first three months after cell closure, then monthly	• confirm all required signage is visible	• repair and/or replace as necessary
			• cracked, broken manhole cover	• replace manhole cover
			• leaking seal on manhole cover	• replace seal
			• completion of OSDF construction	• remove designed valves and replace with pipe spool piece
			• general structural condition of manhole	• check for structural integrity; if damage is observed, assess extent and make repair recommendations

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) LDS/LCS manholes and LTS gravity line shall by inspected after the occurrence of major earthquakes.

TABLE 3-3

GRAVITY LINE INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy
	Active Period	Closure Period		
Temporary Gravity Line	Weekly	N/A	• record accumulated flow at disc flow meter; check that flow meter is operation (3) • leakage from temporary gravity line and plumbing • condition of liquid transmitter for temporary gravity secondary containment system • frost protection soil cover • liquid in temporary gravity line containment pipe	• repair and/or replace as necessary • investigate source of leakage, repair as necessary • check sensor operations, electrical connections, and alarm light • increase soil cover if inadequate cover exists • keep containment pipe drained; perform video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) LDS/LCS manholes and LTS gravity line shall by inspected after the occurrence of major earthquakes.

- Check instruments/valves (e.g., note sticking or jammed devices, corrosion, leaks, and misalignments);
- Note any temperature extremes which may exist inside the manhole (e.g., temperature outside of equipment-specific operating temperature ranges);
- Verify instrument systems status (e.g., elevation and location of automatic level switch in the lift station manhole),
- Monitor flow for pulsating, over pressure, or under pressure;
- Check for the presence of liquids in all secondary containment systems;
- Confirm pump operation/priming;
- Check hoses for physical wear and poor connections prior to each use;
- Rate condition of manhole covers;
- Note condition of concrete slab; and
- Confirm adequate protection is provided around the temporary gravity line. Should any of the above inspections reveal systems deficiencies, the conductor shall be connected utilizing a procedure approved by the Construction Manager.

3.7 EMERGENCY PROCEDURES FOR SPILLS

The OSDF leachate management system has been designed with multiple safeguards and redundancies to prevent the accumulation of liquids in the secondary containment or the overflow of liquids from the primary containment components of the leachate management system. These safeguards and redundancies include the following:

- The LDS primary containment will be equipped with a level transmitter which activates an alarm light if the liquid level is less than 6 in. from the top of the containment.
- The secondary containment of the LCS manholes will include level transmitters which will activate an alarm if the liquid level exceeds 2 in. (50 mm) from the bottom of the containment.
- The liquid level alarm consists of a submersible level transmitter, programmable logic controller, and alarm light. The level transmitter originates a signal which is sent to the programmable logic controller, and if the programmable logic controller concludes that the liquid level exceeds the maximum preset value, it activates the alarm light.
- The Subcontractor personnel shall respond to the alarm within one hour to assess the problem and to take appropriate corrective actions. A Subcontractor representative shall be "on call" 24 hours a day.

3.8 RECORDKEEPING

The Subcontractor shall maintain written records of all monitoring activities, inspections, and maintenance repairs in accordance with the recordkeeping and reporting requirements of Section 8.0 of this plan.

4.0 FINAL COVER SYSTEM

4.1 OVERVIEW OF COVER SYSTEM

The construction, placement of impacted material, and closure of the OSDF is scheduled to occur over a 7 year period. As each cell is filled to final grade, the final cover system will be installed over that cell. Figure 1-1 of this plan presents the final cover system cross section. As seen in this figure, the topmost surface of the final cover system is vegetation. The goals of the vegetation are: (i) to stabilize the final cover systems surface with grass species that limit the erosion of topsoil; (ii) to closely follow the local vegetation; (iii) to be visually attractive; and (iv) to require minimal maintenance. The vegetation is underlain by, in turn, the topsoil layer and the vegetative soil layer.

Vegetation for newly closed cells will initially consist of selected mixes of native species. This vegetation will require inspection and maintenance in order to manage bare areas and erosion, and to intercede in the process of old field vegetation succession, which, if left unimpacted, would result in climax forest vegetation at the site within a 60 year timeframe. The topsoil and vegetative soil layer also require inspection and maintenance with respect to the potential for surface erosion, gully formation, and settlement and subsidence.

The final cover system grading plan is shown on the Construction Drawings.

4.2 FINAL COVER SYSTEM INSPECTION AND MAINTENANCE ACTIVITIES

The final cover shall be inspected and maintained in accordance with the schedule and activity requirements presented in Table 4-1 of this plan. The inspection and maintenance activities identified in this table are designed to provide a final cover system that maintains its effectiveness and performs as intended. In addition, the inspection activities are designed to detect any significant deterioration in the final cover systems components.

The inspection shall consist of a walkover survey of the entire OSDF final cover system. The visual inspection shall be conducted by traversing the cover system on a 100 ft (30 m) grid pattern. Suspect areas shall be delineated on a topographic plan of the site. The inspections shall result in evaluation of the following items, if present:

- Vegetative stress (i.e., if areas without vegetation or with dead vegetation (not just dormant) or sparse vegetation and/or undesirable plant growth are present);
- Erosion, bare spots, poor performing vegetation;

TABLE 4-1

FINAL COVER SYSTEM
INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections Closure Period	Condition	Remedy	Maintenance
Vegetation[1]	Monthly for at least six months	• stressed vegetation • erosion, bare spots, and poor performing vegetation • unwanted deep rooted plants, weeds, or saplings	• evaluate cause; vegetate or remedy • remove sediment; reseed and mulch • remove as necessary	• analyze soil and fertilize • revegetate as needed • mechanically, chemically, or by controlled burn
Topsoil	Monthly for at least six months	• topsoil erosion or drainage gullies • topsoil settlement or subsidence • burrowing animals	• replace topsoil; reseed and mulch; utilize non-vegetative stabilization (e.g., jute mat) if necessary • add topsoil and regrade • implement program (e.g., catch/release) to eradicate	• revegetate and refertilize • reconstruct • fill in holes
Cover Drainage Layer	Monthly for at least six months	• seepage erosion of drainage material • clogging or covering of cover drainage layer outlet by topsoil	• Construction Manager will evaluate placing granular "cap" over cover drainage outlet and develop corrective action plan • remove topsoil, replace granular soil at outlet as necessary	• replace, regrade material • replace, regrade material

Notes:
(1) See the text of this Section for requirements related to grass mowing.
(2) Frequencies of inspection and maintenance activities are preliminary. These frequencies will be finalized as material supplier's inspection and maintenance instructions are available.
(3) Final cover system shall be inspected after the occurrence of major earthquakes.

TABLE 4-1 (continued)

FINAL COVER SYSTEM
INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections Closure Period	Condition	Remedy	Maintenance
Final Cover System	Monthly for at least six months	• toe bulges • tension cracks	• notify the Construction Manager to investigate and develop corrective action plan • notify the Construction Manager to investigate and develop a corrective action plan	• cordon off affected area; maintenance/repair activities will be defined by the investigation results • cordon off affected area; maintenance/repair activities will be defined by the investigation results
Final Cover System	Monthly for at least six months	• leachate seep	• notify the Construction Manager to investigate and develop a corrective action plan	• contain leachate; cordon off affected area; maintenance/repair activities will be defined by the investigation results
Surveying	Monthly for at least six months	• survey monuments	• N/A	• obtain survey data

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) Fnal cover system shall be inspected after the occurrence of major earthquakes.

- Unwanted rooted plants, weeds, or saplings;
- Topsoil erosion or drainage gullies;
- Topsoil settlement or subsidence;
- Presence of burrowing animals;
- Seepage erosion of cover drainage material;
- Clogging or covering of cover drainage layer outlet by topsoil or any other material(s);
- Tension cracks which may be indicative of the instability of cover systems;
- Toe bulges which may be indicative of the instability of cover systems; and
- Leachate seeps.

Note that the need for, and frequency of, grass cutting will depend on the final seed mix selected for the OSDF final cover system. Mowing shall occur at least once annually (in the late fall) at a time when the final cover system is reasonably dry. Mowing equipment shall not cause rutting or disturbance of topsoil. More frequent mowing will be specified if needed, in a subsequent version of this Systems Plan based on the final seed mix selected for the OSDF.

Maintenance activities for the OSDF final cover system shall include surveying of settlement monuments placed on the OSDF final cover system. These monuments shall be surveyed monthly for at least six months after installation, then semi-annually for five years, then annually.

Repairs to the OSDF final cover systems, except vegetation and topsoil, shall not be made unless approved by the CM. Any repair activity involving any component of the final cover systems shall be in full conformance with the original Project Specifications for that component.

Woody species reproduction that develops in the OSDF final cover system shall be eliminated mechanically, chemically or by fire. Many woody species maintain the root systems when cut and rapidly resprout. The root systems continues to grow through repeated cuttings and can become extensive. For this reason, chemical herbicides (spraying of individual trees and shrubs) or fire shall be preferred for control of woody species reproduction, as eradication of the whole plant including the root systems is a primary goal. A combination of mechanical and chemical treatment where cut stumps are treated with herbicide to prevent resprouting may also be considered. The most effective method for managing woody vegetation shall be evaluated for the OSDF by the Subcontractor based on available equipment, expertise, and cost.

It is noted that additional Systems requirements for the OSDF project, which the Subcontractor shall follow, are contained in the: (i) *OSDF Borrow Area Management and Restoration Plan*; and (ii) *OSDF Surface-Water Management and Erosion Control Plan*.

4.3 RECORDKEEPING

The Subcontractor shall maintain written records of all monitoring, operational activities, maintenance inspections, and maintenance repairs in accordance with recordkeeping and reporting requirements of Section 8.0 of this Systems Plan.

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5.0 TEMPORARY SUPPORT FACILITIES, UTILITIES, AND SITE SECURITY FENCE

5.1 DESCRIPTION OF SYSTEMS

The function of the temporary support facilities and utilities is to provide support for the OSDF during construction, impacted material placement, and closure. Temporary support facilities include survey benchmarks, administrative support trailers, equipment maintenance facilities, decontamination facilities, and material storage areas. Utilities include electricity, water, wastewater, and telephone system. A site security fence will be erected during construction and will be dismantled at the end of construction.

The support facilities and utilities must be maintained to provide adequate and reliable support for the construction activities that will be performed for the OSDF. The support facilities and utilities must be maintained in a manner that is consistent with the requirements of applicable utility codes at the FEMP and with applicable health and safety requirements for the FEMP.

A site security fence, consisting of 6-ft (1.8-m) high chain linked fence with three strands of barbed wire on the top of the fence will be erected around the OSDF construction area. The fence gates will be locked with keyed-alike locks. The location of the security fence will be periodically relocated as cell construction progresses from north to south. If it is determined that a fence is to remain around the OSDF (permanently), it will be evaluated for both security and aesthetics.

5.2 TEMPORARY SUPPORT FACILITIES INSPECTION AND MAINTENANCE ACTIVITIES

Temporary support facilities, utilities, and site security fence shall be inspected and maintained in accordance with the schedule and activity requirements presented in Table 5-1. During winter shutdown, unoccupied facilities shall be inspected to detect any breach or damage to the systems contained in the facilities and to ensure the systems are functioning properly.

The permanent survey benchmarks shall be inspected for any evidence of damage or disturbance. If such evidence is observed, it should be noted and reported. The CM will then have the benchmark resurveyed and re-established if necessary.

The administrative support trailers and equipment maintenance facilities shall be inspected for the following items: (i) leaks in roof, windows and doors; (ii) structurally sound stairs, access ways and fire escapes; (iii) security of doors and windows; (iv) condition of tie-downs (for trailers only); (v) condition the heating, ventilating, and air conditioning (HVAC) systems; (vi) condition of associated storage tanks; and (vii) cleanliness.

TABLE 5-1

TEMPORARY SUPPORT FACILITIES AND SITE SECURITY FENCE INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections Closure Period	Condition	Remedy	Maintenance
Temporary Facilitiies (Vacant)	Semi-Annually	• inadequate and unreliable support facilities • damage or broken items	• maintain livable condition, clean, and workable equipment • replace if needed, repair	• janitorial services as needed
Utilities	Semi-Annually	• confirm utility is useable • confirm utility grounded	• replace if needed, repair	• maintain as needed; use lockout program
Storage areas/ stockpiles/ temporary decontamination facilities	Daily	• ponding of water • protection from elements • adequate storage or disposal	• regrade if needed • repair cover • clean, maintain workable equipment, fix as needed	• clean daily • provide sufficient ballast for cover • daily inspections of equipment • proper disposal of hazardous materials
Fence	Quarterly	• damaged • under fence erosion	• repair or replace as necessary • repair erosion or extend fence as necessary	• replace or repair fence • provide erosion and sedimentation control
Gates	Quarterly	• tampering/damage to locks	• repair or replace as necessary	• install proper lock
Warning Signs	Quarterly	• damaged or missing warning signs	• replace as needed	• install warning signs to fence or gates

N/A - Not applicable
Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) Temporary support facilities and site security fence shall be inspected after the occurrence of major earthquakes.

Equipment decontamination facilities will require routine maintenance of pumps and valves and cleaning out of sump areas. The operation, inspection, and maintenance of all electrical and mechanical equipment shall be in accordance with the manufacturer's instructions. These instructions are provided in Attachment B of this Systems Plan.

Material storage areas shall be inspected to ensure that the area is secure and trafficable. If the area is not secure, security fence shall be installed. If the area is not trafficable due to excessive rutting, poor drainage, etc., the Subcontractor shall notify the CM. The CM will evaluate the situation and issue a plan for corrective actions.

Utilities shall be inspected to ensure that no deterioration has occurred and that proper grounding of system is functioning. Utilities shall meet all applicable standards (i.e., Cincinnati Gas and Electric, NEC, ASTM, ASCE, ANSI, ACI, and FEMP site facility standards).

The construction security fence shall be inspected for the following items: (i) holes in the mesh; (ii) three strands of barbed wire on top of the fence; (iii) security of all access points; and (iv) warning signs posted on 100 ft (30 m) centers along the fence. Repair work or replacement of the security fence shall be performed in a timely manner to prevent unauthorized access to the OSDF. After closure of the OSDF, the construction security fence shall be dismantled, and disturbed areas shall be regraded and re-vegetated. A permanent fence (that is aesthetically pleasing to stakeholders) may be installed and maintained for the duration of the post-closure period. If a permanent fence is determined necessary; the details will be provided in a subsequent design submittal.

Maintenance of temporary support facilities and utilities shall include repair or replacement of items as necessary. All new materials and installation work for repair or maintenance activities shall be in full conformance with the original Project Specifications.

5.3 RECORDKEEPING

The Subcontractor shall maintain written records of all monitoring, inspections, and maintenance repairs in accordance with recordkeeping and reporting requirements of Section 8.0 of this Systems Plan.

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6.0 OSDF ACCESS ROADS

6.1 DESCRIPTION OF ROADS

Access to the OSDF will be continuously controlled. Access to the OSDF will be provided by: (i) construction haul roads (ii) impacted material haul roads; and (iii) leachate transmission systems access corridor.

Access roads to the OSDF will be developed in phases in conjunction with the phased development of the OSDF. Access to the OSDF must be maintained to provide safe, efficient ingress and egress to the work areas and other areas. Safety and traffic control signals at critical locations (e.g., flagmen) will be utilized as needed throughout construction (e.g., intersection of the relocated north entrance road and the construction haul road) to mark potential hazard areas. Traffic will be routed and controlled in a manner that maintains an orderly flow of vehicles to minimize accidents and to avoid delays in the construction. Road maintenance and control will be the responsibility of the Subcontractor.

The layout of the roads providing access to the Construction Drawings.

6.2 ACCESS ROADS INSPECTION AND MAINTENANCE ACTIVITIES

Access roads to the OSDF shall be inspected and maintained in accordance with the schedule and activity requirements presented in Table 6-1. The Subcontractor shall be responsible for safe and efficient OSDF access road operations during OSDF construction, filling, and closure. The Subcontractor shall maintain all road signage in a clearly visible state. Road signage shall be increased if needed to achieve safe and efficient traffic operations. If necessary, the Subcontractor shall provide traffic control personnel at key locations.

Road maintenance shall be performed utilizing appropriate construction equipment. Areas of soft subgrade soil, pumping, or excessive rutting shall be improved by removing and replacing subgrade soils, installing a geotextile separation layer (if required), and replacing/increasing the road aggregate. Areas of the road that are frequently wet or inundated shall be improved by regrading adjacent areas to change stormwater runoff patterns or cutting roadside ditches to drain near-surface perched ground water.

As necessary, the Subcontractor shall maintain the OSDF access roads free of snow accumulations that would interfere with OSDF activities. The Subcontractor shall prevent the generation of excessive road dust such that fugitive emission levels remain in full compliance with

TABLE 6-1

ACCESS ROADS INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy	Maintenance
	Active Period	Closure Period			
Access Roads	Weekly and following rain storms	Monthly and following rain storms	• inadequate traffic control	• improve traffic control	• install signage (e.g., stop signs, traffic flow arrows) or provide traffic control personnel
			• soft soil, pumping, or excessive rutting	• remove and replace subgrade soil, add aggregate geotextile separation layer, if necessary	• grade as necessary to provide positive drainage
			• roadway inundation	• improve storm water routing and/or eliminate perched ground water	• regrade area to change runoff patterns; cut roadside ditches to drain perched ground water
			• snow	• clear roadway	• plow snow
			• excessive road dust	• reduce dust generation	• use water truck to suppress dust; apply chemical dust suppressant (only after Construction Manager approval)

Notes: (1) Frequencies of inspection and maintenance activities are preliminary. These frequencies will be finalized as manufacturer's equipment operating and maintenance instructions are available.

FEMP Policy. Dust suppression shall be achieved by using a water truck. Alternatively, periodic application of dust suppressants, such as magnesium or calcium chloride, liquid polymer emulsion, or agglomerating chemicals may be considered, but only with approval of the CM.

Any repair activity to roadways within the OSDF battery limit shall utilize materials and procedures in full conformance with the original Project Specifications.

6.3 RECORDKEEPING

The Subcontractor shall maintain written records of all monitoring, inspection, and repairs in accordance with recordkeeping and reporting requirements of Section 7.0 of the Systems Plan.

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7.0 RECORDKEEPING AND REPORTING

The Subcontractor shall be responsible for preparing and maintaining accurate and complete records of all inspection, operation, and maintenance activities. The Subcontractor is also responsible for reporting these activities to the CM.

This section of the plan describes the general record procedures that will be followed by the personnel performing OSDF activities. These procedures will ensure that consistent and reproducible records are developed when the work is performed by various individuals. This section also addresses the Subcontractor reporting requirements.

7.1 RECORDKEEPING PROCEDURES

The Subcontractor shall be responsible for establishing the detailed procedures and requirements for the collection, storage, maintenance, and disposition of all OSDF records. Records shall be protected from damage or deterioration by being placed in lockable, fire-proof filing cabinets and by duplication and/or microfilming. Records shall be filed in accordance with a subject file index and shall be retained at the FEMP for 30 years after closure of the OSDF. Required records shall include, but not be limited to, field logbooks, other data collection forms, equipment calibration records, cost data, drawings, maintenance records, and all associated reports.

All original data collected in the field by the Subcontractor shall be considered a permanent record. This includes all field logbooks, other data forms, and photographs. All of these documents shall be authorized by the signature and date of the originator. Errors shall be corrected by crossing a single line through the error and entering the correct information. Corrections will be initialed and dated by the person making the correction.

7.2 REPORTING PROCEDURES

After each inspection and maintenance activity, a draft report that includes an executive summary, copies of field logs, photographs, checklist forms, and other pertinent data shall be submitted to the CM for review, approval, the forwarding to DOE. Following review and approval, final copies of the inspection report and associated documents shall be submitted to OEPA and USEPA.

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8.0 REFERENCES

Fluor Daniel Fernald (FDF), *"OSDF Post-Closure Care and Inspection Plan"*, DOE Fernald Area Office, Fernald Environmental Management Project, Fernald, OH, 1997.

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U.S. Department of Energy (DOE), *"Final Remedial Design Work Plan for Remedial Actions at Unit 2"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995b.

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ATTACHMENT A

OWNER'S MANUALS FOR LEACHATE MANAGEMENT SYSTEM EQUIPMENT

(TO BE PROVIDED BY THE OSDF CONSTRUCTION CONTRACTOR AS PART OF CONSTRUCTION ACCEPTANCE)

ATTACHMENT B

OWNER'S MANUALS FOR DECONTAMINATION FACILITIES

(TO BE PROVIDED BY THE OSDF CONSTRUCTION CONTRACTOR AS PART OF CONSTRUCTION ACCEPTANCE)

POST-CLOSURE CARE AND INSPECTION PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-010
Revision 1
July 1997

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

Prepared by

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Under Contract DE-AC05-920R21972

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LIST OF ACRONYMS

ACA	Amended Consent Agreement
ACM	asbestos containing materials
a.k.a.	also known as
ARARs	applicable or relevant and appropriate requirements
AWWT	Advanced Wastewater Treatment
BSL	Biodenitrification Surge Lagoon
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended
CFR	Code of Federal Regulations
CQA	Construction Quality Assurance
CRP	Community Relations Plan
DCP	Design Criteria Package
DOE	United States Department of Energy
EPA	United States Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FFCA	Federal Facility Compliance Agreement
HDPE	high-density polyethylene
HWMU	Hazardous Waste Management Unit
IEMP	Integrated Environmental Monitoring Plan
IMP	Impacted Materials Placement
LCS	Leachate Collection System
LDS	Leak Detection System
LTS	Leachate Transmission System
mg/kg	milligram per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan (also known as the National Contingency Plan)
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NESHAPs	National Emission Standards for Hazardous Air Pollutants
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ODNR	Ohio Department of Natural Resources
OSDF	On-Site Disposal Facility
OSHA	Occupational Safety and Health Administration
OU	operable unit, as numbered
PCCI	Post-Closure Care and Inspection

LIST OF ACRONYMS
(continued)

pCi	picoCurie(s)
PVC	polyvinyl chloride
PTI	permit to install
RCRA	Resource Conservation and Recovery Act, as amended
RI/FS	remedial investigation/feasibility study
RDWP	remedial design work plan
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986, as amended
SWMEC	Surface Water Management and Erosion Control Plan
TBCs	to be considered criteria
WAC	waste acceptance criteria

PROLOGUE

This plan has been developed with a specific focus on the Fernald Environmental Management Project (FEMP) On-Site Disposal Facility. However, many aspects of post-closure care are common regardless of the characteristics of the facility for which it is implemented. Hence, this plan could be revised as needed to expand the scope of coverage to encompass the entire FEMP site. This plan has been specifically developed in such a manner to facilitate such a potential.

1.0 INTRODUCTION

This Post-Closure Care and Inspection (PCCI) Plan covers the Fernald Environmental Management Project (FEMP) On-Site Disposal Facility (OSDF) and its associated buffer area after the last cell of the OSDF has been closed and covered. As such, the period of coverage of this PCCI Plan begins at the cessation of the period covered by the *OSDF Systems Plan* [FDF, 1997b].

This plan has been developed to address reasonably expected circumstances which may arise during the post-closure care period. Other relevant key concepts addressed by this PCCI Plan are: ownership; access controls and restrictions; deed and/or use restrictions; environmental monitoring; leachate management; inspections (of three types — scheduled, unscheduled, and contingency); custodial maintenance; contingency repair; corrective actions; emergency notification and reporting; modifications to this plan; and public involvement. These concepts are addressed in subsequent sections of this plan.

1.1 Plan Scope and Duration

This PCCI Plan establishes the inspection, monitoring, and maintenance activities necessary to ensure the continued proper performance of the OSDF. The period covered by this PCCI Plan begins after the last cell of the OSDF has been closed and covered — i.e., at the cessation of the period covered by the *OSDF Systems Plan*. Many of the activities under this PCCI Plan are carried over from the *OSDF Systems Plan*. The facilities and structures covered under this PCCI Plan include:

- Security system (e.g., fences, gates, warning signs),
- Permanently surveyed benchmarks,
- OSDF run-on/run-off controls,
- OSDF final cover,
- Leachate collection system (LCS),
- Leak detection system (LDS),
- Leachate transmission system (LTS), and
- Other appurtenances as necessary.

As specified in the Records of Decision (RODs) and in accordance with appropriate regulations, the initially established duration of the post-closure care period is 30 years (subject to potential future modification, as discussed in Section 12.0) [Ohio solid waste rule Ohio Administrative Code (OAC) 3745-27-14(A) in lieu of federal solid waste regulation 40 Code of Federal Regulations (CFR) §258.61(a), and Ohio hazardous waste rules OAC 3745-66-17 and 3745-68-10 in lieu of federal hazardous waste regulations 40 CFR §§265.117(a)(1) and 264.117(a)(1), respectively].

1.2 Plan Organization

The remainder of this plan is organized as follows:

- a description of the parties responsible for this plan and the plans related to this plan are presented in the remainder of Section 1.0;
- the requirements pertinent to this plan are addressed in Section 2.0;
- final site conditions at closure of the OSDF are addressed in Section 3.0;
- institutional controls and points of contact are addressed in Section 4.0;
- environmental monitoring is addressed in Section 5.0;
- leachate management is addressed in Section 6.0;
- routine scheduled inspections are addressed in Section 7.0;
- unscheduled inspections are addressed in Section 8.0;
- custodial maintenance and contingency repair are addressed in Section 9.0;
- corrective actions are addressed in Section 10.0;
- emergency notification and reporting are addressed in Section 11.0;
- modifications to this plan are addressed in Section 12.0;
- public involvement is addressed in Section 13.0; and
- references are presented in Section 14.0.

1.3 Responsible Parties

The governing document for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions at the FEMP is the Amended Consent Agreement between the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) Region V, signed in September 1991. As such, responsibility for the implementation of the PCCI Plan lies with DOE, as the lead agency responsible for CERCLA activities at the FEMP, and with EPA, as the oversight agency. The DOE Fernald Area Office has the ultimate authority for ensuring that the post-closure care of the OSDF meets all the goals, standards, specifications, and requirements of this PCCI Plan.

1.4 Related Plans

Several other support plans have been prepared for the OSDF remedial action project and should be used in conjunction with this plan, or referred to for information on how impacted materials were placed into the OSDF. The other plans containing information relevant to this plan are listed below with a brief statement of the relationship to this plan.

- *Permitting Plan and Substantive Requirements for the On-Site Disposal Facility* [FDF, 1997a]: identifies the administrative and substantive requirements for the National Pollutant Discharge Elimination System (NPDES) Permit, and the substantive requirements for all of the FEMP's operable units' on-site disposal needs for the Wetlands Nationwide Permit, the Ohio Solid Waste Permit to Install (PTI), and the Resource Conservation and Recovery Act (RCRA) Permit; additionally, discusses how the requirements relate to the OSDF, presents the plan for compliance with the requirements, and discusses additional applicable or relevant and appropriate requirements (ARARs) that are not related to the issuance of a specific permit.

- *OSDF Construction Quality Assurance (CQA) Plan* [GeoSyntec, 1997c]: contains procedures used to evaluate soils and other features of the OSDF liner and final cover system.

- *OSDF Impacted Materials Placement (IMP) Plan* [GeoSyntec, 1996]: outlines waste acceptance criteria (WAC) for the OSDF, and contains procedures used to place the impacted materials into the OSDF.

- *OSDF Surface-Water Management and Erosion Control (SWMEC) Plan* [GeoSyntec, 1997d]: provides details of permanent erosion and sediment controls and surface-water controls for the OSDF, including maintenance requirements for channels and sediment controls.

- *OSDF Systems Plan* [FDF, 1997b]: contains procedures used to inspect and maintain the OSDF — including the leachate management system, cover system, and temporary facilities — during the active remediation phase of activities which includes construction, impacted material placement, and closure of individual cells or phases of the OSDF until closure of the final cell/phase of the OSDF.

- *OSDF Groundwater/Leak Detection and Leachate Monitoring Plan* [DOE, 1997a]: provides details on the leak detection monitoring program for the OSDF, addressing monitoring both within the OSDF — in the leachate collection system and leak detection — and the underlying groundwater — in the glacial till immediately underneath the OSDF and the groundwater in the Great Miami Aquifer.

- *Integrated Environmental Monitoring Plan* (IEMP) [DOE, 1997b]: sets the schedule for reporting environmental monitoring results.

- *Community Relations Plan for the Fernald Environmental Management Project, Fernald, Ohio (CRP)* [DOE, 1995a]: provides details on how the DOE will involve the public in decisions related to the site.

2.0 PERTINENT REQUIREMENTS

2.1 Overview

Regulatory and other requirements pertinent to this plan primarily take the form of ARARs and to be considered criteria (TBCs) as determined by the record of decision for each of the various FEMP operable units, functional requirements, and general design criteria. These are addressed in the following subsections.

2.2 Pertinent Requirements

ARARs and TBCs that should be addressed by this plan are provided here, as obtained from the *Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)* [DOE, 1995b], the *Final Record of Decision for Remedial Actions at Operable Unit 5 (OU5 ROD)* [DOE, 1996a], and the *Operable Unit 3 Record of Decision for Final Remedial Action (OU3 ROD)* [DOE, 1996b], as identified by the checkmark (✓) in the appropriate column. Additional regulatory requirements that are appropriate guidance for development or maintenance of this plan have been identified and are indicated by a checkmark in the *Permitting Plan and Substantive Requirements for the On-Site Disposal Facility (OSDF Permitting Plan)* [FDF, 1997a] column but no checkmark in the previous columns.

#	Title	Requirement	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		PLANS				
1	Ohio Municipal Solid Waste Rules—Sanitary Landfill Facility Permit to Install Application OAC 3745-27-06(C)(7)	• Prepare a post-closure plan as detailed in OAC 3745-27-11(B).		✓	✓	✓
		• Prepare a leachate monitoring plan to ensure compliance with OAC 3745-27-19(M)(4).		✓	✓	✓
		• Prepare a leachate contingency plan as required by OAC 3745-27-19(K)(6).		✓	✓	✓
		• Prepare a groundwater detection monitoring plan as required by OAC 3745-27-10, and if applicable a groundwater quality assessment plan and/or corrective measures plan required by OAC 3745-27-10.		✓	✓	✓
2	Ohio Municipal Solid Waste Rules—Final Closure of Sanitary Landfill Facility OAC 3745-27-11(B)	The owner shall prepare a post-closure plan which shall contain: • The name and location of the facility and unit(s) included in the plan. • A description of the post-closure activities. • The name, address and telephone number of the person or office to contact regarding the unit(s) of the facility during the post-closure care period. The Ohio EPA shall be notified of any changes.			✓	✓

#	Title	Requirement	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		PLANS (CONTINUED)				
3	Ohio Hazardous Waste Interim Standards Rules—Post-closure Plan; Amendment of Plan OAC 3745-66-18(A) & (C)	The owner of a hazardous waste disposal unit shall have a written post-closure plan, which shall identify the activities that will be carried on after closure of each unit and the frequency of those activities, and include at least: • a description of the planned monitoring activities and frequencies at which they will be performed; • a description of the planned maintenance activities and frequencies at which they will be performed, to ensure (a) the integrity of the cap and final cover or other containment systems, and (b) the function of the monitoring equipment; and • the name, address and telephone number of the person or office to contact about the hazardous waste disposal unit or facility during the post-closure period.				✓
		CLOSURE AND POST-CLOSURE OBJECTIVES				
4	Ohio Municipal Solid Waste Rules—Final Closure of a Sanitary Landfill Facility OAC 3745-27-11(H)	At final closure of a landfill facility: • All land surfaces shall be graded to prevent ponding of water where solid waste has been placed. Drainage facilities shall be provided to direct surface water from the landfill facility. • A groundwater monitoring system shall be designed and installed in accordance with OAC 3745-27-10, if a system is not already in place.	✓	✓		✓
5	Ohio Municipal Solid Waste Rules—Final Closure of a Sanitary Landfill Facility OAC 3745-27-11(O)	Closure of the sanitary landfill facility must be completed in a manner that minimizes the need for further maintenance and minimizes post-closure formation and release of leachate...to surface water to the extent necessary to protect human health and the environment.	✓	✓		✓
6	Ohio Hazardous Waste Interim Standards Rules—Closure Performance Standard OAC 3745-66-11	The owner shall close his facility in a manner that: • minimizes the need for further maintenance; • controls, minimizes, or eliminates to the extent necessary to protect public health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the groundwater, or surface waters, or to the atmosphere; and • complies with closure requirements.		✓	✓	✓

#	Title	Requirement	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		CLOSURE AND POST-CLOSURE OBJECTIVES (CONTINUED)				
7	Ohio Hazardous Waste Landfill Rules—Closure and Post-closure OAC 3745-68-10(A) (in lieu of 40 CFR § 265.310(a))	At final closure of the landfill...the owner or operator must cover the landfill...with a final cover designed and constructed to: • provide long-term minimization of migration of liquids through the closed landfill; • function with minimum maintenance; • promote drainage and minimize erosion or abrasion of the cover; • accommodate settling and subsidence so that the cover's integrity is maintained; and • have a permeability less than or equal to the permeability of any bottom liner system or natural subsoil present.		✓	✓	✓
8	Ohio Municipal Solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(J)(1) & (4)	Surface water shall be diverted from areas where solid waste has been deposited. The facility shall be designed, constructed, maintained, and provided with surface water control structures, as necessary, to control run-on and run-off of surface water to ensure minimal infiltration of water through the cover material and cap system, and minimal erosion of the cover material and cap system. If ponding or erosion occurs on areas of the landfill facility where solid waste has been deposited, action will be taken to correct the conditions causing the ponding or erosion.	✓	✓	✓	✓
9	Ohio Municipal Solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(E)(26)	The integrity of the engineered components of the landfill facility shall be maintained and any damage to, or failure of, the components shall be repaired.	✓	✓	✓	✓
		DURATION OF POST-CLOSURE CARE PERIOD				
10	Ohio Municipal Solid Waste Rules—Post-closure Care of Sanitary Landfill Facilities OAC 3745-27-14(A) (in lieu of RCRA Subtitle D)	Following completion of final closure activities in accordance with OAC 3745-27-11, post-closure care activities shall be conducted at the sanitary landfill facility for a minimum of 30 years.	✓	✓	✓	✓
11	Ohio Hazardous Waste Interim Standards Rules—Post-closure Care and Use of Property OAC 3745-66-17(A) (in lieu of 40 CFR §265.117(a)(1))	Post-closure care...must begin after completion of closure of the unit and continue for 30 years after that date, unless shortened or extended by the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] in accordance with OAC 3745-66-18(G) (40 CFR §265.117(a)(2)). **NOTE:** Identified in OU5 ROD as applicable only to existing Hazardous Waste Management Units (HWMUs).			✓	

#	Title	Requirement	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		DESCRIPTION OF POST-CLOSURE CARE				
12	Ohio Municipal Solid Waste Rules—Post-closure Care of Sanitary Landfill Facilities OAC 3745-27-14(A)(1) & (2) (in lieu of RCRA Subtitle D)	Post-closure care activities for all sanitary landfill facilities shall include, but are not limited to: • continuing operation and maintenance of the leachate management system, surface water management system...and the groundwater monitoring system; and • maintaining the integrity and effectiveness of the cap system, including making repairs to the cap system as necessary to correct the effects of erosion and preventing run-on and run-off from eroding or otherwise damaging the cap system.	✓	✓	✓	✓
13	Ohio Hazardous Waste Interim Standards Rules—Post-closure Care and Use of Property OAC 3745-66-17(A)(1) (in lieu of 40 CFR §265.117(a)(1))	Post-closure care...must consist of at least the following: • monitoring and reporting; and • maintenance and monitoring of waste containment systems. **NOTE:** Identified in OU5 ROD as applicable only to existing HWMUs.			✓	
14	Ohio Hazardous Waste Landfill Rules—Closure and Post-closure OAC 3745-68-10(B) (in lieu of 40 CFR § 265.310(b))	After final closure, the owner or operator must comply with post-closure requirements, including maintenance and monitoring throughout the post-closure care period. The owner or operator must: • maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events; • *continue to operate the leachate collection and removal system until leachate is no longer detected;* • *maintain and monitor the leak detection system;* • maintain and monitor the groundwater monitoring system; • prevent run-on and run-off from eroding or otherwise damaging the final cover; and • protect and maintain surveyed benchmarks.		✓	✓	✓
15	Ohio Hazardous Waste Landfill Rules—Closure and Post-closure OAC 3745-68-10(D) (in lieu of 40 CFR §265.310(b))	During the post-closure period, the owner of a hazardous waste landfill must: • maintain the function and integrity (integrity and effectiveness) of the final cover; • maintain and monitor the leachate collection, removal and treatment system...to prevent excess accumulation of leachate in the system; and • protect and maintain surveyed benchmarks.		✓	✓	✓
		LEACHATE MANAGEMENT				
16	Ohio Municipal Solid Waste Rules—Sanitary Landfill Facility Construction OAC 3745-27-08(C)(5)	If required by the Director [of the OEPA, a.k.a. Ohio Director of Environmental Protection], leachate storage structures are to be monitored.	✓	✓	✓	✓

#	Title	Requirement	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		LEACHATE MANAGEMENT (CONTINUED)				
17	Ohio Municipal Solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(K)(1)	If leachate is detected on the surface of the landfill facility, then the outbreak(s) shall be repaired and: • leachate shall be contained and properly managed at the sanitary landfill facility; • if necessary, leachate shall be collected and disposed in accordance with OAC 3745-27-19(K)(5) & (6); and • actions shall be taken to minimize, control, or eliminate the conditions which contribute to the production of leachate.	✓	✓	✓	✓
18	Ohio Municipal Solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(K)(3)	The collection pipe network of the leachate management system shall be inspected...annually [after placement of the initial lift of waste]...to ensure that clogging has not occurred.	✓	✓	✓	✓
19	Ohio Municipal Solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(K)(4)	If authorized by the Director [of the OEPA, a.k.a. Ohio Director of Environmental Protection], leachate may be temporarily stored within the limits of solid waste placement until the leachate can be treated and disposed.	✓	✓	✓	✓
20	Ohio Municipal Solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(K)(5)	The owner shall treat and dispose of collected leachate in accordance with the following: (a) treat and dispose of collected leachate on site at the sanitary landfill facility; or (b) pre-treat collected leachate on-site and dispose of collected leachate off-site of the sanitary landfill facility; or (c) treat and dispose of collected leachate off-site of the sanitary landfill facility.		✓	✓	✓
21	Ohio Municipal Solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(K)(6)	The owner...shall prepare a contingency plan for the storage and disposal of leachate...The plan shall describe the immediate and long-term steps, including the setting aside of land for the construction and operation of an on-site treatment facility, to be taken for leachate management in the event that collected leachate cannot be managed in accordance with the management option selected in OAC 3745-27-19(K)(5).		✓	✓	✓
22	Ohio Municipal Solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(M)(4) & (5)	The owner annually shall report: • a summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year; • location of leachate treatment and/or disposal; • verification that the leachate management system is operating in accordance with this rule; and • results of analytical testing of an annual grab sample from the leachate management system.		✓	✓	✓

#	Title	Requirement	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		LEACHATE MANAGEMENT (CONTINUED)				
23	Federal Criteria for Municipal Solid Waste Landfills—Closure and Post-closure Care 40 CFR §258.61	The Director [of the OEPA, a.k.a. Ohio Director of Environmental Protection] may allow the owner or operator to stop managing leachate if the owner or operator demonstrates that leachate no longer poses a threat to human health and the environment.	✓	✓	✓	✓
		MODIFICATIONS TO POST-CLOSURE CARE PLAN OR PERIOD				
24	Ohio Hazardous Waste Interim Standards Rules—Post-closure Plan; Amendment of Plan OAC 3745-66-18(D)	The owner may amend the post-closure plan any time during the active life of the facility or during the post-closure period.				✓
25	Ohio Hazardous Waste Interim Standards Rules—Post-closure Plan; Amendment of Plan OAC 3745-66-18(G)	The post-closure plan and length of the post-closure care period may be modified any time prior to the end of the post-closure care period. A modification of the post-closure plan may include, where appropriate, the temporary suspension rather than permanent deletion of one or more post-closure care requirements. At the end of the specified period of suspension, the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] would then determine whether the requirements should be permanently discontinued or reinstated to prevent threats to human health and the environment.				✓
		PROPERTY USE RESTRICTIONS				
26	Ohio Hazardous Waste Interim Standards Rules—Post-closure Care and Use of Property OAC 3745-66-17(C) (in lieu of 40 CFR §265.117(c))	Post-closure use of property on or in which hazardous wastes remain after partial or final closure must never be allowed to disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the facility's monitoring systems, unless the Director [of the OEPA, a.k.a., Ohio Director of Environmental Protection] approves otherwise. **NOTE:** Identified in OU5 ROD as applicable only to existing HWMUs. **NOTE:** If clean closure is performed then post-closure care is not required.			✓	
27	Ohio Hazardous Waste Landfill Rules—Closure and Post-closure OAC 3745-68-10(D)(5)	During the post-closure period, the owner of a hazardous waste landfill must restrict access to the landfill as appropriate for its post-closure use.		✓	✓	✓

#	Title	Requirement	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		POST-CLOSURE NOTICE/SURVEY PLAT				
28	Ohio Municipal Solid Waste Rules—Final Closure of a Sanitary Landfill Facility OAC 3745-27-11(H)(5)(a)	The owner shall file — with the board of health having jurisdiction, with the county recorder of the county in which the facility is located, and with the Director [of OEPA, a.k.a. the Ohio Director of Environmental Protection] — a plat of the unit(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume and nature of the solid waste deposited in the unit(s) of the sanitary landfill facility.		✓		✓
29	Ohio Hazardous Waste Interim Standards Rules—Survey Plat OAC 3745-66-16	The owner shall submit — to the local zoning authority, or the authority with jurisdiction over local land use, and to the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] — a survey plat, prepared and certified by a professional land surveyor, indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed, which states the owner's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with OAC 3745-66-17(C).		✓		✓
30	Ohio Hazardous Waste Interim Standards Rules—Post-closure Notices OAC 3745-66-19(A)	The owner shall submit — to the local zoning authority, or the authority with jurisdiction over local land use, and to the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] — a record of the type, location, and quantity of hazardous wastes disposed of within each cell or disposal unit of the facility.				✓
		DEED NOTATION				
31	Ohio Municipal Solid Waste Rules—Final Closure of a Sanitary Landfill Facility OAC 3745-27-11(H)(5)(b)	The owner shall record a notation on the deed to the sanitary landfill facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity any potential purchaser of the property that: • the land has been used as a sanitary landfill facility; • includes information describing acreage, exact location, depth, volume, and nature of solid waste deposited in the sanitary landfill facility.	✓	✓		✓

#	Title	Requirement	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		DEED NOTATION (CONTINUED)				
32	Ohio Hazardous Waste Interim Standards Rules—Post-closure Notices OAC 3745-66-19(B)	The owner shall record, in accordance with state law, a notation on the deed of the facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity the potential purchasers of the property that: • the land has been used to manage hazardous wastes; • its use is restricted under the Ohio Administrative Code closure and post-closure rules; and • the survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or hazardous waste unit of the facility as required by OAC 3745-66-16 and 3745-66-19(A) have been filed with the local zoning authority or the authority with jurisdiction over local land use and with the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection].				✓
33	Ohio Hazardous Waste Interim Standards Rules—Post-closure Notices OAC 3745-66-19(C)	If the owner or any subsequent owner of the land upon which a hazardous waste disposal unit was located wishes to remove hazardous wastes and hazardous waste residues in satisfaction of the criteria in OAC 3745-66-17(C), the owner may request that the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] approve either: • the removal of the notation on the deed to the facility property or other instrument normally examined during title search; or • the addition of a notation to the deed or instrument indicating the removal of the hazardous waste.				✓
		OTHER DOE CRITERIA				
34	Disposal Site Closure/Post-closure DOE Order 5820.2A, Chapter III(3)(j)	• During post-closure, residual radioactivity levels for surface soil shall comply with existing DOE decommissioning guidelines. • Inactive disposal facilities, disposal sites, and disposal units shall be managed in conformance with RCRA, CERCLA, and SARA. • Corrective measures shall be applied to new disposal sites or individual disposal units if conditions occur or are forecasted that could jeopardize attainment of the performance objectives [of the unit]. • Termination of monitoring and maintenance activity at closed facilities or sites shall be based on an analysis of site performance at the end of the institutional control period.	✓	✓	✓	

#	Title	Requirement	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		OTHER DOE CRITERIA (CONTINUED)				
35	Environmental Monitoring DOE Order 5820.2A, Chapter III(3)(k)	Each non-operational low-level waste disposal facility shall be monitored by an environmental monitoring program that conforms with DOE Order 5484.1 and, at a minimum, meets the requirements listed below: • The environmental monitoring program shall be designed to measure: (a) operational effluent releases; (b) migration of radionuclides; (c) disposal units subsidence; (d) changes in disposal facility and disposal site parameters which may effect long-term site performance. • Based on the characteristics of the facility monitored, the environmental monitoring program may include, but not necessarily be limited to, monitoring: (a) surface soil; (b) air; (c) surface water; and (d) subsurface soil and water, both in the saturated and unsaturated zones. • The monitoring program shall be capable of detecting changes in trends in performance far enough in advance to allow application of necessary corrective action before exceeding performance objectives. The monitoring program shall be able to ascertain whether or not effluents from each treatment or disposal facility or disposal site meets the requirements of applicable DOE Orders.	✓	✓	✓	

2.3 Functional Requirements

The *Design Criteria Package (OSDF DCP)* [GeoSyntec, 1997b] contains a variety of functional requirements that have been established for the OSDF. The functional requirements pertinent to this plan are:

- protect the OSDF from damage caused by precipitation and stormwater run-on and run-off;
- route run-on and run-off to designated diversion channels locations for appropriate management; and
- discharge surface water to existing watercourses in accordance with applicable regulatory and DOE requirements.

The surface water management system should be maintained such that it will continue to perform in a manner that meets the project requirements for long-term conditions (i.e., after closure of the OSDF). The system should prevent stormwater run-on to the OSDF and uncontrolled stormwater run-off from the OSDF. Features of the long-term surface-water management system were constructed to require minimal monitoring and maintenance. The system was integrated, to the extent possible, with existing topography, features, and facilities.

2.4 General Design Criteria

The *OSDF DCP* also identifies a number of general design criteria for the OSDF. The general design criteria pertinent to this plan are:

- long-term erosion and sediment control features for the OSDF were designed for the 2,000-year, 24-hour storm event (design criterion for assumption of a DOE Performance Category 2 facility); and

- long-term run-on/run-off control structures for the OSDF were designed to limit interruption and damage (i.e., washout) of the OSDF in the 2,000-year, 24-hour storm event (design criterion for assumption of a DOE Performance Category 2 facility); run-on should be controlled and diverted away from and around the OSDF using swales, channels, or diversion berms.

2.5 Other Requirements

In addition to the requirements contained in the *OSDF DCP*, other requirements that have been incorporated into this plan are:

- disturbed areas should be stabilized (i.e., vegetated) after the area has been reconstructed to final grade; and

- general practices for inspection and maintenance of erosion and sediment control features should be as recommended by the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation document entitled *Rainwater and Land Development* [ODNR, 1996] or its most current revision.

Other criteria relevant to this plan consist of those industry-standard practices that have proven effective at other waste disposal facilities. Inspection and monitoring requirements from the manufacturers and suppliers of material and equipment installed at the OSDF are also criteria relevant to this plan.

3.0 FINAL SITE CONDITIONS

3.1 Site History

In July 1986, the DOE and the EPA signed a *Federal Facilities Compliance Agreement (FFCA)*, addressing impacts to the environment associated with the federally operated site known as the FEMP. The DOE agreed to conduct the FFCA investigation as a remedial investigation/feasibility study (RI/FS) in accordance with guidelines of CERCLA. In November 1989, the FEMP site was included on the National Priorities List (NPL) of the EPA. The *FFCA* was later amended by the June 1990 *Consent Agreement* between DOE and EPA which was further modified by amendment in September 1991.

In accordance with the September 1991 *Amended Consent Agreement (ACA)*, EPA approved and signed the *OU2 ROD* on June 8, 1995; the *OU5 ROD* on January 31, 1996; and similarly, the *Operable Unit 3 Record of Decision for Final Remedial Action (OU3 ROD)* on September 24, 1996. The design approach for the OSDF is presented in the *Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2 (OU2 RDWP)* [DOE, 1995c], which was submitted to the EPA in August 1995 and subsequently approved in November 1995. The design of the OSDF, as currently developed, is presented in the *Final Design Package, On-Site Disposal Facility* [GeoSyntec, 1997a]. Ohio Environmental Protection Agency (OEPA), which has been actively participating throughout the CERCLA response process, also has concurred with the documentation and decisions to date.

The FEMP OSDF is being/was constructed to permanently contain impacted materials derived from the remediation of the operable units at the FEMP. All material emplaced in the OSDF will be/was required to meet OSDF WAC. The *OU2 ROD* established a radiological waste acceptance criteria of 346 picoCuries/gram (pCi/g) of uranium-238 or 1,030 milligrams per kilogram (mg/kg) total uranium for all soil and soil-like impacted material destined for the OSDF. Similarly, the *OU5 ROD* established additional radiological and chemical waste acceptance criteria for OU5 soils destined for the OSDF. The *OU3 ROD* established radiological waste acceptance criteria for debris materials destined for the OSDF of 105 grams technetium-99. These radiological/chemical WAC have been compiled and presented in Table 3-1. The impacted materials sent to the OSDF from OU3 may also include small material contributions from OUs 1 and 4. Any material from these latter operable units destined for the OSDF met the OU3 waste acceptance criteria. In addition to the radiological/chemical waste acceptance criteria discussed above, the *OSDF IMP Plan* [GeoSyntec, 1996] presents physical waste acceptance criteria for the OSDF.

Table 3-1
ON-SITE DISPOSAL FACILITY
WASTE ACCEPTANCE CRITERIA

	Constituent of Concern	Soil[a]		Debris[b]
		OU2	OU5[d]	OU3
	Radionuclides:			
1	Neptunium-237		3.12×10^{9} pCi/g	
2	Strontium-90		5.67×10^{10} pCi/g	
3	Technetium-99		29.1 pCi/g	105 g
4	Uranium-238	346 pCi/g		
	Total Uranium	1,030 mg/kg	1,030 mg/kg	
	Inorganics:			
5	Boron		1.04×10^{3} mg/kg	
6	Mercury[c]		5.66×10^{4} mg/kg	
	Organics:			
7	Bromodichloromethane		9.03×10^{-1} mg/kg	
8	Carbazole		7.27×10^{4} mg/kg	
9	Alpha-chlordane		2.89 mg/kg	
10	Bis(2-chlorisopropyl)ether		2.44×10^{-2} mg/kg	
11	Chloroethane		3.92×10^{5} mg/kg	
12	1,1-Dichloroethene[c]		11.4 mg/kg	
13	1,2-Dichloroethene[c]		11.4 mg/kg	
14	4-Nitroaniline		4.42×10^{-2} mg/kg	
15	Tetrachloroethene[c]		128 mg/kg	
16	Toxaphene[c]		1.06×10^{5} mg/kg	
17	Trichloroethene[c]		128 mg/kg	
18	Vinyl chloride[c]		1.51 mg/kg	

NOTES:
[a]maximum concentration
[b]maximum total mass
[c]RCRA-based constituent of concern
[d]constituents which have established maximums which serve as Waste Acceptance Criteria; other compounds which will not exceed designated Great Miami Aquifer action levels within 1000-year performance period, regardless of starting concentration in the OSDF, are not listed.

SOURCES:
OU2 ROD [DOE, 1995b]
OU5 ROD [DOE, 1996a]
OU3 ROD [DOE, 1996b]

The volume of this impacted material destined for disposal in the OSDF is estimated as 2.5 million cubic yards (1.9 million cubic meters) bank/unbulked. Approximately 80 percent of this volume is expected to consist of impacted soil, with the remainder being building demolition rubble, fly ash, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials. After soil and soil-like material, debris from demolition of buildings in the FEMP former Production Area is expected to constitute the largest volume of impacted material for OSDF disposal. The *OU3 ROD* indicates that impacted debris can be assigned to one of ten material categories. Only material from seven of these categories are to be/were disposed in the OSDF. The seven material categories of impacted debris allowed for disposal in the OSDF are presented in Table 3-2, which also gives descriptions of the materials making up the categories.

The quantities presented above are best current estimates, and are expected to change as actual remediation progresses. Therefore, this subsection is anticipated to be revised after closure of the final phase/cell of the OSDF to present updated actual volumes (see Section 12.0), as well as to correct to past tense.

3.2 Location and Description of On-Site Disposal Facility Area

A Predesign Investigation was performed to define the most suitable location for the OSDF within an identified best area at the FEMP based on the OU2 and OU5 RI/FSs. The results of that investigation are presented in the *Predesign Investigation and Site Selection Report for the On-site Disposal Facility* [DOE, 1995e]. That report, its objectives, and its results are summarized below.

The identified best area is located on the east side of the FEMP property and measures approximately 2000 feet east to west by 5300 feet north to south. This location is considered the best location for an on-site disposal facility because it has the greatest thickness of gray clay which provides a protective layer over the underlying Great Miami Aquifer. Fate and transport modeling and risk assessments in the OU2 and OU5 FSs have shown that a disposal facility in this area, based on a feasible facility design and a 12-foot thick gray clay layer, would be protective of human health and the environment. The identified best area is bounded on the north, east, and south using the OEPA siting requirements (buffer from property line and water supply wells). The western boundary incorporates areas with greater than 12 feet of gray clay, with the exception of the northern portion of the west boundary line, which was determined based on identification of sand lenses within the gray clay.

Based on planning meetings between DOE, EPA and OEPA, the Predesign Investigation had the three objectives as identified in Table 3-3. Results of the Predesign Investigation served as the basis for selecting the location within the identified best area for siting the OSDF. The selected

Table 3-2
OU3 Material Categories/Descriptions

Category A Accessible Metals	Category B Inaccessible Metals	Category D Painted Light-Gauge Metals	Category E Concrete	Category G Non-Regulated Asbestos-Containing Material (ACM)	Category H Regulated ACM	Category I Miscellaneous Materials
Structural & miscellaneous steel	•Doors •Conduit/wire/ cable tray •Electrical wiring & fixtures •Electrical transformers •Miscellaneous electrical items •HVAC equipment •Material handling equipment •Process equipment •Miscellaneous equipment •Piping	•Ductwork •Lead flashing •Louvers •Metal wall & roof panels	•Asphalt •Slabs •Columns •Beams •Foundations •Walls •Masonry •Clay piping	•Ceiling demolition •Feeder cable •Fire brick •Floor tile •Transite wall & roof panels	•Ductwork insulation •Piping insulation •Personal protective equipment •Copper scrap metal pile	•PVC conduit •Basin liners •Fabric •Drywall •Building insulation •Miscellaneous debris •Personal protective equipment •PVC piping •Roofing build-up •Process trailers •Non-process trailers •Windows •Wood

SOURCE: Table 4-2, OU3 Material Categories/Description, *OU3 ROD* [DOE, 1996b].
NOTE: Only those seven material categories allowed for on-site disposal per the *OU3 ROD* are presented.

Table 3-3
PREDESIGN INVESTIGATION OBJECTIVES AND FIELD COMPONENTS

#	Objective	Field Components
1	Identify the most suitable hydrogeology within the identified best area	• Verification of the gray clay thickness • Identification of interbedded granular material
2	Verify protection of human health and the environment	• Verification of existing vertical and horizontal uranium contamination • Actual uranium solubility • Uranium retardation • Lateral and vertical gradients • Background concentrations of uranium in water in the vadose zone
3	Develop field information for the design of the OSDF	• Location and extent of interbedded granular material • Obtain geotechnical information in the footprint of the OSDF

location, measuring 800 feet east to west by 4300 feet north to south, provides suitable space for the anticipated 2.5 million cubic yards of impacted materials and meets applicable OEPA siting requirements. The gray clay thickness is greater than the minimum 12-foot thickness established in the *OU2 ROD* [DOE, 1995b] for protection of the Great Miami Aquifer; the gray clay is actually greater than 15 feet thick within the selected location and approximately 75 percent of the selected location has a 20-50 foot thickness of gray clay. The investigation identified minimal amounts of interbedded granular material and none that would offer a rapid migration pathway through the gray till.

3.3 OSDF As Built

The design approach for the OSDF is presented in the document *OU2 RDWP*. The design approach of the OSDF, as currently developed, is presented in the document *Final DCP, On-Site Disposal Facility* [GeoSyntec, 1997b]. The design of the OSDF includes a liner system, impacted material placement, final cover system, leachate management system, surface-water management system, and other ancillary features.

After closure of the final cell/phase of the OSDF, as-built conditions will be documented with a set of as-built record drawings (and possibly photographs). These drawings will be developed by DOE or its contractor, and will be used to prepare the topographic map discussed in the next paragraph. This information will illustrate baseline conditions for comparison to future conditions

during the post-closure period. These drawings may be used to document changes in the physical site conditions of the OSDF over time, and to develop a corrective action plan, if required.

The final FEMP OSDF site map will be compiled from a final topographic map of the FEMP. The final topographical survey will be conducted in accordance with the standards of the *Manual of Photogrammetry* [ASP, 1980]. It is anticipated that the following specifications will be used in developing the map, in accordance with the appropriate regulations [Ohio solid waste rules OAC 3745-27-06(B)(2) and 3745-27-11(H)(5)(a), and Ohio hazardous waste general new facility rule OAC 3745-54-18 and hazardous waste interim status facility rule OAC 3745-66-16]:

- a scale of 1 inch = 200 feet (1 mm = 2.4 m)
- a contour interval of 5 ft (1.5 m)
- a coverage area of the FEMP OSDF disposal site and a distance of 1,000 ft
- north arrow displayed

In addition to existing topography, it is anticipated that the maps will define the following:

- property lines of the land owned by the DOE
- limits of impacted material placement
- outline of the toe and crest of the OSDF
- the individual phases/cells of the OSDF
- OSDF site property boundaries, fences, gates, and access roads
- location and extent of permanent stormwater run-off and -on control features
- vegetation, streams, lakes, springs, and other surface waters
- survey control stations/benchmarks
- permanent site surveillance features (e.g., monuments, markers, signs)
- wetlands (if any) within the limits of impacted material placement and within 200 ft of the limits of impacted material placement
- limits of a "regulatory floodplain" [i.e., 100-year floodplain as depicted on a federal insurance administration flood map, as per OAC 3745-27-01 and 3745-54-18(B)]
- site coordinate system

- existing residences, land uses, zoning classifications, property ownership, political subdivisions, and communities
- underground utilities (sewers, water lines, electric cables), field tiles, french drains, pipelines
- location (if any) within 200 ft of the limits of impacted material placement of any fault which has had displacement in Holocene time [OAC 3745-54-18(A)]
- all public and private water supply wells within 2000 ft of the limits of impacted material placement (using a scale insert if necessary), and the current status of each, including depth, use, and where applicable, abandonment date, based on publicly available information.

These as-built drawings will be submitted to the EPA and OEPA as part of the first pre-planned revision of this PCCI Plan (see Section 12.2.2). The map will serve as the base map for site inspections. A new, separate site map will be prepared for field use during a site inspection. The map will be revised as needed to indicate changes noted after each inspection; at a minimum, the map will be revised as part of the 5-year review. Note that DOE plans to update the information under the last bullet above regarding water supply wells only during the 5-year reviews. When the FEMP OSDF map is updated, the revised map will include the year of revision, the revision number, and the type of the activity or event which triggered the need for the revision.

All drawings, disposal site map, and photographs will be archived by the FEMP document control center. The DOE will be responsible for maintaining and archiving these maps, drawings, and photographs, as part of the FEMP OSDF permanent file.

3.4 FEMP OSDF Baseline Photographs

A photographic record of the final conditions after closure of the final cell of the OSDF will be included and maintained in the FEMP OSDF permanent site file. This record is anticipated to consist of a series of aerial and ground photographs that will provide a baseline visual record of final site construction and final site conditions to complement the as-built drawings. In particular, this set of aerial photographs is anticipated to provide a permanent record of site conditions, enabling future inspectors to monitor changes in site conditions (e.g., erosion patterns, vegetation changes, and land use) over time. The need for new aerial photographs will be evaluated at 5-year intervals, beginning with the first 5-year review. Table 3-4 summarizes the anticipated specifications for the aerial photographs.

3.5 Site Inspection Photographs

Photographs will be taken during site inspections to document conditions at the OSDF and its surrounding permanent features. These photographs will provide a continuous record for monitoring changing conditions over time. The photographs can be compared with the baseline photographs to monitor site integrity.

Each photograph will be recorded individually on a site inspection photo log. An appropriate description of the feature photographed will be entered into the log. If possible, a photograph will include a reference point such as a survey monument, boundary monument, site marker, or monitor well.

For specific areas where a photograph is used to monitor change over time, the distance from the feature and the azimuth should be recorded, and all subsequent photographs should be taken from the same orientation to provide an accurate picture of changing conditions. This information will be provided on the inspection checklist and photo log.

Copies of the site inspection photographs and the photo log will be included in the annual site inspection report. All site inspection photographs taken, as well as all corresponding photo log forms, will be maintained in the permanent FEMP OSDF file.

FEATURES TO BE PHOTOGRAPHED

The following site features should be documented with photographs every scheduled inspection of the FEMP OSDF site:

- permanent site surveillance features
- fences, gates, access roads, perimeter roads, and paths
- toe drains
- the OSDF (top, sides, buffer area, surrounding area) — panoramic sequences of photographs from selected vantage points may be used for this purpose
- any evidence of erosion (e.g., gullies, rivulets, rills) that the inspector considers significant and includes in the text of the inspection log book
- any off-OSDF features that may affect the OSDF in the future and that the inspector considers significant and includes in the text of the inspection log book
- vegetation (OSDF topslope and sideslope, and buffer area)

Table 3-4
AERIAL PHOTOGRAPHY SPECIFICATIONS

Area to be photographed	Final disposal site plus a minimum of 0.25 mi (0.4 km) beyond its boundaries unless site conditions require otherwise.
Products to be delivered	One (1) set of vertical color, infrared stereo contact prints; glossy, double weight, not trimmed; 9-in x 9-in (230-mm x 230 mm); Scale: 1 in = 200 ft (1 mm = 2.4 m) (1:2,400) Index map showing flight lines and frame numbers; Scale: 1 in = 1,000 ft (1:12,000) One (1) set of natural color, low oblique photographs taken from a minimum of two (2) different angles with 90 degree rotation. If 35mm or 70mm film used, glossy double-weight 8-inch x 10-inch enlargements; if 9-inch x 9-inch format used, glossy double-weight contact prints.
Flight date	To be determined; mid to late summer, at peak of photosynthetic response of vegetation, unless the flight is to be used exclusively for topographic mapping.
Camera	Vertical photos: Precision, 9-inch x 9-inch (230- x 230-mm) format. Oblique photos: A 35-millimeter (single lens reflex) or larger format camera is acceptable.
Film	Vertical photos: Eastman-Kodak Aerochrome Infrared 2443, or its equivalent Oblique photos: Eastman-Kodak Aerocolor Negative Film 2445, or its equivalent
Filter	Infrared (vertical) photos: Wratten No. 12 or No. 15 Color (oblique) photos: Skylight
Flight line coverage	60 percent end overlap; 30 percent average side overlap
Ground control	Control stations will be second order, Class 1, for horizontal control, and third order for vertical control (standard U.S. Geological Survey map accuracy specifications)

- OSDF topslope and sideslope
- erosion protection material (riprap)
- survey control points for local coordinate system.

Any new or potential problem areas identified during a site inspection will be documented with photographs. Photographs will also be taken to record developing trends and to allow inspectors to make reasonable decisions concerning additional inspections, custodial maintenance or repairs, or corrective action.

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4.0 INSTITUTIONAL CONTROLS AND POINTS OF CONTACT

4.1 Introduction

This section will discuss the institutional controls that will be in place for the OSDF and its buffer area during the post-closure care period. Table 4-1 presents a compilation of the institutional controls for the OSDF and its buffer area as identified in the *OU2 ROD*, and in the *OU5 ROD*. Environmental monitoring (Item 5), inclusive of groundwater monitoring (Item 4), is discussed in

Table 4-1
INSTITUTIONAL CONTROLS AS KEY COMPONENTS IN THE FEMP RODs

#	Component	OU2 ROD	OU5 ROD
		INSTITUTIONAL CONTROLS	
		The selected remedy will include the following as institutional controls:	"Institutional controls, such as ..."[5a]
1	Ownership	"continued federal ownership of the [OSDF] site"[2a]	"property ownership will be maintained by the federal government of the area comprising the [on-site] disposal facility and associated buffer areas"[5b]
2	Access controls/ restrictions	"access restrictions (fencing)"[2a]	"access controls"[5a]
3	Deed restrictions/ use restrictions	"restrictions on the use of property will be noted on the property deed before the property could be sold or transferred to another party"[2c]	"deed restrictions"[5a] ; "if portions of the FEMP property [outside the disposal facility area] are transferred or sold at any future time, restrictions will be provided in the deed, and proper notifications will be provided as required"[5b]
4	Groundwater monitoring program	"groundwater monitoring"[2a] ... "following closure of the on-site disposal facility"[2b]	See entry 5 below, but not identified as an institutional control
		OTHER KEY COMPONENTS OF THE SELECTED REMEDY	
5	Environmental monitoring program	See entry 4 above.	"long-term environmental monitoring program"[5a]
6	Maintenance program	"maintenance of the on-site disposal facility"[2b]	"maintenance program to ensure the continued protectiveness of the remedy"[5a]

[2a]Declaration, Description of the Selected Remedy, p. D-2, *OU2 ROD* [DOE, 1995b]
[2b]Decision Summary, Section 9.1 Key Components, p. 9-2, *OU2 ROD* [DOE, 1995b]
[2c]Responsiveness Summary, Section 3.0 Summary of Issues and Responses, Issue 7 — Future Use/Ownership, p. RS-3-33, *OU2 ROD* [DOE, 1995b]
[5a]Declaration Statement, Description of the Selected Remedy, p. D-ii, *OU5 ROD* [DOE, 1996a]
[5b]Decision Summary, Section 9.1 Key Components, p. 9-18, *OU5 ROD* [DOE, 1996a]

Section 5 of this plan. This plan, in total, addresses the maintenance program (Item 6). The following sections discuss the remaining items.

4.2 Points of Contact

Points of contact by either the name or position title, address, and telephone number of the person or office to contact about the FEMP OSDF during the post-closure care period are provided in Table 4-2, in accordance with appropriate regulations [Ohio solid waste rule OAC 3745-27-11(B)(3) in lieu of federal solid waste regulation 40 CFR §258.61(c)(2), and Ohio hazardous waste rules OAC 3745-66-18(C)(3) and 3745-68-10 in lieu of federal hazardous waste regulations 40 CFR §§265.118(c)(3) and 264.118(b)(3), respectively]. Table 4-2 presents the primary point of contact (entry 1), a backup point of contact (entry 2), and an emergency contact number that is accessible 24 hours each day (entry 3). These points of contact will serve to ensure that access to the facility will be possible for appropriate authorized personnel after closure and in the case of emergency. An updated copy of this plan will be maintained at each of the locations identified in Table 4-2.

Due to the duration of the post-closure period, DOE anticipates that the points of contact are likely to change over time. DOE will notify the regulatory agencies of any changes to the points of contact via modification to this PCCI Plan, likely as change pages to this section (see Section 12.0).

Table 4-2
POINTS OF CONTACT

	Title of contact	Telephone	Address: Mailing	Address: Shipping
1	DOE FEMP Site Manager	(513) 648-3101	DOE Fernald Area Office P.O. Box 538704 Cincinnati, OH 45253-8704	DOE Fernald Area Office 7400 Willey Road Fernald, OH 45030
2	DOE Ohio Field Office Contact	(513) 865-3862	DOE Ohio Field Office P.O. Box 3020 Miamisburg, OH 45343-3020	Not applicable
3	DOE Headquarters Emergency Operations Center 24-HOUR NUMBER	(202) 586-8100	Not applicable	Not applicable
Refer to the Fernald Environmental Management Project On-Site Disposal Facility				

4.3 Ownership

As presented in Item 1 of Table 4-1, property ownership of the area comprising the FEMP OSDF and its associated buffer areas will be maintained by the federal government (*e.g.*, DOE, or a successor federal agency).

4.4 Access Controls/Restrictions and Security Measures

As long as the federal government maintains property ownership, access to the FEMP OSDF will be restricted by means of fences, gates, and warning signs. Access to those areas within the fencing will be controlled by DOE authorization, and is anticipated to be limited to personnel for inspection, custodial maintenance, or corrective actions. The fences, gates, and warning signs are covered by the inspection and custodial maintenance components of the post-closure care program implemented under this PCCI Plan (see Sections 7.0 and 9.0, respectively).

To provide additional security, a warning sign with the following information will be/was placed on the access gates to the OSDF — the name of the site, the international symbol indicating the presence of radioactive material, a notice that trespassing is forbidden on this U. S. Government owned site, and a DOE 24-hour telephone number (entry 3 in Table 4-2); this same 24-hour telephone number will be recorded in agreements with local agencies to notify the DOE in the event of an emergency or breach of site security or integrity.

In addition to the entrance sign, signs mounted on fence posts at approximately equal spacing around the OSDF perimeter will display the following information — the international symbol indicating the presence of radioactive material, and a notice that trespassing is forbidden on this U. S. Government property.

The effectiveness of site security measures (e.g., fence condition, locked gate, etc.) will be monitored through routine scheduled site inspections (see Section 7.0).

4.5 Deed Restrictions/Use Restrictions

If ownership of a portion or portions of the FEMP is transferred in the future, restrictions will be included in the deed, and proper notifications will be provided as required by the appropriate rules and regulations. A preliminary draft of such notice in deed is provided below in Table 4-3, along with information extracted from the appropriate rules and regulations presented side by side to facilitate understanding of development of that notice. Note that specifics and the exact language

appropriate to the specific parcel(s) of property will need to be developed and inserted at the time of such recording of deed notice.

In such an event, signed certification that the notation in the deed has been recorded will be submitted to the EPA Regional Administrator and the Ohio Director of Environmental Protection in accordance with appropriate regulations [Ohio solid waste rule OAC 3745-27-11(H)(5) in lieu of federal solid waste regulation 40 CFR §258.60(I), and Ohio hazardous waste rules OAC 3745-66-19(B) and 3745-68-10 in lieu of federal hazardous waste regulations 40 CFR §§265.119(b)(1) and 264.119(b)(1)] accompanied by a copy of the document in which the notation has been placed.

Table 4-3
NOTICE IN DEED OR OTHER TRANSFER INSTRUMENT

Ohio Solid Waste Rules	Ohio Hazardous Waste Rules	CERCLA	FEMP
[OAC 3745-27-11(H)(5)] The owner is required to submit — to the local zoning authority, or the authority with jurisdiction over local land use, and to the board of health having jurisdiction, and to the Director — a survey plat showing the units(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume, and nature of the solid waste deposited in the unit(s) of the sanitary landfill facility.	[OAC 3745-66-16 & -19 and 3745-68-10(B)] The owner is required to submit — to the local zoning authority, or the authority with jurisdiction over local land use, and to the Director — a survey plat, prepared and certified by a professional land surveyor, indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed, which states the owner's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with OAC 3745-66-17(C).	[CERCLA §120(h)] Whenever any agency, department, or instrumentality of the United States enters into any contract for the sale or other transfer (e.g., lease) of real property owned by the United States and on which any hazardous substance was stored for one year or more, known to have been released, or disposed of, that agency, department or instrumentality shall include in such contract or instrument — to the extent such information is available on the basis of a complete search of agency files — (I) notice of the type and quantity of such hazardous substances, (ii) notice of the time at which such storage, release, or disposal took place, and (iii) a description of the remedial action taken, if any.	

Table 4-3
NOTICE IN DEED OR OTHER TRANSFER INSTRUMENT

Ohio Solid Waste Rules	Ohio Hazardous Waste Rules	CERCLA	FEMP
The owner is required to record a notation on the deed to the sanitary landfill property, or on some other instrument which is normally examined during title search, that will notify in perpetuity any potential purchaser that the land has been used as a sanitary landfill facility. The notation shall include information as described above regarding the requirement for filing the survey plat.	The owner is required to record a notation on the deed to the facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity the potential purchasers that: (a) the land has been used to manage hazardous wastes; (b) its use is restricted under OAC closure and post-closure rules; and (c) the survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or hazardous waste disposal unit of the facility has been filed as per above.		
NOTICE IN DEED	**SAMPLE NOTICE IN DEED**	**NOTICE IN TRANSFER INSTRUMENT**	**SAMPLE NOTICE IN TRANSFER INSTRUMENT**
	TO WHOM IT MAY CONCERN: I, *(owner or operator)*, the undersigned, of *(street address)*, City of *(city)*, County of *(county)*, State of *(state)*, hereby give the following notice, as required by Ohio Administrative Code hazardous waste rules 3745-66-19(A) & (B) and 3745-68-10(B) — in lieu of 40 CFR §§265.119(b)(1) and 264.119(b)(1), respectively.		TO WHOM IT MAY CONCERN: I, *(owner or operator)*, the undersigned, of *(street address)*, City of *(city)*, County of *(county)*, State of *(state)*, hereby give the following notice, as required by Ohio Administrative Code solid waste rule 3745-27-11(H)(5), and as required by Ohio Administrative Code hazardous waste rules 3745-66-19(B) and 3745-68-10(B) — in lieu of 40 CFR §§264.119(b)(1) and 265.119(b)(1), respectively — and as required by CERCLA §120(h).
	1 I am, and since *(month, day, year)*, have been in possession of the following described lands *(legal description)*.		1 I am, and since *(month, day, year)*, have been in possession of the following described lands *(legal description)*.

Table 4-3
NOTICE IN DEED OR OTHER TRANSFER INSTRUMENT

Ohio Solid Waste Rules	Ohio Hazardous Waste Rules	CERCLA	FEMP
	2 Since *(month, day, year)*, I have disposed of hazardous chemical wastes on/in the above described land under the terms of the Ohio Administrative Code rules, and regulations promulgated by the United States Environmental Protection Agency.		2 Between *(month, year)* and *(month, year)*, remedial actions have been conducted on the property which have disposed of materials consisting primarily of soils and building debris containing asbestos containing materials, chemical hazardous substances & radiological hazardous substances, under the terms of regulations promulgated by the United States Environmental Protection Agency on/in the above described land.
	3 The future use of the above-described land is restricted under the terms of Ohio Administrative Code hazardous waste rules 3745-66-17(C) and 3745-68-10 — in lieu of 40 CFR §§265.117(c) and 264.117(c); the post-closure use of the identified property must never be allowed to disturb the integrity of either the containment system or the facility's monitoring system, unless the EPA Regional Administrator or the Director of OEPA [a.k.a. the Ohio Director of Environmental Protection] determines that the proposed use: • will not increase the potential threat to human health or the environment, or • is necessary to reduce the threat to human health or the environment.		3 The future use of the above-described land used for disposal is restricted under the terms of Ohio Administrative Code hazardous waste rules 3745-66-17(C) and 3745-68-10 — in lieu of federal hazardous waste regulations 40 CFR §§265.117(c) and 264.117(c). The post-closure use of such property must never be allowed to disturb the integrity of either the On-Site Disposal Facility's containment system or monitoring system, unless the EPA Regional Administrator and/or the Ohio Director of Environmental Protection determines that the proposed use: • will not increase the potential threat to human health or the environment, or • is necessary to reduce the threat to human health or the environment.

Table 4-3
NOTICE IN DEED OR OTHER TRANSFER INSTRUMENT

Ohio Solid Waste Rules	Ohio Hazardous Waste Rules	CERCLA	FEMP
	4 Any & all future users of the land shall inform themselves of the requirements of the regulations and ascertain the amount & nature of wastes disposed of on/in the above-described property.		4 Any & all future users of the land shall inform themselves of the requirements of the regulations and ascertain the amount & nature of remediation wastes/ impacted materials disposed of on/in the above-described property.
File a survey plat with each of the following, showing the unit(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume, and nature of the solid waste deposited in the unit(s) of the sanitary landfill facility:	5 I have filed a survey plat with each of the following, showing the location and dimensions of the disposal facility and its individual units, and a record of the type, location and quantity of waste material disposed within each unit of the disposal facility:		5 I have filed a survey plat with each of the following, showing the location & dimensions of the On-Site Disposal Facility & its individual cells/phases, and a record of the type, location & quantity of remediation waste/ impacted material disposed within the On-Site Disposal Facility:
• *name & address of local zoning authority, or authority with jurisdiction over local land use*	• *name & address of local zoning authority, or authority with jurisdiction over local land use*		• Butler County Recorder's Office 130 High Street Hamilton, Ohio 45001 (513-887-3409) AND Hamilton County Recorder's Office ATTN: Registered Land Recordings 138 E. Court Street, Cincinnati, Ohio 45202 (513-632-8336)

Table 4-3
NOTICE IN DEED OR OTHER TRANSFER INSTRUMENT

Ohio Solid Waste Rules	Ohio Hazardous Waste Rules	CERCLA	FEMP
• *name & address of the board of health having jurisdiction*			• Butler County Health Department ATTN: Environmental 202 S. Monument Street Hamilton, Ohio 45001 (513-887-5228) AND Hamilton County Environmental Health Division 11499 Chester Road, Suite 1500 Sharonville, Ohio (513-326-4500) AND Ohio Department of Health Chief, Bureau of Radiological Protection 246 N. High St. Columbus, Ohio 43266-3534 (614) 644-2727
	• Regional Administrator of EPA Region 5		• EPA Region 5 Administrator 77 W. Jackson Blvd Chicago, Illinois, 60604-3590
• Ohio Director of Environmental Protection	• Ohio Director of Environmental Protection		• Ohio Director of Environmental Protection 1800 Watermark Drive P.O. Box 1049 Columbus, Ohio 43266-0149
		A covenant warranting that— • all remedial action necessary to protect the human health & the environment with respect to any such hazardous substances remaining on the property has been taken before the date of such transfer, and • any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States.	A covenant warranting that— • all remedial action necessary to protect the human health & the environment with respect to any such hazardous substances remaining on the property has been taken before the date of such transfer, and • any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States.

5.0 ENVIRONMENTAL MONITORING

5.1 Introduction

Two primary elements of environmental monitoring are associated with the FEMP OSDF post-closure care period, namely air monitoring and groundwater monitoring. This section describes the focus and scope of the plans for monitoring these two primary environmental media. LCS and LDS flow rate monitoring are addressed in Section 6.

5.2 Air Monitoring

The environmental air monitoring at the FEMP is performed on a sitewide basis under the IEMP. The air emission monitoring program for the FEMP OSDF during the post-closure care period — the air monitoring stations, analytical parameters, sampling frequency, equipment, procedures, and analytical methods — will be presented in a future revision to the IEMP in order to provide data for annual 40 CFR Part 61 National Emissions Standards for Hazardous Air Pollutants (NESHAPs) Subpart H reporting and for other annual site environmental reporting.

It is anticipated that data will be collected under that ongoing program during at least a portion of the OSDF post-closure care period from air monitoring stations located on-property in the vicinity of the OSDF, near the FEMP property fenceline, and at several off-property locations in nearby communities. That monitoring program has been developed in response to DOE Orders 5400.1 and 5400.5 and is currently presented in the *IEMP*. Some air monitoring locations may require relocation to accommodate changes in site conditions due to FEMP remediation activities. Any such location-based modifications will be addressed in the *IEMP*.

5.3 Groundwater Monitoring

Groundwater monitoring for the OSDF is currently presented in the *OSDF Groundwater/Leak Detection and Leachate Monitoring Plan* [DOE, 1997a]. The focus of that plan is the leak detection monitoring program for the OSDF, addressing monitoring both within the OSDF (in the leachate collection system and leak detection) and the underlying groundwater (in the glacial till immediately underneath the OSDF and the groundwater in the Great Miami Aquifer). Although the temporal coverage of that plan begins in part prior to the placement of impacted material/remediation waste into the OSDF, its coverage is anticipated to extend through the active phase of the OSDF, when remediation wastes are being emplaced in the individual cells of the OSDF, and into the post-closure phase after the last cell of the OSDF has been covered and closed. It is anticipated that the *OSDF Groundwater/Leak Detection and Leachate Monitoring Plan* might be revised over time to fine tune

the monitoring strategy and its individual components; any such revisions are anticipated to be done in a consultative manner between the DOE, EPA, and OEPA.

If a leak is detected from the OSDF, DOE will consult with the EPA and OEPA in accordance with the requirements established in the *OSDF Groundwater/Leak Detection and Leachate Monitoring Plan* for notifications and response actions.

5.4 Monitoring of Other Media

It is anticipated that monitoring of selected additional media — e.g., surface water, vegetation — during the OSDF post-closure care period might also be addressed in a future revision to the *IEMP* focusing on the OSDF post-closure care period. See the second bullet under DOE Order 5820.2A, Chapter III(3)(k) (entry 35) in the table presented in Section 2.0.

6.0 LEACHATE MANAGEMENT SYSTEM

6.1 Introduction

This section covers the LCS and LDS, and will address:

- Procedures for collecting, handling, and disposing of leachate, if any, during the post-closure period in order to prevent excess accumulation of leachate in the system [federal solid waste regulation 40 CFR §§258.61(a)(2) and 258.40, and Ohio hazardous waste rule OAC 3745-68-10(D)(2) in lieu of federal hazardous waste landfill regulations 40 CFR §§264.301(c) and 265.301(a)]

- E.g., if leachate is to be collected in a tank for periodic removal, the plan should estimate the quantity of leachate per time period, and specify the frequency of removal and how it will be treated or disposed [federal hazardous waste landfill regulations 40 CFR §§264.301(c) and 265.301(a)]

- Such procedures are to remain in effect until leachate is no longer detected [federal hazardous waste landfill regulation 40 CFR §§264.310(b)(2)]

- The Ohio Director of Environmental Protection may allow the management of leachate to cease if it is demonstrated that leachate no longer poses a threat to human health or the environment [federal solid waste regulation 40 CFR §258.61].

Note that leachate flow monitoring, sampling and analysis, and notification and response actions for leachate, are addressed in the *OSDF Groundwater/Leak Detection and Leachate Monitoring Plan*, as is stated in Section 1.3 of this plan.

6.2 Leachate Management System

The following discussions in large part have been reproduced with minor modification from Section 3 of *OSDF Systems Plan* [FDF, 1997b].

6.2.1 Overview

The double liner system of each OSDF cell contains a LCS and LDS. These systems are designed to convey any liquids that enter the system through pipes (i.e., the LCS pipes and LDS pipes) to manholes located outside each cell. After closure of the OSDF, liquids that enter the LCS are leachate generated in the emplaced impacted material which infiltrates through the impacted material into the LCS. Liquid that collects in the LDS manhole primary containment vessel of a cell will be pumped to the adjacent LCS manhole. In turn, the LCS manholes are connected by a LTS gravity line which conveys leachate from the LCS pipe outlets in the LCS manholes via gravity flow

to a permanent lift station. From the permanent lift station, leachate is pumped through a permanent double-wall forcemain to the Biodenitrification Surge Lagoon (BSL).

The locations of the LCS, LDS and LTS pipes, manholes, and gravity lines are shown in the (as-built) Construction Drawings.

6.2.2 Basic System Operation

The basic operation of the OSDF leachate management systems is described below.

- The LCS and LDS pipes from liner system to the LCS and LDS manholes for each cell consist of double-wall high-density polyethylene (HDPE) pipes (i.e., inner carrier pipes and outer containment pipes). Each pipe drains by gravity from the OSDF cell and terminates in an LDS or LCS manhole.

- The LDS manhole allows for direct discharge of flow from the LDS carrier pipe into a primary containment vessel located inside the manhole. The LDS manhole serves as a secondary containment structure for the primary containment vessel. The LDS manhole has provisions for the monitoring of liquid in the primary containment vessel component of the manhole. The primary containment vessel has a 2-in. (50-mm) diameter liquid level pipe, a 2-in. (50-mm) diameter suction pipe, and a 2-in. (50-mm) diameter discharge pipe. The discharge pipe is connected to the LTS gravity line in the adjacent LCS manhole. The LDS containment pipe has a monitoring port and fixed end seal within the LDS manhole to verify the absence of liquid in the annular space between the carrier pipe and containment pipe.

- Each LDS manhole has a cleanout adjacent to the manhole for maintaining the LDS carrier pipe.

- The LCS manhole allows for direct discharge of flow from the LCS carrier pipe into the LTS gravity line that passes through the manhole. Prior to final closure of the OSDF, the LCS carrier pipe has temporary valves for regulating leachate flow into the gravity line during OSDF construction, impacted material placement, and periods of gravity line maintenance, extension, repair, etc. These valves shall be removed (and replaced with a solid-wall HDPE spool) from the LCS carrier pipe prior to final closure of the OSDF (so that, for the long term post-closure period, there are no obstructions in the pipe). The LCS carrier pipe in each LCS manhole also has a sampling port for obtaining leachate samples. Each LCS manhole has an inlet for a redundant LCS carrier pipe. The redundant carrier pipe has a valve (secured in a closed position) and monitoring port (for periodically confirming the absence of liquid in the pipe). The redundant carrier pipe valve is configured so that it can be opened to allow flow to the LTS gravity line at any time in the event of a failure due to clogging of the primary LCS carrier pipe. This valve will also be removed (and replaced with solid-wall HDPE spool) after final closure of the entire OSDF. Both the primary and redundant LCS containment pipes have

monitoring ports and fixed end seals within the LCS manholes to verify the absence of liquid in the annular space between the carrier pipe and the containment pipe.

- LCS manholes are equipped with liquid level alarms, consisting of a submersible liquid level sensor, logic controller, and alarm light. The liquid level sensor shall be calibrated such that the alarm is activated when the liquid level in the LCS manhole exceeds 2 in. (50 mm). The LCS and LDS manholes have pipe supports for the LTS gravity line and the LDS carrier pipe, respectively.

- The LTS gravity line and LCS and LDS manholes will be/were installed in stages, progressively advancing from north to south in conjunction with the progressive development of the OSDF. Each stage may involve the installation of manholes and LTS gravity line for several cells. At a given stage, the LTS gravity line will run/runs through all of the manholes previously installed and those installed for a given stage to the southernmost manhole installed in that stage.

- The LTS gravity line consists of a double-wall HDPE pipe with a 6-in. (150-mm) diameter inner carrier pipe and a 10-in. (150-mm) diameter outer containment pipe. The inner carrier pipe of the LTS gravity line will be/is continuous over its entire length (i.e., from its upgradient to its discharge point). The outer containment pipe will be/is continuous between the LCS manholes and joined to the manhole walls.

- The LTS gravity line will be/is equipped with a vent and 4-in. (100-mm) diameter quick-connect hose connection at its northern end. The purpose of the vent is to prevent pressure buildup in the systems. The quick-connect hose allows pressure testing of the systems and jetting water in the line to clean it. The gravity line will have/has cleanouts on the upgradient end of each LCS manhole for maintenance.

- The permanent lift station is provided with secondary containment which is designed so that it can be monitored for the presence of leakage.

- The permanent lift station is capable of storing the quantity of leachate generated during a one-week period using design assumptions simulating final closure of the OSDF.

- Prior to the discharge of liquid into the permanent lift station, the liquid passes through a motor-operated inflow valve which closes automatically in the event of power failure or if liquid levels in the lift station rises above the high level alarm setpoint or any level that would cause an electrical short or damage to equipment in the lift station). In the event of a power failure, or high level alarm, the outlet valve for the leachate transmission systems will close automatically. The lift station also has a manual means for closing the lift station motor-operated inflow valve. Therefore, this valve can be closed manually, if needed, until appropriate maintenance activities can be implemented.

- The permanent lift station will be/is equipped with a pumping system to transfer liquids in the lift station to the BSL.

Each major component of the leachate management systems will be/were identified (i.e., numbered) during installation. Manufacturer's equipment operating and maintenance instructions provided by the OSDF Construction Subcontractor as part of Construction Acceptance Testing, which served during the life of the *OSDF Systems Plan*, will be carried over for this PCCI Plan. Construction Acceptance Testing is the performance of all necessary testing to demonstrate that subcontractor supplied or installed equipment and system are installed satisfactorily and safely in accordance with the Construction Drawings and Specifications.

6.3 LDS and LCS Operation Procedures

The LDS and LCS of each OSDF cell shall be operated in conformance with the requirements of this section. All alarm levels and response timeframes are preliminary.

- The level transmitter for the primary containment vessel of the LDS manholes shall be maintained at the setting from the *OSDF Systems Plan* to activate the alarm (strobe light and radio signal) for a liquid level 6 in. (150 mm) below the top of the vessel.

- Similarly, the level transmitter for the secondary containment vessel of the LCS manhole shall be maintained at the setting from the *OSDF Systems Plan* to activate the alarm for a liquid level 2 in. (50 mm) above the bottom of the vessel.

- The valve on the redundant LCS carrier pipe shall be maintained closed at all times, unless overridden by conditions dictated by Section 6.4.

- In order to allow discharge to the LTS gravity line, the butterfly valve on the LCS carrier pipe shall be maintained open at all times during the post-closure period of the OSDF, except for those periods where the valve needs to be closed for systems maintenance and repair or in the event of an operational emergency.

- The LCS manholes are designed as closed system; liquids should not accumulate in these manholes. If the alarms are activated, personnel shall respond within one hour to assess the problem and to take appropriate corrective actions.

All Occupational Safety and Health Administration (OSHA), DOE, and FEMP site requirements for confined space entry shall be followed when performing monitoring and inspection activities in the LDS and LCS manholes.

6.4 LDS and LCS Inspection and Maintenance Activities

The LCS and LDS shall be inspected and maintained in accordance with the schedule and activity requirements outlined in Table 6-1, or until leachate is no longer generated and an alternative

activity schedule has been approved (see Sections 6.11 and 12.0). Specific details of the required inspection and maintenance activities are given below.

According to appropriate regulations [OAC 3745-27-19(k)(3)], the LCS and LDS pipe network shall be inspected annually to ensure that clogging has not occurred. Clogging can occur by deposition of particles within the pipe or by biological growth inside the pipe. This pipe network shall be inspected between the manhole and the first 100 ft (30 m) of subdrain pipe inside the cell. The portion of the pipe beyond this point inside the cell is considered to be redundant because gradation for the LCS granular drainage material is designed to limit the level of leachate on the geomembrane liner to less than 1 ft (0.3 m) without need for a subdrain pipe.

Access to the LCS and LDS pipes for inspection shall be through HDPE cleanouts located adjacent to the LDS or LCS manholes. Inspections shall be performed using a video camera or any other appropriate inspection equipment or other appropriate inspection equipment. The inspection equipment shall have the ability to monitor its location (e.g., distance counter), be sized to fit within the LCS and LDS inner carrier pipes indicated on Construction Drawings and be capable of being pushed the length to be inspected.

If an inspection indicates that a LCS or LDS pipe is obstructed, the pipe shall be flushed by pumping fresh water from a water truck through a hose inserted in the pipe cleanout. If flushing does not remove the obstruction, other methods shall be used to clean the pipe. These other methods may include blowing the obstruction out with air, vacuuming, jet rodding, or inserting a snake, fish tape, or other suitable device. If air or water pressure is used, the working pressure inside the pipe shall not exceed the rated pressure for the pipe.

The specific pipe maintenance procedures (other than flushing) to use to remove a pipe obstruction should be selected by DOE on a case by case basis.

In the event that LCS or LDS pipe obstruction cannot be dislodged, or in the very unlikely event that a pipe has undergone partial or total crushing, the following procedures should be considered:

- for the LCS, activate the redundant LCS pipe;
- for the LCS or LDS, insert a new small diameter pipe within the obstructed or collapsed pipe; and
- for the LCS or LDS pipe, if the obstruction or collapse is outside of the disposal facility containment systems, replace the pipe.

Table 6-1
LEACHATE COLLECTION AND LEAK DETECTION SYSTEMS INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspection Frequency	Conditions to Check	Remedy
LDS	To be determined based upon observations from the period governed by the *OSDF Systems Plan*	• condition of submersible level transmitter and appurtenances	• check level transmitter operations (e.g., operating temperature range, accuracy, etc.), electrical connections, and alarm light.
		• leakage from primary containment vessel	• check for source of leak; if source identified then take appropriate corrective measures (i.e., spot-seal vessel, replace vessel, etc.)
		• liquid in LDS containment pipe	• keep monitoring port drained; perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects
LCS	To be determined based upon observations from the period governed by the *OSDF Systems Plan*	• condition of submersible level transmitter and appurtenances	• check level transmitter operations (e.g., operating temperature range, accuracy, etc.), electrical connections, strobe light, and radio transmission
		• condition of shutoff valve	• check valve operability; correct any deficiencies
		• liquid in LCS containment pipe	• keep monitoring port drained; perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects
		• liquid in redundant LCS carrier pipe	• drain pipe into LTS gravity line
LDS & LCS Pipes	Annually	Video inspect for: • crushing of pipe • clogging of pipe	• flush clogged pipe with water or mechanically clean • insert small diameter pipe in crushed pipe, if possible • replace crushed pipe if crushed portion is outside of the cell • utilize redundant LCS pipe

NOTES:
(1) Frequencies of inspection and maintenance activities are preliminary.
(2) Leachate collection and leak detection systems shall be inspected after the occurrence of major earthquakes (see Section 11.3).

All equipment inserted into the LCS or LDS line for inspection and/or maintenance shall be decontaminated prior to removal from the OSDF battery limits.

In addition to the foregoing requirements, all mechanical and electrical equipment shall be calibrated, operated, maintained, and serviced in accordance with the manufacturer's instructions for that equipment. Manufacturer's instructions are those contained in Attachment A of the *OSDF Systems Plan*, which will be carried over to an attachment or appendix to this PCCI Plan as part of one of its first planned revisions (see Section 12.0).

6.5 LTS Operation Procedures

|To be inserted later, after installation|

6.6 LTS Inspection and Maintenance Activities

The LTS shall be inspected and maintained in accordance with the schedule and activity requirements outlined in Table 6-2, or until leachate is no longer generated and an alternative activity schedule has been approved (see Sections 6.11 and 12.0). Specific details of the required inspection and maintenance activities are given below.

The manholes, leachate transmission system, valves, connections, sampling ports, monitoring ports, pumps, etc., shall be routinely inspected and maintained to provide for proper OSDF operation. All mechanical and electrical equipment shall be calibrated, operated, maintained, and serviced in accordance with the manufacturer's instructions for that equipment. Manufacturer's instructions are those contained in Attachment A of the *OSDF Systems Plan*, which will be carried over to an attachment or appendix to this PCCI Plan as part of its first planned revision (see Section 12.0).

In addition, the inspection and maintenance activities for the LTS shall include the following:

- confirm that appropriate warning signs are visible (e.g., confined spaced);
- check instruments/valves (e.g., note sticking or jammed devices, corrosion, leaks, and misalignments);
- note any temperature extremes which may exist inside the manhole (e.g., equipment-specific operating temperature ranges);
- verify instrument systems status (e.g., elevation and location of automatic level switch in the lift station manhole),

- monitor flow for pulsating, over pressure, or under pressure;
- check for the presence of liquids in all secondary containment system;
- confirm pump operation/priming;
- check hoses for physical wear and poor connections prior to each use;
- repair or replace damaged manhole covers;
- note condition of concrete slab.

6.7 Leachate Management

6.7.1 During AWWT Operational Life

Liquids collected from the LCS and LDS will initially be treated on-site in the Advanced Wastewater Treatment (AWWT) facility, as long as that facility is operational.

6.7.2 After Cessation of AWWT Operational Life

Prior to cessation of operation of the AWWT, alternatives for treatment of the liquids collected from the LCS and LDS will be evaluated. In accordance with Ohio solid waste rule OAC 3745-27-19(K)(5), those alternatives are expected to consist of:

- on-site pre-treatment of collected liquids with off-site disposal, and
- off-site treatment and disposal of collected liquids.

Various options may exist for the off-site portion of either of these alternatives. A modification to this PCCI Plan would be required prior to implementing such a change (see Section 12.0).

It is anticipated that off-site treatment and/or disposal would likely require that collection of leachate in the sump or another accumulation tank while awaiting periodic removal. Any modification to this PCCI Plan involving such accumulation in a tank would need to estimate the quantity of leachate per time period, in order to specify the frequency of removal, and how it will be treated or disposed [federal hazardous waste landfill regulations 40 CFR §§264.301(c) and 265.301(a)].

Table 6-2
LDS/LCS MANHOLES AND LTS GRAVITY LINE INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspection Frequency	Conditions to Check	Remedy
LDS Manholes	To be determined based upon observations during the period governed by the *OSDF Systems Plan*	• confirm all required signage is visible • cracked, broken manhole cover • leaking seal on manhole cover • general structural condition of containment vessel • odors, bacterial growth (containment vessel)	• repair and/or replace as necessary • replace manhole cover • replace seal • check for structural integrity; if problems are found, take appropriate measures (i.e., spot seal vessel, replace vessel, etc.) and implement permanent solution • flush and/or spray sodium hypochlorite into containment vessel
LCS Manholes	To be determined based upon observations during the period governed by the *OSDF Systems Plan*	• confirm all required signage is visible • cracked, broken manhole cover • leaking seal on manhole cover • completion of OSDF construction • general structural condition of manhole	• repair and/or replace as necessary • replace manhole cover • replace seal • remove designated valves and replace with pipe spool piece • check for structural integrity; if damage is observed, assess extent and make repair recommendations
LTS Gravity Line	To be determined based upon observations during the period governed by the *OSDF Systems Plan*	• liquid in LTS gravity line containment pipe • inspection of pipe for clogging or crushing (annual only)	• keep containment pipe drained; perform video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options • flush clogged pipe with water, or mechanically clean; repair as necessary

NOTES:
(1) Frequencies of inspection and maintenance activities are preliminary.
(2) LDS/LCS manholes and LTS gravity line shall be inspected after the occurrence of major earthquakes (see Section 11.3).

6.8 Cessation or Temporary Suspension of Leachate Management

The procedures presented above in this section are anticipated to remain in effect until leachate is no longer detected [federal hazardous waste regulation 40 CFR §§264.310(b)(2)], or until it is demonstrated that leachate no longer poses a threat to human health or the environment. Rather than complete cessation or permanent deletion of one or more of these leachate management requirements, temporary suspension may also be considered, in accordance with appropriate regulations [Ohio hazardous waste interim status rule OAC 3745-66-18(G)]. A modification to this PCCI Plan would be required prior to implementing such a change (see Section 12.0).

7.0 ROUTINE SCHEDULED INSPECTIONS

7.1 Introduction

This section will establish inspection techniques and frequency as required by the appropriate regulations [Ohio hazardous waste rules OAC 3745-66-18(A) & (C) in lieu of federal hazardous waste regulations 40 CFR §§ 264.118(b)(2) and 265.118(c)(2)]. Components covered by these inspections are:

- Security system (e.g., fences, gates, locks, warning signs)
- Final cover system
- Run-on and run-off control system(s)
- Surveyed benchmarks— at least three (3) third-order benchmarks on separate sides of the OSDF within easy access to the limits of waste/impacted materials placement [Ohio solid waste rule OAC 3745-27-08(C)(7)(a)-(c), and Ohio hazardous waste rule OAC 3745-68-10(D)(4) in lieu of federal hazardous waste regulation 40 CFR §265.310(b)(6)]

7.2 Routine Facility Inspections

Discussed in this section are those background details and preliminary considerations necessary to conduct routine scheduled site inspections including the inspection team, frequency and timing of inspections, and inspection aids. Also discussed are the procedures during routine scheduled site inspections.

7.2.1 Preliminary Considerations

FREQUENCY AND TIMING OF INSPECTIONS

Routine scheduled inspections will be conducted at the FEMP OSDF during years 1, 2, 3, 4, 5, 7, and 9 following closure of the final cell of the OSDF. The objective of these inspections is to establish and record physical modifications to the site through many seasonal cycles and to provide a basis for decisions regarding future inspections. At the 5-year point and subsequent 5 year increments, as part of the CERCLA 5-year review, the DOE will evaluate all inspection and maintenance reports and records for the FEMP OSDF for the period under review, and may specify a new routine scheduled inspection frequency, to be approved by EPA and concurred on by OEPA, via a modification to this plan (see Section 12.0).

Timing of these routine scheduled inspections, as determined by DOE, will take into consideration such factors as:

- Inability to reach the site due to snow cover, run-off, or impassible roads.
- Inability to inspect due to snow cover.
- Climatic cycles most likely to adversely impact the site such as periods of heavy precipitation, run-off, or wind.
- Need to acquire data to confirm aerial photography data or reports from local officials or concerned citizens.

Should the inspectors find weather conditions at the site not conducive to making a complete and thorough inspection, they will use the opportunity to observe and record changes to cover, diversion channels, and other site features. The remainder of the inspection tasks will then be rescheduled to a more favorable day.

INSPECTION TEAM

The inspection team for routine scheduled inspections will consist of a chief inspector and one or more assistants. The minimum number on a team is two; more can be assigned depending on the conditions expected at the site at the time of inspection. If only two inspectors are assigned, one will be a geotechnical engineer/geologist, and the second will be a civil engineer. Inspection team size will be specified by the DOE or its contractor prior to each inspection. EPA and OEPA will be notified of the scheduled dates and times of these routine inspections so they may send representatives to accompany the inspection team. 1

The chief inspector will have a degree in civil engineering or soil mechanics, and at least five (5) years experience (or an equivalent amount of experience/education) in projects involving the planning and implementation of earthen structure designs. Where possible, the chief inspector will have made at least one site inspection as an assistant inspector. Assistant inspectors will have degrees and experience complementing the chief inspector's as appropriate for the expected site conditions. Assistants will have a minimum of three (3) years experience (or an equivalent amount of experience/education) in their field. The chief inspector and assistant(s) will be designated by the DOE or its contractor prior to each inspection.

FAMILIARIZATION WITH SITE CHARACTERISTICS

The site inspection team will become familiar with the site by reviewing this PCCI Plan, and the most recent previous inspection report.

PREPARATIONS FOR CONDUCTING SITE INSPECTIONS

After site familiarization, preparations must be made to conduct the field inspection. This requires the inspection team to:

- Obtain approval to enter adjacent property (if required).
- Assemble the equipment needed to conduct the inspection. Equipment may include such items as camera(s) and film, binoculars, tape measure, optical ranging devices, Brunton compass, photo scale stick, erasable board, additional signs, *etc.*

7.2.2 Site Inspection

The primary objective of the routine scheduled site inspection is to identify potential problems at an early stage prior to the need for significant maintenance or repairs. The inspection team will be guided by a knowledge and understanding of the processes which could adversely change the disposal facility. A fundamental part of the inspection will be the detection of change, and particularly the progressive change, over a number of years due to slow processes. The inspection checklist will include the following:

- Security of fences, gates, and locks, as well as the condition of applicable warning signs
- General health and density of the vegetative cover
- Evidence of burrowing by animals on the cover
- Presence, depth, and extent of erosion or surface cracking, indicating possible cap deterioration
- Visibly noticeable subsidence, either localized or over a large area
- Presence and extent of visible settlement, including a determination of whether observed settlement is sufficient to pond water
- Presence and extent of any leachate seeps

- Integrity of run-on and run-off control features
- Integrity of benchmarks

FIELD PROCEDURES

Adjacent Off-Site Features

A reconnaissance of the adjacent area within approximately 0.25 mi of the FEMP property line (in no case shall this property line be smaller than the OSDF and its buffer zone) will usually be the first stage of a site inspection. Any evidence of a change in land use will be described. The development of inadequately engineered roads and trails may, because they concentrate run-off, lead to initiation of gully erosion; increased use in any form is likely to bring about a reduction in vegetative cover and, therefore, an acceleration of erosion. In general, any increase of human activity in the vicinity increases the probability of either inadvertent or purposeful intrusion into the site.

Evaluation will be made of whether the natural drainage courses in the immediate vicinity of the FEMP OSDF pose any threat to the continued integrity of the OSDF. An "overview" observation from a prominent topographic feature will be made first, looking for indications of high water levels, areas of active erosion and sedimentation, and potential changes in channel position.

Reaches of adjacent natural drainage courses will then be walked for approximately one thousand (1000) feet and notes made of unusual or changed sediment deposits, large debris accumulations, man-made or natural constrictions, and recent or potential channel changes. Any such features will be documented with photographs which will include recognizable landmarks and known objects for scale.

Similarly, any gullies or locations which appear to be favorable to the development of gullies will be examined. The portion of the head of the gully will be the most important observation, but the shape of the cross-section will give an indication of the degree of the activity, and any interruption in the longitudinal profile may suggest rejuvenation or the presence of a local base level.

Access Roads, Fences, Gates and Signs

The FEMP OSDF area is anticipated to be accessible via automobile. The condition of the on-property roads will be described, and if the need for maintenance is indicated, the location and type of work will be recommended. Roads and associated grading are frequently points of gully

initiation, and near the FEMP OSDF particular care will be taken in looking for evidence of recent erosion associated with the roads.

A waking traverse of the fence will be made to inspect the condition of fencing, gates, locks, and signs. Evidence of deterioration, damage, or vandalism will be noted. Any breaks in the perimeter fence or conditions which might lead to a break will be described. Signs will be evaluated for legibility and proper location and spacing. If human intrusion is indicated, an effort will be made to determine whether it was inadvertent or purposeful, and whether it poses any threat to the integrity of the FEMP OSDF. Missing, badly damaged, or defaced signs will be replaced during the inspection.

Monuments

Each survey monument, boundary marker and site marker will be examined for evidence of disturbance. If any have been disturbed, a recommendation for their re-establishment and possible protective action will be made.

Crest

The crest of the FEMP OSDF is an obvious vantage point from which to examine the site and surrounding area. Observations, with the aid of binoculars, will be made in all directions from the crest of any features which are anomalous or unexpected, and which may require further inspection. These will be recorded on the checklist and on the overlay. Examples of such features that might be observed include: changes in soil color; distressed vegetation patterns; trails; and patterns of erosion.

A walk around the edge and diagonal transects of the crest will be made. Additional transects, at approximately 50-yard intervals, will be walked along the sideslopes. A search will be made for evidence of differential settling, subsidence, and cracks, if any. The patterns of cracks and evidence of subsidence will be described in an overlay and photographed. The depth and width of the cracks will be measured; notes will be made of any points at which the cracks extend below the outer erosion barrier.

Erosion of the crest is not expected to be a problem because of the low slopes. However, differential settling or sliding along the slopes may cause flow concentrations which may disturb that protection, and thus irregularities will be examined for early evidence of erosion. Evidence of wind erosion including the presence of ripple marks, partially exhumed vegetation, the presence of pedestal rocks, or obvious lag gravels will be noted. As the FEMP OSDF will be vegetated as part of the

closure activities, careful examination will be made to determine areas of distressed or sparse vegetation, or the presence of deep-rooted species.

Slopes

Changes to the FEMP OSDF are most likely to occur in the lower portions of the slopes. Therefore, an examination at the toe of the slope will be a key part of the inspection. A traverse at the toe of the slope will be made, and one (or more, dependent on findings) additional traverse on the upper slopes will be made.

Settlement or sliding, although highly unlikely, will be apparent by the presence of bulges and depressions, cracks, and scarps. If any such features are observed, the extent of the area affected, whether the area is stable or likely to continue moving, and the nature of the movement that is occurring (settlement, planar, or rotational sliding). Evidence of related erosion will be noted. Photographs showing detail and area perspective will be taken of any such features observed.

Any localized change in color (e.g., "stained" vegetation) or concentration of vegetation will be described and examined for evidence of seepage. Continuity and density of the vegetative cover will be noted, and areas where the vegetative cover has been stressed — i.e., areas with sparse vegetation or without vegetation, or areas with dead (not just dormant) vegetation — or destroyed will be mapped and described. Undesirable invader species, particularly woody species such as large shrubs and trees, will be identified if present.

During these inspections, the slopes will be examined for evidence of animal intrusion, burrowing, changes in vegetation, and human activity. Regularly used trails (human or animal) can concentrate run-off and encourage erosion; any such trails observed will be mapped and described. Any signs of small animal trails or burrows will be noted and photographed, and an effort will be made to tentatively identify the species. If animal burrows have been observed during previous inspection, the burrow site(s) will be examined for indications of current activity.

Erosion of vegetated slopes will first be apparent by the development of rills and rivulets which extend only part way up the slope. If they are present, their spacing, length, depth and width will be measured and noted. Particular attention will be placed on evidence of integration of the drainage and development of a master channel. Such a development can, in a short time, evolve into a gully.

Inadvertent or casual intrusion by humans is not of great concern, but evidence of removal of the cover, extensive vandalism to signs and monuments, or the presence of well-established trails will be described in detail.

Periphery

The area adjacent to the FEMP OSDF will be examined during the traverse at the toe of the slope. Features to be looked for and described, if present, include: erosion channels; accumulations of sediment; evidence of seepage; and signs of animal or human intrusion.

Diversion Channels

Each diversion channel will be walked its entire on-property length to determine whether the channels have been functioning, and can be expected to continue as designed. The channels and sideslopes will be examined for evidence of erosion or sedimentation, slides or incipient erosion channels, debris, or growing vegetation. The sideslopes of the diversion channels also will be examined for evidence of piping or burrowing by animals which could lead to sloughing of material into the channel.

The portion of the channel that has riprap (or a concrete spillway), the soil or rock material adjacent to the structure will be examined carefully for evidence of unstable conditions such as piping, or destructive currents. The riprap (or concrete) will be examined for evidence of deterioration caused by weathering or erosion.

At those portions of the channel slopes which are rock, plant colonization will be slow to develop, but will gradually occur. The inspection procedure is expected to record this gradual colonization by noting the extent of vegetation, its location, and cover density.

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8.0 UNSCHEDULED INSPECTIONS

8.1 Introduction

An unscheduled inspection may be triggered by reports or information that the site integrity has been or may be compromised. The two types of unscheduled inspections anticipated — follow-up inspections, and contingency inspections — are discussed in the following subsections.

8.2 Follow-up Inspections

Follow-up inspections investigate and quantify specific problems encountered during a routine scheduled inspection, special study, or other DOE or other regulatory agency activity. They determine whether processes currently active at or near the site threaten site security or stability, and they evaluate the need for custodial maintenance and/or repair or corrective action.

Because of the standards to which the FEMP OSDF has been designed, it is considered unlikely that problems will occur. However, some of the situations which may require a follow-up inspection include:

- unforeseen subsidence of the OSDF slopes or its foundation,
- gullying which has cut through or is threatening to cut through the outer cover,
- slides on the slopes of the FEMP OSDF,
- seepage,
- change in the position of an adjacent stream channel,
- indications of rapid headward cutting of a nearby gully,
- cracks which extend deeply (greater than six (6) inches) into the slopes,
- presence of animal burrows on the FEMP OSDF or in its diversion channels,
- invasion of trees or shrubs onto the vegetative cover of the FEMP OSDF, and
- removal of some of the material from the FEMP OSDF cover.

Follow-up inspections should be made by technical specialists in a discipline appropriate to the problem that has been recognized. That is, if erosion is a problem, the inspector(s) will be individuals knowledgeable in evaluating erosion, presumably a soils scientist or geomorphologist; if settlement or sliding is the problem, a geotechnical engineer; if changes in an adjacent stream, a hydrologist; if plant invasion, a botanist; and the like.

The follow-up inspection begins with an on-site visit to determine the need for definitive tests or studies. Additional visits may be scheduled if more data are needed to draw conclusions and recommend corrective action. If custodial maintenance or repair or corrective action is warranted, the DOE will notify the EPA, OEPA, appropriate local officials, and other appropriate local stakeholders.

8.2.1 Objectives and Procedures

These investigations include all additional investigations or studies necessary to evaluate the continued effectiveness of the FEMP OSDF for containment of the impacted materials therein. The procedures used will be those required in the judgement of the DOE and will depend upon the nature and severity of the problem. Representative and appropriate responses for several possible problems are listed in Table 8-1.

Table 8-1
POSSIBLE PROBLEM SITUATIONS AND RESPONSES

Situation	Representative Response
Gullying on slopes	Measurement or mapping not done as part of routine scheduled inspection will be done. The primary objective is to determine the factors which led to the initiation of the gully. This might involve evaluation of the erosion barrier design parameters or site drainage, and the role of sheet erosion, rill formation, slides, or burrows. The product will be a recommendation for maintenance and preventative measures, if required.
Headward gully erosion	Procedures to determine the rate of headcutting will be established and implemented. A line of reference stakes (capped rebar) upstream from the gully head is a simple and effective method of measuring change in the position of the gully; comparison of periodic aerial photographs might also be useful. An understanding of the why dissection is occurring and any limiting conditions will be sought. The product will be a recommendation for maintenance and preventative measures, if required.
Invasive vegetation	Species identification and abundance determination will be conducted if/when large trees or shrubs invade the vegetative cover of the FEMP OSDF. If deep-rooted species are present, analysis of plant material for radionuclides and heavy metals might be done. An eradication program might be recommended; if so, cover repair would also be undertaken.
Creep	The occurrence of creep can be determined by setting rows of stakes parallel to contours on the sideslopes, which will gradually tilt downslope if creep is occurring. The rate of creep can best be determined by marking a number of rock fragments on the slopes and accurately determining their location in relation to additionally emplaced survey monuments over a number of years.
Landslides	Upon evidence of a slide or debris flow, an additional investigation will be made. The area and volume affected, the type of movement, and causal factors will be determined. Drilling, hand augering, or excavation might be necessary. The product will be a recommendation for what remedial and preventive maintenance are required.

8.2.2 Schedule and Reporting

Once a routine scheduled inspection has identified a concern, the DOE will notify the EPA and OEPA and begin a followup inspection by submitting a preliminary assessment of the concern and a plan for follow-up inspection. Upon review by EPA and OEPA, the DOE will implement the inspection plan. Once the follow-up inspection is completed, the DOE will recommend maintenance or other appropriate action to be performed, as needed.

8.3 Contingency Inspections

Contingency inspections are unscheduled, situation-unique inspections ordered by the DOE when it receives information indicating that site integrity has been or may be threatened. Events that could trigger contingency inspections include severe vandalism, intrusion by humans or livestock, severe rainstorms, or unusual events of nature such as tornadoes or earthquakes. Events that have caused severe damage to the OSDF or that pose an immediate threat to human health and the environment will be immediately reported to EPA and OEPA.

A preliminary inspection/assessment report of each contingency inspection triggered by such an unusual event will be submitted to the EPA and OEPA within 60 days of the initial report that damage or disruption has occurred at the FEMP OSDF site. At a minimum, this report will include: 1

- problem/event description;
- preliminary assessment of the custodial maintenance or repair or corrective action required;
- conclusions and recommendations;
- assessment data, including field and inspection data and photograph; and
- names and qualifications of the field inspectors.

A copy of the report and all other data and documentation from such a contingency inspection will be maintained in the permanent site file. The quarterly report submitted to the EPA and OEPA in accordance with the *IEMP* will contain the results of these inspections. The annual site report to the EPA and OEPA submitted in accordance with the *IEMP* will also include the results of these contingency inspection reports.

After EPA and OEPA have reviewed the preliminary inspection/assessment report, the DOE will submit a corrective action plan (for those events requiring corrective action) for EPA review and approval in accordance with a schedule to be determined on a case-by case basis via consultation between DOE, EPA and OEPA. Based on the findings of these reports, the DOE will implement the corrective action.

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9.0 CUSTODIAL MAINTENANCE AND CONTINGENCY REPAIR

9.1 Introduction

This section explains the procedures to be used by the DOE to determine when maintenance or contingency repairs are needed at the FEMP OSDF. In general, the decision to conduct maintenance or contingency repair will be based on the results of follow-up site inspections or contingency site inspections (see Section 8.0 for both), which assess problems at the site.

This section will establish maintenance activities and their frequency, fulfilling the requirements to do so established in the appropriate regulations [Ohio hazardous waste rules OAC 3745-66-18(A) & (C) in lieu of federal hazardous waste regulations 40 CFR §§265.118(c)(2) and 264.118(b)(2)]. The following subsections address custodial maintenance of the security system (e.g., fencing, gates, signage) and the impacted materials containment system as summarized below.

SECURITY SYSTEM

- Repair/replacement of sections of fence(s) and gates due to normal wear, severe weather conditions, vandalism; and
- Replacement of warning signs for similar reasons.

IMPACTED MATERIALS CONTAINMENT SYSTEM

- Maintain the integrity and effectiveness of the final cover, including making repairs to the cap/cover as necessary to correct the effects of settling, dead vegetation, subsidence, erosion, leachate outbreaks, or other events [Ohio solid waste rule OAC 3745-27-14(A), and Ohio hazardous waste landfill rule OAC 3745-68-10 in lieu of federal hazardous waste regulation 40 CFR §265.310];
- Mowing;
- Seeding and mulching repaired areas;
- Maintaining surface water run-on and run-off drainage features to prevent erosion of or other damage to the final cover [Ohio solid waste rule OAC 3745-27-14(A), and Ohio hazardous waste landfill rule OAC 3745-68-10 in lieu of federal hazardous waste regulation 40 CFR §265.310]; and
- Control of burrowing animals.

9.2 Conditions Requiring Maintenance or Repair Actions

Inspection reports and monitoring results will be reviewed and site conditions will be compared from inspection to inspection so that trends of changing conditions can be determined. Identifiable trends will provide a means for predicting when maintenance or repair will be needed. The DOE, in conjunction with EPA and OEPA, will decide whether or not to initiate custodial maintenance or contingency repair. After the decision to initiate maintenance or a contingency repair, a statement of work will be prepared for the work to be performed. The maintenance or repair action required to correct a site problem will be dependent upon the nature of the problem. Although the details of maintenance or repair actions that may be needed throughout the post-closure care period cannot be reliably predicted in advance, examples of conditions which may require custodial maintenance or which may trigger contingency repair are outlined in Table 9-1, along with the appropriate action(s).

When compared with contingency repair, custodial maintenance is expected to be generally less costly, smaller in scale, and more frequent in occurrence. In contrast, contingency repairs are very unlikely to be needed; however, repair costs may be more substantial due to the size of the work force and technical skills required for repairs.

9.3 Maintenance and Repair

The following subsections discuss custodial maintenance for the security system, cap and final cover, and the run-on and run-off drainage features.

9.3.1 Security System

The security system established for the FEMP OSDF includes fencing, gates, locks, and warning signs. Routine custodial maintenance or repair of the security systems includes visual inspection and repair or replacement of the affected components. Possible problems include deterioration, erosion, or frost heave of fence post anchors resulting in fence damage. Normal wear, deterioration, and vandalism is also possible on fencing, gates, locks, and signs. Table 9-2 presents the inspection and maintenance activities for these features. These activities will be performed as needed as identified during the routine inspections (see Section 7.0).

9.3.2 Cap and Final Cover System

Routine custodial and preventative maintenance of the cap and final cover includes visual inspection of benchmark integrity, upkeep of the vegetative cover, general mowing, clearing of debris,

Table 9-1
EXAMPLES OF CONDITIONS WHICH MAY REQUIRE CUSTODIAL MAINTENANCE OR CONTINGENCY REPAIR

	Condition	Appropriate Actions
	CUSTODIAL MAINTENANCE	
1.	Damage due to normal wear, severe weather conditions, or vandalism to survey control monuments.	• Re-establish survey control monument(s).
2.	Growth of woody species such as deep-rooted shrubs or trees on the cover.	• Remove deep-rooted shrubs or trees from the cover. • Backfill root hole with soil, compact to re-establish grade, and re-establish the regular vegetative cover via seeding and mulching.
3.	Development of animal burrows on the cover or in the diversion channels.	• Control or eradication of burrowing animals. • Backfill burrow hole with soil, compact to re-establish grade, and re-establish the regular vegetative cover via seeding and mulching. • If the problem becomes extensive, the services of a professional exterminator will be retained.
	CONTINGENCY REPAIR	
4.	Development of rills or gullies deeper than 6 inches with near vertical walls and no vegetative cover.	• Fill in gullies or rills with soil, compact to re-establish grade, and re-establish the regular vegetative cover via seeding and mulching[1,2].
5.	Surface rupture where the dimensions of the cracks are larger than 1 inch wide by 10 feet long by 1 foot deep, which would indicate severe shrinkage of cover materials or differential settlement.	• Reconstruction of slope segments where slumping, mass wasting, liquefaction, or other severe events have occurred[1]. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions[1,2].
6.	Instability of the slopes to the point where mass wasting or liquefaction has occurred due to earthquakes, differential settlement, or other causes.	• Reconstruction of slope segments where slumping, mass wasting, liquefaction, or other severe events have occurred[1]. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions[1,2].
7.	Encroachment of stream channels or gullies into the disposal facility or its buffer area.	• Reconstruction of cover or other features[1]. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions[1,2].
8.	Flood damage to the site in the form of new channels, or debris deposits.	• Reconstruction of cover or other features[1]. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions[1,2].
9.	Intrusion by man whereby cover materials have been removed.	• Reconstruction of cover or other features[1]. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions[1,2].

[1] This might involve general regrading in the area to modify drainage and/or the use of temporary drainage structures and controls to reduce run-off velocities until vegetation has been re-established.
[2] Severe or repetitive occurrences might best be addressed via a corrective action (see Section 10.0).

Table 9-2
SITE SECURITY SYSTEM
INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspection Frequency	Condition	Remedy	Maintenance
Fence	To be determined based upon observations during the period governed by the *OSDF Systems Plan*	• damaged fence fabric or posts • under fence erosion	• repair or replace as necessary • repair erosion or extend fence as necessary	• repair or replace as necessary • provide erosion and sedimentation control
Gates	To be determined based upon observations during the period governed by the *OSDF Systems Plan*	• tampering or damage to locks	• repair or replace as necessary	• install proper lock
Warning Signs	To be determined based upon observations during the period governed by the *OSDF Systems Plan*	• damaged or missing warning signs	• repair or replace as necessary	• install or re-attach warning signs to fence or gates

NOTES:
(1) Frequencies of inspection and maintenance activities are preliminary.
(2) Site security system shall be inspected after the occurrence of major earthquakes (see Section 11.3).

removal of woody weeds and seedlings, and reseeding. These activities will be performed as needed as identified during the routine inspections (see Section 7.0). Table 9-3 presents the custodial maintenance schedule for these features. When excessive localized depression is indicated by persistent water ponding, repair will be performed.

Table 9-3
CUSTODIAL MAINTENANCE SCHEDULE

Each April/May	• Implement treatments or repairs as indicated by September inspection. • Re-seed, lime and fertilize on 3-year cycles, as needed.
Each September	• Inspect site to determine adequacy of perennial vegetative (grass) cover, and to delineate erosion problems.
Each October	• Mow area inside fence to control invasion by woody species. • Evaluate options for less frequent mowing, and/or use of herbicides which affect only woody species.

Note that the need for, and frequency of, grass cutting will depend on the final seed mix selected for the OSDF final cover systems. Mowing shall occur at least once annually (in the late fall) at a time when the final cover system is reasonably dry. Mowing equipment shall not cause rutting or disturbance of topsoil. More frequent mowing will be specified, if needed, in a subsequent modification to this PCCI Plan (see Section 12.0).

Woody reproduction that develops on the OSDF final cover systems shall be eliminated mechanically, chemically, or by fire. Many woody species maintain the root systems when cut and rapidly resprout. The root system continues to grow through repeated cuttings and can become extensive. For this reason, chemical herbicides (spraying of individual trees and shrubs) or fire shall be preferred for woody species control, as eradication of the whole plant including the root system is a primary goal. A combination of mechanical and chemical treatment where cut stumps are treated with herbicide to prevent resprouting may also be considered. The most effective method for managing woody species vegetation will be evaluated for the OSDF by DOE based on available equipment, expertise, and cost.

Inspection/investigation, corrective maintenance, or contingency repair of the final cover may be required for one of the following reasons:

- formation of localized depressions caused by subsidence of the emplaced impacted materials;

- progressive deterioration of the cover caused by erosion; or
- destruction of a portion of the final cover by some gross physical event.

Settlement is not expected to be a significant problem as the OSDF contains little putrescible waste. In the case of localized depressions, it will likely be necessary to strip existing topsoil in the affected area and stockpile it in an adjacent area. General soil would then be used to fill the settled area to restore uniform grades in order to promote proper drainage. Topsoil would then be replaced. Where this phenomenon occurs in the upper cover, simple regrading and filling of the depression with compacted fill will likely be satisfactory. All affected areas will be reseeded and mulched immediately upon completion of repairs. The following are typical steps to repair excessive settlement:

1. When maintenance is required, the amount of soil needed should be estimated and arrangements for stockpiling or delivery should be made in advance in order to minimize the amount of time the repair area is disturbed.
2. Install temporary silt control and surface water controls.
3. Remove and stockpile topsoil and rooting soil layers. Segregate as necessary.
4. Clay can be added to the existing clay portion of the cover or the existing clay (or portions thereof) can be excavated and appropriate fill placed to bring the area to acceptable grades. Adding clay is preferred since the geosynthetic layer is not exposed and tie-in to adjacent clay is not necessary.
5. Document clay placement and compaction in accordance with the original construction quality assurance program (see *OSDF CQA Plan* [GeoSyntec, 1997c]).
6. Replace rooting and topsoil layers and revegetate. Care should be taken during final grading to assure the area is tracked perpendicular to the slope to minimize channelization of surface water.

Progressive deterioration of the cover caused by erosion will likely be addressed by reconstruction of the cover in that area and by amelioration of the erosion problem. This may involve some general regrading in the area to modify drainage and/or the use of temporary drainage structures and controls to reduce run-off velocities until vegetation has been re-established.

9.3.3 Run-on and Run-off Drainage Features

Diversion and drainage channels surrounding the OSDF function to collect run-off and divert run-on. The channels may require mowing and, from time to time, reshaping to control the run-off in a controlled manner. Vegetative growth in and around diversion channels will be maintained by periodic mowing and clearing. Mowing of the vegetation on the same schedule as the OSDF final cover system

(see Section 9.3.2) will ensure proper maintenance of the channels. Any large plants or seedlings will be removed to prevent sediment buildup and damage caused by roots. Reseeding and mulching will be performed as needed in bare areas to prevent excessive erosion.

During the routine inspections (see Section 7.0), the drainage channel(s) will be examined for erosion. Any problems identified by inspections will be repaired to conform as closely as possible to the original construction specifications and drawings. To the extent possible, appropriate measures will be taken to prevent problems from recurring.

Maintenance of the diversion channel system might be needed in areas of excessive sediment buildup, sloughing of banks, or plugging of culverts due to sediment and vegetation buildup. The grade control structures — rocks placed at an inlet, outlet, or along the length of a drainage channel — might also require maintenance for sediment and vegetation buildup. Appropriate actions will be taken to address these situations, including cleaning out and/or recontouring channels, repair of banks, and unplugging of culverts. Table 9-4 presents the inspection and custodial maintenance schedule for these features.

Table 9-4
DRAINAGE CHANNEL SYSTEM
INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspection Frequency	Condition	Remedy	Maintenance
Drainage Channels	To be determined based upon observations during the period governed by the *OSDF Systems Plan*	• free-flowing • clogging by sediment or debris • scouring, other evidence of erosion, or other damage	• None — desired condition • remove accumulated debris or sediment • repair damage	• None — desired condition • remove accumulated debris or sediment • maintain as-built or undertake corrective action
Grade control structures	To be determined based upon observations during the period governed by the *OSDF Systems Plan*	• free-flowing • clogging by sediment or debris • scouring, undermining, other evidence of erosion, or other damage	• None — desired condition • remove accumulated debris or sediment • repair damage	• None — desired condition • remove accumulated debris or sediment • remove emergent vegetation • maintain as-built or undertake corrective action
Culverts	To be determined based upon observations during the period governed by the *OSDF Systems Plan*	• free-flowing • clogging by sediment or debris • other damage	• None — desired condition • remove accumulated debris or sediment • repair damage	• None — desired condition • remove accumulated debris or sediment • maintain as-built or undertake corrective action

NOTES:
(1) Frequencies of inspection and maintenance activities are preliminary.
(2) Drainage system shall be inspected after the occurrence of major earthquakes (see Section 11.3).

10.0 POST-CLOSURE CORRECTIVE ACTIONS

10.1 Introduction

Previous sections of this plan address maintenance or repair activities for the OSDF, which are directed at routine or custodial problems. This section will discuss at the conceptual level the steps necessary to evaluate and correct situations of more significant concern. Those steps include:

- Preliminary assessment of situation,
- Development of technical approach and work plan,
- Identification of alternatives,
- Evaluations of alternatives,
- Identification of the preferred alternative,
- Public involvement,
- Selection of corrective action/response action alternative, and
- Implementation of selected alternative.

10.2 Future Corrective Actions/Response Actions

The following points are important to keep in mind, based upon legislation and regulations in effect at the time of formulation of this plan:

- The FEMP has been listed on the NPL

- "Response actions" under CERCLA are being/have been conducted at the FEMP to remediate the threats (or potential threats) to public health and the environment from past releases and potential releases at the FEMP

- Regardless of whether the FEMP is deleted from the NPL in the future, any future corrective actions/response actions needed for the FEMP also would be conducted as a "response action" under CERCLA, either as a removal action or a remedial action as appropriate to the situation.

The inspection and maintenance activities identified elsewhere throughout this plan will be the mechanism to identify, and address as appropriate, situations needing maintenance or repair activities of a custodial or routine nature. DOE will consult with EPA and OEPA whenever it identifies a situation believed worthy of more significant attention.

In that situation, the first focus will be identification of the perceived problem ("problem statement"). This should include, as possible based upon existing information, a preliminary assessment

of the nature of the problem and its threats to public health and the environment. This step is intended to be a remedial or removal site evaluation, as those terms are currently used in the National Oil and Hazardous Substances Pollution Contingency Plan [NCP, 40 CFR Part 300]. The intended outcome of this first step is an assessment of the seriousness of the situation and a determination of the time-criticalness of response action. From this, the appropriate course of CERCLA response action — removal action *vs.* remedial action — will be decided.

Regardless of removal *vs.* remedial course of action, the next step would be development of a technical approach, including identification of objectives, activities to fulfill those objectives, and associated timeframes. The embodying document would vary depending on the course of CERCLA response action identified as appropriate:

(1) if a time-critical removal action, this would be a removal action work plan;
(2) if a non-time-critical removal action, an engineering evaluation/cost analysis; and
(3) if a remedial action, a work plan for a focused feasibility study.

For the last two of the above, the process would address the remainder of the bullets stated above, which are repeated below for clarity:

- Identification of alternatives
- Evaluations of alternatives
- Identification of the preferred alternative
- Public involvement
- Selection of corrective action/response action alternative
- Implementation of selected alternative.

11.0 EMERGENCY NOTIFICATION AND REPORTING

11.1 Introduction

The FEMP OSDF was designed to comply with EPA and OEPA standards with minimum maintenance and oversight during the post-closure care period. However, unforeseen events could create problems that could affect the disposal facility's ability to remain in compliance with these standards. Therefore, the DOE has requested notification from local, state and federal agencies of discoveries or reports of any purposeful intrusion or damage at the site, as well as the occurrence of earthquakes, tornadoes, or floods in the area of the disposal facility. Such notification would trigger a contingency inspection, as discussed in Section 8.3.

11.2 Agency Agreements

The DOE will negotiate/has negotiated notification agreements with the Butler and Hamilton County Sheriff's Departments, and the National Weather Service. Copies of the agreements, once completed, will be presented in an appendix to this PCCI Plan. The designated point of contact for emergency notification is the 24-hour phone line recorded as Entry #3 in Table 4-2, will be/as recorded in these agreements and will be/as posted on the site signage so that the public can notify the DOE if problems are discovered.

In accordance with the agreements, the DOE (Entry #3 in Table 4-2) will be the designated facility emergency contact.

Contact lists and telephone numbers for all agencies with whom DOE has entered into agreements will be updated in conjunction with the site inspection, for inclusion in the site inspection report, and for inclusion into an appendix of this PCCI Plan as change pages as necessary.

11.3 Unusual Occurrences and Earthquakes

As the majority of the FEMP OSDF is within Hamilton County, the DOE has requested the Hamilton County Sheriff's Department notify the DOE (Entry #3 in Table 4-2) of any unusual occurrences in the area of the FEMP OSDF that may affect surface or subsurface stability, as well as any reports of vandalism or unauthorized entry. DOE has also requested the same from the Butler County Sheriff's Department.

Because the FEMP and its OSDF are (1) not in an active seismic zone, and (2) not constructed of or in lithified earth materials, the probability of occurrence of seismic events which could damage the

OSDF are slim. If they did occur, seismic events that could potentially damage the OSDF would manifest themselves in numerous ways in the area, the most apparent of which are:

- rupture of potable water supply lines,
- rupture of natural gas supply lines,
- rupture of natural gas transmission lines, etc.

These and other consequences of seismic events in the area of the FEMP would be readily discerned by an untrained observer without the aid of seismic monitoring equipment. The local sheriff's departments, which are tied in to emergency response mutual aid networks in the area, would be aware of the occurrence of any such seismic event in the area. Therefore, DOE will rely on notification from the sheriff's departments of any such potentially damaging seismic events in the FEMP area. Such notification would trigger a contingency inspection (see Section 8.3) that at a minimum would encompass the LCS (Table 6-1), LDS (Table 6-2), site security system (Table 9-2), and drainage systems (Table 9-4).

11.4 Meteorological Events

The National Weather Service, located |location to be determined|, has agreed to notify the DOE (entry #1 in Table 4-2) within |to be determined| hours of issuing a flash flood or tornado warning in Hamilton or Butler Counties, Ohio. |NOTE: these are to be determined prior to closure of the last cell of the OSDF.|

12.0 MODIFICATIONS OF POST-CLOSURE PLAN

12.1 Introduction

This section will identify conditions under which this plan may need to be modified/amended, and the mechanism/process by which to modify this plan. In accordance with appropriate regulations, modifications to the post-closure plan are allowed in recognition of the need to preserve flexibility during the post-closure care period in order to incorporate changes in conditions [Ohio hazardous waste rule OAC 3745-66-18(G), in lieu of federal hazardous waste regulations at 40 CFR §265.118(d) and (g), and §264.118(d)]. These subjects are discussed in the following subsections.

12.2 Conditions Triggering Potential Need for Modification

Currently anticipated conditions which might trigger a need to modify this plan include, but are not necessarily limited to, the following:

- At closure of the final cell of the OSDF — In order to incorporate as-built drawings of the OSDF and its permanent features, as well as to incorporate lessons learned to that point from the inspections and performance of the OSDF cells/phases that have been covered/closed.
- Change in any of the points of contact.
- Cessation of management of leachate [federal solid waste regulation 40 CFR §258.61(a)(2)], or change in the on-site *vs.* off-site management of leachate treatment/disposal [OAC municipal solid waste rules 3745-27-19(K)(5) & (6)].
- Changes in post-closure inspection or maintenance activities (e.g., a more extensive erosion control program is needed).
- Reduction in inspection frequency — After the first 5-year review after completion of OSDF closure activities, and no less frequently than subsequent 5-year increments, DOE will evaluate the need to continue the pre-established inspection frequency, basing its recommendation on an evaluation of annual reports and any other reports filed for maintenance or unscheduled events.
- Changes in surrounding land use (e.g., an increase in population density surrounding the facility may warrant increased security provisions during the post-closure care period).
- Temporary suspension or permanent deletion of one or more post-closure care requirements [Ohio hazardous waste interim standards rule OAC 3745-66-18(G)].

- Extension or reduction in length of post-closure care period — The post-closure care period may be extended or reduced at the discretion of the regulatory agency(ies), based on whether an extended period is necessary, or a reduced period is sufficient, to protect public health and the environment. Changes to the duration of the post-closure care period are allowable in accordance with appropriate regulations [federal solid waste regulation 40 CFR §258.61(b), and Ohio hazardous waste rule OAC 3745-66-18(G) in lieu of federal hazardous waste regulations 40 CFR §§265.117(a)(2) and (g), and §§264.117(a)(2) and (g)]. The justification for adjustment of period must make the demonstrations required by appropriate regulations [federal solid waste regulation 40 CFR §258.61(b), and Ohio hazardous waste rule OAC 3745-66-18(G) in lieu of federal hazardous waste regulations 40 CFR §§265.118(g)(1)(I) and 264.118(g)(1)(I)].

- Implementation of a corrective action or other response action.

12.3 Mechanism

If it is determined that a modification to the plan is necessary or warranted, DOE will modify this PCCI Plan (or sections or pages as appropriate) and submit the revision to the regulatory agency(ies) (EPA and OEPA, as appropriate per the regulations and enforceable agreements in effect at that time) for review and approval/concurrence. At present, the regulations and enforceable agreements in effect require that EPA review and approve any such modification, while OEPA receives the opportunity for review but not approval. It is currently anticipated that the regulatory agency(ies) may first review and comment on such proposed modification, in which case DOE would revise the proposed modification to address the review comments and then resubmit the proposed modification for further consideration.

DOE anticipates that substantive modifications (e.g., those beyond change sheets to update points of contact, changes to specifications for photographs, changes to inspection checklists, etc.) will be accompanied by appropriate public involvement opportunities, as discussed in Section 13.0.

13.0 COMMUNITY RELATIONS

The *Community Relations Plan for the U.S. Department of Energy Fernald Environmental Management Project, Fernald Ohio (CRP)* [DOE, 1995a] was revised in September/October 1994, and approved by Ohio EPA in December 1994 and by EPA in January 1995. The *CRP* complies with the public participation requirements of all applicable laws and regulations, including CERCLA, FFCA, NEPA, and the NCP, and also reflects EPA guidance in *Community Relations in Superfund: A Handbook* (January 1992).

The *CRP* provides details about how DOE will involve the public in decisions related to the site during the remedial activities phase of CERCLA response action at the FEMP. Supplemental activities identified in that plan pertinent to the post-closure care and inspection phase are summarized in Table 13-1. When practicable, the DOE will continue to offer public involvement opportunities — surpassing regulatory requirements — throughout the site cleanup.

The remedial action phase also is presented in Table 13-1 because it is similar to any corrective action/response action that might have to be undertaken during the post-closure period. In the event that a non-emergency corrective action/response action is required, the DOE would conduct public involvement activities *similar* to those during the CERCLA selection of remedy phase (remedial investigation, feasibility study, proposed plan) — an opportunity for public involvement relative to the findings on the condition(s), alternatives evaluated, the alternative recommended by the DOE to the regulatory agency(ies), etc. In the event that an emergency corrective action/response action is required, DOE's priority will be on addressing the emergency situation, with public involvement to follow.

Throughout the duration of FEMP remediation activities, the *CRP* may be revised to reflect changing community concerns, as well as changes in the law, regulations or regulatory agreements.

Table 13-1
PUBLIC INVOLVEMENT ACTIVITIES DURING REMEDIAL ACTIVITIES

CERCLA Remedial Action	CERCLA Operations & Maintenance/ Post-Closure Care
REQUIRED PUBLIC INVOLVEMENT ACTIVITIES	
Publish in a local newspaper of general distribution a *Notice of Availability* of documents submitted to the EPA under the remedial action [DOE commitment/directive].	Publish in a local newspaper of general distribution a *Notice of Availability* of any proposed substantive modification of this Plan submitted to the EPA for review [DOE commitment/directive].
Notify public prior to beginning of remedial action [40 CFR §300.435][1].	Publish in a local newspaper of general distribution a *Notice of Availability* for public comment of any proposed substantive modification of this Plan submitted to the EPA that has been approved for public comment; the public comment period shall be a minimum of 30 days [federal hazardous waste regulations 40 CFR §§265.112(c)(3) and 265.118(d)(4) and Ohio hazardous waste rule OAC 745-66-12(D)(4)].
SUPPLEMENTAL PUBLIC INVOLVEMENT ACTIVITIES[3]	
Maintain public involvement and dialogue.	
Offer availability sessions, public workshops, and public meetings.	
Conduct site tours.	
Provide briefings at township and community meetings.	
Issue fact sheets and newsletters to provide periodic updates describing cleanup activities.	
Conduct press briefings and issue news releases.	
Review/revise CRP.	

NOTES:
1. These activities are required by CERCLA under the NCP [40 CFR Part 300].
2. These activities, although not specifically required by CERCLA or the NCP for the CERCLA operations & maintenance phase, are required by the solid and/or hazardous waste regulations and rules as identified for the analogous post-closure care period.
3. Not all supplemental tools will be used as part of each public involvement process. DOE will work with the community to establish what tools will be used.

SOURCE:
Appendix B — Required and Supplemental Community Relations Activities, and Figure 5.1 — Technical Milestones and Associated Required and Supplemental Public Involvement Activities, *Community Relations Plan for the U.S. Department of Energy Fernald Environmental Management Project, Fernald, Ohio* (CRP), [DOE, 1995a].

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GROUNDWATER/LEAK DETECTION AND LEACHATE MONITORING PLAN

ON-SITE DISPOSAL FACILITY

AUGUST 1997

United States Department of Energy
Fernald Area Office

FINAL

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LIST OF ACRONYMS

ADM	analytical data management
ARARs	applicable or relevant and appropriate requirements
ASL	Analytical Support Level
AWWT	advanced wastewater treatment facility
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	constituent of concern
COC/RFA	Chain of Custody/Request for Analysis
CPTs	cone penetrometer tests
D&D	decontamination and demolition
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FAL	Field Activity Log
FD	Fluor Daniel
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FRL	final remediation level
HDPE	high density polyethylene
IEMP	Integrated Environmental Monitoring Plan
LCS	leachate transmission system
LDS	leak detection system
LTS	leachate transmission system
MS/MSD	matrix spike/matrix spike duplicate
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	record of decision
SCQ	Sitewide CERCLA Quality Assurance Project
SDWA	Safe Drinking Water Act
SED	Sitewide Environmental Database
SOP	Standard Operating Procedure
SWIFT	Sandia Waste Isolation Flow and Transport
TBC	to be considered criteria
TDS	total dissolved solids
TOC	total organic carbon
TOX	total organic halogens
UMTRCA	Uranium Mill Tailings Radiation Control Act
WAC	Waste Acceptance Criteria

1.0 INTRODUCTION

This document presents the groundwater/leak detection and leachate management monitoring program for the On-Site Disposal Facility (OSDF) at the U. S. Department of Energy's (DOE's) Fernald Environmental Management Project (FEMP). This plan is a support plan for the OSDF that is required by the Remedial Action (RA) Work Plan for the OSDF (DOE 1996e). Following its approval by the U. S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA), this plan will be used to monitor the performance of the OSDF.

As will be discussed in detail in this document, the monitoring program is divided into two primary elements: (1) a leak detection component, which will provide information to verify the ongoing performance and integrity of the OSDF and its impact on groundwater; and (2) a leachate monitoring component, which will satisfy regulatory requirements for leachate collection and management. The leak-detection monitoring layers (a leak detection layer inside the facility, and two groundwater zones occurring in the subsurface below the facility) will be utilized collectively to assess the existence of leakage from the facility and to satisfy OSDF groundwater monitoring requirements. The two groundwater zones in the monitoring plan are the Great Miami Aquifer (found at depths ranging from 45 to 90 feet beneath the facility) and the perched groundwater residing in the glacial till overlying the Great Miami Aquifer.

This OSDF monitoring plan has been developed to meet the regulatory requirements for groundwater detection monitoring in both the Great Miami Aquifer and the perched groundwater system. These detection monitoring requirements constitute the first tier of a three-tiered detection, assessment, and corrective action monitoring strategy required for engineered disposal facilities. Consistent with this three-tiered requirement, if, in the future, it is determined from detection monitoring that a leachate leak from the OSDF into the underlying natural hydrogeologic environment has occurred, follow-up groundwater quality assessment and corrective action monitoring plans will be developed and implemented as necessary. Conversely, if the detection monitoring continues to successfully demonstrate that leachate leaks are not of concern (i.e., the facility is performing as designed), then the monitoring program will remain in the first-tier "detection mode" and the need for the follow-up groundwater quality assessment and/or corrective action monitoring plans will not be triggered.

1.1 Overview of the On-Site Disposal Facility

The OSDF will ultimately provide on-site disposal capacity for an estimated 2.5 million cubic yards of contaminated soil and debris generated through the FEMP's environmental restoration and building decontamination and demolition (D&D) activities. The OSDF footprint (including the capped

area extending beyond the disposal area) is anticipated to occupy approximately 70 acres of the 1050-acre FEMP property. This area will be dedicated to disposal and will remain under federal administrative control following the completion of the FEMP's cleanup mission. The OSDF will be sited along the northeast portion of the FEMP property and, as required by the FEMP's Operable Unit 2, 3, and 5 Records of Decision, is situated over the "best available geology" at the FEMP to take maximum advantage of the protective hydrogeologic features of the glacial till above the Great Miami Aquifer.

The OSDF will be constructed in phases, with eight individual cells planned, plus a ninth contingency cell, if needed. Each individual cell is planned to be 700 feet by 400 feet, or 280,000 square feet (6.5 acres). Each individual cell will be constructed with a leachate collection system (LCS) to collect infiltrating rainwater (and storm water runoff during waste placement) and prevent it from entering the underlying environment. Other engineered features include a multi-layer composite liner system; a leak detection system (LDS) positioned beneath the primary liner; and a multi-layer composite cover that will be placed over each cell following the completion of waste placement activities. The LCS and LDS layers will each drain to the west to a point where the collected fluids will be removed from each layer for treatment (these LCS and LDS collection points are referred to as "sumps" for the remainder of this plan). The "sumps" represent the lowest elevational area of each cell and the location of the extraction piping needed to remove the collected fluids for subsequent treatment. By definition, these necessary features cause the "sumps" within each cell to be the most likely location for a potential leak to originate.

1.2 Program Overview

The OSDF monitoring plan was developed by reviewing the pertinent regulatory requirements for detection monitoring and translating those requirements into site-specific monitoring elements (designation of monitoring zones, monitoring station locations, sampling frequency, and establishment of analytical parameters). As the remaining sections of this plan will discuss, the OSDF monitoring strategy is responsive to monitoring needs both during the active remediation of the site and during the post-remediation period when restoration activities at the FEMP are complete. Similarly, the strategy recognizes the various operating phases of the OSDF including the periods before, during, and after waste placement, at which point the facility will enter a long-term post-closure care mode after the final cap is in place.

The plan also considers current hydrogeologic and contaminant conditions in the glacial till and Great Miami Aquifer beneath the facility. Pre-existing contamination in the perched groundwater system and the Great Miami Aquifer, the variable nature of the geology and hydrogeology of the clay-rich glacial deposits, and the influence of aquifer restoration activities in the Great Miami Aquifer

add complexity to the development of a groundwater monitoring program. The Great Miami Aquifer will be undergoing restoration during the same overall time period that the OSDF will be actively accepting waste for disposal. During the aquifer restoration activity, current flow conditions in the aquifer will be modified as new area-specific restoration modules are brought on line and other restoration modules are retired from service following attainment of restoration objectives within a particular area. Once aquifer restoration activities are complete, natural flow conditions in the aquifer, including those in the vicinity of the OSDF, are expected to be restored.

The development of the monitoring strategy and monitoring locations for the OSDF considered all of the available site-specific information that has been generated from more than ten years of detailed site characterization efforts at the site, including current representations of the site geology and hydrogeology, results of detailed contaminant fate and transport modeling, and the anticipated impacts of OSDF construction and groundwater remediation activities on the scope of the plan.

The overall strategy employs a four-layer vertical slice/trend analysis approach to independently monitor the potential for leachate generation and leakage from each of the individual disposal cells comprising the facility. As part of this strategy, "baseline" conditions for each individual cell will be established to facilitate trend analysis for data generated for each of the monitoring stations over time. The initial baseline condition for each cell will be established prior to actual waste placement in the individual cell (i.e., over a time period that extends up through construction of the cell's composite liner system and other elements necessary to prepare for waste placement). This initial baseline will help define existing conditions in both the perched groundwater and the Great Miami Aquifer in the immediate vicinity of the facility.

This plan focuses primarily on the monitoring needs associated with active cell operations and the definition of the baseline. Future amendments to the plan will be prepared to address program modifications as necessary for each cell once waste placement is complete and the cell has been capped. At that point in time, the cell will enter its inactive (post-closure care) mode. An in-depth review of program needs is also envisioned at the completion of Great Miami Aquifer restoration activities and the return of natural flow directions and rates in the aquifer. At that point, formal long-term upgradient to downgradient comparisons of analytical data gathered for the Great Miami Aquifer can effectively begin, a key regulatory requirement for detection monitoring. Prior to the closure of the cells and the completion of the aquifer restoration activities, the data comparisons will focus on shorter-term "interim" leakage effects that might potentially occur during active cell operations. The initial baseline established at the beginning of cell operations will enhance the ability to conduct the interim comparisons until the facility enters its final long-term post-closure mode and aquifer restoration activities are complete.

Throughout this process, the analytical results and trend analyses for all three leak-detection monitoring layers (the LDS, perched groundwater, and the Great Miami Aquifer) and the LCS will be compared with one another to evaluate the overall performance of each cell and to determine whether a release from the facility has occurred. In concert with the groundwater monitoring component of the program, the leachate characterization and tracking component will provide for the monitoring of leachate concentrations and flows in the LCS and LDS to support leachate management and treatment decisions.

As part of this effort, contaminant concentrations in the leachate (if present) collected from the LCS and LDS will be compared to one another and to the groundwater concentrations in the perched groundwater and Great Miami Aquifer monitoring systems. Additionally, trend analysis of the LCS and LDS flow monitoring measurements will be conducted in order to provide indication of changes in trends in containment system performance far enough in advance to allow application of appropriate follow-up inspection and corrective action measures as necessary.

During the development of this plan, EPA and OEPA identified the need to monitor the potential for leachate leakage from the OSDF at its first point of entry into the natural hydrogeologic environment (rather than relying on Great Miami Aquifer groundwater monitoring alone). This led to the decision to install horizontal monitoring wells in the glacial till directly beneath the "sumps" of the LCS and LDS layers in each cell. The subsurface area beneath the "sumps" is considered to provide the best opportunity to monitor for an initial leak into the subsurface environment, should such a leak occur. As a result of the low transmissive properties of the glacial till and the discontinuous nature of the perched groundwater system in the till, it may not be possible to collect fluids routinely from the horizontal wells. In view of this limitation, DOE, EPA, and OEPA concur that the placement of the horizontal wells beneath the sumps represents the most feasible site-specific approach to monitor for first-entry leakage from the facility to the FEMP environment, and this approach will provide adequate and appropriate early-warning detection capabilities for this site-specific setting.

Once approved, the groundwater monitoring plan will be implemented as a project-specific plan for the OSDF, with the results presented for EPA and OEPA review as part of the FEMP's comprehensive Integrated Environmental Monitoring Plan (IEMP). The IEMP will provide a consolidated reporting mechanism for all of the FEMP's individual environmental regulatory compliance monitoring activities including the data and findings for this OSDF groundwater monitoring plan. Incorporating the OSDF data into the IEMP will maintain the FEMP's continued commitment to an effective remediation-focused environmental surveillance monitoring program. Once the FEMP has completed its environmental remediation requirements and the site is successfully removed from the Superfund National Priorities List (NPL), the monitoring activity for the OSDF (which will be the last

remaining facility in place at the site) will continue in accordance with applicable regulatory monitoring and reporting requirements.

1.3 Plan Organization

The remainder of this plan is organized as follows:

- A summary of the geology and hydrogeology in the immediate area of the OSDF is provided in Section 2.0;
- A regulatory analysis and strategy for OSDF monitoring is provided in Section 3.0;
- The OSDF leak detection monitoring program is provided in Section 4.0, including a description of program elements, monitoring frequencies, selection of analytical parameters, and data evaluation; and
- The OSDF leachate management monitoring program, which will be used to support leachate management decisions, is provided in Section 5.0;
- Reporting requirements and notifications are provided in Section 6.0; and
- References are provided in Section 7.0.

The four appendices that support the plan are:

- Appendix A - OSDF ARARs and Other Regulatory Requirements
- Appendix B - Sampling and Analysis Requirements
- Appendix C - Quality Assurance/Quality Control
- Appendix D - Data Management Plan

1.4 Related Plans

Several other remedial action plans being prepared for the OSDF, or for the FEMP site as a whole, contain information relevant to this plan. These other plans are listed below along with a brief statement of their relationship to this plan:

- *OSDF Systems Plan* (GeoSyntec, 1996b): describes the inspection and maintenance for the LCS and LDS prior to closure of the OSDF.
- *OSDF Post-Closure Care and Inspection Plan* (FERMCO, 1996): describes the post-closure care and inspection for the LCS and LDS, and summarizes at the conceptual level corrective actions/response actions.

- *IEMP* (DOE, 1997): describes FEMP sitewide environmental monitoring efforts and the requirements for reporting on environmental monitoring, including the data collected from this OSDF monitoring program.

2.0 OSDF AREA GEOLOGY AND HYDROGEOLOGY

2.1 Introduction

The Operable Units 2, 3, and 5 Records of Decision contain requirements that the OSDF be located in an on-site area of the FEMP that takes maximum advantage of available geologic and hydrogeologic conditions to further reduce the potential for contaminant migration from the facility. To identify the preferred OSDF location, a detailed predesign geotechnical and hydrogeologic investigation was conducted as a supplement to the sitewide characterization efforts contained in the Operable Unit 5 Remedial Investigation (RI) Report (DOE, 1995d). The detailed findings of the predesign investigation are documented in the Predesign Investigation and Site Selection Report for the OSDF (DOE, 1995c). As documented in the site selection report, a final site location along the eastern margin of the FEMP was selected to satisfy the Records of Decision and other regulatory-based siting requirements.

The following sections summarize the principal geologic, hydrogeologic, and subsurface contaminant conditions in the OSDF site area that have a direct bearing on the development of the leak detection and groundwater monitoring strategy for the facility. For more detailed information, the reader is referred to the Predesign Investigation and Site Selection Report and the Operable Unit 5 RI Report.

2.2 OSDF Area Geology

The OSDF, inclusive of its final cap configuration, is expected to occupy an area of approximately 70 acres along the eastern margin of the FEMP. The facility will be oriented in a north to south direction with ultimate dimensions at closure expected to be 3900 feet by 1000 feet. The facility will be set back from the eastern property line by approximately 300 feet. The subsurface conditions in the immediate area of the selected OSDF location have been characterized through the following field and laboratory activities:

Test Borings	Fifty-four (54) borings were drilled in the immediate vicinity of the OSDF to obtain geotechnical soil samples and characterize underlying geology
Monitoring Wells	Fifty-one (51) groundwater monitoring wells were installed in the general vicinity of the OSDF from which water level, pre-existing groundwater contaminant concentration data, and lithology data have been obtained

Geotechnical Tests	Key geotechnical tests (i.e., Atterberg limits, water content measurements, and permeability tests) were performed on subsurface geologic samples including 116 grain-size sieve analyses.
Lysimeter Installation	Eight (8) lysimeters were installed in the OSDF site area to determine the nature and concentration of uranium in the vadose zone of the glacial till and the unsaturated Great Miami Aquifer.
Slug Tests	Twenty-four (24) slug tests were performed to assess the hydraulic characteristics of the perched groundwater system.
Water Level Monitoring	Water levels obtained from the perched groundwater and the Great Miami Aquifer wells were used to determine hydraulic gradients and flow directions
Soil Analyses	Soil samples collected during the RI and the Predesign Investigation were analyzed for uranium and other constituents of concern to determine pre-existing contaminant levels in the subsurface beneath the OSDF
Groundwater Flowmeter Study	Twenty-two (22) flowmeter readings were obtained in the perched groundwater in the OSDF site area.
K_d Study	A distribution coefficient (K_d) study was performed to determine how uranium will partition itself between groundwater and soil in the OSDF site area.
Cone Penetrometer Tests (CPTs)	Eighty-eight (88) CPTs were conducted in the OSDF site area to aid in making subsurface lithologic interpretations.

The information obtained through these activities, coupled with the sitewide interpretations gained through the Operable Unit 5 RI, form the basis for the current interpretations of subsurface conditions in the vicinity of the OSDF site.

In general, the OSDF site is situated on glacial till underlain by sand and gravel deposits which comprise the Great Miami Aquifer, designated as a sole source aquifer under the Safe Drinking Water Act (SDWA). The Great Miami Aquifer is a high-yield aquifer (wells completed in some areas of the aquifer yield greater than 500 gallons of water per minute) and supplies a significant amount of potable and industrial water to people located in Butler and Hamilton counties.

The glacial till ranges in thickness from approximately 20 to 60 feet in the immediate vicinity of the OSDF. Based on the results of 116 sieve and hydrometer analyses, the till can be characterized

as a dense, heterogeneous sandy lean clay, with occasional discontinuous interbedded sand and gravel lenses. The glacial till can be further divided into an upper brown clay layer and a lower gray clay layer. The brown clay layer is more weathered and contains a greater abundance of desiccation fractures compared to the underlying gray clay layer, and a higher incidence of interbedded sand and gravel lenses. In the eastern portions of the FEMP, the gray clay ranges in thickness from approximately 15 to 42 feet, and the brown clay ranges from approximately 8 to 15 feet. As indicated sitewide by the Operable Unit 5 RI, the gray clay is the most uniform and least permeable (and therefore most protective) geologic layer found above the Great Miami Aquifer.

As a follow-up to the Operable Unit 5 RI, one of the primary objectives of the Predesign Investigation was to identify the location where the thickest laterally persistent gray clay layer is present that contains the least amount of interbedded coarse granular material and which allows regulatory-based siting requirements (such as property-line and other geographic setbacks) to be met. The selected location for the OSDF has a minimum thickness of gray till of approximately 15 feet and an average thickness of approximately 30 feet. The percentage of interbedded sands and gravels in the gray till in this area is approximately four percent.

Beneath the glacial till layer, the sand and gravel deposits comprising the Great Miami Aquifer are approximately 175 feet thick. For RI characterization and monitoring purposes, the Great Miami Aquifer deposits have been divided into three geologic zones: the uppermost zone, represented by the FEMP's Type 2 monitoring wells; the middle zone, represented by the Type 3 monitoring wells; and the lowermost zone, represented by the Type 4 monitoring wells. The sand and gravel deposits comprising the aquifer are really extensive and, at the regional scale, occupy a land area of more than 970,000 acres.

Beneath the Great Miami Aquifer deposits, shale and limestone bedrock is encountered at a total depth of approximately 200 feet beneath the planned OSDF site. Regional studies by the Geological Survey of Ohio indicate the shale and limestone bedrock is approximately 330 feet thick in the FEMP area (Fenneman, 1916).

2.3 Hydrogeologic Conditions

The FEMP has two distinctive bodies of groundwater that have been extensively characterized through the remedial investigation/feasibility study (RI/FS) process and the Predesign Investigation: the Great Miami Aquifer, and the perched groundwater found within the overlying glacial till. The discontinuous sand and sand/gravel lenses found within the glacial till can provide water to a pumping well because the deposits are more permeable than the surrounding less permeable clay-rich glacial till.

The entire section of glacial till is believed to be saturated or near-saturated with groundwater. An unsaturated sand and gravel zone approximately 20 to 30 feet thick separates the base of the glacial till from the regional water table in the Great Miami Aquifer. Depending on localized weather patterns and rainfall, the water table in the Great Miami Aquifer fluctuates up to eight feet yearly within the unsaturated zone separating the two groundwater systems.

The Great Miami Aquifer is a classic example of an unconfined buried valley aquifer. The depth to water in the aquifer in the vicinity of the OSDF ranges from 45 to 90 feet below the ground surface. The groundwater flow direction in the aquifer in this area under natural conditions is from west to east, with an average hydraulic gradient of approximately 6.25×10^{-4} ft/ft. Based on pump test data and other hydraulic information collected during the RI/FS process, the average hydraulic conductivity of the aquifer is approximately 1.6×10^{-1} cm/sec, the average effective porosity is approximately 30 percent, and the bulk density averages 1.8 g/cm^3. Using the representative distribution coefficient (K_d) for uranium of 1.78 L/kg determined through the RI/FS process, the retardation factor for uranium movement in the Great Miami Aquifer is 12. Using the above parameters, the average groundwater flow velocities in the Great Miami Aquifer are approximately 345 ft/year, and thus uranium in the aquifer would be expected to migrate at an average rate of approximately 30 ft/year.

Perched groundwater is present above the unsaturated zone of the Great Miami Aquifer within the glacial till. Overall the till exhibits between 90 to 100 percent saturation (close to field capacity) and has the general properties of an aquitard. When the till reaches field capacity it has the capability to release groundwater downward under a unit vertical hydraulic gradient into the underlying unsaturated zone of the Great Miami Aquifer. Eventually, this downward moving groundwater will enter the saturated portion of the Great Miami Aquifer as recharge. Depths to perched groundwater in the till are generally 6 feet or less in the eastern portion of the FEMP in the area of the OSDF.

Although the till is generally saturated, there are no identified suitably thick or laterally continuous coarse-grained zones beneath the OSDF that can facilitate implementation of a comprehensive, interlinked (i.e., up and downgradient monitoring points) perched groundwater monitoring system. The present amount of saturation in the till is expected to be reduced even further in the future, once the cap and underlying liners of the OSDF are in place which will serve as local hydraulic barriers to further reduce the quantity of infiltrating moisture within the OSDF footprint.

Slug test data from 24 perched groundwater wells (the Type 1 monitoring wells) indicate that the average horizontal hydraulic conductivity for wells screened across the brown and gray clay layer interface is 6.30×10^{-6} cm/sec. The gray clay layer beneath the brown clay is the least permeable layer above the Great Miami Aquifer. Laboratory hydraulic conductivities conducted on samples collected

from this layer indicate measured values ranging from 9.53 x 10^{-9} cm/sec to 5.83 x 10^{-8} cm/sec. Other laboratory and field measurements indicate the till has an effective porosity of four to ten percent, and a representative bulk density of 1.85 g/cm^3. The discontinuous nature of the perched water in the glacial till does not facilitate the measurement of a continuous water table gradient in the OSDF site area.

Model calibration studies conducted during the Operable Unit 5 RI/FS indicate average vertical groundwater flow rates through the glacial till (including the gray clay layer) to be approximately six inches per year. The time it takes a contaminant to move through the glacial till and break through into the Great Miami Aquifer is controlled by the thickness of gray clay present in the till, the groundwater infiltration rate through the gray clay, and the retardation properties of the gray clay. In the OSDF site area, modeled breakthrough travel times for uranium, the FEMP's predominant contaminant, range from approximately 210 years (to have a 20 μg/L concentration in the aquifer) to 260 years (to have one percent of the source concentration). These breakthrough times were calculated using a retardation factor of 165 for the gray clay, not taking any credit for movement through the brown clay, and not including any retardation in the unsaturated Great Miami Aquifer sand and gravel. The modeled breakthrough travel time for one percent of a technetium source, the FEMP's most mobile contaminant, is approximately 3.6 years. This breakthrough time was calculated using a retardation factor of 2.29 for the gray clay, not taking any credit for movement through the brown clay, and not including any retardation in the unsaturated Great Miami Aquifer sand and gravel. This modeling strategy was later used in the Operable Unit 5 Feasibility Study (FS) to calculate Waste Acceptance Criteria (WAC) for the OSDF.

The extensive presence of low permeability lean sandy clay throughout the till matrix and the discontinuous nature of the coarser grained lenses are the dominant factors controlling the rate at which fluids can migrate through the more permeable portions of till, either vertically or laterally.

Unlike conditions in the Great Miami Aquifer, the upgradient and downgradient directions of perched groundwater flow are difficult to assign at the local scale. Groundwater flow meter readings from 22 wells taken during the Predesign Investigation indicate that the horizontal flow directions vary abruptly from well to well, with no consistent patterns discernable. Consequently, horizontal flow regimes are interpreted to be very localized in nature (perhaps on the order of tens to hundreds of feet in length) and not laterally persistent due to the discontinuous nature of the interbedded coarse grained lenses. Taken collectively, the water levels obtained during the Operable Unit 5 RI indicate that if an area gradient were present it would range between 0.008 to 0.015.

Model calibration studies conducted during the Operable Unit 5 RI/FS indicate that vertical flow tends to dominate in the glacial till because of several factors: 1) the steep vertical hydraulic gradients across the till -- which are at or near unity -- compared to the small localized lateral hydraulic

gradients which collectively indicate a gradient that is much less than unity (0.008 to 0.015); 2) the laterally discontinuous nature of the coarse grained lenses in the till; and 3) the shorter overall flowpath distance in the vertical dimension for the FEMP site (60 feet compared to hundreds or thousands of feet in the horizontal) before a potential discharge point for the glacial till groundwater is reached.

It can be generally interpreted from this information that if a leachate leak was able to exit through the OSDF liner system, it would be expected to migrate vertically towards the Great Miami Aquifer (although some localized "stair-step" motion laterally may also be expected to take place in route). The exact pathway(s) that a hypothetical leachate leak from the facility would take is difficult to differentiate, but it is clear that an effective monitoring program needs to consider both the most likely point of entry of the leak into the subsurface environment beneath the facility and the ultimate arrival of the leak at the Great Miami Aquifer, should it occur.

2.4 Existing Contamination

In the immediate vicinity of the OSDF, existing contaminant concentrations are present above background levels in surface and subsurface soil, the perched groundwater, and the Great Miami Aquifer. The nature and extent of contamination in these three media was documented sitewide in the Operable Unit 5 RI Report and preliminary remediation levels were developed for the FEMP's environmental media in the Operable Unit 5 FS (DOE 1995a). Final remediation levels (FRLs) were documented in the Operable Unit 5 Record of Decision.

Based on the data presented in the Operable Unit 5 RI Report, only the surface soil (to a depth of approximately six inches) is considered to be contaminated above FRLs within the actual boundaries of the OSDF. The remaining media within the OSDF footprint are contaminated above background, but generally below FRLs. An area of deep soil excavation to address deep soil and perched groundwater contamination is planned just outside the OSDF at the FEMP's sewage treatment plant, located immediately east of the OSDF. This area is the closest planned excavation necessary to address soil FRL exceedances that are deeper than six inches.

The nearest area of the Great Miami Aquifer that is contaminated above FRLs, and is thus targeted for remediation, occurs in the vicinity of Plant 6 approximately 330 feet west of the OSDF. Sporadic and isolated detections of constituents in the Great Miami Aquifer above the FRLs are observed from time to time at the FEMP's property boundary (located approximately 300 feet east of the OSDF), but these isolated detections are not considered to be part of a definitive plume requiring remediation. These detections will continue to be tracked as part of the IEMP property boundary activity.

In accordance with the Operable Unit 5 Record of Decision, remedial actions for surface and subsurface soil, the perched groundwater in the glacial till, and the Great Miami Aquifer are to be implemented at all sitewide locations where FRLs are exceeded. However, at the completion of the sitewide remedial actions, low levels of some contaminants (i.e., above background levels but below FRLs) are expected to remain in the various environmental media at the FEMP, including the area adjacent to and beneath the OSDF. This residual low-level contamination that will remain after cleanup is recognized as a factor that creates a degree of uncertainty in the ability to distinguish small quantities of potential OSDF leakage from the pre-existing levels of contamination in the media. A strategy to accommodate this uncertainty factor in the development of the monitoring plan is provided in Section 4.0.

3.0 REGULATORY ANALYSIS AND STRATEGY

The OSDF groundwater/leak detection and leachate monitoring plan is designed to comply with all regulatory requirements associated with groundwater detection monitoring and leachate monitoring for disposal facilities. The source of these regulatory requirements are the applicable or relevant and appropriate requirements (ARARs) listed in the Records of Decision for Operable Units 2, 3, and 5. This section summarizes the regulatory requirements by describing each ARAR, and presents the regulatory strategy for compliance with these ARARs.

3.1 Regulatory Analysis Process and Results

The analysis of the regulatory drivers for groundwater monitoring for the OSDF was conducted by examining the suite of ARARs in the FEMP's approved Operable Unit Records of Decision to identify a subset of specific groundwater monitoring requirements for on-site disposal facilities. Three Records of Decision include requirements related to on-site disposal – Operable Units 2, 3, and 5. The Records of Decision for these three operable units were reviewed and the ARARs relevant to the OSDF identified. The results of this review are tabulated in Appendix A and summarized below.

The following sets of regulations were identified as being ARARs for the OSDF groundwater monitoring program:

- Ohio Solid Waste Disposal Facility Groundwater Monitoring Rules, Ohio Administrative Code (OAC) 3745-27-10, which specify groundwater monitoring program requirements for sanitary landfills. These regulations describe a three-tiered program for detection, assessment, and corrective measures monitoring.

- Resource Conservation and Recovery Act (RCRA)/Ohio Hazardous Waste Groundwater Monitoring Requirements for Regulated Units, 40 Code of Federal Regulation (CFR) 264.90 through .99 (OAC 3745-54-90 through 99), which specify groundwater monitoring program requirements for surface impoundments, landfills, and land treatment units that manage hazardous wastes. Similar to the Ohio Solid Waste regulations, these regulations describe a three-tiered program of detection, compliance, and corrective action monitoring. Because the Ohio regulations mirror or are more stringent than the federal regulations, the Ohio regulations are the controlling requirements and are cited within this document.

- Uranium Mill Tailings Reclamation and Control Act (UMTRCA) Regulations, 40 CFR 192.32(A)(2), which specify standards for uranium byproduct materials in piles or impoundments. This regulation requires conformance with the RCRA groundwater monitoring performance standard in 40 CFR 264.92. Compliance with RCRA/Ohio Hazardous Waste regulations for groundwater monitoring will fulfill the substantive requirements for groundwater monitoring in the UMTRCA regulations.

- DOE Order 5820.2A Chapter III.3.k, Environmental Monitoring, which requires low-level radioactive waste disposal facilities to perform environmental monitoring for all media, including groundwater. Compliance with RCRA/Ohio Hazardous Waste and Ohio Solid Waste regulations for groundwater monitoring will fulfill the requirement for groundwater monitoring in this Order, along with incorporating pertinent radiological parameters.

The following drivers were determined to govern the leachate monitoring plan:

- Ohio Municipal Solid Waste Rules, OAC 3745-27-06(C)(7), which requires that facilities prepare a leachate monitoring plan to ensure compliance with OAC 3745-27-19(M)(4)

- Ohio Municipal Solid Waste Rules--Operational Criteria for a Sanitary Landfill Facility, OAC 3745-27-19(M)(4)&(5), which requires submittal of an annual operational report including:

  - a summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year, location of leachate treatment and/or disposal, and verification that the leachate management system is operating in accordance with the rule, and;

  - results of analytical testing of an annual grab sample of leachate from the leachate management system.

3.2 OSDF Monitoring Regulatory Compliance Strategy

Of the ARARs presented above, the Ohio Solid Waste and the Ohio Hazardous Waste regulations are the most prescriptive, and therefore warrant further discussion on how compliance with these two regulatory requirements will be met. The leak detection monitoring requirements of these two sets of regulations are similar, and dictate the development of detection monitoring plans capable of determining the facility's impact on the quality of water in the uppermost aquifer and any significant zones of saturation above the uppermost aquifer underlying the landfill. Typically a detection monitoring program consists of the installation of upgradient and downgradient monitoring wells, routine sampling of the wells and analysis for a prescribed list of parameters, followed by a comparison of water quality upgradient of the landfill to water quality downgradient of the landfill. The detection of a statistically significant difference in downgradient water quality suggests that a release from the landfill may have occurred. As discussed in Section 2.0, low permeability and pre-existing contamination within the glacial till, and the implementation of a site-wide groundwater remedial action, add complexity to the development of a groundwater detection monitoring program consistent with the standard approach of the Solid and Hazardous Waste regulations. Both sets of regulations accommodate such complexities by allowing alternate monitoring programs, which provide flexibility with respect to well placement, statistical evaluation of water quality, facility-specific analyte lists, and sampling frequency. The OSDF groundwater/leak detection monitoring program will require the use

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of an alternate monitoring program, in accordance with the criteria in the Ohio Solid and Hazardous Waste regulations. Compliance with the criteria is discussed below in Section 3.2.1.

The regulatory requirements for the leachate monitoring program are provided by the Ohio Solid Waste regulations. The compliance strategy for the leachate monitoring program is discussed below in Section 3.2.2.

3.2.1 Leak Detection Monitoring Compliance Strategy

As described above and in Section 1.0, the groundwater/leak detection monitoring program for the OSDF will include routine sampling and analysis of water drawn from four zones within and beneath the disposal facility including the LCS, the LDS, perched water within the glacial till, and the Great Miami Aquifer. This four-layered "holistic" approach allows for the earliest leak detection from the OSDF given the unique hydrogeologic and pre-existing contaminant situation at the site. However, this tailored approach differs from a typical leak detection monitoring program in several ways, and requires a compliance strategy to ensure that the program meets or exceeds the substantive requirements within the Ohio Solid and Hazardous Waste regulations. Below is a detailed discussion of compliance with several elements of the program, including alternate well placement, statistical analysis, monitoring frequency, and parameter selection. The implementation of the OSDF groundwater/leak detection program is presented in Section 4.0.

3.2.1.1 Alternate Well Placement

The Ohio Solid Waste regulations require that a groundwater monitoring system consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from both the uppermost aquifer and any overlying *significant zones of saturation* (OAC 3745-27-10(B)(1)). Groundwater samples will be obtained through wells installed in the glacial till as well as the Great Miami Aquifer. The regulations also state that the wells must represent the quality of groundwater passing directly downgradient of the limits of solid waste placement (OAC 374-27-10(B)(1)(b)). In lieu of installing vertical glacial till monitoring wells along the perimeter of the OSDF, horizontal wells will be installed beneath the OSDF and screened beneath the sumps of the LDS of each disposal cell, where the greatest potential for leakage exists. Horizontal wells are preferred to vertical wells due to restrictions on well installation within 200 feet of waste placement so as to avoid interference with the disposal facility cap, and the absence of significant lateral flow within the overburden. The time required for contaminants to migrate laterally in the till toward wells located 200 feet from the limits of waste placement greatly exceeds the vertical travel time through the overburden; therefore, the aquifer would be impacted by contaminants long before OSDF glacial overburden perimeter wells could detect the release. Although the existence of the OSDF may result in

dewatering of the glacial till such that samples cannot be regularly obtained, horizontal wells installed beneath the liner of the OSDF represent the highest potential for detecting releases to the till. Such an alternate placement for the till wells is allowed in the Ohio Solid Waste regulations. The performance criteria in OAC 3745-27-10(B)(4) requires that the number, spacing, and depth of the wells must be based on site-specific hydrogeologic information and must be capable of detecting a release from the facility to the groundwater at the closest practicable location to the limits of solid waste placement. The placement of till wells beneath the facility, as opposed to along its perimeter, meets or exceeds the requirement to be located adjacent to waste placement.

3.2.1.2 Alternate Statistical Analysis

A statistical analysis is required in both the Ohio Solid and Hazardous Waste regulations (OAC 3745-27-10(C)(6) and OAC 3745-54-97(H)). The statistical analysis methods listed in the regulations are: parametric analysis of variance, an analysis of variance based on ranks, a tolerance or prediction interval procedure, a control chart approach, or another statistical test method. The preferred method of evaluation for the OSDF groundwater/leak detection monitoring data is an intra-well trend analysis following the establishment of baseline conditions in the till and Great Miami Aquifer beneath the OSDF. Although vertical monitoring wells will be installed in the Great Miami Aquifer upgradient and downgradient of the OSDF, an intra-well comparison is more appropriate than an up- versus down-gradient comparison until aquifer restoration is complete. The groundwater extraction associated with the aquifer restoration will cause variation of the flow directions throughout the restoration. Initiation of pumping in the vicinity of Plant 6 will reverse the flow direction beneath the OSDF for the duration of the Plant 6 extraction operation. Transient flow conditions within the aquifer, as well as the existence and anticipated fluctuation of contaminant concentrations at levels below the final remediation levels, discourages the use of a statistical comparison of upgradient and downgradient water quality as a reliable indicator of a release from the OSDF. Once the aquifer restoration has been completed, and the hydraulic conditions in the Great Miami Aquifer have been stabilized, a standard up- versus down-gradient water quality comparison will be initiated using an appropriate statistical method.

3.2.1.3 Alternate Parameter Lists

The intra-well trend analysis discussed above will be performed for all facility-specific indicator parameters. The process used to select the indicator parameter list, described in detail in Section 4.5, utilized the extensive RI database and fate and transport modeling to evaluate potential indicator parameters. RIs have been completed for all FEMP source terms and contaminated environmental media. The RIs included extensive sampling and analysis to characterize wastes and quantify environmental contamination so that health protective remedies, such as the construction of the

OSDF, could be selected. The extensive databases were also used to develop WACs that consist of concentration- and mass-based limitations on the waste entering the OSDF. The WAC for the OSDF were developed with consideration of the types, quantities, and concentration of wastes that would be placed into the OSDF; the leachability, mobility, persistence, and stability of the waste constituents in the environment, and the toxicity of the waste constituents. Of 93 constituents that were evaluated for waste acceptance, 18 constituents were identified as having relatively higher potential to impact the aquifer within the 1000-year specified performance period. Maximum allowable concentration limits were established for wastes containing these constituents.

The factors used to establish WAC are similar to the consideration criteria for development of an alternate parameter list specified in the Ohio Solid and Hazardous Waste regulations [OAC 3745-27-10(D)(2) and (3); OAC 3745-54-93(B); OAC 3745-54-98(A)] and OEPA policy and guidance (Solid Waste Policy DDAGW-04-03-221, Interim Solid Waste Guidances GD0403.222 and GD0403.205). The methodology for developing an OSDF-specific leak detection monitoring parameter list utilized the WAC methodology and the Ohio Solid and Hazardous Waste regulatory criteria to identify waste constituents that are expected to be derived from wastes placed in the OSDF, and will be reliable indicators of a release from the OSDF.

3.2.1.4 Alternate Sampling Frequency

The Ohio Solid Waste regulations require that, for detection monitoring, at least four samples from each well be taken to determine the baseline water quality during the first 180 days after implementation of the groundwater detection monitoring program (OAC 3745-27-10(D)(5)(a)(ii)(*a*)). Implementation of the monitoring program must be initiated prior to waste receipt (OAC 3745-27-10(A)(2)(b)), presumably to ensure that at least one sample for the baseline determination is obtained before any waste is placed within the disposal facility. The Ohio Hazardous Waste regulations do not specify a frequency for determining a baseline dataset. A typical statistical test for a hazardous waste disposal facility requires an up- versus down-gradient comparison of background water quality to downgradient water quality. This type of comparison is inappropriate for the OSDF during the time period that aquifer restoration operations are underway (discussed in Section 4.3). The Ohio Hazardous Waste regulations do require a performance standard for establishing background, in OAC 3745-54-97(G), which states that the number and kinds of samples taken to establish background be appropriate for the statistical test employed. While baseline is established during the first year of monitoring, the frequency will be approximately monthly for up to 12 sampling events prior to waste placement or until waste placement is initiated. This frequency meets the Ohio Hazardous Waste performance standard and exceeds the minimum frequency requirement within the Ohio Solid Waste regulations. The monthly baseline frequency was selected so as to develop an appropriate statistical procedure and to compensate for the varying temporal conditions in the groundwater flow direction and chemistry due to the remedial action and seasonal fluctuations.

The Ohio Solid Waste regulations require a semiannual sampling frequency for detection monitoring but also allow for the proposal of an alternate sampling program (OAC 3745-27-10(D)(5)(a)(ii)(*b*) and (b)(ii)(*b*) and 3745-27-10(D)(6)). During active cell operations, the sampling frequency for the OSDF groundwater/leak detection monitoring program will be quarterly for the indicator parameters, which exceeds the semiannual frequency requirement.

3.2.2 Leachate Monitoring Compliance Strategy

The Solid Waste regulations (OAC 3745-27-19(M)(5)) require collection and analysis of leachate on an annual basis for parameters listed in Appendix I of OAC 3745-27-10. Leachate samples in the LCS will be collected on a quarterly basis and analyzed for parameters to support leachate treatment and discharge, as well as the annual analysis for Appendix I parameters. The annual grab sample analysis for Appendix I parameters will ensure the accuracy of assumptions regarding the nature of wastes within the OSDF that were used to develop the groundwater/leak detection parameter list. Although constituents may be detected in the annual grab that are not part of the indicator parameter list for leak detection, it is not anticipated that the concentrations will be high enough to warrant revision of the leak detection parameter list. The quarterly leachate analysis will ensure that the character of the leachate will not adversely impact the advanced wastewater treatment facility (AWWT) or the AWWT effluent receiving stream (the Great Miami River).

Although not specified in the Operable Unit Records of Decision as an ARAR, the federal RCRA (Hazardous Waste) regulations include specific requirements in 40 CFR 264.303 for monitoring the volume of liquid collected from a disposal facility's leak detection system. Regulation 40 CFR 264.302 includes provisions for determining an "action leakage rate" that, if exceeded, would prompt specific response and notification actions. After waste placement has been initiated, an "action leakage rate" will be determined (discussed in Section 4.0). The response and notification process for an exceedance of the "action leakage rate" (40 CFR 264.304) is provided in Section 6.0.

The leachate monitoring plan required by OAC 3745-27-06(C)(7) must include provisions for obtaining the monthly volume of leachate collected for subsequent treatment in the AWWT, provide the method of leachate treatment and/or disposal, and include verification that the leachate management system is operating properly (OAC 3745-27-19(M)(4)). Monitoring to verify that the leachate management system is operating properly is provided within the OSDF Systems Plan, which was first submitted with the Intermediate (60%) Design Package for the OSDF. The monthly volume of leachate collected for treatment and subsequent disposal will be obtained through a flow rate monitoring program based on the program in 40 CFR 264.303(c), which will be used as the basis for monitoring the flow rates of leachate collected in both the LCS and the LDS. Monitoring of the flow rates will provide data for determining the volume of leachate collected and will also provide data pertinent to the

leak detection monitoring program. Because the flow rates are tied to the leak detection monitoring program, the flow rate monitoring program is described in Section 4.0. A separate leachate management monitoring plan is provided as Section 5.0 to provide information on the method of leachate treatment and/or disposal, including analysis of parameters useful for leachate treatment. Section 5.0 also includes discussion on obtaining an annual grab sample to be analyzed for Appendix I parameters, in order to comply with the requirement in OAC 3745-27-19(M)(5).

4.0 LEAK DETECTION MONITORING PROGRAM

This section presents the technical approach for leak detection monitoring at the OSDF, in light of the regulatory requirements for leak detection monitoring summarized previously in Section 3.0. The section includes a summary of the objectives of the program; a description of the major program elements; the monitoring frequencies to be employed before and after waste placement; the selection of analytical parameters; and the strategy for evaluating the data to determine whether a leak has occurred. A summary of the notifications and potential followup response actions that accompany the monitoring program is discussed in Section 6.0.

4.1 Introduction

As discussed in Section 1.0, the OSDF leak detection monitoring program constitutes the first tier of a three-tiered detection, assessment, and corrective action monitoring strategy that is required for engineered disposal facilities. Consistent with this three-tiered approach, if it is determined from this detection monitoring program that a leachate leak from the OSDF has occurred, followup assessment and corrective action monitoring plans will be developed and implemented as necessary. Conversely, if the detection monitoring successfully demonstrates that leachate leaks have not occurred, then the monitoring program will remain in the first-tier "detection mode" indefinitely. The followup assessment and/or corrective action monitoring plans, if found to be necessary, would be prepared as new, independent plans that would supersede this first-tier detection program.

The leak detection monitoring program employs a multi-component, holistic approach for leak detection, relying on the collective responses obtained from four components: an LCS inside the OSDF; an LDS inside the OSDF and below the LCS; a perched groundwater monitoring component, which will be located immediately below the LDS and LCS "sumps"; and a Great Miami Aquifer monitoring component, found at depths ranging from 45 to 90 feet beneath the OSDF. The data collected from the four components will be evaluated comparatively over time, so that short-term and long-term response relationships between the components can be effectively delineated.

Clearly, the Great Miami Aquifer is the prime resource of concern that could potentially be affected by the OSDF, in the unlikely event that a leachate leak occurred. It therefore makes prudent sense to monitor the aquifer at the immediate boundary of the OSDF to ensure the absence of impact. However, as discussed in Section 2.0, contaminant travel times to the aquifer through the glacial till beneath the OSDF are of such length that reliance on Great Miami Aquifer monitoring alone would be insufficient to provide effective early warning of a leak from the facility. The overriding intention of the "holistic" approach, therefore, is to ensure that there is no reliance on any one element alone to determine whether leakage has occurred.

As will be demonstrated in this section, the groundwater/leak detection monitoring program includes the establishment of pre-existing "baseline" conditions in the native environment underlying the OSDF (i.e., perched and Great Miami Aquifer groundwater) to be used as a point of comparison during the system-wide evaluation of trends. Following the establishment of baseline conditions, the followup sampling that will be conducted at each monitoring interval will provide a "vertical slice/snapshot in time" view of conditions that are present in each of the four components, which can then be compared to past results to determine the collective significance of trends or intermittent fluctuations in the data.

4.2 Monitoring Objectives

The fundamental objective of the leak detection monitoring program is to provide "early detection" of a leak from the facility, should one occur. Recognition of this fundamental objective will allow the FEMP to move confidently into the next regulatory-based tiers of the program -- assessment and corrective action monitoring -- should they be necessary based on detection monitoring trends. This fundamental objective is the primary driver for all of the key site-specific elements (e.g., monitoring locations, frequencies, analytical parameters, and followup response actions) of the program.

In addition to this fundamental objective, there are several other objectives that need to be considered in the site-specific design of the leak detection program:

- the program must have the ability to clearly distinguish an OSDF leak from the above-background pre-existing levels of contamination that are found in the subsurface;
- all monitoring wells must be installed at locations and with construction methods that do not interfere with or compromise the integrity of the cap and liner system of the OSDF;
- the program needs to consider the changing groundwater flow directions in the Great Miami Aquifer that will occur over time, as a result of the FEMP's aquifer restoration activities;
- the program needs to be readily implementable and not overwhelming in terms of reporting, data management, and the ability to identify trends; and
- the program needs to satisfy the site-specific regulatory requirements for leak detection monitoring summarized in Section 3.0.

The four-component leak detection monitoring approach described below meets the intent of providing early detection of a release from the OSDF within the complex hydrogeologic regime at the FEMP, and is tailored to accommodate the additional program design objectives summarized above.

4.3 Leak Detection Monitoring Program Elements

4.3.1 Overview

The success of the leak detection monitoring strategy for the OSDF is dependent upon how well the strategy integrates with facility integrity concerns (cap and liner system performance) and how well the groundwater component of the strategy addresses hydrogeologic conditions in the till and aquifer. The trends revealed by groundwater monitoring data need to be effectively integrated with leachate production information within the OSDF in order to provide a comprehensive evaluation of the OSDF performance and integrity.

The approved design for the OSDF is presented in detail in the OSDF design package (DOE, 1996a). The OSDF will consist of eight individual cells (plus a ninth contingency cell) to be constructed in phases. As shown on Figure 4-1, the liner for each cell is a composite liner system, assembled from the following layers (top to bottom): a soil cushion layer; LCS drainage layer; primary composite liner high density polyethylene (HDPE) membrane and bentonite geocomposite); LDS drainage layer; and the underlying secondary composite liner (HDPE membrane, bentonite geocomposite, and compacted clay). Both the LCS and LDS layers will each drain to the west within each cell. At the western edge of each cell liner, any liquid within the LCS and LDS is collected via extraction pipes penetrating the compacted clay liner. The points where the LCS and LDS extraction pipes penetrate the compacted clay liner are referred to as "sumps" throughout this plan. The "sumps" represent the areas with the greatest leak potential for each cell and is considered the primary location where a leak would first enter the environment if a leak were to occur.

Each cell will also be furnished with an engineered composite cover system following the cessation of waste placement. The cover system will consist of the following layers (top to bottom): a topsoil layer; an underlying subsoil layer; a granular filter layer; a bio-intrusion barrier; a geotextile filter; a cover drainage layer; the primary composite cap (geotextile cushion, geomembrane, bentonite geocomposite, and compacted clay); and an underlying contouring layer. Once the cover system is in place and the cell contents have reached equilibrium, leachate production is expected to diminish as a result of the moisture infiltration barrier properties of the cover system. During the time that the cell contents move towards equilibrium, leachate accumulation in the LCS drainage layer is expected to diminish over time.

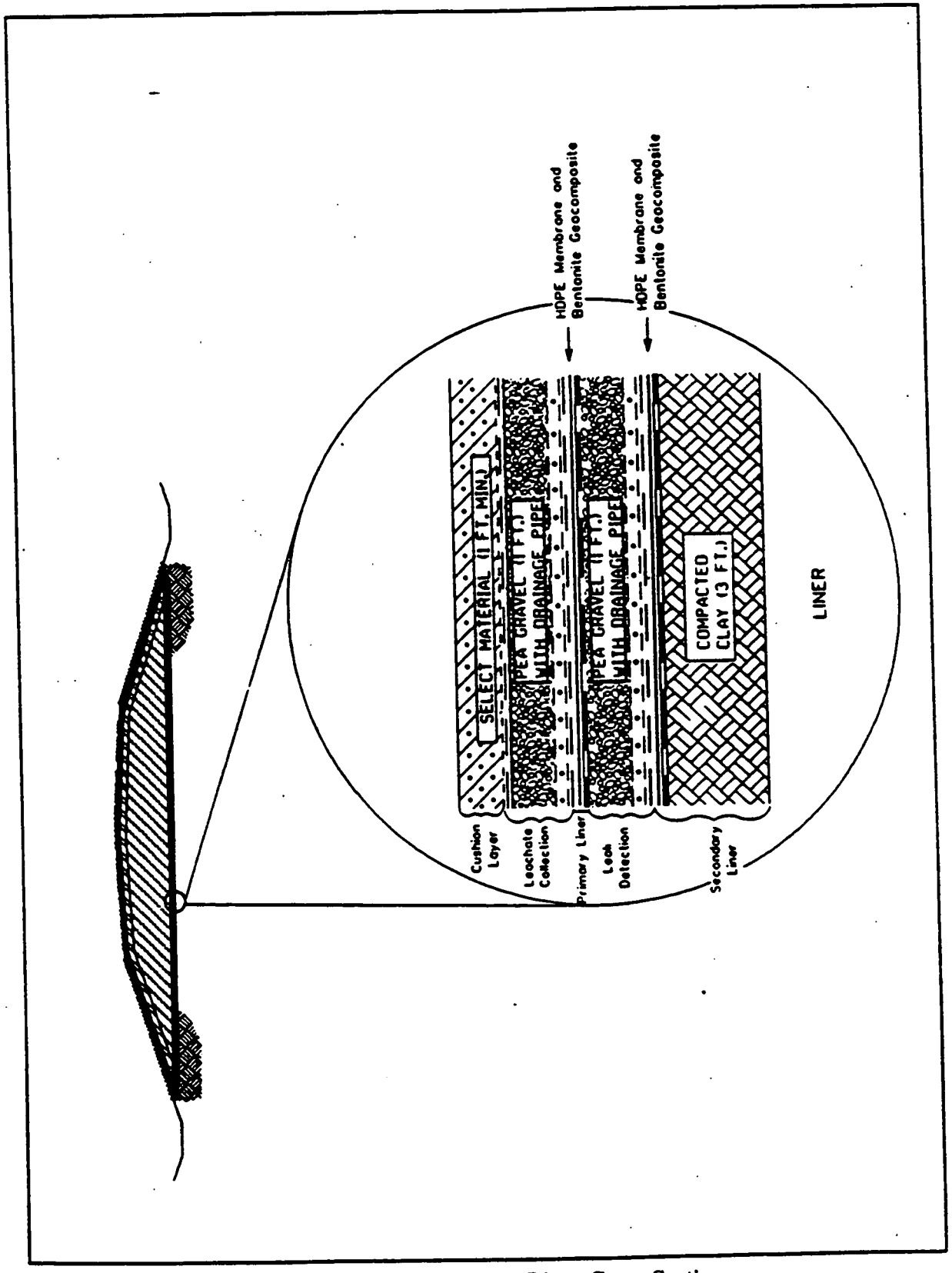


Figure 4-1 - Composite Liner Cross Section

During active cell operations and following OSDF closure, the leak detection monitoring program will involve: 1) tracking the quantity of liquid produced within the LCS and LDS over time; and 2) the periodic monitoring of the leachate, the perched groundwater, and the Great Miami Aquifer groundwater, utilizing an identical list of site-specific analytical parameters for all three fluids to effectively implement a holistic comparative approach. The performance of each cell will be monitored individually, on its own merit; each cell will have its own engineered LCS and LDS drainage layers, perched groundwater monitoring component, and upgradient and downgradient Great Miami Aquifer monitoring wells. The four monitoring components are described below.

4.3.2 Monitoring of the Engineered Layers Within the OSDF

Water quality samples will be collected from the individual LCS and LDS drainage layers within each cell during waste placement and after cell closure. The volume of liquids routinely recovered from both the LCS and LDS drainage layers will also be recorded. The information will be used to support a collective qualitative trend analysis for each cell of the OSDF, as discussed later in this plan. A description of the LCS and LDS monitoring elements is provided below.

4.3.2.1 Leachate Collection System (LCS)

The LCS drainage layer will function primarily to collect infiltrating water (expected to be greatest during construction of the cell) to keep it from entering the environment. Infiltrating water will be greatly reduced after each cell is capped, which may subsequently limit the available sample volume and possibly affect the number of parameters that can be analyzed. The LCS will drain to the west through an exit point in the liner to a manhole located to the west of the OSDF. From there, it will flow by gravity to a lift station and be pumped to the FEMP's biodenitrification surge lagoon for subsequent treatment at the AWWT facility.

Both flow and water quality information will be collected from the LCS drainage layer according to the frequencies specified in Section 4.4, the analytical parameters specified in Section 4.5, and the procedures specified in Appendix B.

4.3.2.2 Leak Detection System (LDS)

By design, the primary composite liner located underneath the LCS drainage layer should not leak. Fluids that accumulate from time to time in the LCS drainage layer above the primary liner will be removed to further reduce the potential for leakage by minimizing the level of fluid head build up on the primary liner. Notwithstanding this design, a second fluid collection layer, the LDS drainage layer, is positioned beneath the primary composite liner to provide a means to track the integrity and

performance of the primary liner. In the event that fluids collect within the LDS layer, they will drain to the west where they will be removed and routed for treatment as in the LCS.

Similar to the LCS, a greater level of fluids may initially collect in the LDS as the moisture contents of the materials comprising the primary liner move towards long-term equilibrium levels. This fluid volume would be expected to gradually decrease over the long term. Below the LDS drainage layer is a secondary composite liner comprised of an HDPE membrane, bentonite geocomposite, and compacted clay. This secondary liner serves as the lowermost hydraulic barrier in the liner system and inhibits fluids from entering the environment before they are collected and removed through the LDS drainage layer.

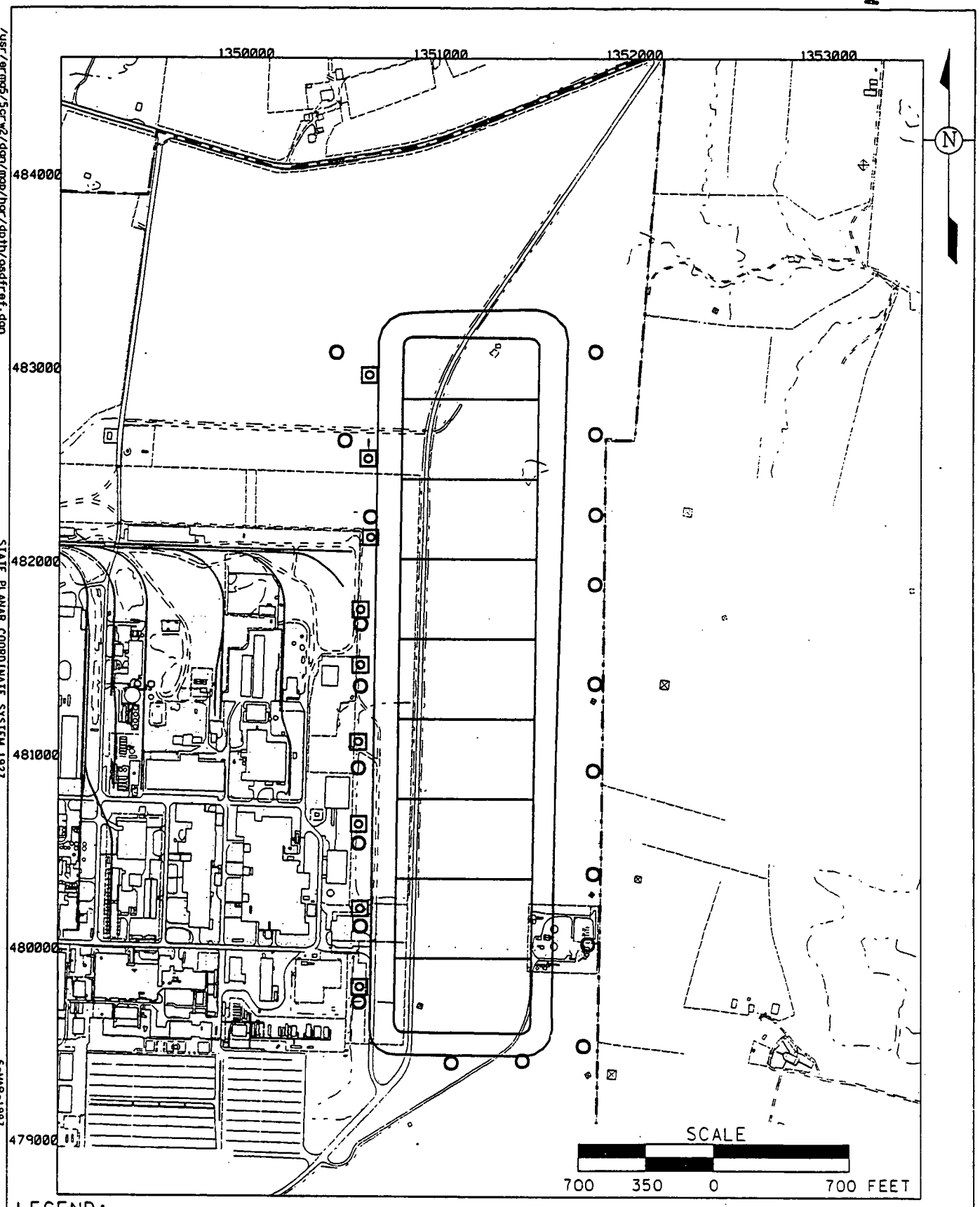
Like the LCS drainage layer, both liquid volume and water quality information will be collected from the LDS drainage layer according to the frequencies specified in Section 4.4, the analytical parameters specified in Section 4.5, and the procedures provided in Appendix B.

4.3.3 Perched Groundwater Monitoring in the Glacial Till

The perched groundwater monitoring component of the program is designed to monitor for the presence of leachate leakage from the OSDF at its first point of entry into the FEMP's natural hydrogeologic environment. As discussed in Section 1.0, EPA, OEPA, and DOE concur that a horizontally-oriented glacial till monitoring well, positioned directly beneath the location of the LCS and LDS drainage layer "sumps" in each cell, represents the most feasible site-specific approach to monitor for first-entry leakage from the OSDF into the FEMP's environment. A horizontal till monitoring well will therefore be furnished for each of the eight individual cells comprising the OSDF (and the ninth contingency cell, if utilized).

The horizontal monitoring wells will be installed as part of the sub-grade construction activities for each of the individual cells comprising the OSDF. This practice will ensure that the individual wells are installed prior to waste placement and eliminate final positioning uncertainties that would be associated with post-construction horizontal drilling techniques. The monitoring wells will be located along the west side of the OSDF (see Figure 4-2), and the sample collection interval will be positioned beneath the bottom of the secondary composite liner in alignment with the location of the LCS and LDS drainage layer "sumps" (see Figure 4-3).

Current lithologic and hydraulic characterization of the till in the vicinity of the OSDF indicates that the clay-rich deposits may not readily yield fluid to a well. The present amount of saturation in the till is likely to be further reduced in the future by the barrier properties of the composite cover and liner system of the OSDF, which will operate to significantly reduce local infiltration beneath the



LEGEND:

- ○ PROPOSED OSDF GMA DETECTION MONITORING WELL
- ⊡ PROPOSED OSDF TILL DETECTION HORIZONTAL MONITORING WELL SAMPLING POINT
- —·—·— FEMP BOUNDARY

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FIGURE 4-2. OSDF WELL LOCATIONS

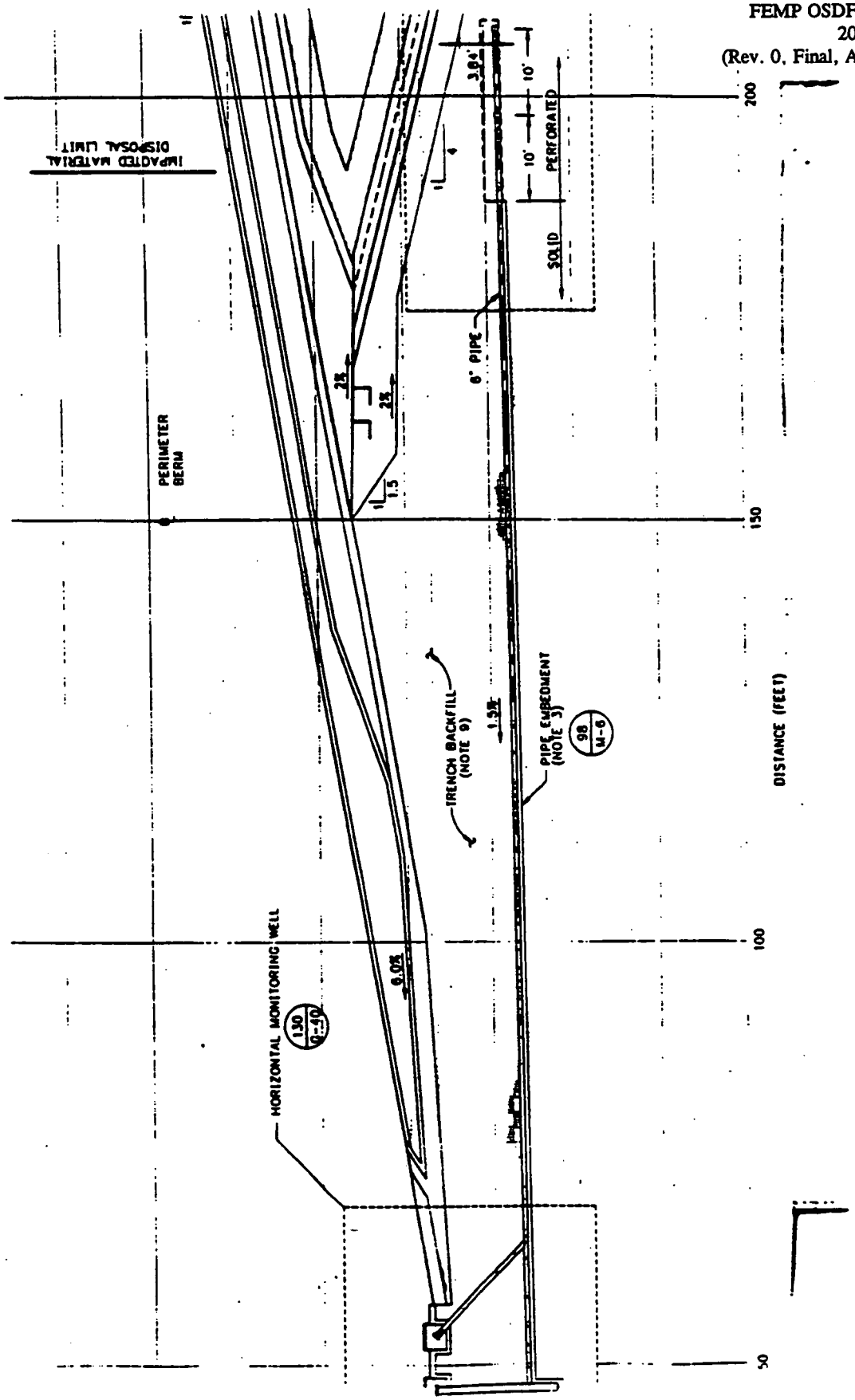

Figure 4-3 - Horizontal Till Well Cross Section

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facility. These conditions may make it impossible to obtain sufficient sample volume from the till wells to perform detailed water quality analyses. In the event sufficient sample volume cannot be obtained to perform the full list of required analyses, a priority list will be implemented as necessary on a case-by-case basis as discussed in Appendix B.

Water quality information is planned to be collected from the perched groundwater wells according to the frequencies specified in Section 4.4, the analytical parameters specified in Section 4.5, and the procedures described in Appendix B.

4.3.4 Monitoring in the Great Miami Aquifer

The sections below describe the Great Miami Aquifer component of the program, including a discussion of the influence of planned aquifer restoration activities on the program, the siting of the monitoring wells, and the use of the Sandia Waste Isolation Flow and Transport (SWIFT) computer model to evaluate the adequacy of the planned well locations.

4.3.4.1 Influence of Aquifer Restoration Activities

Restoration activities that are planned for the Great Miami Aquifer will have a bearing on the current directions of groundwater flow in the area of the OSDF. As a consequence, the requirement for conducting upgradient to downgradient well comparisons in the Great Miami Aquifer will need to consider this influence during the time that active restoration activities are underway.

The Great Miami Aquifer will be restored using a modular, area-specific, pump-and-treat approach that is presented in the Baseline Remedial Strategy Report for Aquifer Restoration (DOE, 1996a). Based on the FEMP's current plan, full restoration of all affected portions of the aquifer is projected to be complete in year 2005. During the years of active pumping, current groundwater flow directions in the Great Miami Aquifer will be modified as the various area-specific restoration modules come on line. Computer model simulations of the restoration process indicate that the current west-to-east groundwater flow direction for the aquifer in the immediate area of the OSDF will be reversed as a result of pumping from the Plant 6 Area Groundwater Restoration Module, which is scheduled to begin pumping in year 2003. The flow direction in the OSDF area will revert back to its west-to-east direction after the three years of restoration activities for the Plant 6 Area Module are complete (scheduled at the end of 2005).

While the changing flow directions that result from the aquifer restoration activities do not alter the overall placement strategy for the OSDF's Great Miami Aquifer monitoring wells, they will affect

the approach to data interpretations during the time period the restoration activities are underway. The strategy for evaluating the data during this time period is discussed in Section 4.6.

4.3.4.2 Siting of the Great Miami Aquifer Monitoring Wells

The Great Miami Aquifer monitoring wells will be installed immediately adjacent to the OSDF, just outside the footprint of the final composite cap configuration so as not to interfere with the integrity of the facility. Each cell will have its own individual set of monitoring wells to assist with the evaluation of conditions associated with that cell. As each new cell is to be brought on line, its associated monitoring wells will be installed before (or concurrently with) the construction of the cell liners, so that the wells will be available for the establishment of baseline conditions prior to waste placement in that cell. The well installations will thus follow the north-to-south progression of planned construction for the OSDF cells. Once all nine potential cells are in place (including the contingency cell, if used), the OSDF will be bordered by a network of 20 Great Miami Aquifer monitoring wells that will provide the upgradient and downgradient monitoring points for the entire facility (see Figure 4-2). If the OSDF, as constructed, is a different length than currently anticipated, or the ninth cell is not utilized, the final number of Great Miami Aquifer wells may be altered in an intent to achieve the same relative positions described in this plan.

The overall objective of the Great Miami Aquifer component of the leak detection monitoring program is to provide for long-term surveillance. The current and future (post-remediation) aquifer flow conditions were therefore used to select and evaluate the 20 monitoring well locations. As discussed in the next section, groundwater flow and particle tracking using the SWIFT aquifer simulation model were used to help select the final monitoring locations provided in this plan.

All new monitoring wells will be constructed in accordance with the Sitewide CERCLA Quality Assurance Project Plan (SCQ) for Type 2 Great Miami Aquifer wells (DOE, 1992).

4.3.4.3 SWIFT Model Evaluation of Well Locations

The SWIFT groundwater modeling code was used to evaluate the adequacy of the density and locations of the monitoring wells planned for the Great Miami Aquifer. The modeling effort examined the fate of a hypothetical release from each cell to the aquifer at a point directly beneath the "sumps" of the LCS and LDS drainage layers. The groundwater model runs predicted the most likely flow path of a particle released from the "sump" area over time, and the shape and extent of a theoretical plume resulting from a release in the area of a "sump". The modeling was conducted for pre- and post-aquifer remediation conditions (when groundwater flow directions would be from west to east) and for

groundwater remediation conditions in the Plant 6 area (when groundwater flow conditions would be reversed).

Particle flow path modeling was conducted using the STLINE particle tracking software with the SWIFT code. Ten particles were seeded in each of nine model grid blocks which were located nearest the nine individual-cell "sump" locations. These particles were tracked for a ten-year period with no retardation. The velocity flow field data from the pre/post-aquifer remediation scenario shows the advective particle path results (Figure 4-4). These results allowed for the placement of downgradient monitoring wells in the modeled flowpaths traced out by the particle tracks for each OSDF cell. This procedure resulted in the placement of a Great Miami Aquifer monitoring well downgradient of each OSDF cell in the most likely position to detect a leak based on anticipated groundwater flow.

During the years 2003 through 2005, the groundwater gradient in the OSDF area is predicted to be reversed due to aquifer pumping from Recovery Wells 2 and 23 in the Plant 6 area (see Figure 4-5) . The predicted groundwater velocity flow data from these three years was used to track particles from the "sump" location of each OSDF cell. Great Miami Aquifer wells on the west side of the OSDF could be located in the center of the modeled flowpaths traced out by these particles as they are drawn toward the Plant 6 aquifer remediation system. However, placing these wells in the center of the flowpaths would not necessarily produce a suitable configuration for these wells to serve as upgradient monitoring stations for the long-term post-closure care period following aquifer restoration. Therefore, the upgradient (western) wells should be placed in line with the center of each cell. This placement will be preferable for the long-term role of the wells as upgradient wells, and will be adequate for the short-term monitoring needs during the three planned years of aquifer restoration in the Plant 6 area.

The SWIFT groundwater model was used to predict if the density of downgradient GMA monitoring wells is adequate to detect the smallest contaminant plume resulting from a leak in the OSDF which would be of concern. A leak from the approximated sump location in OSDF Cell 3 was simulated for both uranium and technetium-99. Constant loading from the cell was simulated throughout the model run (using 125 foot grid spacing) such that a plume of minimum areal extent (i.e., a plume with maximum concentration equal to the FRL) was maintained in the GMA. Hypothetical plumes of 20 ppb and 94 pCi/L were maintained for uranium and technetium-99, respectively. The plumes were loaded from two hypothetical locations. One location was approximated to be below the "sump" at the western edge of Cell 3, to represent the most likely leakage point from the cell. The other location was further east, to provide a more conservative scenario where the plume would be less able to expand by the time the leading edge would reach the downgradient monitoring well.

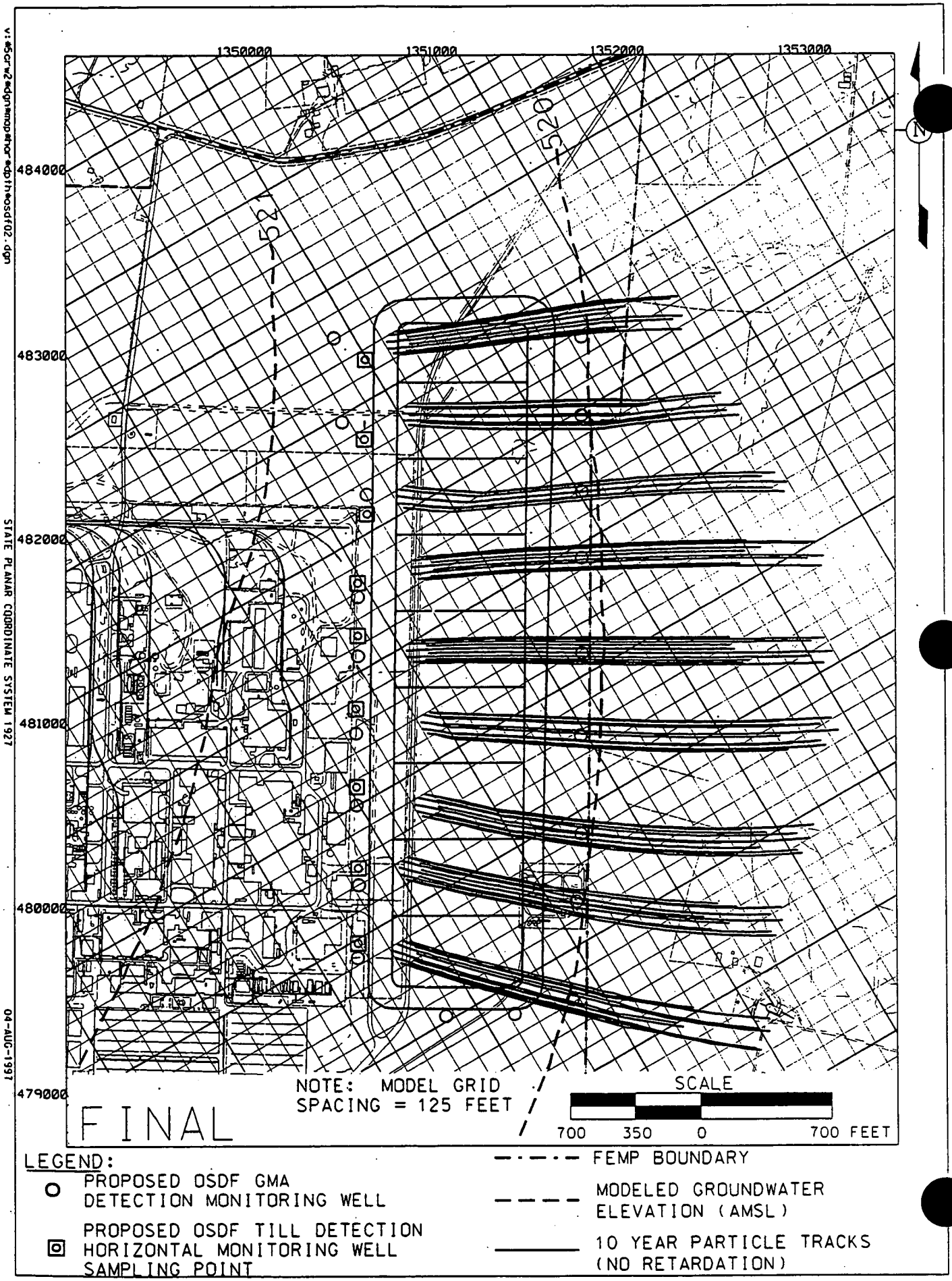

FIGURE 4-4. POST REMEDIATION SCENARIO

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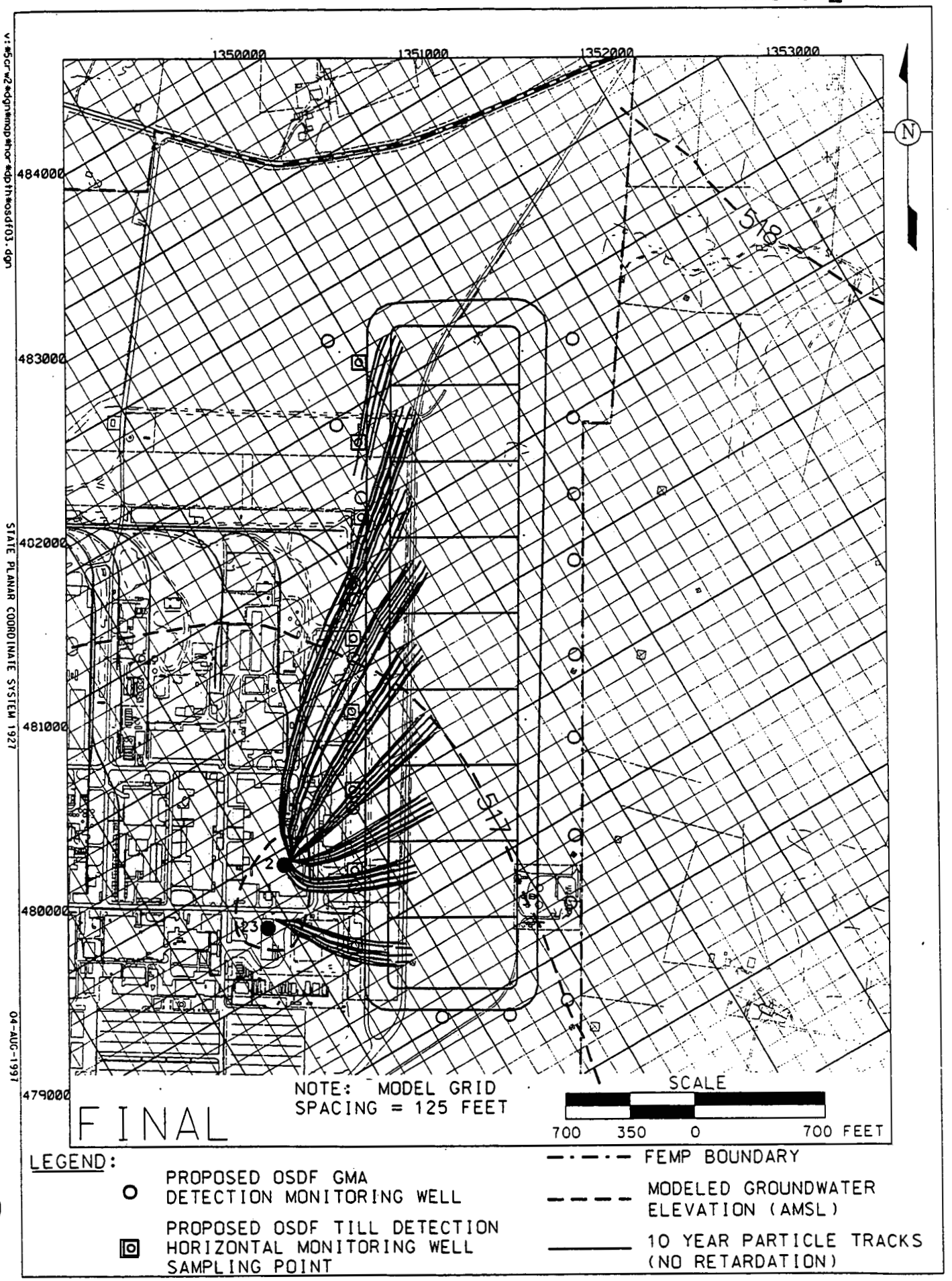

FIGURE 4-5. PLANT 6 PUMPING SCENARIO

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The modeling results for uranium at model year 55 (2051) and for technetium-99 at model year 30 (2026) are shown in Figures 4-6 and 4-7, respectively. The durations were determined from the modeling, and represent the period of time under constant loading for the respective plumes to disperse to the width of the spacing distance between monitoring wells (approximately equal to the OSDF cell width). Modeling results indicate that the density of downgradient GMA monitoring wells is sufficient to detect this minimal plume given the lateral expansion and the plume width under this minimal constant loading.

The width of each plume from horizontal dispersion is approximately the width of an OSDF cell, indicating that one downgradient Great Miami Aquifer monitoring well per cell is sufficient to ensure that a Great Miami Aquifer contaminant plume would be detected. Therefore, the configuration of Great Miami Aquifer wells shown on Figure 4-2 is sufficient both in terms of well density and location for the OSDF leak detection monitoring program.

Water quality information is planned to be collected from the Great Miami Aquifer wells according to the frequencies specified in Section 4.4, the analytical parameters specified in Section 4.5, and the procedures described in Appendix B.

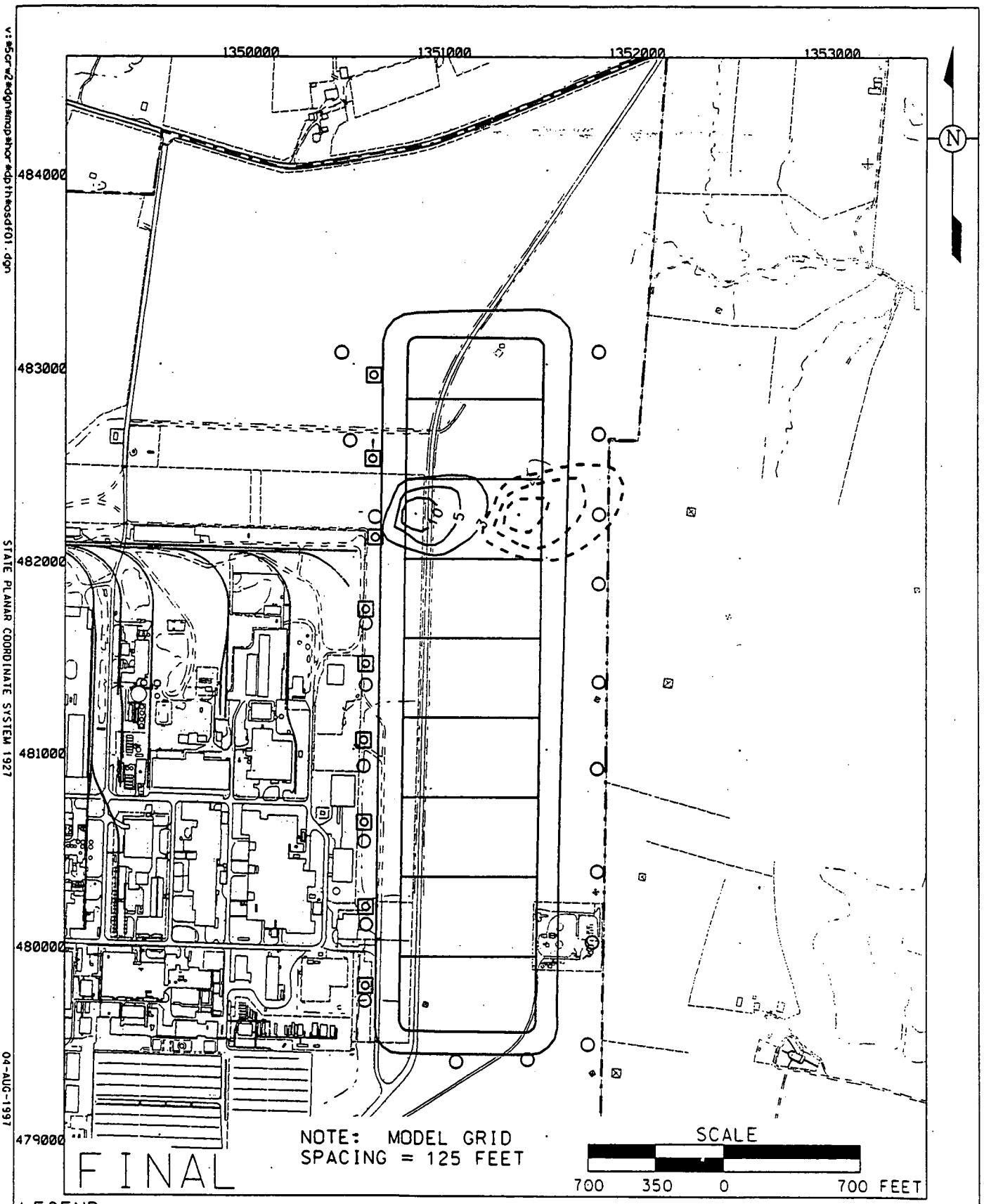
4.4 Leak Detection Monitoring Frequency

The following subsections discuss the sample collection frequency for the four components of the leak detection program: the LCS and LDS drainage layers, the horizontal monitoring wells in the glacial till, and the monitoring wells in the Great Miami Aquifer. The frequency of leachate production volume monitoring in the LCS and LDS drainage layers is also discussed.

The subsections discuss the sampling frequencies necessary for the establishment of baseline conditions in the perched groundwater and Great Miami Aquifer components prior to waste placement, and the sampling frequencies that will accompany all four components following the commencement of waste placement operations.

4.4.1 Establishment of Pre-Waste Placement "Baseline" Conditions

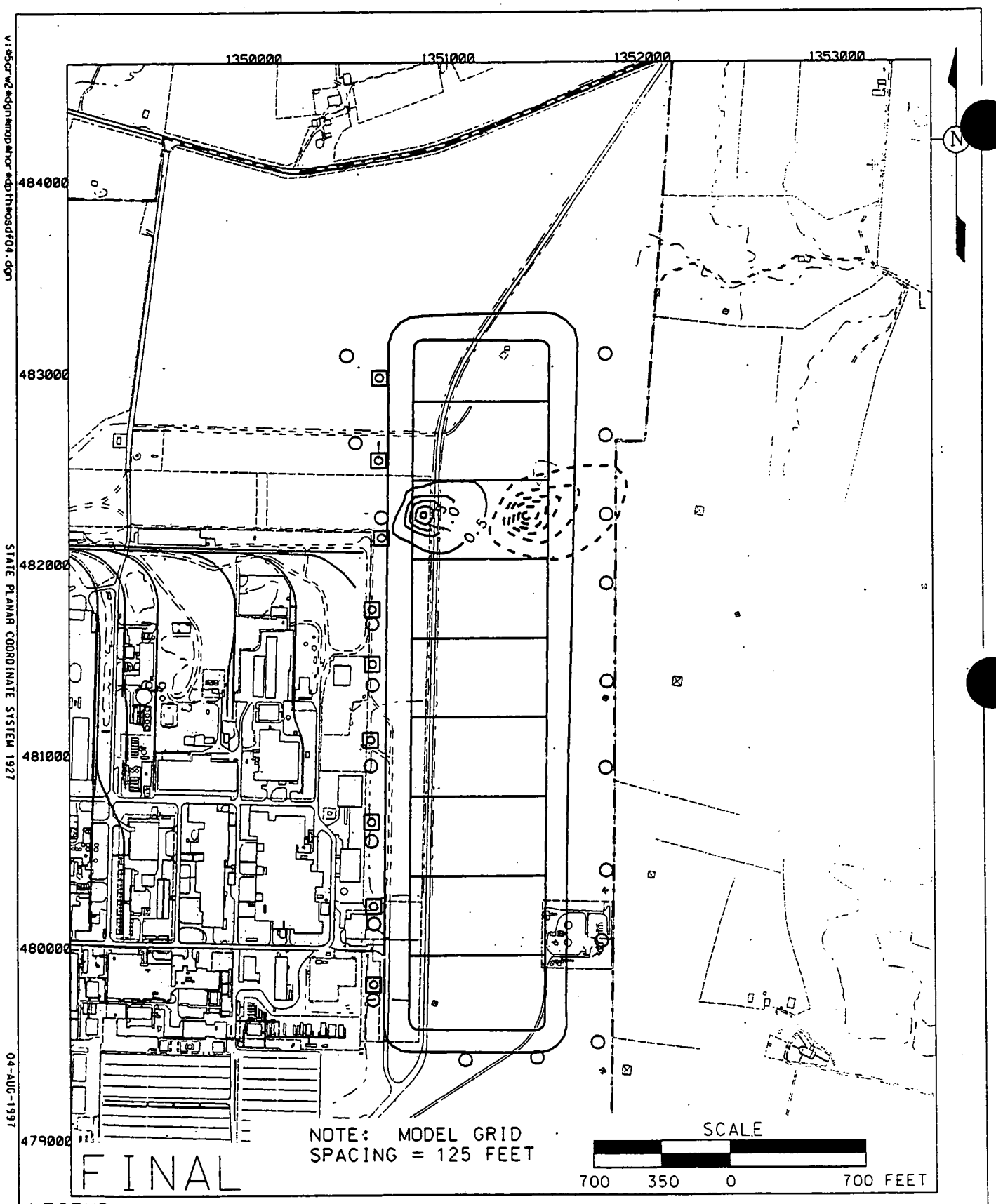
In order to accurately determine whether there has been a leak from the OSDF, it is necessary to establish representative baseline (defined for this plan as pre-waste placement) conditions in the natural environment underlying the facility, from which to draw future comparisons. As discussed in Section 2.0, both the perched groundwater system and the Great Miami Aquifer in the vicinity of the OSDF contain uranium and other FEMP-related constituents at levels above background. Many of these constituents are also members of the OSDF analytical parameter list discussed in Section 4.5. It



LEGEND:

- PROPOSED OSDF GMA DETECTION MONITORING WELL
- PROPOSED OSDF TILL DETECTION HORIZONTAL MONITORING WELL SAMPLING POINT
- FEMP BOUNDARY
- 3 MODELED TOTAL URANIUM CONCENTRATION (ppb)
- U2381Y55.DXF

FIGURE 4-6. SWIFT MODELING WITH URANIUM LOADING - 55 YEARS



LEGEND:

- ○ PROPOSED OSDF GMA DETECTION MONITORING WELL
- ⊡ PROPOSED OSDF TILL DETECTION HORIZONTAL MONITORING WELL SAMPLING POINT
- —·—·— FEMP BOUNDARY
- 1.5 MODELED TECH 99 CONCENTRATION (ppt)
- - - - - - TC99PPT.DXF

FIGURE 4-7. SWIFT MODELING WITH TECH 99 LOADING - 33 YEARS

is therefore important to establish pre-existing conditions (constituent concentration levels and variability) for all of the OSDF analytical parameters so that accurate assessments of future data trends in the perched system and the Great Miami Aquifer can be made.

The FEMP's existing information concerning pre-existing contaminant conditions in the subsurface is derived from the Operable Unit 5 RI and the OSDF Predesign Investigation. This existing information has been sufficient for the purposes of risk assessment, the development of conceptual and detailed designs for the FEMP's remedial actions, and the formulation of conservative assumptions for fate and transport modeling. The existing information is not of such detail, however, to permit the statistical evaluations, precise spatial and temporal comparisons, and comprehensive data trending that will accompany the leak detection program. More pre-waste placement information regarding data variability and seasonal influences is needed in the immediate vicinity of the OSDF for both the perched system and the Great Miami Aquifer.

The regulatory analysis presented in Section 3.0 indicates that the Ohio Solid Waste regulations require that groundwater monitoring at a disposal facility be initiated prior to waste placement, and at least four samples be obtained to define background conditions. At least one of these samples must be collected prior to waste placement, and the remainder must be collected within 6 months of waste placement initiation. Based on the current understanding of pre-existing levels of contaminants in the OSDF subsurface, the FEMP is electing to perform up to 12 rounds of baseline sampling (prior to waste placement) for both the perched system and the Great Miami Aquifer for all of the site-specific analytical parameters specified in Section 4.5. The intent of the 12 sampling events is to procure enough data to be able to accurately forecast the variability in pre-existing levels of site constituents that are known to be above background. Generally, one sampling round per month is envisioned wherever possible, although the frequency will be modified as necessary to accommodate the most current projection of the waste placement schedule for each individual cell.

For both the perched groundwater and Great Miami Aquifer wells, once the data from the initial sampling events have been procured, DOE will evaluate whether sufficient information is available to ascertain the variability and type of distribution that is present in the data (e.g., parametric or non-parametric distributions) at a level precise enough to move forward with active cell monitoring. At this juncture, an appropriate statistical method and associated statistical measure to establish pre-existing baseline conditions will be selected and documented as an addendum to this plan. This identification is anticipated to be made on an individual parameter-, monitoring point-, and cell-specific basis for both the perched groundwater and Great Miami Aquifer components of the program. If the amount of data is insufficient for this purpose, additional baseline samples will be collected, again prior to waste placement. The initial planned sampling intervals will be scheduled far enough in advance of waste placement to allow for additional sampling if necessary to augment the baseline database.

In the event that one or more monitoring points (for example, the perched water wells) produce insufficient water volume for sampling the full suite of analytical parameters, the data accumulation period for establishing that monitoring point's baseline might need to be extended (at a sampling frequency independent of the frequency for the other monitoring points which have a baseline) until sufficient data are obtained for that monitoring point.

This approach exceeds the minimum State of Ohio regulatory requirements for background sampling and should provide the FEMP with sufficient information to conduct future comparative evaluations.

4.4.2 Monitoring Frequency During Active Cell Operations

Once baseline conditions have been established for the perched and Great Miami Aquifer groundwater components and waste placement operations commence in an individual cell, the flow and water quality monitoring frequencies for the four components will follow the guidelines described below.

4.4.2.1 Flow Monitoring in the LCS and LDS

Leachate collected by the LCS from each cell flows by gravity to the leachate transmission system (LTS) permanent lift station. Anticipated leachate production rates in the LCS were determined during the design of the OSDF (see Section 7.1 of the OSDF Calculation Package) as follows:

	LCS, each cell, gallons per acre day		LCS baseline design flow rate per cell, gallons per day
	Average	Peak	
Initial stage (10 ft. or less waste)	1145	1754	11401
Intermediate stage (> 10 ft. of waste)	696	1754	
After closure	0.002	0.024	0.16

The initial stage is when construction of the liner system has been completed and waste placement starts and continues until 10 feet of waste has been placed in the cell. The intermediate stage is the placement of waste from the initial 10 feet of waste until cell closure. After closure is the period after the cell has been capped.

The amount of liquids removed from the OSDF via the LCS will be recorded in accordance with the following graded approach. This graded approach is patterned after federal hazardous waste landfill regulations 40 CFR 264.303(c)(2), which also satisfies Ohio solid waste rule OAC 3745-27-19(M)(4)]:

Tier	LCS Flow Monitoring Frequency
	PRIOR TO PLACEMENT OF FINAL COVER ON THE LAST OSDF CELL
0	Record at least monthly.
	POST CLOSURE (AFTER PLACEMENT OF FINAL COVER ON THE LAST OSDF CELL)
1	Record at least monthly, except as provided by the following.
2	If the liquid level stays below the "pump operating level" for two consecutive months, record at least quarterly, except as provided by the following.
3	If the liquid level stays below the "pump operating level" for at least two consecutive quarters, record at least semi-annually.

NOTE: The post-closure point of measurement is the LTS permanent lift station sump. If at any time during the post-closure care period the "pump operating level" is exceeded when on quarterly (Tier 2) or semi-annually (Tier 3) recording schedule, the recording schedule will revert to monthly (Tier 1) until the requirement is met to move to the next higher numbered tier.

"Pump operating level" is that liquid level based on pump activation level, sump dimensions, and the level that avoids backup into the LCS drainage layers in the OSDF cells, and minimizes head in the LTS permanent lift station sump. "Pump operating level" for the LTS permanent lift station sump is to be developed later (as an amendment to this plan, as discussed in Section 6.0) after the final cover has been placed over the last cell of the OSDF. It is anticipated that this will be established via trend analysis on leachate flow monitoring measurements prior to and after closure of the last cell of the OSDF.

Additionally, trend analysis of these LCS flow monitoring measurements will be conducted in order to provide indication of changes in trends in system performance far enough in advance to allow application of appropriate follow-up inspection and corrective action as necessary. The required notifications and response actions for leachate flow monitoring are discussed in Section 6.0.

The amount of liquids removed from each LDS primary containment vessel manhole will be recorded in accordance with the following graded approach, consistent with the approach for the LCS:

Tier	LDS Manhole Primary Containment Vessel Flow Monitoring Frequency
	PRIOR TO PLACEMENT OF FINAL COVER ON AN INDIVIDUAL OSDF CELL
0	Record weekly.
	POST CLOSURE (AFTER PLACEMENT OF FINAL COVER ON AN INDIVIDUAL OSDF CELL)
1	Record at least monthly, except as provided by the following.
2	If the liquid level in the LDS manhole primary containment vessel stays below the "action leakage rate" for two consecutive months, record at least quarterly, except as provided by the following.
3	If the liquid level in the LDS manhole primary containment vessel stays below the "action leakage rate" for at least two consecutive quarters, record at least semi-annually.

NOTE: These are intended to apply individually to each cell of the OSDF. If at any time during the post-closure care period the "action leakage rate" is exceeded at a cell on quarterly (Tier 2) or semi-annually (Tier 3) recording schedule, the recording schedule for that cell will revert to monthly (Tier 1) until the requirement is met to move to the next higher numbered tier.

The configuration of the LDS manholes are shown in OSDF Construction Drawing sheet M-6A. "Action leakage rate" is that liquid level based on LDS manhole primary containment vessel dimensions, and the level that avoids backup into the LDS drainage layer and minimizes head in the LDS manhole. "Action leakage rate" for each LDS manhole is to be developed later (as a future amendment to this plan, as discussed in Section 6.0) based upon measurements after the final cover has been placed over that cell. It is anticipated that this "action leakage rate" will be established via trend analysis on closed cells prior to closure of the last cell of the OSDF.

Additionally, trend analysis of the LDS flow monitoring measurements will be conducted in order to provide indication of changes in trends in system performance far enough in advance to allow application of appropriate follow-up inspection and corrective action as necessary. The required notifications and actions are discussed in Section 6.0.

4.4.2.2 Water Quality Monitoring in the LCS and LDS

The frequency of water quality monitoring for the LCS and LDS drainage layers within each cell, for leak detection monitoring purposes during active cell operations, will be quarterly. Samples will be collected from the LCS cleanout and the LDS primary containment vessel. The samples will be analyzed for the parameters contained in Section 4.5.

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Prior to collecting the sample, the volume contained in the LCS manhole and the LDS primary containment vessel will be estimated to determine if sufficient volume is present for the full suite of analytes (see discussion in Appendix B for the setting of priorities). In the case of an absence of liquid in the LCS and/or LDS drainage layers such that water quality sampling cannot be conducted, it will be inferred that no leak from the cell has occurred.

While it is desired that the samples be collected from the LCS and LDS at the same time interval to enhance the comparability of the data, the overriding requirement is that enough fluid be is present in the individual system to collect sufficient volume for the analyses.

4.4.2.3 Perched Groundwater and Great Miami Aquifer Water Quality

After the perched groundwater and Great Miami Aquifer baselines are established and waste placement operations have begun, the groundwater monitoring wells for both of these components will be sampled quarterly, to address the potential for seasonal variation in the analytical parameters. Four quarters of sampling over one year are generally accepted for providing seasonal variation in groundwater chemistry. Because of the existing contamination in the Great Miami Aquifer and the perched groundwater and the current remediation underway site-wide, the sampling frequency will be quarterly until future conditions warrant otherwise (see Section 4.4.3 below). Section 4.5 discusses the analytical parameters to be utilized for both components.

Sampling both the perched groundwater and the Great Miami Aquifer groundwater during the same time frame is desired to enhance the comparability of the data; however, the overriding requirement is that enough fluid be present in the individual monitoring point to collect sufficient volume for the analyses.

Prior to collecting the sample, the volume contained in the monitoring point will be estimated to determine if sufficient volume is present for the full suite of analytical parameters (see Appendix B for a discussion on setting priorities for low sample volume). The sufficiency of volume is of particular concern in the till monitoring point; if no liquid is found in the till monitoring point, it will be inferred that no leak from the cell has occurred. However, if water exists in the well, it will not be directly inferred that a leak has occurred, and water volume measurements will be taken and plotted versus time to assist in the holistic approach of determining a leak.

4.4.3 Future Considerations

The previous sections discussed the monitoring frequencies to be employed during the establishment of baseline conditions and during active cell operations. Two additional conditions will

occur in the future that may require the monitoring frequency for any or all of the four leak detection components to be reevaluated:

- final capping of the individual cells, which will generally result in a decrease in the overall quantity of leachate produced and a potential corresponding change in leachate composition; and

- completion of restoration activities for the Great Miami Aquifer, and the return of groundwater flow directions to pre-restoration conditions.

Section 4.6 discusses the manner in which the leak detection program data will be evaluated during the time period that aquifer restoration activities are underway and upgradient to downgradient comparisons of Great Miami Aquifer data are not possible. It is envisioned that following the completion of the restoration activities and the return of groundwater flow directions to their natural state, upgradient to downgradient comparisons will be formally initiated and continued indefinitely following closure of the OSDF. At the completion of aquifer restoration activities and the return of flow conditions to a more stable condition, it may be beneficial to increase the frequency of sampling from the Great Miami Aquifer for an intervening period to more comprehensively establish upgradient conditions prior to the formal implementation of the upgradient and downgradient statistical comparisons. After upgradient conditions are established through a more frequent sampling interval (if used), a reduction of the sampling frequency to semiannual will be considered, particularly if the quarterly sampling results do not reveal any seasonal variation beyond what would be revealed by semiannual sampling results. The need for (and scope of) this frequency modification will be evaluated once aquifer restoration activities are terminated. An amendment to this plan would be developed at that time to accommodate any modifications.

It may also be beneficial to increase the frequency of sampling from the LCS and LDS layers, and perhaps the groundwater components as well, for an intervening period once the final cap on an individual cell is installed. This could potentially facilitate a more comprehensive tracking of the changes in leachate quality (and changes in perched groundwater quality because of reduced moisture contents in the underlying till) that accompany the reduced infiltration rates associated with the placement of the final cap and closure of the cell. As with the possible modification listed above, the need for (and scope of) this frequency modification will be evaluated once waste placement is near completion in the first cell and the data compiled to date from all four of the leak detection monitoring components have been fully evaluated. An amendment to this plan would be developed at that time to accommodate any modifications.

4.5 Selection Of Monitoring Parameters

As discussed in the regulatory analysis provided in Section 3.0, a successful leak detection monitoring program must focus on the best indicators of potential releases, as opposed to analyzing for every possible constituent that may be present in a disposal facility (which would not be manageable and would add unnecessary complexity to the data analysis process). This section presents the criteria and process used to identify the site-specific indicator parameters for the OSDF groundwater leak detection monitoring program. The selected indicator parameters will supplement the leachate flow monitoring conducted in the LCS and LDS layers (described in Section 4.4) to promote the early detection of potential leaks from the facility.

4.5.1 Guidelines for Site-Specific Monitoring Parameter Selection

At the FEMP, statistically significant deviations from current groundwater conditions are anticipated throughout the remediation period, as pre-existing contamination in the aquifer is removed and flow directions change in response to the groundwater remediation being undertaken at the FEMP. Additionally, residual contamination in soil is expected to move through the glacial till and impact the aquifer at concentrations below the groundwater FRLs, but statistically elevated above current background conditions, for several years.

It is important to recognize that all of the inorganic constituents and all but nine organic constituents included in the regulatory default monitoring parameters list (i.e., Appendix I of OAC 3745-27-10) have been detected in perched groundwater samples collected at various locations under the FEMP. Such pre-existing contamination in the environment beneath the OSDF along with aquifer remediation activities add complexity to the development of a successful leak detection parameter list capable of indicating the presence of a leak from the OSDF. Therefore a tailored leak detection parameter list must be developed that provides adequate leak detection and that is in compliance with the standard requirements of the Ohio Solid Waste Rules and the Ohio Hazardous Waste Rules. As discussed in Section 3.0, both sets of rules allow the use of an alternate monitoring parameter list based on site-specific conditions.

Ohio Solid Waste regulations OAC 3745-27-10(D)(2)&(3) allow six considerations in proposing an alternate monitoring parameter list in lieu of some or all of the parameters listed in Appendix I of OAC 3745-27-10. Also, the Ohio Hazardous Waste regulations for new facilities, OAC 3745-54-98(A), recognizes four considerations in formulating the facility-specific monitoring parameter list.

Table 4-1 summarizes the important considerations and approval criteria related to monitoring parameter selection under the Ohio Solid Waste and Ohio Hazardous Waste regulations.

Table 4-1
Regulatory Criteria for Alternate Parameter List

Ohio Solid Waste Regulation	Ohio Hazardous Waste Regulation
REQUIREMENTS:	
• for all parameters, the removed parameters are not reasonably expected to be in or derived from the waste contained or deposited in the landfill facility; and [OAC 3745-27-10 (D)(2)]	—
• for inorganic parameters, the approved alternative monitoring parameter list will provide a reliable indication of inorganic releases from the landfill facility to the groundwater. [OAC 3745-27-10 (D)(3)]	indicator parameters (e.g., specific conductance, total organic carbon, or total organic halogen), waste constituents, or reaction products that provide a reliable indication of the presence of hazardous constituents in groundwater. [OAC 3745-54-98 (A)]
CONSIDERATIONS:	
• types, quantities, and concentrations of constituents to be managed at the facility; [OAC 3745-27-10 (D)(2)(b) & (D)(3)(a)]	types, quantities, and concentrations of constituents to be managed at the regulated unit; [OAC 3745-54-98 (A)(1)]
• mobility, stability, and persistence of the waste constituents or their reaction products in the unsaturated zone beneath the facility; [OAC 3745-27-10 (D)(3)(b)]	mobility, stability, and persistence of the waste constituents or their reaction products in the unsaturated zone beneath the waste management area; [OAC 3745-54-98 (A)(2)]
• concentrations in the leachate from the relevant unit(s) of the facility; [OAC 3745-27-10 (D)(2)(c)]	—
• detectability of the parameters, waste constituents, and their reaction products in the groundwater; [OAC 3745-27-10 (D)(3)(c)]	detectability of the indicator parameters, waste constituents, and their reaction products in the groundwater; and [OAC 3745-54-98 (A)(3)]
• concentrations or values and coefficients of variation of monitoring parameters or constituents in the background [baseline] groundwater quality; and [OAC 3745-27-10 (D)(3)(d)]	concentrations or values and coefficients of variation of monitoring parameters or constituents in the background [baseline] groundwater quality. [OAC 3745-54-98 (A)(4)]
• any other relevant information. [OAC 3745-27-10 (D)(3)(c)]	—

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It is important to point out that the chemical constituents listed in Appendix I of OAC 3745-27-10 are typical contaminants found in sanitary landfills. Appendix I does not include any radionuclides which are the primary contaminants of concern at the FEMP. Therefore, any FEMP-specific constituents not included in Appendix I of OAC 3745-27-10 but that are good indicators of potential leaks from the OSDF also need to be evaluated in the parameter selection process. However, the general considerations summarized in Table 4-1 can apply to any constituents when selecting the leak detection indicator parameters.

Parameter selection in this initial version of the OSDF groundwater monitoring plan is intended to focus on establishing the baseline conditions for the individual cells of the OSDF (i.e., up to 12 monitoring events prior to waste placement). Parameters in this initial baseline sampling and analysis approach of the OSDF groundwater monitoring program are selected using site-specific contamination data generated during the previous RI/FS processes in accordance with the regulatory considerations presented above.

The remainder of this section presents the site-specific monitoring parameters list, corresponding to an alternate monitoring parameters list as defined in the regulations. Although being proposed as an initial list, these indicator parameters will likely provide sufficient and reliable indication of potential releases throughout the active operation of the OSDF. However, future considerations for potential modifications of the parameter list are also discussed at the end of this section.

4.5.2 Initial Leak Detection Monitoring Parameters List

An alternate leak detection monitoring parameters list should include both primary (i.e., chemical-specific) parameters and supplemental indicator parameters. As suggested by the regulatory considerations summarized in Table 4-1, primary parameters should consist of selected site-specific chemical constituents which are expected to be of significant amounts in the monitored facility, and which are persistent, mobile, and differentiable from existing background conditions when released. The supplemental indicator parameters may include general groundwater quality parameters which will have rapid and detectable changes in response to variations in chemical compositions in groundwater under the monitored facility, potentially as a result of a leak.

Fourteen (14) primary parameters and four supplemental indicator parameters are proposed for the initial groundwater leak detection monitoring for the OSDF. Samples collected in the perched groundwater and Great Miami Aquifer monitoring wells for the initial baseline analyses as well as samples collected in all four monitoring components during and after waste placement will be analyzed for these 18 parameters according to the frequency specified in Section 4.4. This subsection presents the rationale for the selection of the primary and supplemental indicator parameters.

4.5.2.1 Primary Parameters

In general, organic constituents are more mobile but less persistent than most inorganic constituents and radionuclides. Because inorganic constituents and most radionuclides are present in natural soil, if the OSDF was constructed in a pristine site, organic constituents may be the preferred primary monitoring parameters for early leak detection purposes. However, because all three types of constituents have been detected in the media (i.e., perched groundwater and the Great Miami Aquifer), in order to be differentiable from background conditions in case of a release, a good leak detection monitoring parameter must also be present in significant abundance or at relatively high source strengths in the OSDF.

Constituent-specific quantity, persistence, and mobility data have been considered during the development of the WAC for the OSDF. Therefore, information from the OSDF WAC development process was first reviewed to select the primary parameters for leak detection monitoring purposes. The WAC for the OSDF were developed for 42 constituents during the Operable Unit 5 FS; 41 of the WAC are included in the final Operable Unit 5 Record of Decision (as discussed later, one compound, magnesium, was eliminated following completion of the FS). As will be discussed in this section, 18 of the 41 WAC are numerical limits and 23 are non-numerical limits that were established to satisfy regulatory screening criteria for RCRA-regulated constituents.

The maximum acceptable leachate concentrations for constituents that will be present in the OSDF were determined by fate and transport modeling. The constituent-specific leaching potential, solubility, mobility and benefits of the engineering controls in the OSDF were considered in the modeling process. These maximum acceptable leachate concentrations were converted into solid phase WAC at the end of the process. These solid phase WAC represent the maximum concentrations for soil and debris that can be disposed of in the OSDF.

To assist in selecting the primary parameters, the actual soil concentrations for each of the 18 Constituents of Concern (COCs) for which numerical WAC were developed are also reviewed to provide a clear perspective regarding which COCs may approach their corresponding WAC concentrations and therefore are more likely to be detectable when released from the OSDF.

During the Operable Unit 5 FS, two categories of COCs were evaluated in the WAC development process. The first category includes all of the site-specific groundwater pathway COCs that were identified in the Operable Unit 5 RI. As a result of the process, 12 numerical WAC were developed for the groundwater pathway COCs. The second category includes those FEMP constituents which need to be managed and accounted for under RCRA regulations. Six additional numerical WAC were developed for the RCRA regulated constituents, bringing the total numerical WAC for the OSDF to 18.

The following subsections summarize the WAC development process for these two categories of constituents, as derived from the sitewide WAC development process described in the Operable Unit 5 FS. Figure 4-8 summarizes the process in flow chart fashion.

4.5.2.1.1 Groundwater Pathway COCs

Initially, only the WAC for groundwater pathway COCs were developed. WAC were determined necessary for 15 groundwater pathway COCs selected from Table F.2-2 of Appendix F of the Operable Unit 5 FS. Among all the detected soil and groundwater constituents at the FEMP, these 15 COCs have potential to reach and impact the Great Miami Aquifer through the glacial till under natural conditions (i.e., before being disposed in the OSDF) within 1000 years. Table F.2-2 also lists all the other constituents screened for potential cross-media impacts. Overall 53 organics, 25 inorganics, and 15 radionuclides were evaluated in the groundwater COC selection process, including all the RCRA constituents that have been detected in soil and groundwater at the FEMP.

After considering the engineering controls provided by the OSDF in the modeling procedures, 12 of the original 15 groundwater pathway COCs were found to require a numerical WAC. Compliance with the 12 numerical WAC, when determining what materials can be disposed in the OSDF, will be required for long-term protection of the Great Miami Aquifer. Table 4-2 lists the 15 COCs considered and the WAC that were developed. The technical approach of fate and transport modeling conducted to develop the COC-specific WAC has been summarized in Section F.5 in the Operable Unit 5 FS.

Upon further review of the initial WAC development process contained in the Operable Unit 5 FS, EPA, OEPA, and DOE concurred that magnesium does not present a significant threat to human health. Therefore, magnesium was eliminated from further consideration and a WAC for magnesium was not presented in Table 9-6 of the Operable Unit 5 Record of Decision.

The numerical WAC for the 12 groundwater pathway COCs will likely be the main controlling factors for the disposal of contaminated soil in the OSDF. The 12 groundwater pathway COCs which have numerical WAC have significantly higher mobility and persistence, and therefore should be considered as prime candidates when selecting the indicator parameters for the detection monitoring program for the OSDF.

The numerical WAC for the 12 groundwater pathway COCs in Table 4-2 only define the maximum allowable soil concentrations that can be safely disposed in the OSDF; they do not indicate what level of soil concentrations will actually be encountered during soil remediation. In order to frame the relative significance of these 12 WAC, the maximum soil concentrations for the 12 constituents that are expected in the OSDF following soil placement are provided in Table 4-3.

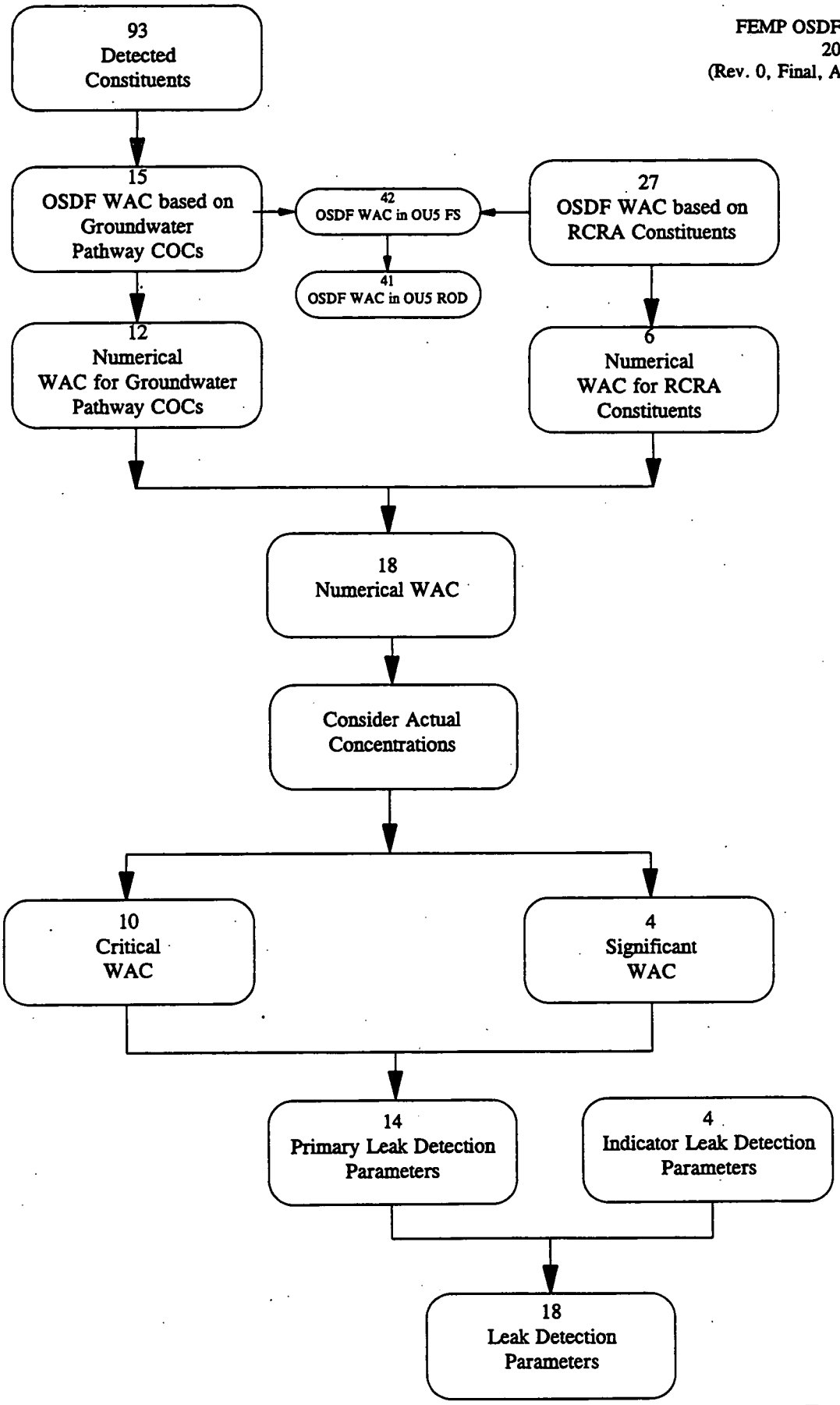

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FIGURE 4-8 - Groundwater/Leak Detection Parameter Selection Process

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TABLE 4-2

WAC FOR GROUNDWATER PATHWAY COCS

COC	WAC
Radionuclides: (pCi/g)	
Neptunium-237	3.12×10^{9}
Strontium-90	5.67×10^{10}
Technetium-99	2.91×10^{1}
Total uranium - (mg/kg)	1.03×10^{3}
Organics: (mg/kg)	
Alpha-Chlordane	2.89×10^{0}
Bis(2-chloroisopropyl)ether	2.44×10^{-2}
Bromodichloromethane	9.03×10^{-1}
Carbazole	7.27×10^{4}
1,2-Dichloroethane	*
4-Nitroaniline	4.42×10^{-2}
Vinyl Chloride[1]	1.51×10^{0}
Inorganics: (mg/kg)	
Boron	1.04×10^{3}
Chromium vi[1]	*
Magnesium	*
Mercury[1]	5.66×10^{4}

Notes: *: Denotes constituents that will not exceed designated Great Miami Aquifer action level within 1000-year performance period, regardless of starting concentration in the disposal facility.
1: RCRA constituent.

TABLE 4-3

EXPECTED MAXIMUM COC CONCENTRATIONS IN THE OSDF

COC	Maximum Concentration[1]	WAC	MAX/WAC
Radionuclides: (pCi/g)			
Neptunium-237	2.63×10^{0}	3.12×10^{9}	8.43×10^{-10}
Strontium-90	6.49×10^{0}	5.67×10^{10}	1.14×10^{-10}
Technetium-99	2.91×10^{1}	2.91×10^{1}	**1.00×10^{0}**
Total uranium - (mg/kg)	1.03×10^{3}	1.03×10^{3}	**1.00×10^{0}**
Organics: (mg/kg)			
Alpha-Chlordane	5.10×10^{-3}	2.89×10^{0}	1.76×10^{-3}
Bis(2-chloroisopropyl)ether	2.44×10^{-2}	2.44×10^{-2}	**1.00×10^{0}**
Bromodichloromethane	7.00×10^{-3}	9.03×10^{-1}	7.75×10^{-3}
Carbazole	2.50×10^{-1}	7.27×10^{4}	3.44×10^{-6}
4-Nitroaniline	4.42×10^{-2}	4.42×10^{-2}	**1.00×10^{0}**
Vinyl Chloride[2]	1.51×10^{0}	1.51×10^{0}	**1.00×10^{0}**
Inorganics: (mg/kg)			
Boron	1.43×10^{1}	1.04×10^{3}	1.38×10^{-2}
Mercury	1.30×10^{0}	5.66×10^{4}	2.30×10^{-4}

Notes: 1: Lower value between the WAC and the maximum soil concentration presented in Table F.3.4-3, Operable Unit 5 RI.
2: Also consider Tetrachloroethene and Trichloroethene in soil.

As shown in Table 4-3, the expected maximum soil concentrations in the OSDF reveal that only 5 of the 12 groundwater pathway COCs with numerical WAC (technetium-99, total uranium, vinyl chloride, bis(2-chloroisopropyl)ether, and 4-nitroaniline) are expected to approach their respective WAC concentrations. The other 7 COCs will have maximum soil concentrations in the OSDF that are much less than their corresponding WAC. This information regarding overall abundance is also an important consideration for selecting indicator parameters for the leak detection monitoring program.

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4.5.2.1.2 RCRA Constituents

After the WAC for the groundwater pathway COCs were developed, WAC for 27 additional RCRA-regulated constituents (termed the RCRA COCs) were evaluated. Development of WAC for these specific constituents was considered necessary from a regulatory standpoint to address a requirement that the RCRA COCs not be eliminated in any COC screening step during the RI/FS process. The intention was to demonstrate compliance with RCRA regulations by providing a mechanism for keeping track of the fate of materials contaminated with RCRA constituents during the remediation.

Most of the RCRA COCs are not groundwater pathway COCs and thus the calculated WAC for the majority of these constituents are relatively high (i.e., essentially pure product concentration). Only six of the additional constituents were determined to need a numerical WAC. The details of the RCRA constituent WAC development process is provided in Attachment F.5.I of the Operable Unit 5 FS. Table 4-4 summarizes the results.

The six additional numerical WAC in Table 4-4 are actually not expected to affect any disposal decisions for contaminated waste, soil, and debris from Operable Units 2, 3, and 5. As shown in Table 4-4, the WAC for chloroethane and toxaphene are close to pure product concentration (i.e., 1.00×10^6 mg/kg). The WAC for tetrachloroethene, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethene are higher than the highest detected soil concentrations which were used in the previous screening process summarized in Table F.2-2 of the Operable Unit 5 FS. The maximum detected soil concentrations presented in Table F.3.4-3 of the Operable Unit 5 RI for tetrachloroethene, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethene are 1.6×10^0, 8.90×10^1, 3.90×10^{-2}, and 3.4×10^{-1} mg/kg, respectively.

In general, the original 15 groundwater pathway COCs listed in Table 4-2 already include all the constituents detected in soil and groundwater at the FEMP which may have potential to impact the Great Miami Aquifer and, therefore, are more likely to be detectable in the monitoring system in case of a leak from the OSDF.

4.5.2.1.3 Selected Primary Parameters

Based on information presented in Tables 4-2 through 4-4, 14 constituents are selected to be included in the initial primary parameters list for OSDF leak detection monitoring purposes. Table 4-5 summarizes these constituents and the rationale for their selection. Table 4-5 also indicates whether each of the 14 constituents is listed in OAC 3745-27-10 Appendix I as a regulatory default parameter.

TABLE 4-4

WAC FOR ADDITIONAL RCRA CONSTITUENTS

RCRA Constituents	Detected and Previously Screened	WAC	OAC 3745-27-10 Appendix I
Organics: (mg/kg)			
Acetone	yes	*	Yes
Benzene	yes	*	Yes
Carbon tetrachloride	yes	*	Yes
Chloroethane	no	3.92×10^5	Yes
Chloroform	yes	*	Yes
Chloromethane	no	*	Yes
1,1-Dichloroethane	yes	*	Yes
1,1-Dichloroethene	yes	1.14×10^1	Yes
1,2-Dichloroethene	no	1.14×10^1	Yes
Endrin	no	*	No
Ethylbenzene	yes	*	Yes
Heptachlor	no	*	No
Heptachlor epoxide	no	*	No
Hexachlorobutadiene	no	*	No
Methoxychlor	no	*	No
Methylene chloride	yes	*	Yes
Methyl ethyl ketone	yes	*	Yes
Methyl isobutyl ketone	no	*	Yes
Tetrachloroethene	yes	1.28×10^2	Yes
1,1,1-Trichloroethane	yes	*	Yes
Trichloroethene	yes	1.28×10^2	Yes
Toluene	yes	*	Yes
Toxaphene	no	1.06×10^5	No
Xylenes	yes	*	Yes
Inorganics: (mg/kg)			
Barium	yes	*	Yes
Lead	yes	*	Yes
Silver	yes	*	Yes

Note: * : Denotes constituents that will not exceed designated Great Miami Aquifer action level within 1000-year performance period, regardless of starting concentration in the disposal facility.

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TABLE 4-5

PROPOSED PRIMARY PARAMETERS LIST

Constituents of Concern	Rationale	Appendix I
Radionuclides: (pCi/g)		
Technetium-99	likely detectable when released	No
Total uranium - (mg/kg)	likely detectable when released	No
Organics: (mg/kg)		
Alpha-Chlordane	likely detectable when released	No
Bis(2-chloroisopropyl)ether	likely detectable when released	No
Bromodichloromethane	likely detectable when released	Yes
Carbazole	likely detectable when released	No
1,1-Dichloroethene	significant RCRA constituent	Yes
1,2-Dichloroethene	significant RCRA constituent	Yes
4-Nitroaniline	likely detectable when released	No
Tetrachloroethene	significant RCRA constituent	Yes
Trichloroethene	significant RCRA constituent	Yes
Vinyl Chloride	likely detectable when released and significant RCRA constituent	Yes
Inorganics: (mg/kg)		
Boron	likely detectable when released	No
Mercury	likely detectable when released and significant RCRA constituent	No

Four (4) of the 18 constituents which have numerical WAC listed in Tables 4-2 or 4-4 (i.e., chloroethane, toxaphene, neptunium-237, and strontium-90) are not selected because of their expected actual maximum concentrations in the OSDF and their comparatively high WAC values which indicate less likely potential impacts and detectability in case of a leak from the OSDF. However, four RCRA constituents which are not groundwater pathway COCs (i.e., tetrachloroethene, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethene) are selected since their expected maximum soil concentrations are reasonably close to the WAC.

The 14 constituents (i.e., 12 from the groundwater pathway COCs and four from the RCRA constituents) that are selected as the primary leak detection monitoring parameters have a potential of entering the environment in measurable quantities and are likely to be more differentiable from background conditions. These 14 constituents will provide a reliable indication of potential releases from the OSDF to the groundwater.

4.5.2.2 Supplemental Indicator Parameters

In addition to the primary parameters discussed in the preceding subsection, four general groundwater contamination indicator parameters are also proposed to supplement the selected chemical constituents in the initial leak detection monitoring parameters list. These supplemental indicator parameters are comprised of the following:

- pH;
- Specific Conductance;
- Total Organic Halogens (TOX); and
- Total Organic Carbon (TOC).

These general groundwater contamination indicator parameters are typically used to aid in the detection of releases from disposal facilities. These supplemental indicator parameters will provide an added means to detect contaminant migration, and will be useful as indicators for general groundwater quality degradation.

4.5.3 Future Considerations

As mentioned earlier, parameters selected in the initial baseline sampling and analysis approach of the OSDF long-term groundwater monitoring program are intended for establishing the baseline conditions for perched groundwater and the Great Miami Aquifer under the individual cells of the OSDF (i.e., up to 12 monitoring events prior to waste placement). Two subsequent future re-evaluations of the program (e.g., a review of monitoring results accompanying final capping and immediately after completion of aquifer remediation as described in Section 4.4) are envisioned before the long-term post-closure leak detection monitoring parameters list is ultimately finalized. Any modifications resulting from these two re-evaluations will be documented via future amendments to this plan.

Although the currently selected initial indicator parameters will likely provide sufficient and reliable indications of potential releases throughout the operational life of the OSDF, efficiency of the parameters list may still be improved based on the collected data obtained over the course of the program. Any proposed modifications based on the accumulated data base will involve EPA and OEPA review and approval before adoption.

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4.5.3.1 Eliminating Monitoring Parameters

An indicator parameter will be considered for elimination from the current program (or the long-term leak detection monitoring parameters list) when the initial pre-waste disposal baseline data indicate significant fluctuations and/or very high concentrations in perched groundwater or Great Miami Aquifer monitoring wells. When the baseline concentrations of a constituent are high, a leak from the OSDF may not be noticeable from monitoring results due to background interferences (i.e., false negative). When the background concentrations fluctuate significantly, there will be a high chance of a false positive of a leak. In either case the constituent cannot be considered a reliable indicator for leak detection purposes.

An indicator parameter will also be considered for elimination from the long-term leak detection monitoring parameters list, if it is not detected in the LCS leachate samples collected during active waste placement. Any constituents not detected in the LCS leachate samples after waste placement are likely to be absent, insoluble, or of insignificant abundance in the OSDF. Therefore, it may not be necessary to analyze these constituents further for leak detection purposes, and a proposal for EPA and OEPA approval of their elimination will be developed.

4.5.3.2 Adding Monitoring Parameters

Based on the analytical results of the annual grab sample of leachate collected in LCS for the parameters specified in Appendix I of OAC 3745-27-10 (see Section 5.0 for more details), detected Appendix I constituents will be evaluated to determine whether the original indicator parameters list is sufficient for leak detection purposes. As mentioned before, most of the Appendix I constituents have already been detected in perched groundwater under the FEMP and were considered when selecting the initial leak detection indicator parameters. It is expected that these constituents will also be detected in future OSDF leachate samples. However, they will not necessarily be adequate indicators of a release. Therefore, Appendix I constituents detected in the annual OSDF LCS samples will not be automatically added to the leak detection indicator parameters list, unless it meets the criteria discussed below.

A new indicator parameter will only need to be considered for addition when its detected concentrations in the annual OSDF LCS samples are much higher than the concentrations that exist currently in the contaminated media underlying the facility (which were evaluated during the initial parameter selection process). An indicator parameter will be added when it can be demonstrated under the considerations provided in Section 4.5.1 that routine analysis of the constituent in the leak detection monitoring system can significantly enhance the early detection capability of the monitoring program. Evaluations of the annual leachate grab sampling data will be conducted to determine the need for

adjustments to the current parameter list; the results of the evaluations will be reported in accordance with the OAC 3745-27-19(M) reporting requirement.

4.6 Leak Evaluation Strategy

The leak evaluation strategy for each OSDF cell is two-fold:

- trend analysis for the LCS, LDS, the glacial till, and the Great Miami Aquifer will help pinpoint potential leak-related influences within each leak detection program element; and
- the monitoring results from all elements will be correlated and evaluated holistically to determine whether a release has occurred and if a response action is necessary.

These components are discussed in the next two sections.

4.6.1 Trend Analysis

The initial flow and water quality data obtained from the LCS, LDS, and the groundwater monitoring components will be used to begin a qualitative trend analysis of the volume of leachate produced by each cell and the corresponding concentrations of analytes in each individual monitoring component. Each cell will be evaluated independently; consequently, an "intra-well" trend analysis will be used. As part of the establishment of baseline conditions, an identification of an appropriate statistical method for the trend analysis will be made following the receipt and review of all baseline data. The identified method will be presented to EPA and OEPA for approval at the conclusion of the baseline activity. The type of statistical method will be selected after sufficient sampling events have been completed for each baseline, and will be incorporated as an amendment to this plan following EPA and OEPA approval.

The intra-well trend analysis approach can be applied to data from all the elements — the LCS, LDS, and the groundwater monitoring components. The approach will be most advantageous, however, for groundwater given the inherent difficulties in distinguishing potential releases from the OSDF from existing above-background levels of monitoring constituents in the area of the OSDF, and the expected change in groundwater flow directions that will result from aquifer restoration activities.

After the remediation of the Great Miami Aquifer is complete and groundwater flow directions return to pre-restoration conditions, an inter-well upgradient to downgradient comparison of the groundwater data will be initiated for the Great Miami Aquifer wells. Additionally, the point by point intra-well trending comparisons will continue for each of the Great Miami Aquifer wells and for the perched water obtained from each cell's till monitoring point.

As indicated above in Section 4.4.2.1, "action leakage rate(s)" for the LDS are to be developed later via trend analysis of LDS flow monitoring on closed cells prior to closure of the last cell of the OSDF. The "pump operating level" for the LTS permanent lift station sump also is to be developed later, based upon measurements after the final cover has been placed over the last cell of the OSDF. It is anticipated that this will be established via trend analysis on LCS flow monitoring measurements prior to and after closure of the last cell of the OSDF.

4.6.2 Correlation of Monitoring Data

If liquid is collected from the LDS, it does not necessarily mean that the OSDF's leachate is leaking through the primary liner into the LDS. Liquid in the LDS could be from sources other than from within a particular cell. To determine whether liquid in the LDS is leachate and the primary liner of a cell is leaking, a correlation must exist between the LCS and LDS analyte concentrations; a correlation must also exist between the increases in volume of liquid in the LCS and the LDS ("flow monitoring data"). If volume increases and analyte concentrations between the two systems correlate, then a leak through the primary composite liner system will be suspected. The significance of the suspected leak to the protection of the environment depends upon the concentrations of the analytes found in the LDS and the volume of liquid present. Analyte concentrations and volume versus time plots of groundwater collected from the till monitoring wells will be correlated with LCS and LDS data to detect a leak in the secondary composite liner system that contains the three-foot compacted clay liner.

The primary purpose for the data collected in the Great Miami Aquifer is to establish a baseline from which to determine if leakage from the OSDF is detrimentally affecting the Great Miami Aquifer. It is recognized that an exhaustive characterization of the Great Miami Aquifer has already been conducted from which to determine FEMP impacts (from sources other than the OSDF) and establish FEMP-specific constituents of concern and associated final remediation levels. From this, a protective remedy for the Great Miami Aquifer has been developed, the success of which will be tracked through IEMP monitoring of site specific indicator constituents. This has been documented in the Operable Unit 5 RI and FS Reports, the Operable Unit 5 Record of Decision, and the draft IEMP (DOE, 1997).

A secondary purpose for the Great Miami Aquifer data collected through the OSDF monitoring plan is to supplement the IEMP remedy performance monitoring data that will be collected for the aquifer. Groundwater data for those OSDF leak detection constituents that are also common to the IEMP groundwater remedy performance constituents will be utilized in the IEMP data interpretations as the data become available. Groundwater data collected for those unique OSDF leak detection constituents which are not being monitored by the IEMP groundwater monitoring program will be utilized only for the establishment of the OSDF baseline and subsequent leak detection monitoring.

5.0 LEACHATE MANAGEMENT MONITORING PROGRAM

As discussed in Section 3.0, the Ohio Solid Waste Disposal regulations require the preparation of a leachate management monitoring plan to support the overall leak detection strategy and comply with the leachate management and monitoring requirements in OAC 3745-27-19(M)(4) and (5). To fulfill these requirements, the leachate management monitoring plan needs to provide:

1. a means to track the quantity of leachate collected for treatment and discharge, reported on a monthly basis;

2. a means to verify that the engineering components of the leachate management system will operate in accordance with OAC 3745-27-19, Operational Criteria for a Sanitary Landfill Facility;

3. a description of the site-specific leachate treatment and discharge elements, to ensure that the leachate collected from the facility is properly managed; and

4. collection and analysis of an annual leachate grab sample for parameters listed in Appendix I of OAC 3745-27-10 to confirm, on an ongoing basis, the adequacy and appropriateness of the selected leak detection monitoring parameters.

Item 1 of the above requirements is fulfilled by the flow monitoring component of the leak detection monitoring strategy. Flow measurements will take place at least monthly during active cell operations for both the LCS and LDS drainage layers (see Section 4.4.2). Item 2 of the above requirements is fulfilled by Section 3.0 of the OSDF Systems Plan, which describes the operation and maintenance activities for the OSDF's leachate management system to be employed during active cell operations. The OSDF Systems Plan was first submitted to EPA and OEPA as part of the OSDF Intermediate (60%) Design Package (GeoSyntec, 1996b).

The remaining two items (items 3 and 4) are described in Sections 5.1 and 5.2 respectively.

5.1 Monitoring to Support Leachate Treatment and Discharge

All leachate from the OSDF will be treated within the FEMP's on-site AWWT facility prior to discharge at a National Pollutant Discharge Elimination System (NPDES)-permitted outfall to the Great Miami River. Below is a description of the management approach for leachate treatment within the AWWT facility, along with a description of the treatment system and the leachate monitoring needs to ensure proper operation of the AWWT facility and compliance with the NPDES Permit.

5.1.1 Management Approach

All leachate collected through the OSDF's LCS and LDS drainage layers will be routed to Phase 2 of the AWWT facility for treatment. Phase 2 is a part the AWWT facility which was constructed to treat a variety of sitewide process water, stormwater, and remediation wastewater generated during the FEMP's remedial actions. AWWT Phase 2 includes treatment processes for a broad spectrum of contaminants and includes alum flocculation, clarification, filtration, carbon adsorption, and ion exchange.

Leachate will be collected from both the LCS and LDS layers of each cell of the OSDF, whenever such fluids are present. The leachate that accumulates in each layer will flow by gravity for removal via a lift station at the southwestern edge of each cell, as illustrated in the OSDF Final Design Package (GeoSyntec 1996a). After reaching the lift station, the leachate is then pumped to the surge lagoon, which is the primary collection point for remedial wastewater to be delivered to the AWWT Phase 2 facility. The surge lagoon also collects other process and remediation wastewaters, prior to feeding into the AWWT facility. All AWWT facility treated wastewaters are discharged at an NPDES-permitted outfall to the Great Miami River.

5.1.2 Monitoring Needs

To ensure that the FEMP's NPDES permit conditions associated with the effluent from the AWWT facility are met, and to ensure that introduction of the leachate as a wastestream does not interrupt or affect the proper operation of the AWWT facility, select analytical parameters for the leachate will be monitored after leachate collection and prior to treatment. The volume of leachate, as determined from the flow rate monitoring described in Section 4.4.2, will be recorded and the information provided to the appropriate personnel (AWWT facility operators), along with data on the select parameters.

As stated, OSDF leachate is delivered to the surge lagoon prior to treatment through AWWT Phase 2. Therefore, any significant levels of contaminants within the OSDF leachate will quickly be equalized in the surge lagoon mitigating any potential spikes of contaminant concentration or flow. However, four parameters require analysis to ensure that the leachate does not detrimentally affect the treatment system – pH, TOC, nitrate/nitrite, and total dissolved solids (TDS).

Analysis for pH and TOC are already planned to be conducted quarterly for the leachate as part of the supplemental indicator parameters for the groundwater/leak detection monitoring program described in Section 4.0. The other two parameters, nitrate/nitrite and TDS, will be monitored as part of this leachate management monitoring plan. Nitrate/nitrite is an important parameter to ensure that

State of Ohio Water Quality Criteria are met in the Great Miami River, due to the AWWT facility effluent discharge. Knowledge of TDS concentrations is required to ensure proper operation during removal of metals. Wastewaters high in TDS will also be mixed with other wastewaters, if necessary, to ensure proper operation of the AWWT system.

Any other parameters that are expected in the OSDF leachate are not likely to be present at concentrations that are detrimental to the system operations. An NPDES Permit Renewal Application is being prepared which will address the OSDF leachate. No adverse impacts on future effluent limitations are anticipated as a result of OSDF leachate.

Nitrate/nitrite and TDS concentrations will be analyzed quarterly on recovered leachate fluids to ensure that seasonal changes (if any) in concentrations are accounted for over the course of the year. This frequency is considered adequate for this initial version of the leachate management monitoring plan. In the event that more frequent sampling is found to be necessary to support AWWT operations, a modification will be submitted as an amendment to this plan.

5.2 Confirmation of Leak Detection Parameters

The final leachate management monitoring requirement entails the annual confirmation of the site-specific leak detection monitoring parameter list, discussed in Section 3.2.1.3 and 4.5. The purpose of this annual sampling is to confirm the appropriateness of the site-specific leak detection monitoring parameters in the event that leachate composition changes over time, as described in Proposed OEPA Policy DDAGW-04-03-221. An annual leachate grab sample will be obtained and analyzed for parameters listed in Appendix I of Ohio Solid Waste regulation OAC 3745-27-10. This sampling is necessary to fulfill the reporting requirement in OAC 3745-27-19(M)(5), which requires the reporting of data from an annual grab sample of leachate for all Appendix I constituents.

While it is anticipated that the results from analysis of the annual grab of leachate may indicate the presence of parameters not included in the leak detection monitoring parameter list, it is not anticipated that these other parameters would exist in the leachate at concentrations high enough to warrant their addition to the leak detection parameter list. However, the criteria for adding additional parameters to the program, should they be necessary as a result of the grab sample results, is discussed in Section 4.5.3.

5.3 Future Considerations

The leachate management monitoring program described above is designed for OSDF leachate conditions during the active operations of the facility. Once the OSDF cap has been installed, and the

facility is under post-closure care and monitoring, the leachate management monitoring needs may change. For instance, less leachate will be generated after the cap installation, however, the leachate contaminant concentrations may be increased. Such changes in the leachate characteristics and volume may affect the monitoring needs to ensure proper management of the leachate.

Additionally, the frequency for sampling leachate for parameters necessary to determine proper management within the AWWT facility may be increased, if necessary. Section 6.0 provides further information concerning the process for altering any of the components of this plan.

6.0 REPORTING

6.1 Routine Reporting Responsibilities

The construction, filling, closure, and attendant inspection and maintenance of the OSDF is an OSDF Project Group activity, and the physical monitoring of the LCS, LDS, glacial till, and Great Miami Aquifer will also be the responsibility of the OSDF Project Group.

Construction of the northern-most cell of the OSDF and associated monitoring will begin in 1997. The first glacial till monitoring well will be installed during the initial phase of construction of the northern-most OSDF cell. Monitoring of the glacial till well will begin during construction and before waste placement. Additional glacial till monitoring wells will be installed as the other OSDF cells are constructed.

As indicated in Section 4.4, after the baseline sampling events are completed, DOE will evaluate whether sufficient data are available to ascertain the type of distribution of the data, and from that select an appropriate statistical method and associated statistical measure. This determination is anticipated to be made on a parameter-, monitoring-point-, system- (*i.e.*, glacial till, and Great Miami Aquifer), and cell-specific basis. Also, once sufficient samples are in hand to establish a baseline for a sampling point, the leak detection program sampling frequency for that point will be reduced to quarterly. These cell-specific evaluations are anticipated to be summarized in cell-specific technical memoranda, which will be submitted to EPA and OEPA for review. The technical memoranda will serve as the mechanism to propose modifications to this initial groundwater/leak detection and leachate monitoring plan, in areas such as but not limited to the following:

- modification of sampling frequency for LCS, LDS, glacial till, or Great Miami Aquifer monitoring points, based upon considerations presented in Section 4.4.3
- modification of leak detection monitoring parameters list for routine monitoring based upon considerations presented in Section 4.5.3
- modification of leachate management monitoring parameters based upon considerations presented in Section 5.3
- establishment of parameters list for statistical analysis
- establishment of frequency for statistical analysis
- establishment of appropriate statistical method and associated statistical measurements
- establishment of "action leakage rate" for the LDS

- establishment of "pump operating level" for the LCS
- temporary suspension, or cessation, of sampling and attendant statistical analysis for monitoring points (either singly or in combination)
- modifications to address future needs resulting from the completion of aquifer restoration and/or the entry of the OSDF into the post-closure care mode.

Where appropriate, the approved the technical memoranda will be attached as addenda to this plan, formally resulting in an amended groundwater/leak detection and leachate monitoring plan.

To provide an integrated approach to reporting OSDF monitoring data, the annual IEMP comprehensive annual environmental report will serve as the mechanism by which the OSDF Project Group will report LCS and LDS volumes and concentrations, along with groundwater monitoring results, trending results, and interpretation of the data. Presenting data in one report will facilitate a qualitative assessment of the impact of the OSDF on the aquifer, as well as the operational characteristics of OSDF caps and liners. Additionally, the available monitoring data and interpretation of that data will be made available quarterly as part of the IEMP reporting process.

6.2 Notifications and Response Actions

If the flow rate into the LDS exceeds the "action leakage rate" (see Section 4.4.2.1) for any LDS sump, the actions presented in Table 6-1 will be implemented. Note that some of these response actions — i.e., those that do not pose an immediate and substantial threat to human health or the environment — might best be served by a corrective action (see Section 10.0 of the OSDF Post-Closure Care and Inspection Plan [FERMCO, 1996]).

If it is determined that both the cap and primary liner have failed, then an OSDF response action will be required. A response action might include initiating cap repair, investigating whether or not contamination has breached the compacted clay liner component of the secondary composite liner system that lies beneath the LDS, or increasing Great Miami Aquifer monitoring, or a combination of these. Potential leakage through the clay liner will be assessed by using the till well installed beneath the sump area and secondary liner; however, till well monitoring cannot be considered all conclusive for detecting a leak. Comparison of the data from all four systems is needed to determine if a leak has occurred. If it is determined that a leak has adversely impacted the groundwater (till and/or Great Miami Aquifer), then a *groundwater quality assessment monitoring program* will be developed and initiated to determine the nature, rate, and extent of contaminant migration.

Table 6-1
NOTIFICATION AND RESPONSE ACTIONS

Step	Timeframe	Action
1	Within 7 days of the determination of the exceedance.	Notify both the following in writing: • EPA Region 5 Regional Administrator 77 West Jackson Boulevard Chicago, Illinois 60604-3590 • Ohio Director of Environmental Protection 1800 Watermark Drive P.O. Box 1049 Columbus, Ohio 43266-0149
2	Within 14 days of the determination of the exceedance.	Submit to both of the individuals identified in Step 1 a written preliminary assessment as to the: • Amount of liquids. • Likely sources of liquids. • Possible location, size, and cause of any leaks. • Short-term actions taken and planned.
3	As practicable to meet Step 7.	Determine to the extent practicable the location, size and cause of any leak.
4	As practicable to meet Step 7.	Determine: • Whether receipt of impacted materials should be ceased or curtailed. • Whether any impacted materials within the OSDF or any individual cell/phase should be removed for inspection, repairs, or controls.
5	As practicable to meet Step 7.	Determine any other short- or long-term actions to take to stop or mitigate the leaks.
6	As practicable to meet Step 7.	In order to conduct Steps 3-5: • Assess the source of liquids, and amounts of liquids by source; and • In order to identify the source of liquids and the possible location of any leaks, and the hazard and mobility of the liquid, conduct a fingerprint, hazardous constituent, or other analyses of the liquids in the LDS; and • Assess the seriousness of any leaks in terms of potential for escaping into the environment. OR • Document why such assessments are not needed.
7	Within 30 days of the notification given in Step 1.	Submit to both of the individuals identified in Step 1 a written report of the: • Results of the analyses & determinations made under Steps 3-6 (to the extent completed). • Results of action taken. • Actions ongoing (*i.e.*, analyses and determinations under Steps 3-6 not yet completed) or planned (see Section 10.0 of the *OSDF Post-Closure Care and Inspection Plan*).
8	Monthly thereafter, as long as the flow rate in the LDS exceeds the action leakage rate.	Submit to both of the individuals identified in Step 1 a written report summarizing the: • Results of actions taken. • Actions planned.

SOURCE: Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart N—Landfills, Response Actions, 40 CFR §§264.304(b) and 265.303(b).

Groundwater monitoring might also be increased to determine if leakage from the OSDF has entered the Great Miami Aquifer, although given the distances involved it would be unlikely that leakage from the OSDF would be able to migrate to the Great Miami Aquifer in the short time frame between leak detection and response.

7.0 REFERENCES

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APPENDIX A

OSDF ARARs AND OTHER REGULATORY REQUIREMENTS

APPENDIX A

OSDF ARARS AND OTHER REGULATORY REQUIREMENTS

ARARs and to be considered criteria (TBCs) — for OSDF groundwater detection monitoring, OSDF leachate monitoring, and OSDF response action — that should be addressed by this plan are provided here, as obtained from the *Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)* [DOE, 1995b], the *Record of Decision for Final Remedial Action at Operable Unit 3 (OU3 ROD)* [DOE, 1996d], the *Final Record of Decision for Remedial Actions at Operable Unit 5 (OU5 ROD)* [DOE, 1996b], or the *Permitting Plan and Substantive Requirements for the On-Site Disposal Facility* [DOE, 1996c]. Additional regulatory requirements that are appropriate guidance for formulation of this plan have been also identified and included.

TABLE A-1

OSDF GROUNDWATER/LEAK DETECTION AND LEACHATE MONITORING PLAN COMPLIANCE STRATEGY ARARs AND OTHER REGULATORY REQUIREMENTS

Citation	Requirement
	PLANS
Ohio Municipal Solid Waste Rules—Sanitary Landfill Facility Permit to Install Application OAC 3745-27-06(C)(7)(a) and (c)	• Prepare a "groundwater detection monitoring plan" as required by OAC 3745-27-10, and if applicable a "groundwater quality assessment plan" and/or "corrective measures plan" required by OAC 3745-27-10.
	• Prepare a "leachate monitoring plan" to ensure compliance with OAC 3745-27-19(M)(4).
	GROUNDWATER/LEAK DETECTION MONITORING
Ohio Municipal Solid Waste Rules—Groundwater Monitoring Program for a Sanitary Landfill Facility OAC 3745-27-10(A)	(1) The owner or operator of a sanitary landfill facility shall implement a "groundwater monitoring program" capable of determining the quality of groundwater occurring within the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system underlying the landfill facility, with the following elements: (a) A "groundwater detection monitoring program" which includes: (i) a "groundwater detection monitoring plan" in accordance with OAC 3745-27-10(B) through (D); (ii) a monitoring system in accordance with OAC 3745-27-10(B); (iii) sampling and analysis procedures, including an appropriate statistical method, in accordance with OAC 3745-27-10(C); and (iv) detection monitoring procedures, including monitoring frequency and a parameter list, in accordance with OAC 3745-27-10(D). (2) Schedule for implementation of detection monitoring. (b) The owner or operator of a sanitary landfill facility shall implement the "groundwater detection monitoring plan" prior to waste receipt. (4) For purposes of this rule, the groundwater monitoring program is implemented upon commencement of sampling of groundwater wells.
Ohio Municipal Solid Waste Rules—Ground Water Monitoring System OAC 3745-27-10(B)	(1) The "groundwater detection monitoring program" shall consist of sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from both the uppermost aquifer system and any significant zones of saturation that exist above the uppermost aquifer system that: (a) represent the quality of the background groundwater that has not been affected by past or present operations; and (b) represent the quality of the groundwater passing directly down gradient of the limits of solid waste placement. (4) The number, spacing, and depth of groundwater monitoring wells shall be: (a) based on site specific hydrogeologic information; and (b) capable of detecting a release from the facility to the groundwater at the closest practicable location to the limits of waste placement.

TABLE A-1 (Continued)

Citation	Requirement
	GROUNDWATER/LEAK DETECTION MONITORING (Cont'd.)
Ohio Municipal Solid Waste Rules— Ground Water Sampling, Analysis, and Statistical Methods OAC 3745-27-10(C)	(1) The "groundwater monitoring program" shall include consistent sampling and analysis procedures and statistical methods that are protective of human health and the environment and that are designed to ensure monitoring results that provide an accurate presentation of groundwater quality at the background and down gradient well. (a) Sampling and analysis procedures employed must be documented in a written plan. (b) The statistical method selected by the owner or operator must be in accordance with OAC 3745-27-10(C)(6)&(7). (6) After completing collection of the background data, the owner or operator shall specify one of the following statistical methods to be used in evaluating groundwater quality; the statistical method chosen must be conducted separately for each of the parameters required to be statistically evaluated: (a) a parametric analysis of variance (ANOVA); or (b) an analysis of variance (ANOVA) based on ranks; or (c) a tolerance or prediction interval procedure; or (d) a control chart approach; or (e) another statistical method. (7) Performance standards for statistical methods. (a) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of chemical parameters or leachate and leachate-derived constituents. If shown to be inappropriate, then the data should be transformed or a distribution free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed. (e) The statistical method shall account for data below the limit of detection with one or more statistical procedures that ensure protection of human health and the environment. Any practical quantitation limit (PQL) used in the statistical method shall be the lowest concentration level that can be reliably achieved within the specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility. (f) If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temperal correlation in the data. (9) The number of samples collected to establish groundwater quality data shall be consistent with the appropriate statistical procedures.

TABLE A-1 (Continued)

Citation	Requirement
	GROUNDWATER/LEAK DETECTION MONITORING (Cont'd.)
Ohio Municipal Solid Waste Rules—Ground Water Detection Monitoring Program OAC 3745-27-10(D)	(2) Alternate monitoring parameter list. The owner or operator of a sanitary landfill facility may propose to delete any of the Appendix I parameters of this rule. The alternative monitoring parameter list may be approved if the removed parameters are not reasonably expected to be in or derived from the waste contained or deposited in the landfill facility. The following factors should be considered: (a) which of the parameters in Appendix I shall be deleted; (b) types, quantities, and concentrations of constituents in wastes managed at the landfill facility; (c) the concentrations of Appendix I constituents in the leachate from the relevant unit(s) of the landfill facility; (d) any other relevant information. (3) Alternate inorganic parameter list. The owner or operator of a sanitary landfill facility may propose that an alternative list of inorganic indicator parameters to be used in lieu of some or all of the inorganic parameters listed in Appendix I of this rule. The alternative inorganic indicator parameters may be approved if the alternative list will provide a reliable indication of inorganic releases from the facility to the groundwater. The following factors should be considered: (a) the types, quantities, and concentrations of constituents in wastes managed at the facility; (b) the mobility, stability, and persistence of waste constituents or their reaction products in the unsaturated zone beneath the facility; (c) the detectability of the indicator parameters, waste constituents, and their reaction products in the ground water; and (d) the concentrations or values and coefficients of variation of monitoring parameters or constituents in the background groundwater quality. (5) Monitoring parameters, frequency, location. The owner or operator shall monitor the groundwater monitoring well system (a) and (b) during the active life of the facility (including final closure and the post-closure care period, (ii) at least semiannually by collecting: *(a)* during the initial one hundred and eighty days after implementing the groundwater detection monitoring program (the first semiannual sampling event), a minimum of four independent samples from each monitoring well. *(b)* during subsequent semiannual sampling events, at least one sample for each monitoring well. (iii) beginning with receiving the results from the second semiannual monitoring event and semiannually thereafter, by statistically analyzing the results. (6) Alternative sampling and statistical analysis frequency. The owner or operator of a sanitary landfill facility may propose an alternative frequency for groundwater sampling and/or statistical analysis. The alternative frequency may be approved provided it is not less than annual. The following factors should be considered: (a) lithology of the aquifer system and all stratigraphic units above the uppermost aquifer system; (b) hydraulic conductivity of the uppermost aquifer system and all stratigraphic units above the uppermost aquifer system; (c) groundwater flow rates for the uppermost aquifer system and all zones of saturation above the uppermost aquifer system; (d) minimum distance between the upgradient edge of the limits of waste placement of the landfill facility and the downgradient monitoring well system; and (e) resource value of the uppermost aquifer system. **NOTE:** Table B-3 of the OU5 ROD @ p. B.3-25 states "an alternate list of monitoring parameters will be required".

TABLE A-1 (Continued)

Citation	Requirement
	GROUNDWATER/LEAK DETECTION MONITORING (Cont'd.)
Ohio Hazardous Waste General Facility Standards-New Facilities Rules-Required Programs OAC 3745-54-91; 40 CFR 264.91	Owners or operators subject to the groundwater protection rules must conduct a monitoring and response program as follows: (1) whenever hazardous constituents from a regulated unit are detected at the compliance point, the owner or operator must institute a compliance monitoring program. "Detected" is defined as statistically significant evidence of contamination. (2) whenever the groundwater protection standard is exceeded, the owner or operator must institute a corrective action program. "Exceeded" is defined as statistically significant evidence of increased contamination. (3) whenever hazardous constituents from a regulated unit exceed concentration limits in groundwater between the compliance point and the downgradient facility property boundary, the owner or operator must institute a corrective action program. (4) in all other cases, the owner or operator must institute a detection monitoring program.
Ohio Hazardous Waste General Facility Standards-New Facilities Rules-Groundwater Protection Standard OAC 3745-54-92; 40 CFR 264.92	The owner or operator must comply with conditions specified in the facility permit that are designed to ensure that hazardous constituents detected in the groundwater from a regulated unit do not exceed the specified concentration limits (specified in the permit) in the uppermost aquifer underlying the waste management area beyond the point of compliance. The groundwater protection standard will be established when hazardous constituents have been detected in the groundwater.
Ohio Hazardous Waste General Facility Standards-New Facilities Rules-Hazardous Constituents OAC 3745-54-93; 40 CFR 264.93	(A) The permit will specify the hazardous constituents to which the groundwater protection standard applies. Hazardous constituents are those that have been detected in the groundwater in the uppermost aquifer underlying a regulated unit and that are reasonably expected to be in or derived from waste contained in a regulated unit, unless excluded under paragraph B of this rule. (B) A constituent will be excluded from the list of hazardous constituents specified in the facility permit if it is found that the constituent is not capable of posing a substantial present or potential hazard to human health or the environment. The following will be considered: (1) Potential adverse effects on groundwater quality, considering: (a) the physical and chemical characteristics of the waste in the regulated unit, included its potential for migration; (b) the hydrogeological characteristics of the facility and surrounding land; (c) the quantity of groundwater and the direction of groundwater flow; (d) the proximity and withdrawal rates of groundwater users; (e) the current and future use of groundwater in the area; (f) the existing quality of groundwater, including other sources of contamination and their cumulative impact on the groundwater quality; (g) the potential for health risks caused by human exposure to waste constituents; (h) the potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; (i) the persistence and permanence of the potential adverse effects.
Ohio Hazardous Waste General Facility Standards-New Facilities Rules—General Groundwater Monitoring Requirements OAC 3745-54-97; 40 CFR 264.97	(G) In detection monitoring or where appropriate in compliance monitoring, data on each constituent specified in the permit [or in the monitoring plan] is to be collected from background wells and wells at compliance point(s). The number and kinds of samples collected to establish background shall be appropriate for the form of statistical test employed. The sample size should be as large as necessary to ensure with reasonable confidence that a contaminant release to the groundwater from a facility will be detected. The owner or operator will determine an appropriate sampling procedure and interval for each constituent. (H) The owner or operator is to specify one of the following statistical methods to be used in evaluating groundwater monitoring data for each constituent to be specified ... Use of any of the following statistical methods must be protective of human health and the environment: (1) a parametric analysis of variance (ANOVA); (2) an analysis of variance (ANOVA) based on ranks; (3) a tolerance or prediction interval procedure; (4) a control chart approach; or (5) another statistical method.

TABLE A-1 (Continued)

Citation	Requirement
GROUNDWATER/LEAK DETECTION MONITORING (Cont'd.)	
Ohio Hazardous Waste General Facility Standards-New Facilities Rules—Detection Monitoring Program OAC 3745-54-98; 40 CFR 264.98	(A) The owner or operator must monitor for indicator parameters (e.g., specific conductance, total organic carbon, or total organic halogen), waste constituents, or reaction products that provide a reliable indication of the presence of hazardous constituents in groundwater. The director [of OEPA] will specify the parameters or constituents to be monitored in the facility permit, after considering the following factors: (1) types, quantities, and concentrations of constituents to be managed at the regulated unit; (2) mobility, stability, and persistence of the waste constituents or their reaction products in the unsaturated zone beneath the waste management area; (3) detectability of the indicator parameters, waste constituents, and their reaction products in the ground water; and (4) concentrations or values and coefficients of variation of proposed monitoring parameters or constituents in the ground water background. (D) The permit will specify the frequencies for collecting samples and conducting statistical tests to determine whether there is statistically significant evidence of contamination for any parameter or hazardous constituent specified in the permit. (F) The owner or operator must determine whether there is statistically significant evidence of contamination for any chemical parameter or hazardous constituent specified in the permit at the frequency specified in the permit.
Federal Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings: Subpart D—Standards for Management of Uranium Byproduct Material Pursuant to Section 84 of the Atomic Energy Act of 1954, as Amended 40 CFR §192.30 through .34	Uranium byproduct materials shall be managed to conform to the ground water protection standard in 40 CFR §264.92, which includes detection monitoring. Alternate concentration limits for uranium can be established, as described in 40 CFR §264.95 and §264.94(b).
Environmental Monitoring DOE Order 5820.2A, Chapter III(3)(k)	Each non-operational low-level waste disposal facility shall be monitored by an environmental monitoring program that, at a minimum, meets the requirements listed below: • Based on the characteristics of the facility monitored, the environmental monitoring program may include, but not necessarily be limited to, monitoring subsurface water, both in the saturated and unsaturated zones. • The monitoring program shall be capable of detecting changes in trends in performance far enough in advance to allow application of necessary corrective action before exceeding performance objectives. The monitoring program shall be able to ascertain whether or not effluents from each treatment or disposal facility or disposal site meets the requirements of applicable DOE Orders.
LEACHATE MANAGEMENT & MONITORING	
Ohio Municipal Solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(M)(4)&(5)	The owner annually shall report: • a summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year; location of leachate treatment and/or disposal; and verification that the leachate management system is operating in accordance with this rule; • results of analytical testing of an annual grab sample of leachate.
OTHER REQUIREMENTS	
Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart N—Landfills, Monitoring and Inspection 40 CFR §264.302	Action Leakage Rate: (a) The action leakage rate is the maximum design flow rate that the leak detection system (LDS) can remove without the fluid head on the bottom liner exceeding 1 foot. The action leakage rate must include an adequate safety margin to allow for uncertainties in the design (e.g., slope, hydraulic conductivity, thickness of drainage material), construction, operation, and location of the LDS, waste and leachate characteristics, likelihood and amounts of other sources of liquids in the LDS, and proposed response actions (e.g., the action leakage rate must consider decreases in the flow capacity of the system over time resulting from siltation and clogging, rib layover and creep of synthetic components of the system overburden pressures, etc.). (b) To determine if the action leakage rate has been exceeded, the owner or operator must convert the weekly or monthly flow rate from the monitoring data obtained under 40 CFR §264.303(c), to an average daily flow rate (gallons per acre per day) for each sump. Unless the [EPA] approves a different calculation, the average daily flow rate for each sump must be calculated weekly during the active life and closure period, and monthly during the post-closure care period when monthly monitoring is required under 40 CFR §264.303(c).

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TABLE A-1 (Continued)

Citation	Requirement
	OTHER REQUIREMENTS (Cont'd.)
Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart N—Landfills, Monitoring and Inspection 40 CFR §264.303(c)	An owner or operator required to have a leak detection system must record the amount of liquids removed from each leak detection system sump as follows: (1) During the active life and closure period, at least once each week. (2) After the final cover is installed, in accordance with the following graded approach — • at least monthly; or • if the liquid level in the sump stays below the pump operating level for two consecutive months, at least quarterly; or • if the liquid level in the sump stays below the pump operating level for two consecutive quarters, at least semi-annually; but • if at any time during the post-closure care period the pump operating level is exceeded at units on quarterly or semi-annual recording schedules, the owner or operator must return to monthly recording of amounts of liquids removed from each sump until the liquid level again stays below the pump operating level for two consecutive months. **NOTE:** There are no requirements in Ohio hazardous waste or Ohio solid waste rules regarding leak detection system flow monitoring.
Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart N—Landfills, Response Actions 40 CFR §264.304	(a) The owner or operator of landfill units ... must have an approved "response action plan" before receipt of waste. The response action plan must set forth the action to be taken if the "action leakage rate" has been exceeded [in any leak detection system sump]. (b) At a minimum, the response action plan [see entry 2 above] must describe the following actions to be taken: (1) Notify the Regional Administrator in writing of the exceedance within 7 days of the determination; (2) Submit a preliminary written assessment to the Regional Administrator within 14 days of the determination, as to the amount of liquids, likely sources of liquids, possible location, size, and cause of any leaks, and short-term actions taken and planned; (3) Determine to the extent practicable the location, size, and cause of any leak; (4) Determine whether waste receipt should cease or be curtailed, whether any waste should be removed from the unit for inspection, repairs, or controls, and whether or not the unit should be closed; (5) Determine any other short-term or longer-term actions to be taken to mitigate or stop any leaks; and (6) Within 30 days of the notification that the action leakage rate has been exceeded, submit to the Regional Administrator the results of the analysis specified in (3), (4) and (5) [above], the results of action taken, and actions planned. Monthly thereafter, as long as the flow rate in the leak detection system exceeds the action leakage rate, the owner or operator must submit to the Regional Administrator a report summarizing the results of any remedial actions taken and actions planned. (c) To make the leak and/or remedial action determinations in paragraphs (b)(3), (4) and (5) [above], the owner or operator must: • Asses the source of liquids, and amount of liquids by source; • Conduct a fingerprint, hazardous constituent, or other analyses of the liquids in the leak detection system to identify the source of liquids and possible location of any leaks, and the hazard and mobility of the liquid; and • Assess the seriousness of any leaks in terms of potential for escape to the environment; or • Document why such assessments are not needed.

APPENDIX B

SAMPLING AND ANALYSIS REQUIREMENTS

B.0 SAMPLING AND ANALYSIS REQUIREMENTS

NOTE 1:	Prior to sampling, refer to the addenda to this plan; they are anticipated to override both the frequency(ies) for sampling and the monitoring parameters list(s).

NOTE 2:	If a conflict exists between the specifics in this section (or corresponding sections in subsequent addenda) and Standard Operating Procedure SC-GM-FO-201, the specifics of this section (or corresponding sections in future addenda) govern.

B.1 Sampling Requirements

For the OSDF *groundwater/leak detection monitoring program* for the LCS, LDS, glacial till and Great Miami Aquifer monitoring points, Section 4.0 governs the general strategy including sampling frequency, while Table B-1 summarizes the sampling procedures and analysis requirements, for the *initial baseline period*. Both the frequency for sampling and the monitoring parameters list are anticipated to be overridden by future addenda to this plan.

For OSDF *leachate management monitoring program* monitoring, Section 5.0 governs the general strategy including sampling frequency, while Table B-2 governs the sampling procedures and analysis requirements. Both the frequency for sampling and the monitoring parameters list might be overridden by future addenda to this plan.

NOTE 3:	Field measurement of certain parameters are required; see General Chemistry in Table B-1 and Field Parameters in Table B-2 (or corresponding tables in future addenda).

Prior to sampling, the liquid volume in each monitoring point shall be estimated and recorded on the Water Sample Collection Log by the water monitoring sampling technicians. For the Great Miami Aquifer monitoring points, this consists of measuring the water level in accordance with Standard Operating Procedure SC-GM-FO-201, "Groundwater Sampling Activities." For the glacial till monitoring points and the LDS monitoring points, this consists of a similar measurement of liquid levels. This measured height of liquid column will then be used with the inner diameter of the pipe to estimate the liquid volume.

NOTE 4:	Do not purge the LCS, LDS, and glacial till monitoring points prior to sampling; only the Great Miami Aquifer monitoring wells are to be purged prior to sampling.

A dedicated Teflon bailer or pump shall then be used to purge the Great Miami Aquifer well of the required purge volume prior to sampling in accordance with the procedure; following removal of the required purge volume, the sample shall be collected using the dedicated Teflon bailer.

Great Miami Aquifer monitoring point samples shall be collected using a dedicated Teflon bailer. All sampling activities shall be completed in accordance with Standard Operating Procedure SC-GM-FO-201, "Groundwater Sampling Activities."

NOTE 5: Prior to collecting the sample, the volume contained in the LCS, LDS, and glacial till monitoring points are to be estimated to determine if sufficient volume is present for the full suite of analytical parameters (see Table B-1 and/or Table B-2 , or corresponding tables in future addenda).

If sufficient volume is present in a system for a *full suite* of analytical parameters *at standard volume*, then collect a full sample at standard volume from the system. Else, if sufficient volume is present in a system for a *full suite* of analytical parameters but *at minimum volume*, then collect a full suite of analytical parameters at minimum volume from the system. Else, collect a *partial sample at minimum volume with prioritized analytical groupings* (see Table B-1 and/or Table B-2, or corresponding tables in future addenda) as volume allows.

If volume sufficient for a full set of analytical parameter groups is present in one or more systems but not all the systems (*e.g.*, sufficient volume in LCS but not in LDS monitoring point), then collect a full sample at standard volume from the system(s) with sufficient standard volume (*e.g.*, LCS), and either a full set of analytical parameters at minimum volume, or a partial sample at minimum volumes with prioritized analytical groupings, as volume allows from the other(s), and make appropriate notation in the field log.

The field data from the above activities will be entered into the Sitewide Environmental Database (SED).

B.2 Health and Safety

The health and safety issues regarding all sampling specified under this plan will be addressed by project-specific safety permits.

Each individual field personnel assigned to this project shall conform to all applicable precautionary surveys performed by the personnel representing the utility engineer, industrial hygiene, and radiological control. Concurrence to applicable safety permits (indicated by the signature of each

individual field personnel assigned to this project) is expected of each individual in the performance of their assigned duties in the field.

The supervisor shall ensure that each individual field personnel assigned to sampling activities for the OSDF monitoring programs governed by this plan reads and understands the applicable surveys and permits; any field personnel who does not sign the applicable permit(s) shall not participate in the execution of these sampling activities. A current copy of the permit(s) shall be in the field with the field personnel during sampling events.

B.3 QA/QC Field Samples

Every sampling event will have the following field quality assurance samples collected at a frequency of 1 per 20 samples collected, or 1 per sampling event if fewer than 20 samples are collected; unless indicated otherwise below, analysis shall be for the entire suite of analytical parameters indicated in either Table 7-1 or Table 7-2, dependent on the purpose of the sampling effort and system from which the sample is collected (or corresponding tables in subsequent addenda):

- rinsate (required only if dedicated sampling equipment is not used);
- field blank;
- trip blank (only for parameter group 3. Volatile Organics);
- field duplicate; and
- one matrix spike/matrix spike duplicate (MS/MSD).

The field duplicate and MS/MSD shall be taken from the system(s) which has (have) sufficient volume for the entire suite of analytes at standard volume (likely the LCS and/or Great Miami Aquifer monitoring points).

B.4 Calibration of Field Equipment

All equipment used during this investigation shall be operated and calibrated according to the manufacturer's specification and in accordance with Standard Operating Procedure (SOP) SC-GM-FO-201, "Groundwater Sampling Activities." Written logs of equipment calibration are maintained by the personnel responsible for performing the instrument calibrations.

B.5 Sample Chain-of-Custody Records and Field Data Documents

Sample custody procedures outlined in the *SCQ* shall be adhered to throughout the sample handling process from field collection to shipment of the samples to the laboratory. A Custody

Record/Request For Analysis (COC/RFA) shall be used to document collection data, chain-of-custody, and geotechnical parameters requested for each sample in accordance with EW-0018 "Chain Of Custody/Request For Analysis Record For Sample Control."

In addition to the custody records, a Water Sample Collection Log shall be completed which summarizes all samples collected. All field work shall be documented in detail on a daily basis using the Field Activity Log (FAL). All field documentation will be completed by the lead sampling technician.

B.6 Sample Packaging, Storage, and Shipping

Sample custody seals and labels, and the COC/RFA will be examined and verified by water/groundwater monitoring team leader and personnel of the sample management organization prior to acceptance and shipment of samples. The field screening results will be clearly displayed on the sample label and the COC/RFA. Sample packaging shall be performed in accordance with Section K.10 of the *SCQ*.

Final sample handling, screening, storage, and shipping activities will be completed by the water/groundwater monitoring organization. Samples will be shipped to the designated off-site lab for the analyses required.

B.7 Equipment Decontamination

Sampling equipment shall be decontaminated prior to transport to the sample field site, and after all sampling is completed, to limit the introduction of contaminants from equipment to sampled media, and to protect worker safety and health.

The decontamination of equipment shall be a Level II Decontamination, as referenced in Section K.11 of Vol. II of the *SCQ* and as described in Section 6.4.1 of the *SCQ* and Section 5.7.6 of SOP SC-GM-FO-201, "Groundwater Sampling Activities."

B.8 Disposition of Investigation-Derived Wastes

During completion of sampling activities, water/groundwater monitoring sampling technicians may generate contact wastes and decontamination waste. Following completion of sampling, the water/groundwater monitoring sampling technicians shall place contact wastes into properly labeled bags and disposition in accordance with appropriate FEMP waste management policies. Purge water will go to the Biodenitrification Surge Lagoon. The water/groundwater monitoring sampling

technicians shall decant decontamination solution into appropriate containers which will be ultimately transferred to Plant 8 or the Advanced Wastewater Treatment (AWWT) facility for treatment.

TABLE B-1

OSDF GROUNDWATER/LEAK DETECTION MONITORING PROGRAM
SAMPLING & ANALYSIS REQUIREMENTS FOR THE LCS, LDS, GLACIAL TILL AND GREAT MIAMI AQUIFER

Parameter Groups/Parameters	Method	Priority[a]	ASL[b]	Holding Time	Preservation	Minimum Volume	Standard Volume	Container[c]
1. Radionuclides:								
Technetium-99	SCQ[d]	2	C	6 Months	HNO_3 to pH < 2	500 ml	1L	Plastic or glass
Uranium, total	SCQ[d]	1	C	6 Months	HNO_3 to pH < 2	10ml	100ml	Plastic or glass
2. Inorganics (Metals):								
Boron	CLP[e]	7	C	6 Months	HNO_3 to pH < 2	300ml	1L	Plastic or glass
Mercury	CLP[e]	7	C	28 Days	HNO_3 to pH < 2		1L	Plastic or glass
3. Volatile Organics: Bromodichloromethane 1,1-Dichloroethene 1,2-Dichloroethene (total) Tetrachloroethene Trichloroethene Vinyl chloride	CLP[e]	3	C	7 Days or 14 Days	Cool to 4°C or Cool to 4°C H_2SO_4, HCl, or solid $NaHSO_4$ to pH < 2	1X40 ml	3X40ml	Glass vial with Teflon lined septum cap[f]
4. Semi-Volatile Organics: Carbazole bis(2-Chloroisopropyl)ether 4-Nitroaniline	CLP[e]	6	C	7 Days to extraction 40 Days from extraction to analysis	Cool to 4°C	1L	2L	Amber glass bottle with Teflon lined cap
5. Pesticides: alpha-Chlordane	CLP[e]	8	C	7 Days to extraction 40 Days from extraction to analysis	Cool to 4°C	1L	2L	Amber glass bottle with Teflon lined cap

Parameter Groups/Parameters	Method	Priority[a]	ASL[b]	Holding Time	Preservation	Minimum Volume	Standard Volume	Container[c]
6. General Chemistry:								
Total Organic Halogens (TOX)	9020[i]	4	B	28 Days	Cool to 4°C H_2SO_4 to pH < 2	125 ml	250ml	Amber glass bottle with Teflon lined septum cap[f]
Total Organic Carbon (TOC)	9060[i]	5	B	28 Days	Cool to 4°C H_2SO_4 to pH < 2	20ml	40ml	Amber glass bottle with Teflon lined septum cap
pH	Field	1	A	NA[h]	NA[h]	NA[h]	NA[h]	NA[h]
Specific Conductance	Field	1	A	NA[h]	NA[h]	NA[h]	NA[h]	NA[h]

[a] If sufficient volume is not available for collection of the full suite (groups 1-6) at standard volume, then the minimum volume is to be collected for all analytical groups (Primary Parameter groups 1-5, and Supplemental Indicator Parameter group 6); if sufficient volume is still not available for collection of the full suite, then a partial sample is to be collected in accordance with the indicated priority.
[b] Analytical Support Level, as defined in the SCQ.
[c] Container size is left to the discretion of the individual laboratory.
[d] Radionuclide analyses do not have standard methods; however, the analytical specifications for these parameters are provided in Appendix G of the SCQ.
[e] EPA Contract Laboratory Program Statement of Work, Multi-Media, Multi-Concentration, most recent revision.
[f] No head space.
[g] Field parameters include dissolved oxygen, pH, specific conductance, temperature and turbidity.
[h] NA = Not applicable.
[i] Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846.

Note: Detection limits and highest allowable minimum detectable concentrations will be below the FRLs.

TABLE B-2

OSDF LEACHATE MONITORING PROGRAM
SAMPLING AND ANALYSIS REQUIREMENTS FOR THE LEACHATE MANAGEMENT PROGRAM

Parameter Groups/Parameters[a]	Method	Priority[b]	ASL[c]	Holding Time[d]	Preservation[d]	Minimum Volume	Standard Volume	Container[d,e]
1. General Chemistry:								
Nitrogen, Ammonia	350.1[f], 350.3[f], 4500C[g], or 4500E[g]	7	B	28 Days	Cool to 4°C, H_2SO_4 to pH < 2	100 ml	500 ml	Plastic or glass
Chemical Oxygen Demand	5220D[g]	9	B	28 Days	Cool to 4°C, H_2SO_4 to pH < 2	20 ml	100 ml	Plastic or glass
Chloride	325.2[f] or 4500B[g]	5	B	28 Days	None	50 ml	250 ml	Plastic or glass
Nitrogen, Nitrate/Nitrite	353.1[f], 353.2[f], 4500D[g], or 4500E[g]	1	B	28 Days	Cool to 4°C, H_2SO_4 to pH < 2	20 ml	100 ml	Plastic or glass
Sulfate	375.2[f] or 4500E[g]	6	B	28 Days	Cool to 4°C	50 ml	120 ml	Plastic or glass
Total Alkalinity	310.1[f] or 2320B[g]	8	B	14 Days	Cool to 4°C	20 ml	100 ml	Plastic or glass
Total Dissolved Solids	160.1[f] or 2540C[g]	2	B	7 Days	Cool to 4°C	100 ml	250 ml	Plastic or glass
Total Organic Carbon	9060[h]	1	B	28 Days	Cool to 4°C, H_2SO_4 to pH < 2	20 ml	40 ml	Amber glass bottle with Teflon lined cap
2. Inorganics (Metals): Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc	CLP[i]	4	C	6 Months	HNO_3 to pH < 2	600 ml	1 L	Plastic or glass
3. Volatile Organics: **[Also on Table B-1]** Bromodichloromethane, 1,1-Dichloroethene, 1,2-Dichloroethene (total), Tetrachloroethene, Vinyl chloride	CLP[i]	3	C	7 Days or 14 Days	Cool to 4°C or Cool to 4°C H_2SO_4, HCl, or $NaHSO_4$ to pH < 2	1 x 40 ml	4 x 40 ml	Glass vial with Teflon lined septum cap[j]

TABLE B-2 (Continued)

Parameter Groups/Parameters[a]	Method	Priority[b]	ASL[c]	Holding Time[d]	Preservation[d]	Minimum Volume	Standard Volume	Container[d,e]
4. Volatile Organics: [Not on Table B-1][k]	CLP[i]	3	C	7 Days or 14 Days	Cool to 4°C or Cool to 4°C H_2SO_4, HCl, or $NaHSO_4$ to pH < 2	1 x 40 ml	4 x 40 ml	Glass vial with Teflon lined septum cap
5. Field Parameters[l]: pH, Specific Conductance, Temperature, Turbidity		1	A	NA[m]	NA[m]	NA[m]	NA[m]	NA[m]

[a] All parameters in Table B-2 that are also in Table B-1 along with Nitrogen, Nitrate/Nitrite and Total Dissolved Solids will be monitored quarterly. All other parameters in Table B-2 will be monitored annually.
[b] If sufficient volume is not available for collection of the full suite (Groups 1-5) at standard volume, then the minimum volume is to be collected for all analytical groups; if sufficient volume is still not available for the collection of the full suite, then a partial sample is to be collected in accordance with the indicated priority.
[c] Analytical Support Level, as defined in the SCQ.
[d] Appropriate preservative, holding time, and container requirements will be used for the corresponding method.
[e] Container size is left to the discretion of the individual laboratory.
[f] "Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
[g] "Standard Methods for the Analysis of Water and Wastewater," 17th edition.
[h] Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846.
[i] EPA Contract Laboratory Statement of Work, Multi-Media, Multi-Concentration, most recent revision.
[j] No head space.
[k] 1,1,1-Trichloroethane; 1,1,1,2-Tetrachloroethane; 1,1,2,2-Tetrachloroethane; 1,1,2-Trichloroethane; 1,1-Dichloroethane; 1,2-Dibromo-3-chloropropane; 1,2-Dichloroethane; 1,2-Dichloropropane; 1,2,3-Trichloropropane; 2-Butanone; 2-Hexanone; 4-Methyl-2-Pentanone; 4-Methyl-2-pentanone; Acetone; Acrylonitrile; Benzene; Bromochloromethane; Bromoform; Bromomethane; Carbon Disulfide; Carbon Tetrachloride; Chlorobenzene; Chloroethane; Chloroform; Chloromethane; Dibromochloromethane; Ethylbenzene; Ethylene dibromide; Methylene bromide; Methylene chloride; Methyl iodide; Styrene; Toluene; Trichloroethene; Trichlorofluoromethane; Vinyl Acetate; Xylenes, Total; cis-1,3-Dichloropropene; trans-1,2-Dichloroethene; trans-1,3-Dichloropropene; trans-1,4-Dichloro-2-butene; 1,2-Dichlorobenzene, 1,4-Dichlorobenzene.
[l] Field parameters include dissolved oxygen, pH, specific conductance, temperature, and turbidity.
[m] NA = Not applicable.

Note: Detection limits will be below the FRLs.

APPENDIX C

QUALITY ASSURANCE/QUALITY CONTROL

C.0 QUALITY ASSURANCE/QUALITY CONTROL

C.1 Introduction

The primary objectives of the Quality Assurance/Quality Control (QA/QC) section of this plan relate to the collection of field information and data sufficient to evaluate the OSDF leak detection and leachate monitoring programs. Specific objectives of this field sampling effort shall be designed, organized, and implemented in a manner which will optimize the collection of information which meets the data quality objectives (DQOs). To ensure information is gathered in such a manner that DQOs are met, QA/QC measures will be used to determine conformance with overall project and program objectives.

The fundamental mechanisms used to achieve these quality goals can be characterized as prevention, assessment, and correction. These components are further described as follows:

- Prevention of defects in the data quality through planning and design, documented instruction and procedures, and careful selection and training of skilled, qualified personnel.
- Quality assessment through program or regular audits and surveillance to supplement continual informal review.
- Permanent correction of conditions adverse to quality objectives through a closed-loop corrective action system.

C.2 Quality Assurance/Quality Control Requirements

All FEMP sampling programs follow protocol established in the *Sitewide CERCLA Quality Assurance Project Plan (SCQ)*, in Vol. I, Section 4, and in Vol. II, Appendix K.

Self-assessment and independent assessments of work processes and operations shall be undertaken to assure quality of performance. Self-assessment shall be performed by the Quality Assurance Officer assigned to the OSDF Groundwater Monitoring Program. Self-assessment activities shall encompass technical and procedure requirements, and may be conducted at any point in the project.

At a minimum, one surveillance shall be conducted per sampling event, consisting of monitoring/observing on-going project activity and work areas to verify conformance to specified requirements. Surveillance shall be planned and documented in accordance with Section 12.3 of the *SCQ*.

Requirements for QA/QC samples are presented in Appendix B.3.

C.3 Field Changes

Prior to the implementation of field changes, the OSDF Groundwater Project Manager and Groundwater Monitoring Manager shall be informed of the proposed field changes. Once the OSDF Groundwater Project Manager has obtained approval (verbal or written) from the OSDF Project Manager and Quality Assurance (QA) representative for the field changes to the plan, the field changes may be implemented. Field changes to the plan shall be noted on a Variance Request form. The QA representative must receive the completed Variance Request form, which includes the signatures of the OSDF Groundwater Manager, OSDF Project Manager, and the QA representative, within one week of the granting of the verbal approval.

APPENDIX D

DATA MANAGEMENT PLAN

D.0 DATA MANAGEMENT PLAN

D.1 Introduction

This data management plan will be implemented so that information collected during the investigation will be properly managed following completion of the field activities. Data and field documentation generated during the investigation shall be validated to ensure compliance with the DQOs of this program.

D.2 Field Documentation Validation

As specified in Section 5.1 of the *SCQ*, sampling teams shall describe daily activities on the FAL sufficient for the sampling team to reconstruct a particular situation without reliance on memory. Sample collection logs shall be completed according to instructions specified in Appendix B of the *SCQ*.

To assure appropriate documentation was completed during field activities and that documentation was completed correctly, field documentation shall be validated by the environmental monitoring group and Quality Assurance (QA) as described in Section D.5 of Vol. II of the *SCQ*.

D.3 Analytical Data Validation

Analytical data shall be validated by the data quality group upon receipt. Analytical Support Level (ASL) for deliverables shall be requested from the laboratory for all parameters in accordance with Table B-1 (or corresponding tables in future addenda to this plan). Validation shall be performed to the highest ASL permitted by the data.

The data quality group shall provide to the Project Manager and to the analytical data management (ADM) group copies of the summary reports listing validation qualifiers applied along with copies of the validated data sheets. All original validation summary forms and validation reports shall be submitted to the ADM group for permanent storage.

D.4 Data Entry

Analytical data shall be received from the contract laboratory by electronic data transfer in a compatible format with the FEMP database and in hard-copy format. Validated field data shall be entered into the FEMP Site-Wide Environmental Database (SED) by the ADM group in a timely manner. Manual, double keyed data entry shall be completed and the entered data shall be compared

to the original data sheets; corrections shall be initialed and dated, and made as necessary. Hard-copy documents are kept in permanent storage in the project. Data from the SED will be provided to OEPA in a compatible electronic format.