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OSDF SUPPORT PLANS
ON-SITE DISPOSAL FACILITY

REVISION D
APRIL 1996

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

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DRAFT REMEDIAL ACTION WORK PLAN FOR THE ON-SITE DISPOSAL FACILITY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

APRIL 1996

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

2502-WP-0019

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LIST OF SUPPORT PLANS

Permitting Plan/Crosswalk
Air Monitoring Plan
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Surface Water Management and Erosion Control Plan
Cultural Resource Unexpected Discovery Plan
Construction Quality Assurance Plan
Impacted Material Placement Plan
System Plan
Groundwater Monitoring Plan
Post-Closure Care and Inspection Plan

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LIST OF ACRONYMS AND ABBREVIATIONS

A/E	Architect/Engineer
ACA	Amended Consent Agreement (1991)
AMS	air monitoring system
ARAR	Applicable or Relevant and Appropriate Requirement
CAT	Construction Acceptance Testing
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CM	Configuration Management
CCM	Construction Contracts Manager
CRP	Community Relations Plan
CQA	Construction Quality Assurance
DOE	United States Department of Energy
DOE-FN	Department of Energy - Fernald Area Office
EMP	Environmental Monitoring Program
EPA	United States Environmental Protection Agency
FAR	Federal Acquisition Requirements
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Company
FFCA	Federal Facility Compliance Agreement
FS	feasibility study
H&S	Health & Safety
IEMP	Integrated Environmental Monitoring Plan
IFB	Invitation for Bids
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OU	Operable Unit (as specified by either OU1, OU2, OU3, OU4, OU5)
OSDF	On-Site Disposal Facility

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LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

OSWER	Office of Solid Waste and Emergency Response
PSHSRM	Project Specific Health & Safety Requirements Matrix
QA	Quality Assurance
QC	quality control
RA	remedial action
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RDWP	Remedial Design Work Plan
RD/RA	Remedial Design/Remedial Action
RFP	Request for Proposal
RI	remedial investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SOW	statement of work
TBC	To Be Considered
WACs	waste acceptance criteria

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this On-Site Disposal Facility (OSDF) Remedial Action Work Plan (RAWP) is to identify the implementation strategy and schedule for completion of construction of, and placement of impacted materials resulting from Fernald Environmental Management Project (FEMP) remediation into, the OSDF component of remedial action as set forth in the *Final Record of Decision for Operable Unit 2, May 1995* (OU2 ROD), and in the *Final Record of Decision for Operable Unit 5, January 1996* (OU5 ROD). The OSDF RAWP includes the following activities: construction of, placement of impacted materials into, and long-term maintenance and monitoring of, the OSDF; a separate work plan has been developed for construction of the associated test pads [an activity previously defined in the *Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2, October 1995* (OU2 RDWP) as being within the scope of the OSDF RAWP].

The overall goal of the OSDF remedial action project is to safely construct and operate the OSDF in a timely, efficient and cost-effective manner that ensures compliance with all associated applicable or relevant and appropriate requirements (ARARs) while being protective of human health and the environment. This RAWP has been developed in accordance with the requirements of the *Amended Consent Agreement (ACA)*, and is based on the *Superfund Remedial Design (RD) and Remedial Action (RA) Guidance (Office of Solid Waste and Emergency Response Directive [OSWER] Directive 9355.0-4A)*, and *Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties (OSWER Directive 9355.5-01)*, and *Guidance on Expediting Remedial Design and Remedial Action (OSWER Directive 9355.5-02)*. Furthermore, as the *ACA* is heavily oriented toward the remedial investigation (RI) and feasibility study (FS) phase of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response activities and developed from the model RI/FS consent order, the *Revised Model RD/RA Consent Decree (60 FR 38817, July 28, 1995)* was also consulted during development of this RAWP.

Implementation of the OSDF remedial action project will involve a series of construction tasks and operations in accordance with the strategy set forth in this RAWP, the requirements of CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (hereinafter jointly referred to as "CERCLA"), the Resource Conservation and Recovery Act (RCRA) as amended, and the National Environmental Policy Act (NEPA). This OSDF remedial action project is being implemented by the Department of Energy (DOE), as the lead agency responsible for CERCLA activities at the FEMP.

Consistent with the OU2 RDWP, a phased approach is being utilized to accomplish the remedial action activities. The elements of the selected remedy identified in the OU2 ROD will be implemented on an integrated sitewide basis. This integrated approach will not adversely affect the overall OU2 remedial design and remedial action summary schedule shown in the OU2 RDWP. Note that the OSDF was identified as the major component of the selected remedy in both the OU2 ROD and OU5 ROD; on-site disposal of impacted material is also the preferred remedial alternative for Operable Unit 3 (the ROD for Operable Unit 3 (OU3) is anticipated in mid 1996). In addition, the material sent to the OSDF by OU3 and OU5 may include contributions from Operable Unit 1 (OU1) and Operable Unit 4 (OU4), in accordance with their RODs (signed by EPA March 1, 1995, and December 7, 1994, respectively). The DOE intends to build only one on-site disposal facility; therefore, the disposal facility is being designed to accommodate all impacted material meeting the OSDF waste acceptance criteria (WACs) that results from remediation of all FEMP operable units.

1.2 PROJECT BACKGROUND

This section summarizes the background information relevant to this RAWP.

1.2.1 Project Description

Design, construction, and placement of impacted materials into the OSDF, as well as completion of remedial action activities to address contaminated soil/debris at the flyash piles, lime sludge ponds, south field, and the solid waste landfill, are part of an overall mission of OU2. The scope of this RAWP only discusses activities associated with the construction of, and placement of impacted materials into, the OSDF. As discussed in the OU2 RDWP (and the OU5 ROD), separate work plans (*e.g.*, Waste Unit

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RAWP, Primary Waste Haul Road RAWP) will be prepared for the other activities; hence, activities such as impacted material excavation and impacted material transportation will not be discussed in this RAWP.

1.2.2 Site Status

In July 1986, the DOE and the Environmental Protection Agency (EPA) signed a Federal Facilities Compliance Agreement (FFCA), addressing impacts to the environment associated with federally operated sites (including 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 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 *ACA* (September 1991), EPA approved and signed the Final ROD for OU2 on June 8, 1995; and similarly, the Final ROD for OU5 on January 31, 1996. The Final ROD for OU3 is anticipated in mid 1996. The design approach for the OSDF is presented in the OU2 RDWP, 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 *"Intermediate Design Package, On-Site Disposal Facility."* Ohio EPA (OEPA), which has been actively participating throughout the CERCLA response process, also has concurred with the documentation and decisions to date.

1.3 SUMMARY OF WORK PLAN APPROACH

This OSDF RAWP provides the overall framework for performing the OSDF component of remedial actions authorized under the approved OU2 and OU5 RODs. Presented in this work plan is the overall OSDF remedial action project strategy, including a discussion of the specific tasks in support of the remedial action. The general approach of this work plan is as follows:

- Summarize the purpose and scope of this RAWP;
- Describe programmatic strategies and requirements for implementation of the OSDF remedial action project;

- Identify the permit requirements necessary for performing the OSDF remedial action project; and

- Develop a framework from which support plans will be initiated and completed.

In accordance with the *ACA*, this RAWP identifies OSDF remedial action project specific milestones subject to enforceable deadlines by the EPA. The following identifies the format of this document:

- The remainder of Section 1.0 discusses project organization.

- Section 2.0 discusses the remedial action implementation strategy.

- Section 3.0 discusses project permit requirements.

- Section 4.0 discusses sampling, and analysis or field screening.

- Section 5.0 discusses OSDF systems monitoring.

- Section 6.0 discusses environmental monitoring.

- Section 7.0 discusses health and safety, and the contingency plan.

- Section 8.0 discusses public involvement.

More information on each of these aspects may be found in the various OSDF support plans. The following list (sequenced by permitting, pre-construction, construction, and post-closure) identifies the support plans for the OSDF remedial action project:

- Permitting Plan/Crosswalk

- Air Monitoring Plan

- Borrow Area Management and Restoration Plan

- Surface Water Management and Erosion Control Plan

- Cultural Resource Unexpected Discovery Plan

- Construction Quality Assurance Plan

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- Impacted Material Placement Plan
- System Plan
- Groundwater Monitoring Plan
- Post-Closure Care and Inspection Plan (conceptual — to be developed for final submission and detailed fully prior to initiation of impacted materials placement into the OSDF)

1.4 ORGANIZATION AND RESPONSIBILITIES

The governing document for CERCLA response actions at the FEMP is the *ACA* between the DOE and the EPA Region V, signed in September 1991. As such, ultimate project management responsibility lies with these two agencies as defined by that agreement. As discussed in Section 1.1, the DOE is the lead agency responsible for CERCLA activities at the FEMP. The DOE Fernald Area Office (DOE-FN) is the ultimate authority for ensuring that the OSDF remedial action is performed in a manner that meets all project goals, standards, specifications, and requirements of the OU2 ROD and this work plan. In addition, the OEPA has been granted regulatory authority over certain RCRA activities. Each agency has engaged contractors to perform identified scopes of work related to their prime areas of responsibility for site remediation. Figure 1-1 shows this administrative relationship matrix, and Figure 1-2 identifies the lead project personnel for the OSDF remedial action project.

Within each agency, various organizations and offices have been delegated specific program responsibilities. The DOE OU2 Team Leader will provide the overall programmatic direction for this OSDF remediation project. Although the DOE will perform direct oversight of the remedial action, it will also be represented and actively involved in all OSDF Project Team Management (see later discussions in this section regarding the OSDF Project Team Management activities during all stages of project planning and implementation. The Office of Safety Assessment of DOE-FN will assign an individual from the DOE Facilities Representatives Department that will perform independent field oversight for all remedial activities performed under this project.

DOE-FN will also conduct field oversight through technical leads responsible for construction, engineering, quality assurance and quality control, and health and safety. The DOE Facilities

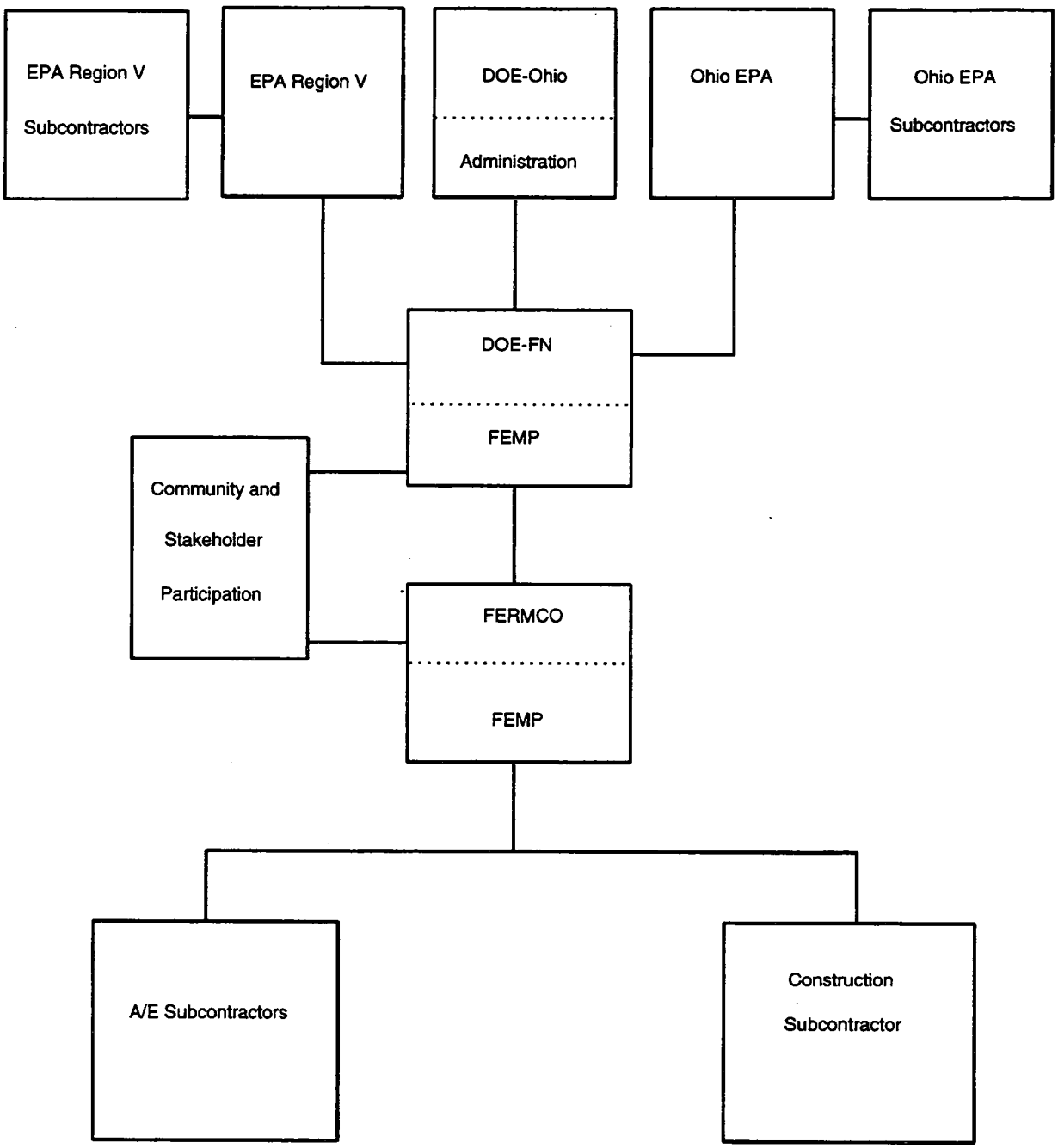

FIGURE 1-1 FEMP ADMINISTRATIVE RELATIONSHIP

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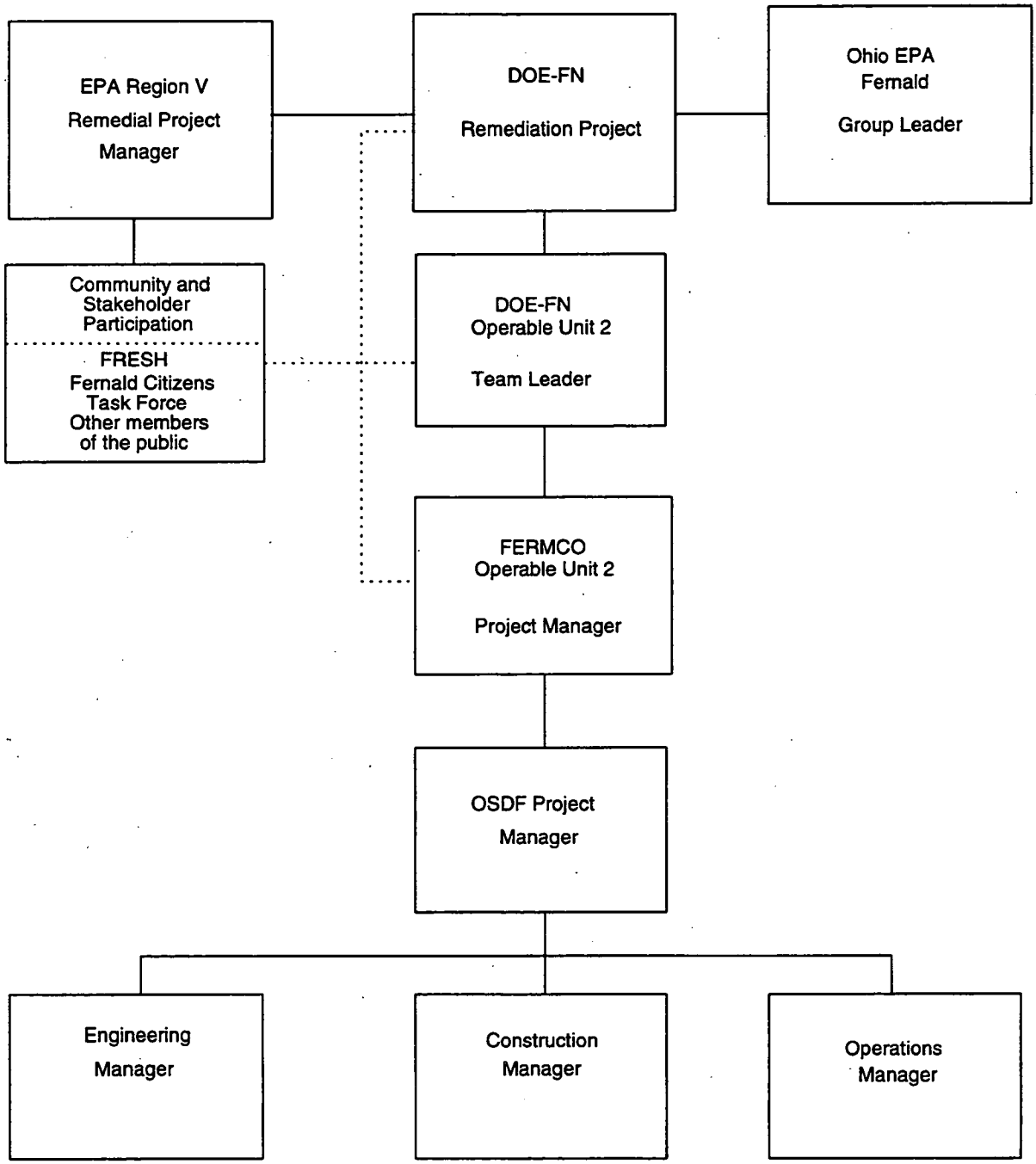

FIGURE 1-2 OPERABLE UNIT 2 REMEDIAL ACTION LEAD PROJECT PERSONNEL

Representative and technical leads will immediately notify the DOE Program Manager of any issues or problems that arise in an effort to seek prompt resolution.

The Fernald Environmental Restoration Management Corporation (FERMCO) Soil Remediation [formerly referred to as the OU2] Project Manager will provide the overall project management and technical guidance to the OSDF Project Team Management (which is inclusive of the OSDF Project Manager). The OSDF Project Team Management will provide all of the necessary technical, regulatory, and administrative input required for the OSDF Remedial Action Project, under the direction of the OSDF Project Manager. Core organizations/entities/individuals (*i.e.*, that provide continual required scheduling and estimating contract support), that constitute this OSDF Project Team Management include the DOE, the OSDF Construction Subcontractor, the Resident Engineer, and FERMCO organizations responsible for support functions such as :

- construction,
- waste management,
- remediation support,
- engineering,
- health and safety (H&S),
- scheduling and estimating,
- contract support,
- regulatory support,
- quality assurance (QA), and
- other groups responsible for various aspects of project planning.

The responsibilities for the OSDF Project Team Management include the following:

- communicate clearly to the Project Manager all requirements within their area of designated technical representation;

- plan and arrange for delivery of technical support, including review of work products from the organizations they represent, as directed by the OSDF Project Manager;
- maintain an appropriate level of knowledge regarding project scope and status as it pertains to their designated technical organizations to ensure effective participation; and
- represent their respective organizations in all meetings and other project communications with the OSDF Project Manager.

FERMCO will directly oversee the Architect/Engineer (A/E) firm responsible for the remedial design (Title I and II Design) and remedial action providing Title III (Construction Management) services as well as the OSDF Construction Subcontractors performing remedial action activities.

Stakeholder participation in the OSDF remedial action project process will be coordinated through the DOE in accordance with the FEMP's *Community Relations Plan* and any subsequent public involvement plans/strategies (refer to Section 8.0 of this RAWP).

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2.0 REMEDIAL ACTION IMPLEMENTATION STRATEGY

This section will discuss the implementation strategy for OSDF activities (Phase II activities as defined in the OU2 RDWP), which are the primary focus of this RAWP, relative to DOE project requirements and CERCLA guidance. During Phase II activities, various construction activities — Site Preparation, Leachate Detection and Collection System and Liner System Installation, Impacted Material Placement, Final Cover System Installation — will be implemented (refer to Section 2.6 for more detail). Details on the implementation strategy for Phase I (primary waste haul road construction) and Phase III (waste units excavation) activities will be provided in separate remedial action planning documents (*e.g.*, RAWPs).

As the FEMP is a DOE facility being remediated under CERCLA, both DOE and EPA requirements must be met throughout the project. This section serves to merge the DOE requirements and CERCLA guidance to create a practical project implementation strategy which meets the intent of both sets of requirements. Refer to Figure 2-1, Responsible Party Lead RA Process (extracted from OSWER Directive 9355.0-4A and modified), which represents the overall OSDF remedial action project approach. This section will expand on the elements of this approach as follows:

- Sections 2.1 and 2.2 define project management controls with regards to specific design and construction;
- Section 2.3 will identify the construction subcontract and equipment/material procurement strategy;
- Section 2.4 will discuss construction acceptance; and
- Section 2.5 and 2.6 will define the OSDF remedial action project milestones and discuss the OSDF construction sequencing.

2.1 CONFIGURATION MANAGEMENT

Configuration Management (CM) will be implemented throughout this OSDF project. CM is the management process by which the technical baseline for projects are identified, graded, documented, tracked, and controlled. CM establishes consistency among the design requirements, physical

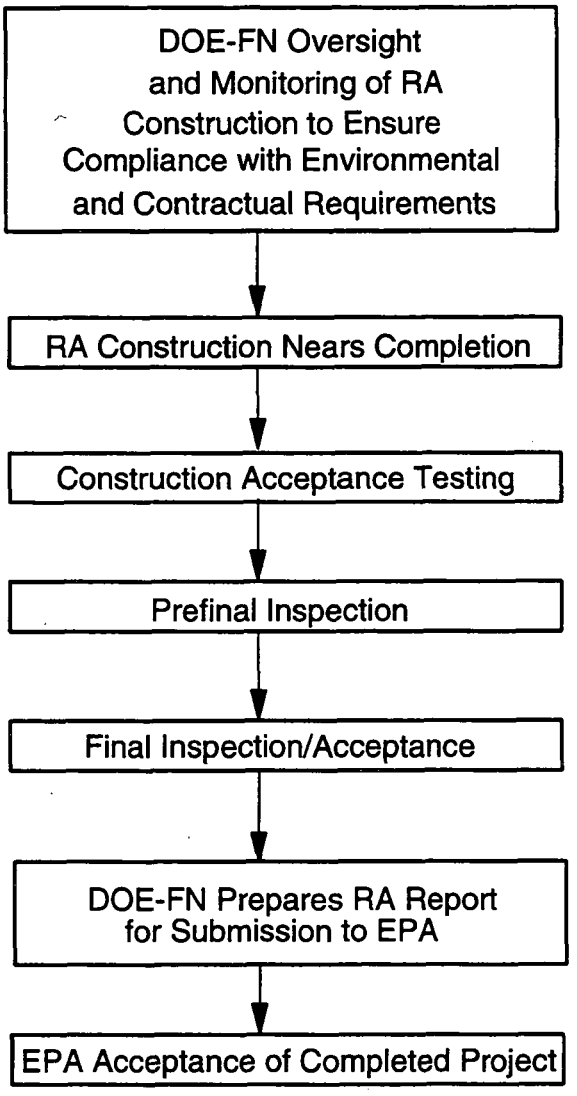

FIGURE 2-1 RESPONSIBLE PARTY LEAD RA PROCESS

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configuration, and technical documentation, and will ensure this consistency is maintained throughout design, construction, and operation. CM also ensures the systematic evaluation, coordination, disposition, documentation, implementation, and verification of all changes, and their impact on cost, schedule, and technical baseline. The FEMP *Configuration Management Procedure (CM-0001)* and relevant supporting procedures will be used as the CM guideline throughout the OSDF project.

QA for the OSDF remedial action project will be in accordance with quality program elements identified in the FEMP *QA Program (RM-0012)*. Construction quality assurance (CQA) for the OSDF remedial action project will be governed by the CQA Plan (an OSDF support plan) developed as part of this OSDF Remedial Action Project; the Construction Quality Control Consultant will develop and implement construction quality control (QC) plan(s).

2.2 CONSTRUCTION MANAGEMENT

FERMCO, as contracted by the DOE at the FEMP, will directly oversee all OSDF Construction Subcontractors performing the work and will be responsible for Construction Management during the work. Construction Management will include, but is not limited to, conducting construction status meetings, daily work surveillance and inspections, and daily safety tours and oversight of the project. The Construction Contracts Manager (CCM) will ensure that safety concerns are brought to the attention of the FERMCO Project H&S Officer and the responsible OSDF Construction Subcontractor who will correct these concerns. The CCM's qualifications are discussed in the Construction Quality Assurance Plan (an OSDF support plan). FERMCO will be responsible for implementing the OSDF remedial action project in accordance with DOE direction. The following sections expand on these activities.

2.2.1 Construction Status Meetings

Upon the award of each subcontract, the CCM will conduct regularly scheduled construction status meetings. These meetings are for the purpose of ensuring orderly and expeditious completion of the work and to provide coordination and communication between all parties (OSDF Project Team Management) involved. Refer to discussions in Section 1.4 of this plan regarding the OSDF Project Team Management. Attendees will include the OSDF Project Manager, Construction, H&S, and QA personnel; Resident Engineer; Project Engineer; OSDF Construction Subcontractor; and others as warranted). These

progress meetings will address action item status, project progress, planning, schedule status, safety items, quality, environmental protection, and problem resolutions.

In addition to the status meetings, OSDF Construction Subcontractors will be required to submit a daily report (or log, or diary). The OSDF Construction Subcontractor's daily report covers the previous day's work status and identifies any safety or quality problems encountered and a description of work performed. In addition to the subcontractor-generated daily report, the FEMP construction division will also generate a Daily Report. Both reports will be maintained in the project file.

2.2.2 Surveillance and Inspections

The OSDF Construction Subcontractor has first line responsibility to inspect its work and correct any deficiencies. In addition to the above and the review of daily reports throughout construction of the OSDF, inspection and surveillance of the OSDF Construction Subcontractor work will be conducted by FERMCO Construction Engineers and Construction QA personnel with support from the Resident Engineer. The surveillances and inspections will verify that the design and associated specifications are being properly implemented and contract requirements are being satisfied. QC inspection and testing will also occur in accordance with the CQA Plan and design requirements. If a deficiency(ies) is noted, the OSDF Construction Subcontractor will be notified immediately so that the necessary corrective action(s) can be taken as soon as possible. Failure of the OSDF Construction Subcontractor to satisfactorily correct a deficiency will constitute cause to either issue a cure order/notice or to stop work.

2.2.3 Health and Safety Oversight

FEMP H&S representatives will be assigned to the project. While all contract and subcontract personnel are responsible for following all safety requirements identified in the Project Specific Health and Safety Requirements Matrix(ces) (PSHSRM) and subsequent OSDF Construction Subcontractors' detailed Safe Work Plans, as appropriate, the OSDF Project Team Management (including H&S) personnel will perform periodic surveillances during the OSDF remedial action project to ensure compliance; OSDF Project Team Management 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 field project will be the single point of contact for all safety, industrial hygiene, fire protection, and

radiological issues or concerns, and will direct those concerns to the CCM. The CCM will also do a weekly safety surveillance and inspection. The Construction Engineer and the Construction Coordinator will monitor health and safety concerns on a daily basis.

2.2.4 Radiological Monitoring/Oversight

Radiological Technicians will be assigned to the 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. The PSHSRM will be the basis for the required monitoring and will identify the action levels that will ensure personnel radiological, as well as the industrial/occupational safety (as discussed earlier) by limiting exposure.

2.2.5 Resident Engineer Services During Construction

All activities for the OSDF remedial action project will be performed under the responsibility of the OSDF Project Manager. There will be occasion to utilize A/E firms responsible for detailed remedial design Title I and II services (design services, in contrast to Construction Management which is referred to as Title III services) to support and perform specific Title III tasks such as construction inspection and report, drawing, and calculation review. The Resident Engineer, who will be from the A/E firm(s), will help to ensure that the project is constructed in accordance with the plans and specifications. Resident Engineer qualifications are discussed in the CQA. Other A/E office and field personnel will be assigned to the project as needed.

2.3 SUBCONTRACT BID/AWARD AND PROCUREMENT STRATEGY

Procurement and subcontract awards for all activities to support and implement the OSDF remedial action project will generally be performed through fixed price or unit price subcontracts and/or will be supported/performed by the appropriate FERMCO division personnel (*e.g.*, Construction). The acquisition system utilized at the FEMP generally follows requirements of the Federal Aquisition Requirements (FARs) and is designed to ensure adequate and effective competition among prospective proposers/bidders. The following sections describe the construction subcontract bid/award and equipment/material procurement strategy for the OSDF remedial action project.

2.3.1 Construction Subcontractor Bid

A pre-qualification process is conducted to evaluate potential bidders' initial qualifications against pre-established criteria at which time those bidders meeting the criteria are placed on the approved bidder's list. Construction subcontractors for the OSDF remedial action project will be solicited competitively via Invitation for Bids (IFB)/Request for Proposals (RFP) Sealed bids/proposals will be required to be submitted by potential OSDF Construction Subcontractors at a specified place, date, and time. The IFB/RFP solicitation(s) will be prepared during the design process by the FEMP Construction Engineering Planning and Bidding group with input from Engineering, H&S, QA, and Procurement personnel, and other applicable disciplines. The IFB/RFP solicitation package(s) is made up of several parts including technical specifications and drawings, the PSHSRM and training requirements, QA requirements, and the statement of work (SOW). Development of a clear and complete IFB/RFP solicitation package will be emphasized to avoid bid protests, to minimize change orders, and to establish the framework for compliance with construction quality acceptance requirements and H&S requirements, as well as ARAR compliance throughout the OSDF remedial action project. As such, much attention will be given to the IFB/RFP solicitation package development, and more specifically the SOW.

2.3.2 Statement of Work

The SOW for each IFB/RFP solicitation package will define the activities that the OSDF Construction Subcontractors will be required to perform. Initiation of SOW development planning will be at the conceptual stages of design for each design package and will be finalized following design approval.

The SOW will be adequately detailed in order for the bidder to define work methods and intended equipment to complete the defined work. This will assist in providing for a better understanding in project goals. Additionally, the level of detail needed to assess the possible hazards be included as an attachment (a safety matrix) to the SOW.

Each SOW will identify project specific information and requirements and will detail the following:

- General Scope of Work;
- Specific Description of Work;

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- Special Conditions;
- Material, Equipment or Services Furnished by the FEMP;
- Interfaces and Restraints;
- Temporary Facilities and Utilities;
- Site Location, Access, Laydown Areas, and Limits of Construction Area;
- Work Hours;
- Performance Schedule and Sequence of Work;
- Pay Item Descriptions;
- Requirements for OSDF Construction Subcontractor's Schedule;
- Submittals; and
- Alignment and Kickoff Meetings.

2.3.3 Pre-Bid Meeting/Tour

Pre-bid meetings will be conducted as necessary to ensure a consistent understanding of the overall requirements and to solicit clarification requests prior to contract award. Prospective bidders for each IFB/RFP solicitation package will be provided the opportunity to attend a pre-bid meeting and work site tour. The pre-bid meeting is intended to allow an opportunity for all bidders to ask questions about the IFB/RFP solicitation package, site policy, and existing site conditions. Questions will be answered in writing and will become an addendum to the bid package. Typical topics covered at the pre-bid meeting include: introductions, bid and award process, SOW and design, terms and conditions, project labor agreement, substance abuse program, PSHSRM, QA/QC requirements, training, regulatory compliance, site security, temporary utilities and facilities, schedule and milestones, reporting, and submittals.

2.3.4 Construction Subcontractor Award

The bids will be reviewed to ensure that the apparent low bidder is both responsive and responsible relative to the terms and conditions of the IFB/RFP. Determination of responsiveness is based on proper completion of bid forms, acknowledgement of amendments, submission of the bid bond, and any other submittal requirements specifically identified in the IFB/RFP solicitation package. Determination of responsibleness is based on whether the bidder possesses the capability and experience as required in the solicitation to perform the work in a safe and timely manner at the bid price. If the apparent low bidder is determined to be either non-responsive or non-responsible, the next lowest bidder will be evaluated. Specifics on this process are covered in the pre-award portion of the IFB/RFP solicitation package.

Following the determination that the apparent low bidder is responsive and responsible, the contracts administrator will recommend and make the final award. The IFB/RFP solicitation package dictates how many days after award or Notice to Proceed that contractor performance begins and ends.

As the lead agency responsible for CERCLA activities at the FEMP, the DOE retains final approval authority for any procurement action which exceeds established dollar thresholds for each type of procurement action. Any OSDF actions over the established limits will be required to be approved by the DOE Contracting Officer prior to award.

2.3.5 Equipment and Material Procurement

The majority of the standard support equipment and materials (*e.g.*, liner material) for the OSDF remedial action project will be procured by the OSDF Construction Subcontractors performing the construction. Procurement of equipment and material will be in accordance with design specifications requirements and other requirements included in each IFB/RFP solicitation package. Vendor data will be submitted by the OSDF Construction Subcontractor for applicable Project Team Management (Resident Engineer, CCM) review to ensure design and specification requirements are achieved. Responsibility for procured equipment and material will lie with the OSDF Construction Subcontractors until final construction acceptance and turnover to FERMCO on behalf of the DOE.

2.4 CONSTRUCTION ACCEPTANCE

As each subcontracted construction phase nears completion, the Construction Acceptance process begins. Construction Acceptance of each construction phase will be in accordance with applicable FEMP site procedures. The procedures are intended to allow for an orderly transfer of the constructed facilities from construction management to the cognizant division. The following sections describe each step in more detail. Specific requirements will be conveyed to the OSDF Construction Subcontractor in the specifications.

2.4.1 Construction Acceptance Testing

Construction Acceptance Testing (CAT) is the performance of all necessary testing to demonstrate that OSDF Construction Subcontractor supplied or installed equipment and systems are installed satisfactorily and safely in accordance with the design drawings and specifications.

CAT criteria will be developed, specified in the contract specifications for the OSDF Construction Subcontractors, and will serve as the basis for CAT acceptance. The OSDF Construction Subcontractor is responsible for conducting CAT for its scope of work, in accordance with the acceptance criteria set forth, making corrective actions where necessary. CAT will be witnessed and recorded by OSDF Project Team Management (including FERMCO QA/QC personnel), and approved by the CCM.

2.4.2 Pre-Final Inspection/Conditional Acceptance

At or near completion of CAT for each construction package, pre-final inspection will occur. Pre-final inspection is the survey of a facility or area of work to determine the status of its acceptability relative to the design drawings, specifications, and contract documents. The pre-final inspection will consist of a walk-through inspection at a minimum by the CCM, Project Engineer, Resident Engineer, and QA. DOE as the lead agency will also be involved (as in every aspect of this remedial action); OSDF Project Team Management will support this effort as necessary. Pre-final inspection will usually result in the conditional acceptance of a facility or work area from the OSDF Construction Subcontractor with a documented list (punchlist) of specific work remaining, including OSDF Construction Subcontractor submittals, and a schedule for completion of the remaining items. Status of punchlist items are provided by the OSDF Construction Subcontractor as completed or at the weekly construction status meetings.

2.4.3 Final Inspection/Acceptance

Upon completion of punchlist items, a final inspection walk-through will be performed. Participants will usually be the same as those during the pre-final inspection. EPA and OEPA, and their respective representatives, are invited to attend the final inspection. The punchlist will be used as the inspection checklist whereby the acceptance of all listed items will be verified and documented. The signed-off checklist by OSDF Construction Subcontractor, construction, start-up/operations, and appropriate project personnel will serve as the final construction acceptance and certification document.

2.5 PROJECT MILESTONES

This section will define and highlight the OSDF (Phase II activities as defined in the OU2 RDWP) remedial action project milestones. Construction sequencing for the OSDF remedial action project is discussed in Section 2.6 of this work plan. Remedial action planning documents covering the Phase I and III elements (as defined in the OU2 RDWP) will be submitted under separate cover. Any schedule revisions from the OU2 RDWP that arise would be indicated in a revised schedule as part of the Phase I and III RAWPs subject to EPA approval.

2.5.1 Initiation of Remedial Activities

In accordance with the OU2 RDWP, the first remedial action construction subcontract will be awarded on or before September 8, 1996, with the award of the Primary Waste Haul Road (OU2 RD Phase I) package subcontract; this award will constitute meeting the 15-month CERCLA requirement for commencing substantial continuous physical on-site remedial action not later than 15 months after the signing of the OU2 ROD (*i.e.*, by September 8, 1996). This date is recognized by the DOE to be an enforceable EPA milestone in accordance with the *ACA*. Remediation of this area (which is inclusive of the OSDF and borrow area footprint) to ROD-selected cleanup levels is a pre-requisite for initiating OSDF construction. Note that these activities will be closely followed by the construction of the primary waste haul road. Prior to the completion of road construction, the construction of the OSDF will begin (see Section 2.6 for more detail).

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2.5.2 Completion of Remedial Action Activities

Subsection 300.435 (f)(1) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) describes completion of a remedial action as the remedy achieving (in the determination of the EPA) the remedial action objectives and goals stated in the ROD. In accordance with the approved OU2 ROD, the integrated sitewide OU2 remedial action approach, and CERCLA guidance, remedial action completion for OU2 is defined as having achieved the following:

- Construction of the OSDF* (the primary subject of this RAWP);
- Excavation of OU2 impacted material and cleanup confirmation sampling;
- Transportation of the OU2 impacted materials;
- Placement of the OU2 impacted materials into the OSDF*;
- Grading and restoration of the OU2 waste units and support areas; and
- Initiation of OSDF long-term monitoring and maintenance.*

However, only the activities annotated with an asterisk (*) — construction, placement, and initiation of long-term monitoring and maintenance of the OSDF — are discussed in this OSDF RAWP.

2.5.3 Milestone Dates

This RAWP will be submitted to EPA in final form along with the pre-final design review package on June 28, 1996; the final design review package will be issued to EPA on October 14, 1996. Table 2-1 identifies the OSDF remedial action project milestones.

TABLE 2-1 OSDF REMEDIAL ACTION PROJECT MILESTONES

ACTIVITY	DATE
Start of OSDF Construction[1]	April 30, 1997
Initial Impacted Material Placement	March 27, 1998
Completion of Remedial Action (*i.e.*, final closure of OSDF)[2]	see footnote

[1] This activity may consist of the award of initial subcontract(s) to support the OSDF remedial action (*e.g.*, leachate transmission/conveyance system).

[2] In accordance with the scope of this Remedial Action Work Plan, completion of remedial action would constitute closure of the OSDF (not completion of the Operable Unit 2 selected remedy in whole); however, final closure of the OSDF is dependent upon disposition of impacted material from the remaining FEMP operable units.

2.6 CONSTRUCTION SEQUENCING

Construction activities for the OSDF will be implemented in a sequence which provides for efficient, safe, and cost-effective operations. The OSDF construction can be categorized into four (4) major phases: 1) site preparation and excavation; 2) leak detection and leachate collection system and liner system installation; 3) impacted materials placement; and 4) final cover/closure system installation. These phases are discussed in sequence below.

Initial site preparation activities may include the construction of a leachate transmission system for the transfer of leachate and collected storm water from the active portions of the OSDF. This system will include pipeline, pumps, and a flow meter.

The initial construction of the OSDF will include excavating the shallow surface (minimum of 6 inches in depth) soil, certifying that the remaining shallow surface soil is not contaminated, and preparing the excavated site (*i.e.*, compacted subgrade) for the placement of the multi-component liner system and construction of leak detection and leachate collection system. Clean soil will be used for the clay layer of the liner system and will be compacted to have a permeability no-greater-than 10^{-7} cm/sec.

The subsequent construction of the OSDF will involve three main construction activities: liner, and leak detection and leachate collection system construction; impacted material placement; and final cover/closure system construction. The goal is to have the three main construction activities phased with the development of each individual cell of the OSDF such that, the liner system construction of Cell 1 precedes the placement of impacted material within Cell 1, which in turn precedes the construction of the final cover/closure system for Cell 1. This sequence will be followed for the remaining eight cells and the contingent ninth cell.

During the construction of the OSDF cells, staging areas will be provided to serve as temporary holding areas for impacted demolition debris and soil. Laydown or stockpile areas will also be established for OSDF construction material and clean soil.

Other related construction facilities and activities include (but may not be limited to) a perimeter safety/security fencing, relocation/removal of existing utilities including underground pipelines, and an air monitoring system.

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3.0 PROJECT PERMIT REQUIREMENTS

Under CERCLA, remedial actions must achieve standards or levels of control that are consistent with environmental laws or regulations, which are termed ARARs. A discussion of the ARARs and TBC criteria were identified in the OU2 ROD and RDWP and the OU5 ROD. All activities undertaken as a result of the ROD must comply with the ARARs that pertain to the activity. Implementation of the OSDF remedial action project will be in compliance with the identified ARARs as identified in those documents.

CERCLA Section 121(e)(1) 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 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), 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 at Section 121 (e)(1) of CERCLA. Discussions with the EPA and Ohio EPA have established a consensual strategy for permitting activities at the FEMP. EPA and Ohio EPA have determined that air releases, fill/dredging of wetlands, and construction and operation of the OSDF are considered "on-site activities" and not subject to the administrative requirements of a permit; further, that waste water and stormwater discharges to the Great Miami River and Paddys Run are considered "off-site" activities subject to both the administrative and substantive requirements of the National Pollutant Discharge Elimination System (NPDES) permit.

An identification of the permitting requirements that will impact the OSDF remedial action project and a discussion on how those requirements will be met (*e.g.*, a permitting crosswalk) is being submitted as a support plan for the OSDF remedial action.

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4.0 SAMPLING AND ANALYSIS REQUIREMENTS

The documentation of whether FEMP remediation project impacted materials (soil or debris) meet the WACs established for the OSDF is the responsibility of the remediation project which will generate the material. Forthcoming FEMP remediation project work plans (*e.g.*, soil excavation work plans) — to be approved by the agencies — will be the documents to discuss how the WACs will be met, as well as when and to what degree the necessary sampling and analysis or field screening will occur. Sampling, and analysis or field screening, shall only be performed when sufficient quality and quantity of data does not exist.

The scope of this OSDF RAWP embarks on activities after it has been determined that FEMP impacted materials meet the OSDF WACs (both radiological/chemical and physical). Conceptual discussions regarding material properties and geotechnical analysis have been included in OSDF support plans (*i.e.*, Impacted Materials Placement Plan, Construction Quality Assurance Plan).

Certification sampling will be conducted in the OSDF and borrow area footprints to ensure that those areas are at or below the ROD-selected cleanup levels prior to construction of the OSDF. Details regarding this certification sampling for Area 1 Phase 1 have been defined in a separate FEMP work plan (anticipated to be submitted to EPA in April 1996 for approval).

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5.0 SYSTEM PLANNING REQUIREMENTS

This section briefly addresses inspection and monitoring requirements for the OSDF, from two different timeframes: (1) active remediation, and (2) after placement of final cover on the last individual cell. These are discussed separately in the following paragraphs.

The first timeframe, the "active remediation" life of the OSDF, spans construction of the individual cells, placement of impacted materials into the cells, and after placement of final cover on individual cells. The OSDF System Plan (an OSDF support plan) has been developed to focus on this first timeframe. As discussed in Section 6.0 of this OSDF RAWP, environmental monitoring is addressed in separate plans. Thus, the OSDF System Plan does not address air or groundwater monitoring.

The second timeframe is after impacted material placement has been completed and the final cover has been established on the last cell of the OSDF. A forthcoming Post-Closure Care and Inspection Plan will be developed to focus on requirements appropriate to this later timeframe. A preliminary outline of that plan is being submitted as an OSDF support plan. That plan is proposed to be further developed for subsequent submittal with the next iteration of this RAWP, and is anticipated to be finalized prior to initiation of impacted material placement into the OSDF.

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6.0 ENVIRONMENTAL MONITORING

Two primary elements of environmental monitoring are associated with this OSDF remedial action project, namely air monitoring and groundwater monitoring. This section describes the focus and scope of the plans for monitoring these two environmental media.

6.1 AIR MONITORING

OSDF remedial action project dust and fugitive emissions control requirements have been identified in the Borrow Area Management and Restoration Plan, the Impacted Materials Placement Plan, the System Plan, and the appropriate specifications. Administrative and engineering controls are established in the plans for minimizing dust and fugitive emissions. Examples of administrative controls include: leaving topsoil and vegetative cover in the borrow area in place until the area becomes active; limiting active borrow area acreage; limiting vehicular traffic speeds on haul roads; and not placing impacted materials into the OSDF when wind speeds exceed certain levels. Examples of engineering controls include: covering loads of borrow soil or impacted materials; application of water to haul roads to limit dust generation; and use of crusting agents and temporary covers during seasonal shutdown of the OSDF.

Air monitoring for the OSDF remedial action project must be compatible with the FEMP site air monitoring programs to provide readily comparable information and data. Hence, the two existing site air emissions monitoring programs will support the OSDF remedial action project: the Occupational Air Monitoring Program and the Fernald sitewide Environmental Monitoring Program (EMP). The air emission monitoring program for the OSDF uses the air monitoring stations, equipment, procedures, and analytical methods from the *Fernald Site Environmental Monitoring Plan* 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. The OSDF Air Monitoring Plan (an OSDF support plan) presents the rationale for the use of this approach. Both the EMP and Occupational Air Monitoring Program will continue to be implemented throughout the OSDF remedial action project.

Radiological environmental monitoring will continue under the sitewide EMP for the frequency specified in the forthcoming FEMP Integrated Environmental Monitoring Plan (IEMP); the IEMP is a revision of

the *Fernald Site Environmental Monitoring Plan* discussed above and will be submitted to EPA for approval prior to the initiation of OSDF remedial activity. Data will be collected under that ongoing program during the implementation of the OSDF remedial action project from air monitoring stations located onsite (including four environmental air monitoring stations (AMS) in the vicinity of the OSDF — AMS-3, AMS-4, AMS-8 and AMS-9), near the fenceline, and at several 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 *Fernald Site Environmental Monitoring Plan (PL-1002, Revision 2)*, which will be superseded by the forthcoming IEMP. Some air monitoring locations will require relocation to accommodate these remediation activities. These location-based modifications will be addressed in the IEMP. Therefore, the OSDF air monitoring (as presented in the support plan) will be merged into the FEMP-wide air monitoring scheme to be presented in the forthcoming IEMP.

6.2 GROUNDWATER PROTECTION MONITORING

Several groundwater monitoring programs are ongoing at the FEMP which focus on radiological and non-radiological constituents in private wells off-site and in a comprehensive on- and off-site sampling program. A specific groundwater monitoring program for the OSDF is being developed to supplement the existing FEMP programs. The groundwater monitoring scheme for the OSDF will consider many factors, among which are:

- function of the leachate collection system and measurement of rate of leachate generation;
- function of the leak detection system and measurement of quantity/rate;
- site-specific hydrogeology — within the till and within the Great Miami Aquifer — under both current conditions as well as under projected conditions, especially in regards to the manipulations of gradients that will be associated with the groundwater remediation schemes;
- time of travel; and
- other principles of detection monitoring.

An outline of the groundwater monitoring plan for the OSDF is being submitted as an OSDF support plan. Groundwater monitoring of the OSDF must be compatible with the FEMP site groundwater monitoring scheme to provide information and data on groundwater flow directions and geochemistry which can be readily compared to information and data collected by the existing FEMP groundwater monitoring programs. Hence, OSDF groundwater monitoring (as outlined in the support plan) will be merged into the FEMP-wide groundwater monitoring scheme to be presented in the forthcoming FEMP IEMP. OSDF groundwater monitoring activities will be coordinated by Groundwater Monitoring Project personnel through appropriate documentation subject to EPA approval.

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7.0 HEALTH AND SAFETY/CONTINGENCY PLAN REQUIREMENTS

The focus of this section is OSDF construction and impacted material placement into the OSDF. Health and safety requirements, and procedures for emergencies during day to day activities, are discussed in this section. All OSDF Construction Subcontractor activities conducted in support of this project are governed by the safety requirements found within the contract which addresses environmental, occupational, industrial, and construction health and safety.

All DOE and FERMCO employees, visitors, vendors, contractors, and subcontractors are required to abide by the provisions of applicable H&S matrices/Safe Work Plans/procedures. Management and supervisors have the responsibility for assuring that the requirements of the applicable H&S matrices/Safe Work Plans/procedures are met. All personnel have stop-work authority for imminent safety hazards resulting from noncompliance with the applicable H&S matrices/Safe Work Plans/procedures.

7.1 PROJECT SPECIFIC HEALTH AND SAFETY PLANS

In accordance with FEMP SH-0001, "*Developing Project Specific H&S Plans*", a PSHSRM(s) will be developed for OSDF construction/impacted material placement activities. The applicable PSHSRM(s) will be included in the subcontract IFB/RFP solicitation package and will provide the OSDF Construction Subcontractor with information related to the possible hazards and the safety requirements to execute each task from which the OSDF Construction Subcontractor can develop their specific Safe Work Plans. The PSHSRM(s) may be revised after reviewing the OSDF Construction Subcontractors' proposed Safe Work Plans, as tasks and/or associated hazards and mitigators are identified, added, or deleted. The DOE proposes to submit the PSHSRM(s) to the EPA for informational purposes only as specifically requested by the agency. The PSHSRM, as well as the detailed Safe Work Plans, will be maintained at the project site, with controlled copies in the project document control files.

7.2 CONTINGENCY PLAN

The contingency plan for the OSDF remedial action project activities is covered by the existing *FEMP Emergency Plan (PL-3020)*. That plan describes the emergency preparedness program that complements the engineered safety features of the FEMP facility, details the procedures to be followed at the FEMP in the event of an accident (spill) or emergency, and is the document which governs the spill response actions at the FEMP. Communications, site assessment, fire, medical, monitoring equipment, and all necessary emergency phone numbers are also provided in that plan. That plan is distributed to participating mutual aid organizations and other local organizations such as local fire departments, hospitals, *etc.*, in the general vicinity of the FEMP.

The FEMP's established emergency organization is available 24 hours a day to respond to all emergencies and abnormal events. The emergency organization includes FEMP personnel and resources as well as those of the local community. This group of trained personnel can be quickly expanded and reinforced as necessary, through existing mutual aid agreements with local fire, ambulance, law enforcement, and medical services. Members of this extended emergency organization undergo a formal training program including participation in sitewide drills and exercises conducted under that plan. These drills and exercises present simulated emergency conditions formulated to allow this extended emergency organization to practice, maintain, test and refine the effectiveness of emergency plans, procedures, training, and response capabilities.

The Emergency Preparedness and Public Affairs groups at the FEMP maintain several ways to inform state and local groups about emergency preparedness and response. Meetings between the state, county, and local government agencies, emergency response personnel and FEMP personnel are held on a regular basis at Cooperative Planning and Training Committee meetings hosted by the FEMP Emergency Preparedness organization. These meetings provide a forum for these agencies to discuss issues related to response, communications, information sharing, available training, drills and exercises. An emergency planning brochure is distributed annually to the Emergency Planning Zone population on what to expect and what to do in the event of an emergency at the site.

8.0 COMMUNITY RELATIONS

The FEMP's *Community Relations Plan (CRP, PL-3045, Revision 4)* 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 management will involve the public in decisions related to the site during the remedial action phase of CERCLA response action at the FEMP. Required activities are summarized below.

Required Public Involvement Activities During Remedial Action

- Provide a public briefing upon completion of the final engineering design and prior to the beginning of the remedial action [NCP 300.435].
- 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].

When practicable, the DOE has and will continue to offer public involvement opportunities — surpassing regulatory requirements — throughout the remedial action phase of site cleanup.

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.

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

Revision D
April 1996

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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Appendix A Substantive Requirements

Appendix B Additional ARARs

ACRONYMS

ACOE	Army Corps of Engineers
ARAR	applicable or relevant and appropriate requirements
AWWT	Advanced Waste Water Treatment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NWP	nationwide permit
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
PTI	permit to install
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	record of decision
TSD	treatment, storage, and disposal

1.0 INTRODUCTION

The Operable Unit 2 Record of Decision (ROD) and Operable Unit 5 ROD established on-site disposal as the selected remedy and established the applicable or relevant and appropriate requirements (ARARs) for the remediation. On-site disposal is also the preferred remedial alternative for Operable Unit 3. 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
- Ohio Solid Waste Permit to Install (PTI)
- Resource Conservation and Recovery Act (RCRA) Permit

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 in the leachate collection system. Following treatment, this water will be discharged to the Great Miami River via a permitted outfall. Construction water (i.e., perched water and storm water contacting 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 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.

3.2 APPLICABILITY TO THE OSDF

Construction of the OSDF will dredge and/or fill less than 1 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, 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;
- Operable Unit 5 Feasibility Study Report;
- OSDF Design Review Package; and
- OSDF Remedial Action Work Plan.

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. Documentation which presents how specific mitigatory requirements will be addressed will be submitted pursuant to the schedule established in the Operable Unit 5 Remedial Design Work Plan.

3.4 ADDITIONAL ARARs

The Operable Unit 2 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.

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 Ohio Administrative Code (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 Remedial Investigation and Feasibility Study Reports:
- Predesign Investigation and Site Selection Report for the On-Site Disposal Facility;
- OSDF Design Review Package; and
- OSDF 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 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 5 ROD and in the Operable Unit 3 Remedial Investigation/Feasibility Study Report. 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 Unit 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 5 ROD 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 5 ROD identifies 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 Operable Unit 5 ROD. Like the substantive requirements, 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 Remedial Investigation and Feasibility Study Reports;
- Operable Unit 5 Remedial Investigation and Feasibility Study Reports;
- Predesign Investigation and Site Selection Report for the On-Site Disposal Facility;
- OSDF Design Review Package; and
- OSDF 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 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. Like the substantive requirements, 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 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

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ACRONYMS

CFR	Code of Federal Regulations
DCP	Design Criteria Package
FEMP	Fernald Environmental Management Project
FS	Feasibility Study
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
ORC	Ohio Revised Code
OSDF	on-site disposal facility
PCB	polychlorinated biphenyl
PSP	Project Specific Plan
RAWP	Remedial Action Work Plan
ROD	Record of Decision

TABLE A-1
WETLANDS SUBSTANTIVE REQUIREMENTS

Citation	Requirement	Remarks	Cross-Reference
General Conditions for a Nationwide Permit			
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 Sitewide Wetland Mitigation Plan(s) which will be submitted with the Operable Unit 5 Soil Excavation RAWP.	
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.		1993 Jurisdictional Wetlands & Waters of the U.S. (FEMP Map)

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TABLE A-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
	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 Sitewide Wetland Mitigation Plan(s) which will be submitted with the Operable Unit 5 Soil Excavation RAWP.	
	• 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 Sitewide Wetland Mitigation Plan(s) which will be submitted with the Operable Unit 5 Soil Excavation RAWP.	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 Sitewide Wetland Mitigation Plan(s) which will be submitted with the Operable Unit 5 Soil Excavation RAWP.	

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;	These requirements will be addressed in the OSDF Groundwater Monitoring Plan or in the Integrated Environmental 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-24 of OSDF Design **Leachate system** - Section 2.5 of OSDF DCP, Drawings M-1, M-2, M-4, M-5, M-7, and M-9 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 and G-31 of OSDF Design
	- Control of wind dispersal of particulate matter, where applicable.		Sections 2.11.2.2 through 2.11.2.6 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 8.0 through 12.0 of OSDF Construction Quality Assurance Plan and Section 3.0 of OSDF System 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.	Monitoring and maintenance information will be provided in the OSDF Groundwater Monitoring Plan or in the Integrated Environmental Monitoring Plan.	Section 2.6 of OSDF DCP, Drawings G-11 and G-26 of OSDF Design, and Sections 3.0 and 4.0 of OSDF System 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, G-3, and G-4 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

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(2) (continued)	• 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
	• 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		Drawings G-2, G-3, and G-4 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 of OSDF Design
	• the location of all borings and hydrogeologic study test pits, and all proposed ground water monitoring wells	This requirement will be addressed in the OSDF Groundwater Monitoring Plan.	Section 2.0 of OSDF Predesign Investigation Report and Drawings X-7 and X-12 of OSDF Design

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(3) (continued)	• 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
	• 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)		Drawings G-2, G-3, and G-4 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

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(5)	Cross sections shall show the following items and shall clearly show the horizontal and vertical scale used:		
	• 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-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	This requirement will be addressed in the Addendum to the OSDF Predesign Investigation Report.	Section 3.0 of OSDF Predesign Investigation Report
	- limits of excavation		Drawings G-13 through G-15 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		Drawings G-2 through G-4 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		Drawings G-2, G-3, and G-4 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		Drawings G-2, G-3, and G-4 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 through G-4, and 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-1, M-2, M-4, M-5, M-7, and M-9 of OSDF Design
	• all leachate management system elements		Drawings M-1, M-2, M-4, M-5, M-7, and M-9 of OSDF Design
	• permanent ground water control structures, if any	This requirement is not applicable to the design of the OSDF.	

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(7) (continued)	• ground water monitoring well construction	This requirement will be addressed in the OSDF Groundwater Monitoring Plan.	
	• 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	This requirement will be addressed in the Haul Roads 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	This requirement will also be addressed in the Addendum to the OSDF Predesign Investigation Report.	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 Addendum to the OSDF Predesign Investigation Report and in the OSDF Groundwater Monitoring Plan.	Sections 2.0 and 3.0 of OSDF Predesign Investigation Report and Section A.2.2 of Appendix A of Operable Unit 5 FS
	• 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	This requirement will also be addressed in the Addendum to the OSDF Predesign Investigation Report.	Sections 2.0 and 3.0 of OSDF Predesign Investigation Report and Section A.2.2 of Appendix A of Operable Unit 5 FS
	• 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	This requirement will also be addressed in the Addendum to the OSDF Predesign Investigation Report and in the OSDF Groundwater Monitoring Plan.	Section 3.0 of OSDF Predesign Investigation Report and Section A.2.2 of Appendix A of Operable Unit 5 FS
	• 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:	This requirement will also be addressed in the Addendum to the OSDF Predesign Investigation Report and in the OSDF Groundwater Monitoring Plan.	Sections 2.3, 2.4, and 2.6 of OSDF Predesign Investigation Report and Section A.2.2 of Appendix A of Operable Unit 5 FS

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	- total organic carbon - turbidity - phosphorus - cyanide		
	• 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
	• 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.	

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	- 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
	- 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

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	- 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 System 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	These requirements are not applicable to the operation of the OSDF.	
	• 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

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(4) (continued)	• 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 7.0 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
	• 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 11.2 of OSDF Calculations Package

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(4) (continued)	• 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
	• 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 Work Plan
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	This requirement is not applicable to the design of the OSDF.	

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(6) (continued)	• sources of [daily] cover material; and from each source, anticipated material quantity, characteristics, and intended use	This requirement is 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 through 9 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		Section 3.4 and 3.6 of OSDF System Plan
	• inclement weather operation procedures		Section 5 of OSDF System 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.	

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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	This requirement will be addressed in the OSDF Groundwater Monitoring Plan or in the Integrated Environmental 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	This requirement will also be addressed in the OSDF Groundwater Monitoring Plan or in the Integrated Environmental Monitoring Plan.	Section 3 of OSDF System Plan
	• leachate contingency plan as required in paragraph (K)(6) of rule 3745-27-19 of the Administrative Code	This requirement will be addressed in the 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	This requirement will be addressed in the OSDF Post-Closure Care and Inspection Plan.	

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(7) (continued)	• 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.	
	• 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	These requirements, as they pertain to post-closure, will be addressed in the OSDF Post-Closure Care and Inspection Plan.	Section 7.2 of OSDF RAWP
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

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(10) (continued)	• 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 OSDF Stormwater Management and Erosion Control Plan.	OSDF Surface Water Management and Erosion Control Plan, Operable Unit 2 and Operable Unit 5 Records of Decision, and FEMP NPDES Permit
	- 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 and Section 10.6 of Operable Unit 5 ROD
	• 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	These requirements will be addressed in the Sitewide Wetland Mitigation Plan(s) which will be submitted with the Operable Unit 5 Soil Excavation RAWP.	
	- 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 of the OSDF Impacted Material Placement Plan

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(10) (continued)	- 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 and Appendix J of Operable Unit 5 FS
	• 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 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.	

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APPENDIX B

ADDITIONAL ARARs

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ACRONYMS

CAMU	corrective action management unit
CFR	Code of Federal Regulations
DCP	Design Criteria Package
DOE	United States Department of Energy
FS	Feasibility Study
MCL	maximum contaminant level
NEPA	National Environmental Policy Act
OAC	Ohio Administrative Code
ORC	Ohio Revised Code
OSDF	on-site disposal facility
PP/EA	Proposed Plan/Environmental Assessment
RAWP	Remedial Action Work Plan
ROD	Record of Decision

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 Sitewide Wetland Mitigation Plan(s) which will be submitted with the Operable Unit 5 Soil Excavation RAWP.	Appendix H of Operable Unit 2 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.	
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.	These requirements will be addressed in the Sitewide Wetland Mitigation Plan(s) which will be submitted with the Operable Unit 5 Soil Excavation RAWP.	Appendix H of Operable Unit 2 FS and Appendix J of Operable Unit 5 FS

TABLE B-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
10 CFR §1022.3(a),(b)(1),(2),(3),(5),(6),(c),(d),(e) (continued)	• 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	This requirement will be addressed in the Sitewide Wetland Mitigation Plan(s) which will be submitted with the Operable Unit 5 Soil Excavation RAWP.	Appendix H of Operable Unit 2 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 and Appendix J of Operable Unit 5 FS
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 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 and Appendix J of Operable Unit 5 FS

TABLE B-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
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 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.	This requirement will be addressed in the Sitewide Wetland Mitigation Plan(s) which will be submitted with the Operable Unit 5 Soil Excavation RAWP.	Appendix H of Operable Unit 2 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.		Appendix H of Operable Unit 2 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 5 FS, and Appendix H of Operable Unit 3 PP/EA

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 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 and Operable Unit 5 FS Reports and RODs
	• air pollution; and		OSDF Air Monitoring Plan
	• soil contamination.		Operable Unit 2 and Operable Unit 5 FS Reports and RODs
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
RCRA ARARs

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.		

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TABLE B-2
RCRA ARARs

Citation	Requirement	Remarks	Cross-Reference
40 CFR §264.552 Subpart S (continued)	• 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. 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.	This requirement will be addressed in the OSDF Groundwater Monitoring Plan or in the Integrated Environmental 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 no 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 and Appendix J of Operable Unit 5 FS
	The groundwater monitoring requirements include procedures for detection, compliance, and corrective action monitoring programs.	This requirement will be addressed in the OSDF Groundwater Monitoring Plan or in the Integrated Environmental Monitoring Plan.	

TABLE B-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
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; • 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.		Section 2.6.1 of OSDF DCP and Drawing G-26 of OSDF Design
	After final closure, the owner or operator must comply with all postclosure requirements, including maintenance and monitoring throughout the postclosure case 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;	This requirement will be addressed in the OSDF Post-Closure Care and Inspection Plan.	Section 4 of OSDF System Plan
	• continue to operate the leachate collection and removal system until leachate is no longer detected; • maintain and monitor the leak detection system;	These requirements will be addressed in the OSDF Post-Closure Care and Inspection Plan.	

TABLE B-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §265.310 Subpart N OAC 3745-68-10 (continued)	• maintain and monitor the groundwater monitoring system;	This requirement will be addressed in the OSDF Post-Closure Care and Inspection Plan and also in the OSDF Groundwater Monitoring Plan or in the Integrated Environmental Monitoring Plan.	
	• prevent run-on and run-off from eroding or otherwise damaging the final cover; and	This requirement will be addressed in the OSDF Post-Closure Care and Inspection Plan.	Section 4 of OSDF System Plan
	• protect and maintain surveyed benchmarks.	This requirement will be addressed in the 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).		Appendix H of Operable Unit 2 FS and Appendix J of Operable Unit 5 FS
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 and Section 9.0 of Operable Unit 5 ROD
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 5 FS, OSDF Surface Water Management and Erosion Control Plan, and the FEMP NPDES Permit

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
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 and Appendix J of Operable Unit 5 FS
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

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	• 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
	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 1×10^{-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. • 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).	These requirements will be addressed in the OSDF Test Pad Program.	Section 2.4.3 of OSDF DCP
	• 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;	This requirement will be addressed in the OSDF Test Pad Program.	
	- slope stability;		Section 3.1 of OSDF Calculation Package
	- maximum friction angle between any soil-geosynthetic interface and between any geosynthetic-geosynthetic interface; and	This requirement will be addressed in the soil-geosynthetic interface direct shear work.	Section 3.2 of OSDF Calculation Package
	- resistance of geosynthetics and geosynthetic seams to tensile forces.		Section 3.2 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)	• constructed on a prepared surface that shall:		
	- be free of debris, foreign material, and deleterious material;		Section 2.4.3 of OSDF DCP
	- 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 5.1 of OSDF Calculation Package
	- not have any abrupt changes in grade that may result in damage to geosynthetics.		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 and G-24 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

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Flexible Membrane Liner The flexible membrane liner shall be:		Section 02770 of OSDF Specification Package
	• placed on the recompacted soil liner.		Section 2.4.5 of OSDF DCP and Drawings G-22 and G-24 of OSDF Design
	• sixty mil high density polyethylene (HDPE).		Section 2.4.5 of OSDF DCP
	• be protected from the drainage layer by a cushion layer, as required by the Director		Section 2.4.5 of OSDF DCP, Drawings G-22 and G-24 of OSDF Design, and Section 7.2 of the OSDF Impacted Material Placement Plan
	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.	DOE does not presently contemplate utilizing these alternative provisions.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	• protected from the drainage layer by a cushion layer, as required by the Director. • have a minimum thickness of 40 mils.		
	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. • 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.		Section 2.4.4 of OSDF DCP
	• be constructed above the recompacted soil liner.		Section 2.4.4 of OSDF DCP and Drawings G-22 and G-24 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

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	• 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 and G-24 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 contemplate 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;		Section 2.5.1 of OSDF DCP and Drawing G-24 of OSDF Design
	- 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-24 of OSDF Design
	- 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 02610 of OSDF Specification Package

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	- 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 Work Plan
	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 contemplate 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 and G-24 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 and G-24 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, Section 10.3 and 10.4 of OSDF Calculation Package, and Drawings M-2, M-4, M-5, M-7, 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.	This requirement, as it pertains to post-closure, will be addressed in the OSDF Post-Closure Care and Inspection Plan.	Section 2.5.3 of OSDF DCP and Section 3.6 of the OSDF System Plan
	• Storage tanks must be provided with spill containment		Section 2.5.3 of OSDF DCP
	• 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 contemplate 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, Section 8 of the OSDF Construction Quality Assurance Plan, and Sections 6 through 8 of the OSDF Impacted Materials Placement Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (D) and (E) (continued)	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 8 of the OSDF Construction Quality Assurance Plan
	• 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 Work Plan, Section 2.4.9 of OSDF DCP, and Section 027710 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:		

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g) (continued)	• 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 - 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.		Section 2.7.1 of OSDF DCP and Section 2.2 of OSDF Test Pad Work Plan
	• 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

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g) (continued)	• 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 contemplate utilizing this alternative provision.	
	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 8 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 9.10 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 6.1.3 and 8.10.2 of OSDF Construction Quality Assurance Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
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; • 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.		OSDF Construction Quality Assurance Plan
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 Work Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
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.	This requirement, as pertains to post-closure, will be addressed in the OSDF Post-Closure Care and Inspection Plan.	OSDF System Plan
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 2.8.1 through 2.8.4 of OSDF DCP, Sections 12.0 and 13.0 of OSDF Calculation Package, and 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.	This requirement, as pertains to post-closure, will be addressed in the OSDF Post-Closure Care and Inspection Plan.	OSDF System 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.	This requirement will be addressed in the Leachate Transmission System documents.	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.	This requirement, as it pertains to post-closure, will be addressed in the OSDF Post-Closure Care and Inspection Plan.	Section 3.4 of OSDF System Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
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.	This requirement, as it pertains to post-closure, will be addressed in the OSDF Post-Closure Care and Inspection Plan.	Section 3 of OSDF System 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. 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.	These requirements will be addressed in the OSDF Groundwater Monitoring Plan or in the Integrated Environmental Monitoring Plan.	
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 Sections 3.5 and 3.6 of OSDF Surface Water Management and Erosion Control Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-11 (H) (continued)	• a groundwater monitoring system shall be designed and installed in accordance with OAC 3745-27-10, if a system is not already in place.	See previous entry on OAC 3745-27-10.	
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.	This requirement will be addressed in the OSDF Post-Closure Care and Inspection Plan.	Sections 2.2 and 2.3 of OSDF DCP
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 13.5 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

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(15) (continued)	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; <u>OR</u>		Section 2.6.9 of OSDF DCP, Drawing G-22 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 2.2 of OSDF Test Pad Work Plan 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. - 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.		Section 02210 of OSDF Specification Package

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(15) (continued)	- 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 8 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 Drawing G-22 of OSDF Design
	Drainage Layer		
	The drainage layer shall be: • a minimum of 1 foot of granular material; OR		Section 2.6.7 of OSDF DCP and Drawing G-22 of OSDF Design
	• a drainage net that has equivalent performance capabilities as the granular material.	DOE does not currently anticipate utilizing these alternative provisions.	
	• 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 Drawing G-22 of OSDF Design

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(15) (continued)	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 11.3 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, Drawing G-22 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.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
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.	This requirement will be addressed in the OSDF Post-Closure Care and Inspection Plan.	
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. Post-closure care activities for all sanitary landfill facilities shall include, but are not limited to:	These requirements will be addressed in the OSDF Post-Closure Care and Inspection Plan.	
	• 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	This requirement will also be addressed in the OSDF Groundwater Monitoring Plan or in the Integrated Environmental Monitoring 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 of OSDF System 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.	This requirement will be addressed in the OSDF Post-Closure Care and Inspection Plan.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
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 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.		Section 2.1.2 of OSDF DCP; see Table B-1 of Appendix B of this plan
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
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, and Sections 10.2.1. and 10.2.2 of Operable Unit 5 ROD
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, and Sections 10.2.1. and 10.2.2 of Operable Unit 5 ROD

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
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 • separated from the limits of solid waste placement by a hydrogeologic barrier, OR • constructed and used solely for monitoring groundwater quality	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
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.		Section 4.2.1 of OSDF Predesign Investigation Report and Drawings X-13 through X-15 of OSDF Design
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)	DOE does not currently anticipate utilizing these alternative provisions.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
GD202.104 (continued)	• 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 • 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; • state 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

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
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; • 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.	The location of the OSDF fulfills these requirements.	Section 2.1.2 of OSDF DCP
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

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
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.	

AIR MONITORING PLAN

ON-SITE DISPOSAL FACILITY

April 1996
Revision D

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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ACRONYM & ABBREVIATION LIST

ALARA	as low as reasonably achievable
AMS	air monitoring station
ARARs	applicable or relevant and appropriate requirements
BAMR	Borrow Area Management and Restoration Plan
cfm	cubic feet per minute
CFR	Code of Federal Regulations
COCs	constituents of concern
Cs	Cesium; ^{137}Cs is Cesium-137
DCG	Derived Concentration Guideline
DCP	Design Criteria Package
DOE	United States Department of Energy
EDE	effective dose equivalent
EMP	Environmental Monitoring Program; when in italics, *Environmental Monitoring Plan*
EPA	United States Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FS	Feasibility Study
ft	foot (feet)
IEMP	Integrated Environmental Monitoring Plan
IMP	Impacted Materials Placement Plan
lpm	liter(s) per minute
m	meter(s)
mg/m^3	milligram(s) per cubic meter
mm	millimeter(s)
mrem	millirem
NESHAP	National Emissions Standards for Hazardous Air Pollutants
Np	Neptunium; ^{237}Np and $^{239/240}Np$ are Neptunium-237 and 239/240, respectively
OAC	Ohio Administrative Code
ORC	Ohio Revised Code
OSDF	On-Site Disposal Facility

ACRONYM & ABBREVIATION LIST (continued)

OU2	Operable Unit 2
OU3	Operable Unit 3
OU5	Operable Unit 5
PEIC	Public Environmental Information Center
pCi/m^3	picoCurie(s) per cubic meter
Pu	Plutonium; ^{238}Pu and $^{239/240}Pu$ are Plutonium-238 and -239/240, respectively
Ra	Radium; ^{226}Ra and ^{228}Ra are Radium-226 and -228, respectively
ROD	Record of Decision
^{90}Sr	Strontium-90
^{99}Tc	Technetium-99
Th	Thorium; ^{230}Th and ^{232}Th are Thorium-230 and -232, respectively
U	Uranium; ^{234}U, $^{235/236}U$ and ^{238}U are Uranium-234, -235/236, and -238, respectively
ug	microgram(s)
WAC	waste acceptance criteria

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1. INTRODUCTION

1.1 Overview

This Air Monitoring Plan describes the environmental air monitoring activities that will be undertaken during construction, impacted material placement, and closure of the On-Site Disposal Facility (OSDF) at the Fernald Environmental Management Project (FEMP), Fernald, Ohio. These activities will include using environmental air monitoring equipment at the FEMP property boundary to monitor the potential public exposure to radionuclide particulate matter emissions that may occur throughout construction, placement of impacted materials, and closure of the OSDF. This environmental air data, along with Occupational Air Monitoring program data, will be used to verify the effectiveness of administrative and engineering control techniques implemented as part of the OSDF construction to mitigate potential dust and particulate radionuclide emissions from the OSDF. This plan does not address air monitoring activities during the post-closure period of the OSDF. Those activities are to be addressed in a plan to be developed later.

Air monitoring for the OSDF remedial action project must be compatible with the FEMP site air monitoring programs to provide readily comparable information and data. Hence, the two existing site air emissions monitoring programs will support the OSDF remedial action project: the Occupational Air Monitoring Program and the Fernald sitewide Environmental Monitoring Program. The environmental air emission monitoring program for the OSDF uses the air monitoring stations, equipment, procedures, and analytical methods from the *Fernald Site Environmental Monitoring Plan* [FERMCO, 1995a] in order to provide data for annual 40 CFR Part 61 NESHAP Subpart H reporting and for other annual site environmental reporting. Both the Environmental Monitoring Program and the Occupational Air Monitoring Program will continue to be implemented throughout the OSDF remedial action project.

Radiological environmental monitoring will continue under the sitewide Environmental Monitoring Program for the frequency specified in the forthcoming FEMP Integrated Environmental Monitoring Plan (IEMP), the successor revision to the *Fernald Site Environmental Monitoring Plan*. Data will be collected under that ongoing program during the implementation of the OSDF remedial action project from air monitoring stations located onsite (including four environmental air monitoring stations (AMS) in the vicinity of the OSDF —

AMS-3, AMS-4, AMS-8 and AMS-9), near the fenceline, and at several 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 *Fernald Site Environmental Monitoring Plan* [FERMCO, 1995a], which will be superseded by the forthcoming IEMP. As discussed in Section 4, some air monitoring locations will require relocation to accommodate these remediation activities. These location-based modifications will be addressed in the IEMP. Therefore, the OSDF air monitoring as presented herein will be merged into the FEMP-wide air monitoring scheme to be presented in the forthcoming IEMP.

1.2 Project Description

The conceptual design of the OSDF was initially developed as an alternative in the *"Feasibility Study for Operable Unit 2"* (OU2 FS) [DOE, 1995b] and was identified as the selected remedial alternative in the *"Record of Decision for Remedial Actions at Operable Unit 2"* (OU2 ROD) [DOE, 1995a]. On-site disposal of impacted material is also the selected remedial alternative in the *"Record of Decision for Remedial Actions at Operable Unit 5"* (OU5 ROD) [DOE, 1996], and the preferred alternative for OU3 at the FEMP. In addition, the material sent to the OSDF by OU3 may include contributions from OU1 and OU4. The final ROD for OU3 is anticipated in mid 1996.

The impacted material from the various areas of the FEMP will be required to meet OSDF waste acceptance criteria (WAC) prior to disposal in the OSDF. The estimated total volume of impacted material is 2.5 million cubic yards (1.9 million cubic meters) bank/unbulked. This volume estimate will be updated during the filling of the OSDF to account for swelling and bulking of the materials.

The construction, filling, and closure of the OSDF is currently anticipated 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, with the possibility of closure on an interim basis should it be required.

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Responses to comments received during a public comment period and public meeting were included in the Responsiveness Summary and became part of the Final OU2 ROD [DOE, 1995b] and the Final OU5 ROD [DOE, 1996]. The Final OU2 ROD and the Final OU5 ROD and their respective Responsiveness Summaries require preparation of an Air Monitoring Plan to address, at a minimum, the following:

- monitoring of potential particulate radionuclide emissions during construction, impacted material placement, and closure of the OSDF to verify compliance with established EPA and DOE radiation dose limits; and

- provide for collection of air particulate data in real-time, as appropriate, to verify effectiveness of engineering controls implemented during OSDF activities.

The OSDF Air Monitoring 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.

1.3 Plan Scope

The objective of this Air Monitoring Plan is to establish an environmental air monitoring program to evaluate potential public exposure due to the OSDF and its on-site borrow area during the construction, impacted material placement, and closure of the OSDF. The scope of this Air Monitoring Plan includes:

- basis for environmental air monitoring;

- visual monitoring of potential OSDF airborne particulate emissions;

- environmental air monitoring and subsequent laboratory analysis of potential radionuclide emissions; and

- periodic review of the plan to evaluate the effectiveness of the plan in meeting the objectives.

1.4 Plan Organization

The remainder of this Air Monitoring Plan is organized as follows:

- a discussion of the predicted potential airborne particulate emissions; a discussion of the technical basis for the Air Monitoring Plan; and a review of the potential airborne constituents are presented in Section 3;
- air monitoring station locations are discussed in Section 4;
- frequency of air monitoring at each air monitoring station location is presented in Section 5;
- types of air monitoring equipment, procedures, and methods that will be utilized are contained in Section 6; and
- data interpretation and actions to be taken based on data interpretation are included in Section 7.

1.5 Responsibilities

This Air Monitoring Plan describes work to be conducted by FERMCO. Responsibilities include: operation and maintenance of air monitoring equipment; reporting results of air monitoring to ensure that administrative and engineering controls are effective; provision of monitoring results and incorporation into annual 40 CFR Part 61 NESHAP Subpart H reporting and for other annual site environmental reporting; periodic evaluation of the air monitoring program, and revision as necessary.

1.6 Related Plans

Several other remedial action implementation plans being prepared for the OSDF contain information relevant to this Air Monitoring Plan. These other plans are listed below along with a brief statement of the relationship of the plan to this Air Monitoring Plan.

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- *OSDF System Plan.* The System Plan provides guidance on the activities related to the inspection and maintenance of the OSDF including the leachate management system, final cover system, seasonal cover system, temporary facilities, and temporary haul and access roads within the battery limits of the OSDF. The System Plan also includes engineering controls to limit dust generation during these activities.

- *OSDF Impacted Materials Placement (IMP) Plan.* The IMP Plan describes procedures for acceptance and placement of impacted materials into the OSDF. The plan provides for engineering controls to limit dust generation during materials placement.

- *OSDF Borrow Area Management and Restoration (BAMR) Plan.* The BAMR Plan includes dust emission engineering controls and management techniques during restoration of the soil borrow area of the OSDF.

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2. APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to the Air Monitoring Plan are contained in the OSDF Design Criteria Package (DCP) [GeoSyntec, 1996]. These requirements take the form of applicable or relevant and appropriate requirements (ARARs) for the various FEMP operable units, functional requirements, and general design criteria. The following requirements applicable to the Air Monitoring Plan were obtained from the DCP.

Applicable or relevant and appropriate requirements (ARARs) that should be addressed by the Air Monitoring Plan are:

- *DOE Facilities Radiation Protection of the Public and Environment, Draft 10 CFR 834* — incorporates provisions of DOE Order 5400.5

- *DOE Order 5400.5* — Radiation Protection of the Public and the Environment;

- *DOE Order 5820.2A Chapter III(3)(k)* — provides for environmental monitoring (including air monitoring) at low level waste treatment, storage, and disposal facilities.

- *National Primary and Secondary Ambient Air Quality Standards, 40 CFR § 50* — establishes standards for ambient air quality including particulates;

- *National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR § 61* — provides national emissions standards for emissions of hazardous and radioactive materials;

- *Ohio General Provisions on Air Pollution Control, OAC 3745-15-07 and ORC 3704.01-.05* — require that measures be taken to adopt and maintain a program for the prevention, control, and abatement of air pollution;

- *Ohio Ambient Air Quality Standards, OAC 3745-17-02 and OAC 3745-17-05* — provides primary and secondary ambient air quality standards for total suspended particulates;

- *Ohio Emissions of Particulate Matter, OAC 3745-17-08* — provides for the restriction of emission of fugitive dust by the use of process controls;

- *Ohio Particulate Matter Standards, OAC 3745-17-11* — describes restrictions for particulates from any operation process or activities which releases or may release particulate emissions into the ambient air;

- *Ohio Emissions of Particulate Matter, OAC 3745-17-07(B)(4)-(6)* — prohibits visible particulate emissions above paved roadways or parking areas for more than 6 minutes in any 60 minute period, or from unpaved roadways, parking areas or storage areas for more than 13 minutes in any 60 minute period; and

- *Ohio Standard for Active Asbestos Disposal Sites, OAC 3745-20-06* — prohibits visible emissions of asbestos during and after placement.

2.2 Functional Requirements

The DCP contains a variety of functional requirements that has been established for the OSDF. The functional requirements applicable to the Air Monitoring Plan are:

- existing air monitoring station locations within the proposed limits of the OSDF will be abandoned in conformance with site specifications and relocated as necessary to maintain the overall monitoring of the FEMP.

2.3 General Design Criteria

The DCP identifies a number of general design criteria for the OSDF. The general design criteria applicable to the Air Monitoring Plan are:

- as low as reasonably achievable (ALARA) goals should apply to workers involved in air monitoring activities near the OSDF;

- the Air Monitoring Plan should be complimentary to other environmental monitoring programs implemented at the FEMP; and

- the air monitoring stations for this Air Monitoring Plan will be located at the FEMP fenceline in order to assess the potential public exposure.

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2.4 Other Requirements

In addition to the requirements contained in the DCP, other guidelines which have been consulted in the formulation of this Air Monitoring Plan are:

- *DOE/EH-0173T* - Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance; and
- *Fernald Site Environmental Monitoring Plan (EMP)* [FERMCO, 1995a].

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3. DESCRIPTION OF AIR MONITORING

3.1 Overview

This Air Monitoring Plan provides for measurement of particulate emissions from the OSDF to verify the efficiency of engineering and administrative controls for such emissions. All of the impacted materials placed in the OSDF must meet waste acceptance criteria (WAC) established for the OSDF. Emissions of particulate matter to the ambient air may result during construction, impacted materials placement, and closure activities at the OSDF. These particulate emissions could result from such sources as: (i) movement of soil during construction of the OSDF liner system; (ii) placement of impacted soil, building demolition debris, concrete, and other remediation waste materials; (iii) movement of soil during construction of the OSDF cover system; (iv) vehicle movement; and (v) wind erosion of soil surfaces.

The *Feasibility Study Report for Operable Unit 5* (OU5 FS) [DOE, 1995c] includes modeling for activities during OSDF construction and impacted materials placement to support the short-term risk assessment. The short-term risk assessment utilized air pathway modeling to predict potential airborne emissions. Based on the short-term risk assessment results, several trends for potential impacts on human health were identified [DOE, 1995c]:

- Chemical carcinogens will not be important factors during soil remediation at the FEMP.
- Inhalation of radionuclides from dust impart the greatest potential risk followed by potential exposure to direct radiation.
- Only the on-property remedial workers could potentially incur risks exceeding one in one million (1.0×10^{-6}) and no greater than 9.4×10^{-4}. This indicates these workers should be monitored in accordance with an approved health and safety program.

The potential risk to public health due to OSDF construction and impacted materials placement is low. The air exposure pathway is potentially greatest through inhalation of particulate emissions containing radionuclides, but concentrations of radionuclides in particulate emissions potentially emanating from the OSDF are predicted to be more than ten times less than applicable EPA and DOE airborne emission standards.

The potential for particulate emissions which might contain constituents of concern (COCs) (*e.g.*, radionuclides) during such activities will be mitigated by various engineering controls such as dust suppression (*i.e.*, application of water to exposed soil surfaces) or placement of impacted materials in the OSDF only when wind speeds are less than certain levels. Environmental air monitoring for particulate emissions and radionuclides from the OSDF, as addressed by this plan, will be performed to provide verification that such engineering and administrative controls are effective in controlling emissions and that potential concentrations of airborne radionuclides are within predicted ranges.

The remainder of this section presents a discussion of the purpose and scope of this Air Monitoring Plan. Included in this section are:

- a review of predicted air particulate emissions from the OSDF based on the OU5 FS [DOE, 1995c];
- the discussion of the basis for this Air Monitoring Plan; and
- a description of the potential airborne constituents which will be covered by this Air Monitoring Plan.

3.2 Predicted Air Particulate Emissions

3.2.1 Overview

Particulate emissions from the OSDF were covered in the air pathway portion of the short-term risk assessment presented in the OU5 FS [DOE, 1995c] as discussed above. The potential risks associated with airborne emissions at the OSDF are discussed in the sections below and were used to focus this Air Monitoring Plan.

3.2.2 Modeling for the OU5 FS Short-Term Risk Assessment

Data from air dispersion modeling for impacted material placement in the OSDF is presented in the short-term risk assessment in the OU5 FS [DOE, 1995c]. This data predicts, for

radionuclides and nonradionuclides (*i.e.*, metals and other organic compounds) the airborne concentrations that the near off-property public might be exposed to. For the OU5 FS, near off-property public is defined as a hypothetical receptor located immediately adjacent to the FEMP property boundary at the fence line for the entire duration of the FEMP cleanup process. The projected risk to a near-property receptor located at any other position would be expected to be less than these projections. Additionally, the application of mitigative measures to reduce fugitive dust emissions would reduce these projected concentrations and risks.

The predicted potential concentrations of nonradionuclides are extremely low, ranging from 9.3 x 10^{-16} mg/m^3 (bischloromethyl ether) to 8.3 x 10^{-10} mg/m^3 (total uranium metal). The OU5 FS short-term risk assessment, when considering the impacts that remediation actions may have on human health, stated that the *"inhalation of chemical toxicants will not be an important contribution to human health impact in this remediation, except for the on-site remediation workers"*. Based on this conclusion and because the predicted air concentrations for metals and organic compounds as described above are extremely low, nonradionuclides will not be included in this Air Monitoring Plan.

The concentrations of radionuclides are also low, ranging from 8.5 x 10^{-5} pCi/m^3 (^{234}U) to 1.6 x 10^{-1} pCi/m^3 (^{238}U). The OU5 FS short-term risk assessment also states *"Inhalation of radionuclides imparts the greatest portion of the carcinogenic risks ... only the on-property remedial workers would incur risks exceeding 10^{-6}"*.

3.3 Technical Basis for Air Monitoring

The *Fernald Site Environmental Monitoring Plan (EMP)* [FERMCO, 1995a] summarized limits and guidelines set by DOE and EPA regarding radiological airborne emissions as follows:

(a) DOE Order 5400.5 Chapter II(1)(a) — The exposure of members of the public to radiation sources as a consequence of all routine activities at the FEMP shall not cause an effective dose equivalent (EDE) greater than 100 mrem in a year.

(b) United States Environmental Protection Agency, 40 CFR 61 Subpart H, and DOE Order 5400.5 Chapter II(1)(b) — The exposure of members of

the public to radionuclides (except radon-220 and radon-222) released to the atmosphere as a consequence of all routine activities at the FEMP site shall not cause an EDE greater than 10 mrem in a year.

(c) United States Environmental Protection Agency, 40 CFR 61 Subpart H — Radionuclide *point sources* with the potential to deliver an EDE of 0.1 mrem/year or greater to any member of the public require continuous air monitoring.

To predict compliance with these criteria, guidelines, referred to as Derived Concentration Guidelines (DCGs), can be utilized. DCGs (established in DOE Order 5400.5) are concentrations of individual radionuclides that, under conditions of continuous exposure for one year by one exposure mode to one radionuclide, would result in an EDE of 100 mrem in one year; for known mixtures of radionuclides, the sum of the ratios of the observed concentration of each radionuclide to its corresponding DCG must not exceed 1.0. These DCGs can be used as comparison criteria to evaluate radionuclide data to assess the potential to exceed the limits on dose to members of the public from activities occurring at the OSDF.

By using the predicted radionuclide concentrations from the short-term risk assessment, calculating the ratios using corresponding DCGs, and comparing the sum of the ratios, compliance with the respective criteria can be assessed by using the comparison thresholds below:

	Criteria	EDE threshold (mrem/year)	Comparison threshold = EDE threshold/DCG threshold
(a)	DOE Order 5400.5 Chapter II(1)(a)	100	100/100 = 1.0
(b)	40 CFR Part 61 Subpart H, and DOE Order 5400.5 Chapter II(1)(b)	10	10/100 = 0.1
(c)	40 CFR Part 61 Subpart H point source monitoring	0.1	0.1/100 = 0.001

Table 3-1 provides a comparison of the predicted radionuclide air concentrations from the short-term risk assessment to the DCGs. Important conclusions drawn from this analysis are:

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TABLE 3-1

COMPARISON OF PREDICTED AIRBORNE RADIONUCLIDE CONCENTRATIONS TO THE DERIVED CONCENTRATIONS GUIDELINES

Radionuclide	Predicted Airborne Concentration[1] (pCi/m^3)	Derived Concentration Guidelines[2] (pCi/m^3)[3]	Ratio of Predicted Airborne Concentrations to Derived Concentration Guidelines
Cesium-137	1.9×10^{-7}	4.0×10^{2}	4.8×10^{-10}
Neptunium-237	3.6×10^{-7}	2.0×10^{-2}	1.8×10^{-5}
Plutonium-238	3.1×10^{-7}	3.0×10^{-2}	1.0×10^{-5}
Plutonium-239/240	3.3×10^{-7}	2.0×10^{-2}	1.7×10^{-5}
Radium-226	2.3×10^{-5}	1.0×10^{0}	2.3×10^{-5}
Radium-228	5.3×10^{-7}	3.0×10^{0}	1.8×10^{-7}
Strontium-90	9.8×10^{-7}	9.0×10^{0}	1.1×10^{-7}
Technetium-99	2.2×10^{-6}	2.0×10^{3}	1.1×10^{-9}
Thorium-228	7.1×10^{-7}	4.0×10^{-2}	1.8×10^{-5}
Thorium-230	1.3×10^{-4}	4.0×10^{-2}	3.3×10^{-3}
Thorium-232	6.6×10^{-6}	7.0×10^{-3}	9.4×10^{-4}
Thorium-234	7.9×10^{-6}	5.0×10^{2}	1.6×10^{-8}
Uranium-234	7.2×10^{-9}	9.0×10^{-2}	8.0×10^{-8}
Uranium-235/236	9.4×10^{-7}	1.0×10^{-1}	9.4×10^{-6}
Uranium-236	1.1×10^{-6}	1.0×10^{-1}	1.1×10^{-5}
Uranium-238	1.3×10^{-4}	1.0×10^{-1}	1.3×10^{-3}
		TOTAL:	5.6×10^{-3} = 0.0056

Notes:

(1) Exposure Air Concentrations in the Vicinity of the Hypothetical Near-Property Public Receptor (Table G.I-23); Short-Term Risk Assessment; *Feasibility Study Report for Operable Unit 5* [DOE, 1995c].

(2) Derived Concentration Guidelines (DCGs) for Concentrations of Radionuclides in Air Emissions; Radiation Protection of the Public and the Environment, DOE Order 5400.5.

(3) DCG concentrations in DOE Order 5400.5 have been converted to pCi/m^3; Measured Radionuclides at AMS 9/9A and AMS 8 (Tables 5-4 and 5-5), *Fernald Site Environmental Monitoring Plan* [FERMCO, 1995a].

- None of the individual radionuclide concentrations predicted for OSDF activities exceeds its corresponding DCG.

- The sum of the ratios of the individual radionuclide concentrations to its corresponding DCG equals 5.6×10^{-3} (0.0056), far below the DOE Order 5400.5 Chapter II(1)(a) threshold of 1.0.

- The radionuclide concentrations predicted for OSDF activities result in a dose to the off-property public of 0.56 mrem/year, which is

  - *approximately 200 times lower* than the DOE Order 5400.5 Chapter II(1)(a) dose limit of 100 mrem/year, and

  - *approximately 20 times lower* than the EPA's 40 CFR Part 61 Subpart H and DOE Order 5400.5 Chapter II(1)(b) dose limit of 10 mrem/year.

However, the EPA threshold of 0.1 mrem/year for determining if a *point source* requires continuous monitoring would be exceeded by over a factor of five; no thresholds exist for area sources. Therefore, although the OSDF is an *area source* rather than a *point source*, continuous air monitoring for radionuclide particulate matter will be performed according to this Air Monitoring Plan during OSDF construction, impacted material placement, and closure.

3.4 Potential Airborne Constituents

3.4.1 Overview

The potential airborne emissions covered in this Air Monitoring Plan include fugitive dust that may be contaminated with radionuclides. A description of the types of potential airborne emissions and the airborne radionuclides currently monitored at the FEMP is provided below.

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3.4.2 Fugitive Dust

Fugitive dust, for the purpose of this Air Monitoring Plan, is defined as solid particulate matter that becomes airborne as a result of remedial activities at the OSDF. Examples of some of the activities that could produce fugitive dust at the OSDF include but are not limited to:

- excavation and trenching activities during cell development at the OSDF;
- placement of impacted soil, building materials, and concrete into the cells at the OSDF;
- capping the cells at the OSDF; and
- borrow area activities.

A conservative approach will be utilized as part of this Air Monitoring Plan to allow for changes to be made in fugitive dust emission controls used during activities at the OSDF on a real-time basis, based first upon visual emissions monitoring by certified Visual Emission Evaluators, and also upon results from the Occupational Air Monitoring Program.

3.4.3 Radionuclide Particulate Matter

An on-going environmental monitoring program exists for the FEMP, as presented in the *Fernald Site Environmental Monitoring Plan (EMP)* [FERMCO, 1995a]. The *EMP* includes an environmental surveillance component to assess the impact on the environment and the general public due to FEMP operations. As part of the environmental surveillance, air monitoring and subsequent radionuclide analyses is currently being performed at air monitoring stations at the FEMP perimeter fenceline and outside the fenceline of the Fernald site. These air monitoring stations consist of high-volume air monitors and their respective housing units. These high-volume air monitors are used to collect particulate matter on filters which are subsequently analyzed for radionuclides that have been targeted in the *EMP*. These target analytes include pertinent uranium, thorium, and radium isotopes as well as ^{238}Pu, ^{239}Pu, ^{237}Np, ^{90}Sr, ^{137}Cs, and ^{99}Tc.

Because radionuclide particulate matter may be resuspended into the atmosphere from activities associated with the OSDF, these same *EMP* analytes will therefore be included as constituents of concern in this Air Monitoring Plan. A specific analysis regimen is presented in Section 6. That analysis regimen will be revised to reflect any changes made to the *EMP* analysis regimen (see Section 7).

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4. MONITORING LOCATIONS

4.1 Prevailing Wind

Airborne pollutants are subject to whatever weather conditions exist. Weather data, particularly windspeed and direction, provide guidance in collecting environmental samples and determining sites for monitoring stations.

Figures 4 and 5 of the *1994 Site Environmental Report* [FERMCO, 1995b] present annual wind roses which illustrate the average wind speed and general direction measured at the 10-meter (33-foot) height and 60-meter (197-foot) levels in 1994. At the 10-meter height, the prevailing winds were from the southwest (11%) and from the west (10%); at the 60-meter height, prevailing winds were from the south-southwest (13%) and from the northeast (10%). Additionally, Drawing X-3 *Facility Plot Plan* presents a wind rose at the 10-meter (33-foot) height for combined 1994-1995 data. The prevailing winds were from the southwest and west for the two-year period, demonstrating no major variability from the 1994 data.

In previous years, trees growing near the meteorological tower affected the measured wind speeds at the 10-meter (33-foot) level because they acted as a wind barrier. In November 1993, trees within a 107-meter (351-foot) radius were cut down. As a result, the winds measured through 1994 appear to be much more representative of the winds which cross the site and general area.

4.2 Waite Methodology

AMS locations for the FEMP perimeter fenceline boundary indicated in the *EMP* were chosen based on the Waite Methodology [FERMCO, 1995a]. The Waite Methodology is an analytical method for distributing air sampling locations around nuclear facilities. It incorporates a weighting factor based on demographics and meteorological data [Waite, 1976].

4.3 OSDF and Borrow Area

The OSDF design calls for eight disposal cells (plus a possible ninth contingency cell) which will be progressively constructed and filled with impacted materials as those materials are generated by remediation activities at the site. The OSDF is being constructed near the eastern FEMP property boundary. The borrow area will be constructed near the south-eastern FEMP property boundary.

AMSs exist under the *EMP* on the FEMP boundaries and at off-property locations. The existing AMS network is illustrated in Figure 21 of the *1994 Site Environmental Report* [FERMCO, 1995b]. Existing AMSs 2 and 3 are located along the FEMP eastern property boundary, east of the location of the OSDF, while existing AMS 4 is located along the southeastern property boundary. Existing AMSs 8 and 9 will be relocated due to FEMP remediation work, and also are planned to be placed along the FEMP eastern boundary. With that relocation, AMSs 3, 8 and 9 are positioned downwind from the OSDF under prevailing wind conditions, and AMSs 2 and 4 provide additional coverage closest to potential public exposure points. The existing AMS network, after the identified relocations, is thus properly situated in relation to the OSDF in order to monitor potential public exposure.

Additional AMSs may be installed if the potential public exposure cannot be adequately assessed by the network or AMSs may be relocated or deleted based on periodic evaluations of this plan as discussed in Section 7.

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5. MONITORING FREQUENCY

5.1 Overview

The frequency of air monitoring during OSDF activities is discussed in this section. The discussion includes background monitoring to establish baseline data prior to OSDF construction activities, monitoring during impacted materials placement, and monitoring during closure activities. As previously stated under Section 1.1, activities during the post-closure period of the OSDF will be addressed in a plan to be developed later.

5.2 Baseline Monitoring

The FEMP's high-volume air sampler network is in place and operational; the two AMSs needing relocation as mentioned previously in Section 4.3 will have been relocated prior to construction at the OSDF cells and borrow area. Data from that air sampler network will be used to establish baseline levels prior to initiation of OSDF construction activities. Baseline levels will be used in the review and interpretation of air monitoring data during OSDF activities.

5.3 Air Monitoring During Remedial Activities

5.3.1 Particulate Emissions Abatement and Visual Monitoring

The short-term risk assessment of the OU5 FS indicates that wind blown dust is a minimal contribution to airborne particulates. Most of the particulate matter is a result of soil movement, impacted material placement, and vehicle traffic. Emissions produced from impacted materials placement activities will be attenuated through standard abatement procedures, including administrative and engineering controls. OSDF remedial action project dust and fugitive emissions control requirements have been identified in the Impacted Materials Placement Plan, the Operations and Maintenance Plan, the Borrow Area Management and Restoration Plan and the appropriate specifications. Administrative and engineering controls are established in the plans for minimizing dust and fugitive emissions. Examples of

administrative controls include: leaving topsoil and vegetative cover in the borrow area in place until the area becomes active; limiting active borrow area acreage; limiting vehicular traffic speeds on haul roads; and not placing impacted materials into the OSDF when wind speeds exceed certain levels. Examples of engineering controls include: covering loads of borrow soil or impacted materials; application of water to haul roads to limit dust generation; and use of crusting agents and temporary covers during seasonal shutdown of the OSDF. Visual monitoring will be used to assess fugitive emissions and the effectiveness of these abatement controls in accordance with 40 CFR Part 60 Appendix A Method 9.

5.3.2 Radionuclide Monitoring Frequency

Radiological air monitoring will be conducted in accordance with the *EMP* (or its subsequent revisions). That program is briefly summarized in the following paragraph.

High-volume samplers will be operated on a 24-hour, 7-days a week basis. FERMCO will be responsible for routine checks on the equipment, following the procedures established in the *EMP* (or its subsequent revisions). Filters from the high-volume air samplers will be collected by FERMCO on a weekly basis and composited for biweekly analysis for total uranium. A portion of the biweekly sample will be retained by the laboratory to be added to an annual composite that will be analyzed for the target analytes as indicated in Section 6.

5.4 Monitoring During Closure of the Last OSDF Cell

In order to obtain post-remediation background data, the high-volume air samplers will be operational two months after closure of the last cell of the OSDF. This data will allow for verification of the assumption that after completion of the OSDF, fugitive dust emissions should be negligible. As previously stated under Section 1.1, activities during the post-closure period of the OSDF will be addressed in a plan to be developed later.

6. AIR MONITORING EQUIPMENT

6.1 Overview

Air monitoring stations have been established along the FEMP property boundary and at off-property locations under the *EMP* [FERMCO, 1995a]. These stations consist of the following air monitoring equipment:

- High-volume air monitor & housing unit.

For information purposes, a brief description of the air monitoring equipment is provided in this section, including equipment specifications and air monitoring procedures. The *EMP* (or its subsequent revisions) will govern the equipment specifications and procedures.

6.2 High-Volume Air Samplers

High-volume air samplers have been included as part of the FEMP's existing AMS network to collect airborne particulate matter on filters that are subsequently analyzed for radionuclides.

As part of the on-going Environmental Monitoring Program, filters are collected from high-volume air samplers at the AMSs weekly but are then combined to form two-week composite samples. At the laboratory, the filters are stored for at least three days to allow naturally occurring, short-lived radionuclides to decay. The filters are then heated to 550 degrees Celsius to remove organic matter and are then dissolved in acid. The resulting solution is analyzed for uranium. A portion of the solution is retained for an annual composite which is subsequently analyzed for trace concentrations of radionuclides listed in Table 6-1.

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TABLE 6-1

MINIMUM ANALYSIS REGIMEN FOR AMBIENT AIR SAMPLES(1)

Analysis Frequency	Target Analytes	Description of Analysis	Required Detection Level (RDL)	Required Accuracy at 10 x RDL
Biweekly	Total Uranium	Uranium by KPA	2.0 ug/filter	±50%
Annual composites	^{137}Cs	Isotopic	11.0×10^{-6} pCi/m^3	±50%
	^{237}Np	Isotopic	0.3×10^{-6} pCi/m^3	±50%
	$^{239/240}Np$	Isotopic	0.7×10^{-6} pCi/m^3	±50%
	^{238}Pu	Isotopic	0.7×10^{-6} pCi/m^3	±50%
	^{226}Ra	Isotopic	0.8×10^{-6} pCi/m^3	±50%
	^{228}Ra	Isotopic	8.0×10^{-6} pCi/m^3	±50%
	^{90}Sr	Isotopic	0.7×10^{-6} pCi/m^3	±50%
	^{99}Tc	Isotopic	74.0×10^{-6} pCi/m^3	±50%
	^{228}Th	Isotopic	2.3×10^{-6} pCi/m^3	±50%
	^{230}Th	Isotopic	2.3×10^{-6} pCi/m^3	±50%
	^{232}Th	Isotopic	2.3×10^{-6} pCi/m^3	±50%
	^{234}U	Isotopic	7.0×10^{-6} pCi/m^3	±50%
	$^{235/236}U$	Isotopic	7.0×10^{-6} pCi/m^3	±50%
	^{238}U	Isotopic	7.0×10^{-6} pCi/m^3	±50%

Note: (1) All entries in this table are informational only (*i.e.*, governed by the *EMP* and its subsequent revisions)

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Because the environmental air monitoring data collected during activities at the OSDF will be used as part of the environmental surveillance effort under the *EMP* (or its subsequent revisions), it is imperative that monitoring equipment, operating procedures, and analytical methods be compatible to those used in the *EMP* (or its subsequent revisions). No changes to the *EMP*'s existing air monitoring regime, aside from physical relocation of two AMSs due to remediation at their present locations as discussed previously in Section 4.3, are considered necessary. These relocations will be addressed in the forthcoming FEMP Integrated Environmental Monitoring Plan (IEMP), the revision to the *EMP*.

6.2.1 Specifications

The *EMP* (or its subsequent revisions) has established specifications for high-volume AMS. Since the air monitoring network under the *EMP* governs this air monitoring, those specifications are presented below for information purposes only:

- a pump capable of producing air flow covering a range of 40 cfm (1,132 lpm) to 50 cfm (1,416 lpm) with air filter in place;
- an adjustable flow control device to maintain constant flow rates from 40 cfm to 50 cfm (1,416 lpm);
- capability of providing permanent records of air flow rates over a seven-day period;
- timing device to record actual pump operating time;
- capability to check air flow of pump;
- 8 in. (203 mm) x 10 in. (254 mm) filter in a removable cassette unit;
- pressure-sensitive switch to activate a warning light when unit is down; and

- mounted warning light visible to naked eye at a distance of 100 ft (30 m).

6.2.2 Operating Procedures

The High-Volume Air Monitoring Procedure (Procedure No. SRS-REM-001) used in the *EMP* (or its subsequent revisions) will be adopted in this Air Monitoring Plan. This procedure includes detailed instructions on the following: filter exchange; sample submittal, including chain-of-custody requirements; completion of operating logs; etc.

FERMCO will ensure that the filters are analyzed for radionuclides in accordance with the laboratory procedures listed in Table 6-1.

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7. DATA INTERPRETATION AND RESPONSE

7.1 Overview

This section of the Air Monitoring Plan describes actions to be taken based on environmental air monitoring during OSDF activities. As stated in the OU2 ROD [DOE, 1995a] and OU5 ROD [DOE, 1996] and their respective Responsiveness Summaries, summaries of the environmental air monitoring data will be made available to EPA, OEPA, and also to the public in a timely manner through the Public Environmental Information Center (PEIC). It is the responsibility of FERMCO to coordinate this effort with the PEIC. This section also provides for annual review to evaluate the efficacy of this plan in meeting OSDF environmental air monitoring objectives.

7.2 Data Interpretation

The DCGs for the target analytes of this Air Monitoring Plan are listed in Table 3-1. These DCGs will be used as comparison criteria to evaluate the radionuclide data to assess the potential to exceed the limits on dose (*e.g.*, 10 and 100 mrem/year) to members of the public from activities occurring at the FEMP. This trending comparison will be made every two weeks for total uranium data. An annual comparison will be performed for the trace radionuclides based on the analysis of the annual composite sample.

This approach and frequency are considered more than sufficient in light of the conclusions presented in Section 3 and reiterated below:

- The exposure pathway of greatest concern is through inhalation of particulate emissions containing radionuclides.

- Visual emissions monitoring is the EPA-recognized methodology (40 CFR Part 60 Appendix A Method 9) for assurance of dust and fugitive particulate emissions control.

- The potential risk to public health due to OSDF construction and impacted materials placement is low.

- Only the on-property remedial workers could potentially incur risks exceeding one in one million (1.0×10^{-6}) and no greater than 9.4×10^{-4}.

- The radionuclide concentrations predicted for OSDF activities result in a dose to the off-property public of 0.56 mrem/year, which is

  - *approximately 200 times lower* than the DOE Order 5400.5 Chapter II(1)(a) dose limit of 100 mrem/year, and

  - *approximately 20 times lower* than the EPA's 40 CFR Part 61 Subpart H and DOE Order 5400.5 Chapter II(1)(b) dose limit of 10 mrem/year.

- These are based on a hypothetical receptor located immediately adjacent to the FEMP property boundary at the fence line for the entire duration of the FEMP cleanup process. The projected risk and dose to a near-property receptor located at any other position would be expected to be less than these projections.

- Additionally, the application of mitigative measures to reduce fugitive dust emissions would reduce these projected concentrations, risks, and doses.

7.3 Response

7.3.1 Visible Emissions

It is the responsibility of the Visible Emissions Evaluator to be visually observant of activities conducted that could cause fugitive dust emissions to occur. If the visible emissions are detected, the Visible Emissions Evaluator will first verify the visible emission. After verification, the Visible Emissions Evaluator will notify the FERMCO Construction Contracts Manager that emission controls are not effectively controlling fugitive dust emissions. The Visible Emissions Evaluator will log in the date; time; activities within the battery limit of the OSDF as well as outside the battery limit that could contribute to the visible emissions; and actions that were taken to further the control of fugitive dust emissions.

7.3.2 Uranium and Radionuclide Data

Comparisons of monitoring results to DCGs will be performed by FERMCO to evaluate the radionuclide data to assess the potential to exceed the limits on dose (*e.g.*, 10 and 100 mrem/year) to members of the public from activities occurring at the FEMP. This comparison will be made every two weeks for total uranium data. The radionuclide results will be reviewed as part of an annual evaluation of the Air Monitoring Plan, as described further below.

7.4 Periodic Plan Evaluation

The Air Monitoring Plan will be reviewed at least annually to evaluate the effectiveness of the plan in meeting the OSDF air monitoring objectives. The review will focus on the following areas of the plan:

- the number and location of OSDF AMSs;

- the frequency of radionuclide analyses;
- advances in monitoring and analytical technologies that become field-proven, commercially available, and acceptable to the regulatory agencies; and
- the effectiveness of administrative and engineering dust emission controls.

The environmental air monitoring results will also be reviewed and the information used to evaluate the plan with respect to available historical FEMP environmental air data and the progressive findings of the environmental air monitoring program. Based on this review, certain aspects of the Air Monitoring Plan could be modified. Should visible emissions occurrences and radionuclide data show that administrative action levels are not being met, then recommendations for improved administrative and engineering emission control measures will be made.

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BORROW AREA MANAGEMENT AND RESTORATION PLAN

ON-SITE DISPOSAL FACILITY

April 1996
Revision D

United States Department of Energy

Fernald Environmental Management Project
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1. INTRODUCTION

1.1 Overview

This Borrow Area Management and Restoration (BAMR) Plan describes the management and restoration activities that will be undertaken at 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"* [DOE, 1995a] (Operable Unit 2 ROD). 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 *"Intermediate Design Criteria Package, On-Site Disposal Facility"* [GeoSyntec, 1996a]. 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 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, with the possibility of closure on an interim basis should it be required.

1.3 Plan Scope

The scope of this BAMR Plan is to identify all development, management, and restoration activities associated with the borrow area to ensure its proper development in accordance with the DCP. 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 requirements from the OSDF DCP applicable to this work plan are presented in Section 2;
- a description of the borrow area is presented in Section 3;
- borrow area operations are described in Section 4;
- the borrow area sequence of development is contained in Section 5;
- borrow activities at the OSDF footprint are described in Section 6; and

- erosion and sediment control measures are presented Section 7.

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 Construction Quality Assurance (CQA) Plan [GeoSyntec, 1996c]:* provides soil testing standards and frequencies which are required for the borrow soil excavated from the borrow area;

- *OSDF Surface-Water Management and Erosion Control (SWMEC) Plan [GeoSyntec, 1996d]:* provides details of temporary and permanent erosion and sediment controls and surface-water controls for the borrow area; and

- *Intermediate Design Specification Package [GeoSyntec, 1996e]:* provides project specifications which are to be met during construction.

2. APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to the BAMR 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 criteria. There are no ARARs 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 applicable to the BAMR Plan are:

- 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.

- Requirements for processing of the borrow area soils shall be identified during design. If possible, such processing shall be performed in the borrow area or any temporary stockpile area. Such processing could include moisture conditioning, blending, screening, or crushing.

- 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 access controls for the borrow area; and

  - establishment of soil processing facilities (if any are needed).

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3. 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 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.

If needed, material from the borrow area will also be used to construct 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 construction 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 presented in Appendix A.

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 will be separated as described in a later section of this report 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 From OSDF Footprint

Prior to constructing any OSDF cells, brown till at the OSDF footprint must be excavated to subgrade. The depth of excavation to subgrade at the OSDF footprint ranges from zero to 15 feet. A portion of this excavated material will be impacted material. The remaining portion of this material will be used for construction of the cell liner (if suitable) and site work applications. 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). If it is decided that impacted material will be removed concurrently with cell construction, this BAMR Plan will either be amended or a separate plan will be developed for the impacted material.

4. 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 or a separate plan will be developed for that impacted material.

4.2 Access Controls

Access control at the borrow area shall consist of access gate(s) across the borrow area haul road at each entrance to the borrow. These controls shall be implemented, as are appropriate, prior to the commencement of any soil disturbance activities in the borrow area.

Direct access to the borrow area shall be controlled. The entrance to the borrow area is defined as the intersection of the construction haul road with the crest of the 6H:1V cut slope of the borrow area. The location for the borrow area access control gate is shown on the Construction Drawing.

Sediment controls shall be protected. The controls shall be established to the limits reasonably achievable during construction. At the end of each day during construction of a sediment controls, a visual barrier, such as straw bale barriers placed end to end, shall be established in front of any portion of the sediment controls that can not be fenced due to construction. Once construction of the sediment controls is complete, additional protection shall be installed as necessary to completely contain the facility. Signs warning unauthorized individuals to keep out shall be placed on the fence at 50 ft (15 m) intervals. A control gate shall be provided to allow vehicle and personnel access to the sediment basin for routine maintenance and periodic cleaning.

4.3 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 are discussed in detail in Section 5 (see also the *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 Construction Subcontractor is responsible for the maintenance of the erosion and sediment controls. Maintenance requirements for the controls are presented in Section 5.

4.4 Borrow Area Haul Road

The layout for the haul roads within the borrow area shall be planned prior to commencement of borrow activities. The OSDF Construction Subcontractor may establish haul road layouts within the borrow area limits suitable for planned excavation sequence and for transportation of materials to the OSDF. 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 (refer to the *SWMEC Plan*).

The OSDF Subcontractor is responsible for the maintenance of 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 as a dust control measure. Haul roads and haul road entrance shall be constructed with suitable road construction material conforming to Ohio Department of Transportation (ODOT) standard specifications.

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4.5 Clearing and Grubbing

Clearing and grubbing shall take place in areas that will be stripped for borrow activities. Clearing and grubbing activities shall take place as two distinct operations, in a manner consistent with the Project Specifications Section 02110. Cleared material shall be disposed of as directed by the Construction Contracts Manager (CCM). Grubbed material may be stockpiled and reused at other locations at the FEMP or a part of OSDF construction in accordance with the Project Specifications.

4.6 Topsoil Removal and Stockpiling

Topsoil shall be stripped from the borrow area from an area no larger than ten acres. The thickness of the topsoil will be determined by the CQC Consultant. The stripped topsoil shall be stockpiled at or near the borrow area at a location designated by CCM that is easily accessible by the Contractor for maintenance. The side slopes of the topsoil stockpile shall be sloped at 3H:1V or flatter. The surface of the topsoil stockpile shall be shaped and tracked at the end of each day in which topsoil was placed in the stockpile. Once topsoil stockpiling is complete, the stockpile shall receive temporary seeding unless the material will immediately be needed for use as topsoil elsewhere at the FEMP site. Temporary seeding shall be done as directed by CCM in accordance with temporary seeding requirements of Project Specification Section.

4.7 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 the clean soil stockpile area. Based on visual observation by the CQC Consultant, and on the results of pre-construction tests conducted on the borrow soils, the soils shall be separated into two stockpiles; one stockpile containing borrow material suitable for use as clay liner and clay cap, and one stockpile containing all other borrow material.

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 seeded and mulched in accordance with the project specifications. The maximum area of bare soil that may be exposed at any one time in the borrow area is 10 acres. 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. Decommissioning of the sediment basin shall consist of:

- draining the sediment basin of all water;
- removing sediments from the basin as described in Section 5;
- grading the sediment basin to the lines and grades shown on Construction Drawings.
- seeding and mulching the regraded areas in accordance with the project specifications.

4.8 Soil Processing

In the event that results of preconstruction testing of borrow soil samples indicate that the borrow soils are not suitable for use as clay liner and/or clay cap material, a material processing area shall be established by the OSDF Construction Subcontractor. The material processing area may be located at or near the borrow area, or in the vicinity of the clean soil stockpile area.

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5. 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. 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 is presented below.

1. Construction fencing shall be established around the sides of the sediment control structures.

2. 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.

3. Clearing, grubbing and topsoil stripping operations shall take place in the vicinity of the sediment controls. These materials shall be handled as described in Section 4.5 (clearing and grubbing), or Section 4.6 (topsoil), as appropriate.

4. Construction of sediment controls shall begin. Construction activities include: (i) excavating for the sediment controls 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 controls.

5. Concurrently with the construction of sediment controls, an area suitable for establishing a soil processing operation, if needed, shall be established as described in Section 4.8.

6. 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) within the early stage of the borrow area.

7. Clearing, grubbing, and topsoil stripping of the borrow site shall occur as described in Section 4.5 (clearing and grubbing), or Section 4.6 (topsoil), as appropriate.

8. Borrow operations shall begin. Excavated material shall be hauled and stockpiled as described in Section 4.7. Excavation grades shall be established such that positive drainage to relevant erosion and sediment controls is maintained.

9. Throughout excavation operations, the OSDF Construction Subcontractor shall maintain all erosion and sediment controls.

10. As final grades are reached within the active borrow site, the finished areas shall be seeded and mulched to minimize erosion. Topsoil need not be placed over finished grades in cut areas. However, all finished grades in cut areas shall be disced and/or tilled prior to seeding and mulching to facilitate germination of the seed.

11. 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

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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.

12. Once final grades are obtained throughout the early stage of the borrow area, and vegetation has been established over the entire early stage of the borrow area, sediment controls shall be decommissioned as described in Section 4.7.

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 is presented below.

1. Construction fencing shall be established to the extent possible around the site of sediment controls.

2. Erosion and sediment controls shall be implemented in the vicinity of sediment controls.

3. Clearing, grubbing and topsoil stripping operations shall take place in the vicinity of sediment controls. These materials shall be handled as described in Section 4.5 (clearing and grubbing), or Section 4.6 (topsoil), as appropriate.

4. Construction of sediment controls shall begin. Construction activities include: (i) excavating for the sediment controls and removing the excavated materials as described in Section 4; and (ii) seeding the base and side slopes of the sediment controls.

5. The current location of the soil processing area, if one exists, shall be re-assessed and relocated, if required, by the OSDF Construction Subcontractor.

6. 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) within the late stage of the borrow area. Every effort shall be made by the OSDF Construction Subcontractor to minimize erosion and/or sedimentation in the completed early stage of the borrow area.

7. Clearing, grubbing, and topsoil stripping of the borrow site shall occur as described in Section 4.5 (clearing and grubbing), or Section 4.6 (topsoil), as appropriate.

8. Borrow operations shall begin. Excavated material shall be hauled and stockpiled as described in Section 4.7. Excavation grades shall be established such that positive drainage to relevant erosion and sediment controls is maintained.

9. Throughout excavation operations, the OSDF Construction Subcontractor shall maintain all erosion and sediment controls.

10. As final grades are reached within the active borrow site, the finished areas shall be seeded and mulched to minimize erosion. Topsoil need not be placed over finished grades in cut areas. However, all finished grades in cut areas shall be disced and/or tilled prior to seeding and mulching to facilitate germination of the seed.

11. 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. 6 through 10 above shall be implemented for each subsequent borrow site within the late stage of the borrow area.

12. Once final grades are obtained throughout the late stage of the borrow area, and vegetation has been established over the entire late stage, sediment controls shall be decommissioned as described in Section 4.7.

6. 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 be removed from the OSDF foot print during excavation to OSDF cell subgrade elevation. The excavated material will be used for construction of the compacted clay liner (if suitable) and site work applications. The construction activities associated with this excavation are similar to those within the borrow area and are briefly described below.

Prior to commencing excavation, the OSDF Subcontractor shall implement access controls and fencing. Erosion and sediment controls, including sediment basins, shall be implemented in accordance with the *SWMEC Plan*. Excavated materials will be hauled to the clean soil stockpile area. Based on visual observation by the CQC Consultant, and on results of the preconstruction testing, the excavated soils shall be separated into two stockpiles: one stockpile containing soils suitable for construction of clay liner, and one stockpile containing all other soil excavated. These stockpiled materials will then be used to construct the compacted clay liner and compacted fill components of the cell. Once subgrade has been reached and prepared in one area of the cell, and provided that the results of preconstruction testing do not preclude it, excavated soil from another location of the cell may be placed directly over the prepared subgrade to construct the compacted clay liner. To the extent possible, all excavated material from the OSDF footprint will be used to construct compacted fill and compacted clay liner prior to obtaining material from the borrow area.

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7. EROSION AND SEDIMENT CONTROLS

7.1 General

Several erosion and sediment controls to be implemented at the borrow area were discussed in Section 4. These controls serve as soil stabilization, runon and runoff control, and sediment control measures for the borrow area and consist of:

- vegetation;
- drainage channels;
- silt fence;
- straw bale barriers; and
- sediment basins.

The construction, inspection, and maintenance of these controls shall be based on standard engineering and soil conservation practices. The methods presented in this section are taken from the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation document *"Rainwater and Land Development"* [ODNR, 1996]. The above controls are discussed in detail in the following sections.

7.2 Vegetation

7.2.1 Definition

Vegetative soil stabilization measures refer to establishing vegetative cover on areas subject to erosion by rainfall. Vegetative soil stabilization may be a temporary (i.e., seasonal) or long-term (i.e., permanent) measure. Recommended seed mixes for seasonal and permanent measures are presented in Appendix B [Earth Systems Associates, Ltd., 1996].

7.2.2 Purpose

Vegetative soil stabilization measures shall be applied to:

- reduce erosion and decrease sediment yield from disturbed areas;

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

- to stabilize drainage channels where concentrated overland flow will occur.

7.2.3 Application

Conditions at the borrow area where vegetation shall be applied include:

- temporary seeding on exposed soil surfaces where additional grading or reworking is not scheduled for a period of 45 days to less than one year;

- temporary seeding on rough graded areas which will not be brought to final grade for 45 days or more; and

- permanent seeding on disturbed areas where permanent, long-lived vegetative cover is needed to stabilize the soil.

The basic vegetation selection, planning considerations, and design criteria are provided in the project specifications.

7.2.4 Maintenance

The OSDF Construction Subcontractor is responsible to maintain seeded areas. If vegetative stress or erosion on the revegetated areas of the borrow area is found to exist, repair procedures using the seeding tables presented in Appendix B shall be implemented. If a particular vegetation appears to have a marginal success rate, the vegetation shall be replaced with a similar vegetative type presented in Appendix B. Where seeding does not establish as expected, the area shall be re-seeded. The cause of the failure shall be determined and corrected in a timely manner. Areas requiring

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re-seeding shall be prepared in the same manner as the original installation. Once established, the vegetation shall be maintained by the OSDF Construction Subcontractor until the borrow area is fully restored. See Table 7-1 for maintenance and repair guidelines.

7.3 Drainage Channels

7.3.1 Definition

Drainage channels are natural or constructed channels 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, or other permanent material.

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

7.3.2 Purpose

Drainage channels at the borrow area shall be used to divert runon away from an active borrow site, collect construction water and convey it to a sediment basin, or collect and convey surface water at slope toes where erosion would result in the absence of drainage channel.

7.3.3 Application

Drainage channels in an active borrow site shall be provided as needed by the Contractor. Drainage channels shall be provided upgradient of all active borrow sites to divert runon away from the borrow site. Drainage channels shall also be constructed at all locations shown on Sheet No. 12 titled *Borrow Area Restoration Plan.*

TABLE 7-1

EROSION AND SEDIMENT CONTROL REPAIR AND MAINTENANCE GUIDELINES

Component	Inspection Frequency	Repairs		General Maintenance
		Condition	Remedy	
Vegetation	Until vegetation is established, two times each work week and after every rain event; thereafter, two times per month and after heavy rains.	• bare spots, erosion rills	• Re-seed and mulch in accordance with the project specifications; if erosion rills are excessive, re-grade surface prior to re-seeding and mulching.	• Water vegetated areas as needed. Check for bare spots and evidence of erosion. Re-seed and mulch as needed. Where vegetation is well established, check areas after heavy rains for erosions rills and bare spots. Re-seed and mulch as needed.
Channels	Once per work week during fair weather; once per work day during prolonged rain events and immediately (i.e., that work day, or the first work day) after the rain event.	• bare spots • sediment buildup	• Re-seed and mulch in accordance with the project specifications; if bare spots continually develop in the same location, install erosion mat in accordance with the manufacturer's specifications. • Promptly remove accumulated sediment from channel and dispose of in accordance with the project specifications	• Check that channels are free of debris or overgrowth of vegetation that would interfere with flow; check to see that vegetation is maintained in channels, and that erosion of the channel is not occurring.
Silt Fence	Once per work day during fair weather, immediately (i.e., that work day, or the first work day) after rain events.	• torn or frayed geotextile • broken posts • silt accumulation	• Staple new geotextile between posts over worn or frayed geotextile. • Cut geotextile from posts, remove and replace post, staple geotextile to new post, re-establish minimum 8-in. deep geotextile embeddment below grade. • Remove silt deposits after each rain event or sooner if they reach one-half the height of the silt fence; re-establish the taughtness of the geotextile between posts and 8-in. minimum geotextile embeddment depth.	• Check that geotextile is not torn or frayed, is taught between posts, and is properly embedded in the ground.
Straw Bale Barriers	Two times each work week during fair weather, once per work day during prolonged rain events, and immediately (i.e., that work day, or the first work day) after rain events.	• broken twine • flow beneath bale • gaps between adjacent bales • silt accumulation	• Re-tie bale if feasible; if substantial straw has been lost, remove and replace with new bale; straw from old bale may be used as mulch. • Remove bale; re-establish minimum 4-in. deep trench; restake bale and construct compacted soil at upstream face. • Wedge loose straw between adjacent bales or move bales closer together. • Remove silt deposits after each rain event or sooner if they reach one-half the height of the barrier.	• Check that bales are properly embedded and stapled, are properly oriented relative to the flow direction, and are not deteriorating.
Sediment Basin	Once per work week during fair weather, immediately (i.e., that work day, or the first work day) after rain events.	• stagnant water in basin; little or no flow out of basin outfall	• Low flow structure may be clogged; drain basin to inspect outlet structure.	• Check outfall regularly to ensure flow through the outlet structure. • Check the trash rack and anti-vortex device regularly and remove any accumulated debris. • Clean out basin when the capacity is reduced to 60% of the design volume.

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7.3.4 Maintenance

Drainage channels shall be protected from sediment build-up. Sediment accumulated at the base of a drainage channel shall be removed immediately. Drainage channels shall be protected against erosion by vegetative means within ten days of installation. See Table 7-1 for maintenance and repair guidelines.

7.4 Silt Fence

7.4.1 Definition

Silt fence is a temporary sediment barrier constructed of posts, filter fabric, and in some cases a wire support fence. The filter fabric is stretched across and attached to the supporting posts and is entrenched. The silt fence is placed across or at 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.

7.4.2 Purpose

Silt fences will be used at the borrow area 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.

7.4.3 Application

Silt fences are applicable where sheet and rill erosion or small concentrated flows may be a problem. At a minimum, silt fences shall be placed on the downslope sides of areas to be disturbed until permanent drainage and erosion controls are established. The application of silt fences at the borrow area shall be implemented:

- below disturbed areas subject to sheet and rill erosion;
- where the size of the drainage area is no greater than ¼ acres per 100 feet of silt fence length, the maximum slope length behind the silt fence is 100 feet; and the maximum slope gradient behind the barrier is 50 percent (2H:1V); and
- in drainage channels where the maximum contributing drainage area is no greater than 2 acres, and where the maximum channel flow rate is 1 cfs.

7.4.4 Maintenance

Silt fences shall be inspected each work day for tears in the geotextile, for excessive silt against the silt fence, and for dislodged or broken posts. The maintenance procedures for silt fence are listed below. See Table 7-1 for maintenance and repair guidelines.

- Inspection shall be frequent and repair or replacement shall be made promptly as needed.
- 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.

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- Silt fences 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. Any required repairs shall be made immediately.

- 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 shall be removed after each rainfall event (i.e., that work day, or the first work day each 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.

7.5 Straw Bale Barriers

7.5.1 Definition

A straw bale barrier is a temporary sediment barrier composed of a row of straw bales across or at the toe of the slope that is entrenched and anchored to intercept or detain sediment and decrease flow velocities from drainage areas of limited size.

7.5.2 Purpose

Straw bale barriers are intended to be used to:

- intercept and detain small amounts of sediment from disturbed acres of limited extent in order to prevent sediment from leaving the site; and
- decrease the velocity of sheet flow and low-to-moderate level channel flows.

7.5.3 Application

Straw bale barriers are applicable where sheet and rill erosion from low-to-moderate drainage channel flows may be a problem. It should be noted that improper placement and installation of the barriers, such as staking the bales directly to the ground with no soil seal or entrenchment, will allow undercutting and end flow resulting in additions rather than removal of sediment from runoff waters. The application of straw bale barriers at the borrow area shall be limited to the following conditions:

- below disturbed areas subject to sheet and rill erosion;

- where the size of the drainage area is no greater than ¼ acres per 100 feet of barrier length, the maximum slope length behind the barrier is 100 feet; and the maximum slope gradient behind the barrier is 50 percent (2H:1V);

- in drainage channels where the maximum contributing drainage area is no greater than 2 acres;

- when effectiveness is required for less than 3 months; and

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- under no circumstances shall straw bale barriers be constructed in streams or in channels where there is the possibility of a washout.

7.5.4 Maintenance

The use of straw bale barriers at the borrow area will require that the following maintenance practices be followed.

- Inspection shall be frequent and repair or replacement shall be made promptly as needed.

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

- Straw bale barriers 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. Any required repairs shall be made promptly.

- 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 straw bale barrier, (b) remove the accumulated sediment, or (c) install a different erosion and sediment control measure.

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

- Straw bale barriers shall be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.

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

To ensure their useful application and effectiveness, straw bale barriers shall be diligently maintained. See Table 7-1 for maintenance and repair guidelines.

7.6 Sediment Basins

7.6.1 Maintenance

A sediment basin is a temporary dam or excavation constructed across a watercourse or at other suitable locations to form a basin for catching and storing sediment and other waterborne debris.

7.6.2 Purpose

In general, sediment basins are used as a means of trapping and storing sediment from eroding areas in order to protect downstream areas from damage resulting from sedimentation and waterborne debris. Sediment basins are not 100 percent effective in trapping sediment which flows into them. Therefore, they shall 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.

7.6.3 Maintenance

MaintenanceThe sediment basin shall receive regular maintenance that will 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 will be removed from the basins when the capacity is reduced to sixty percent of the design volume as shown on the cleanout elevation specified on the drawings.

Sediment removed from the sediment basin will be spoiled and vegetated or used for miscellaneous areas at the FEMP site that have been eroded and require maintenance. See Table 7-1 for maintenance and repair guidelines.

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APPENDIX A

GEOTECHNICAL DATA

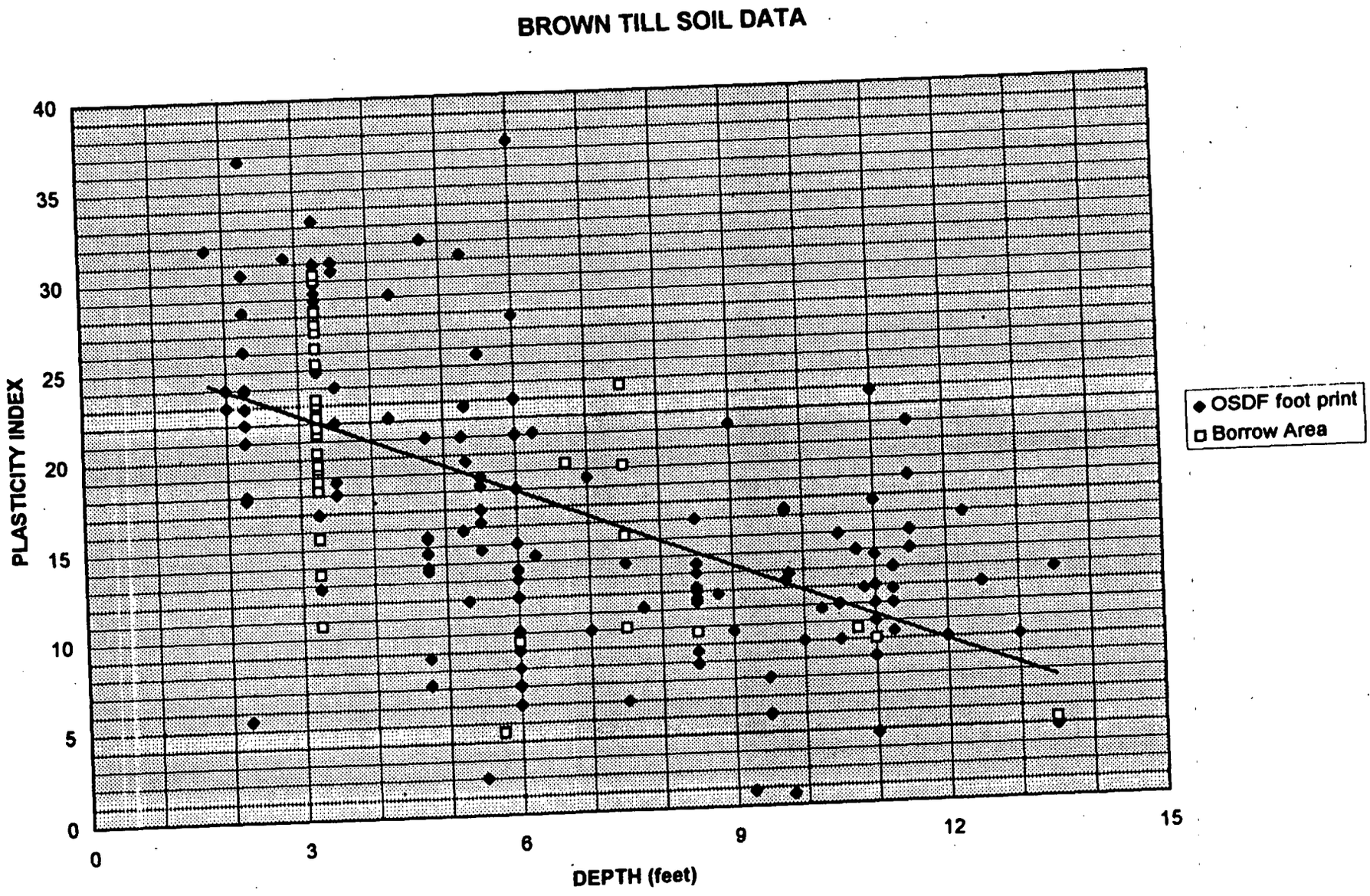

Figure 1. Brown Till Plasticity Index Data

[data obtained from Parsons, 1995 and 1996]

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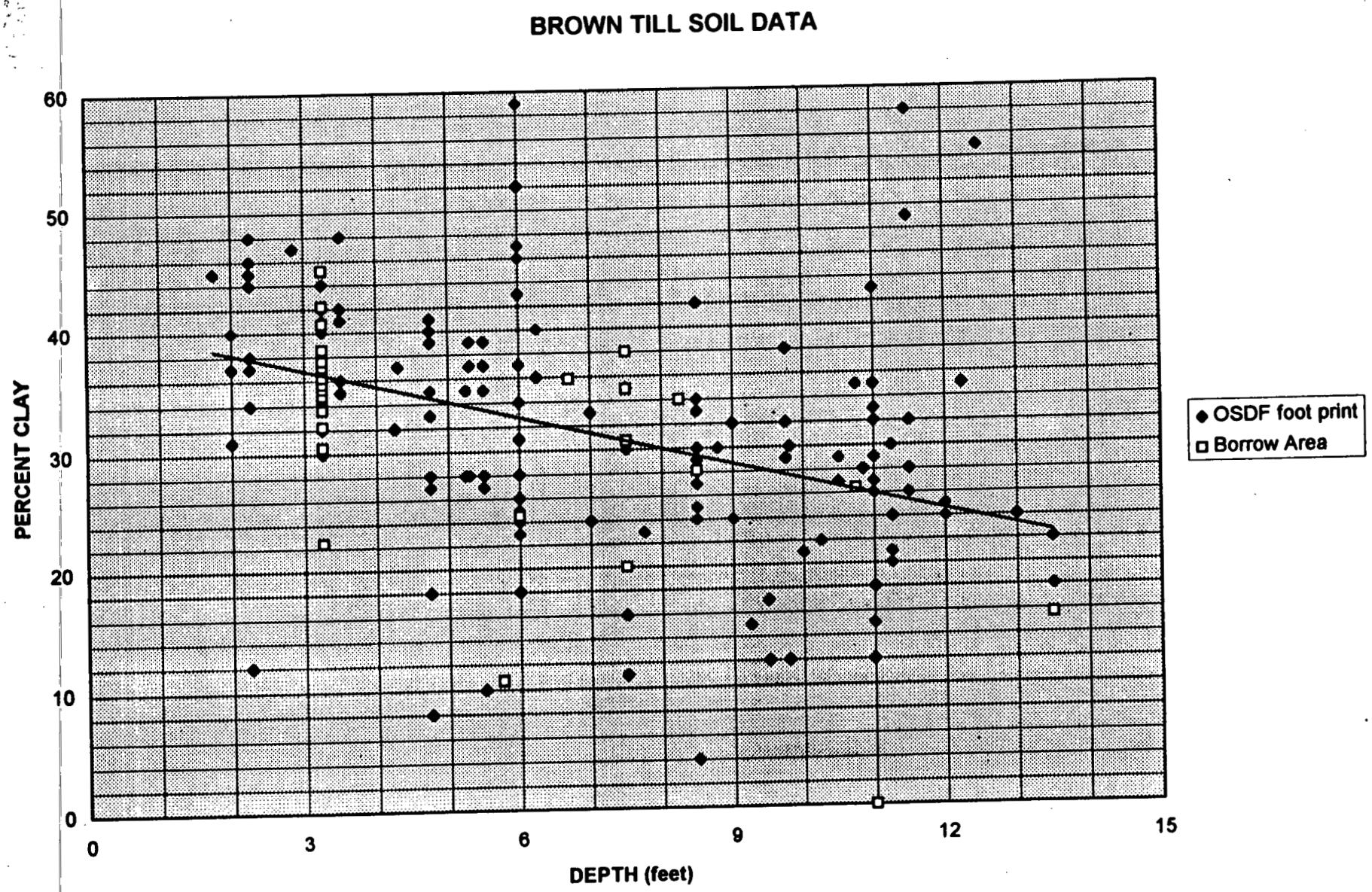

Figure 2. Brown Till Clay Data

[data obtained from Parsons, 199[illegible] and 1996]

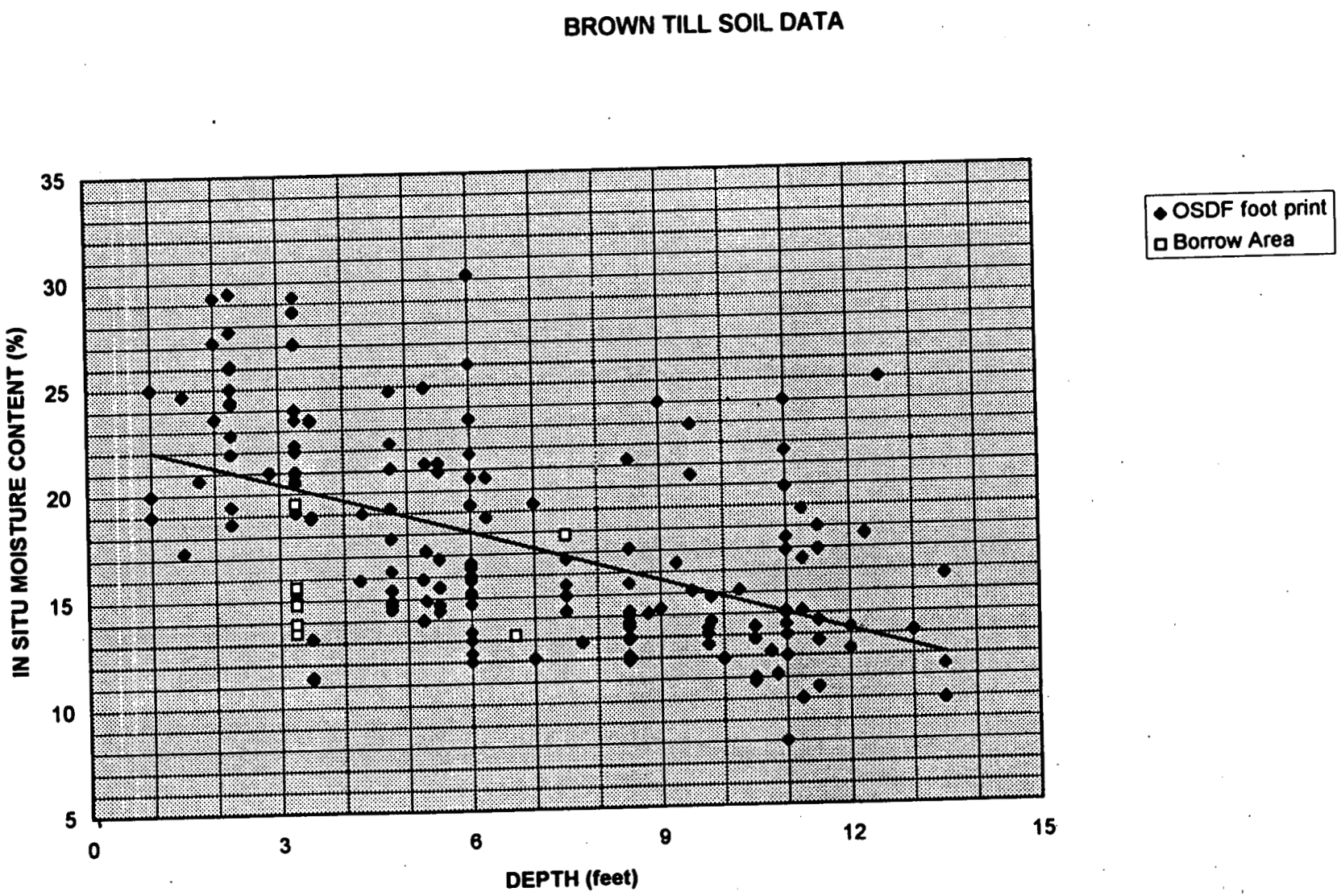

Figure 3. Brown Till In Situ Moisture Content Data

[data obtained from Parsons, 1995 and 1996]

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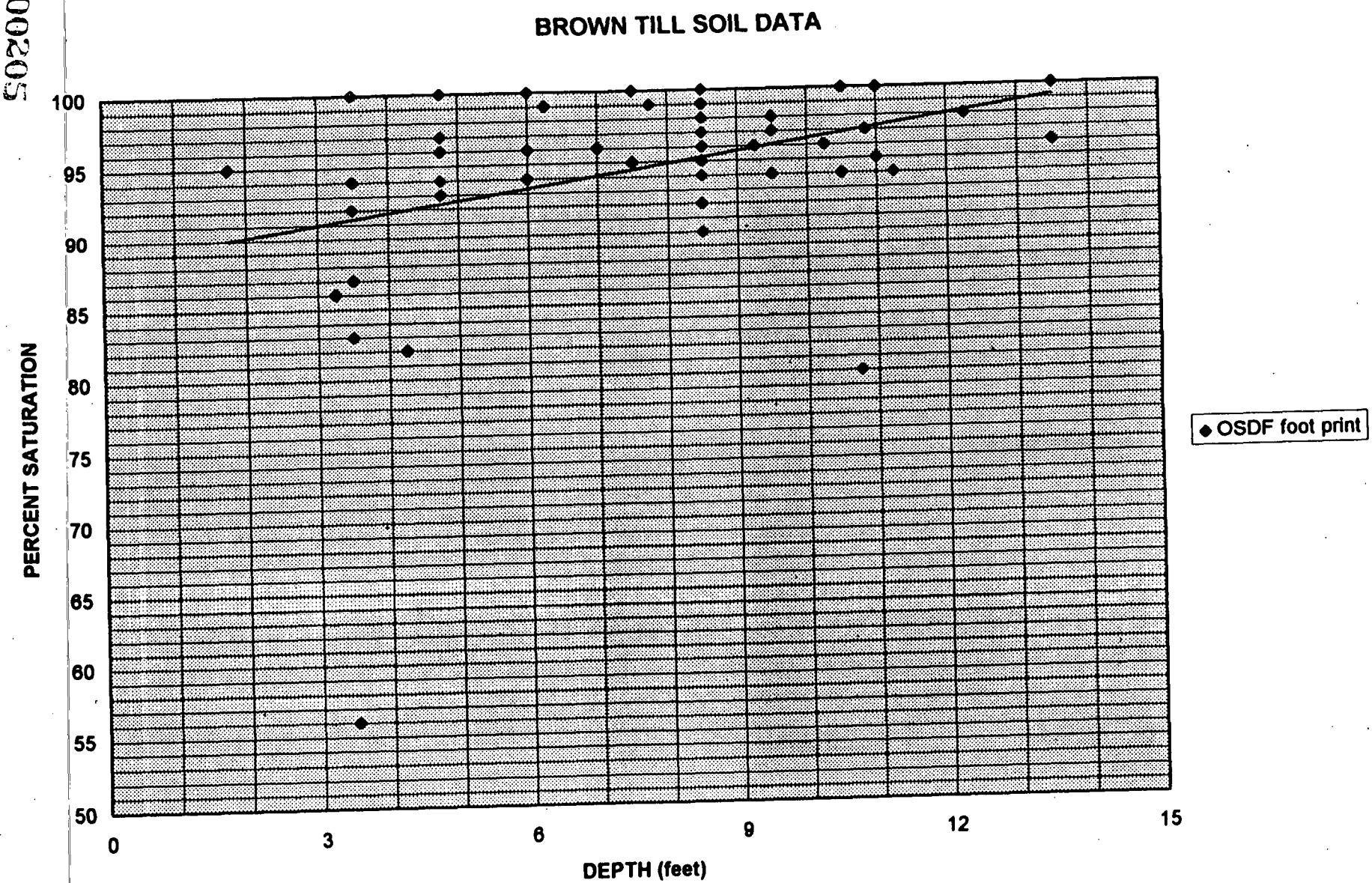

Figure 4. Brown Till In Situ Saturation Data

[data obtained from P[illegible]s, 1995]

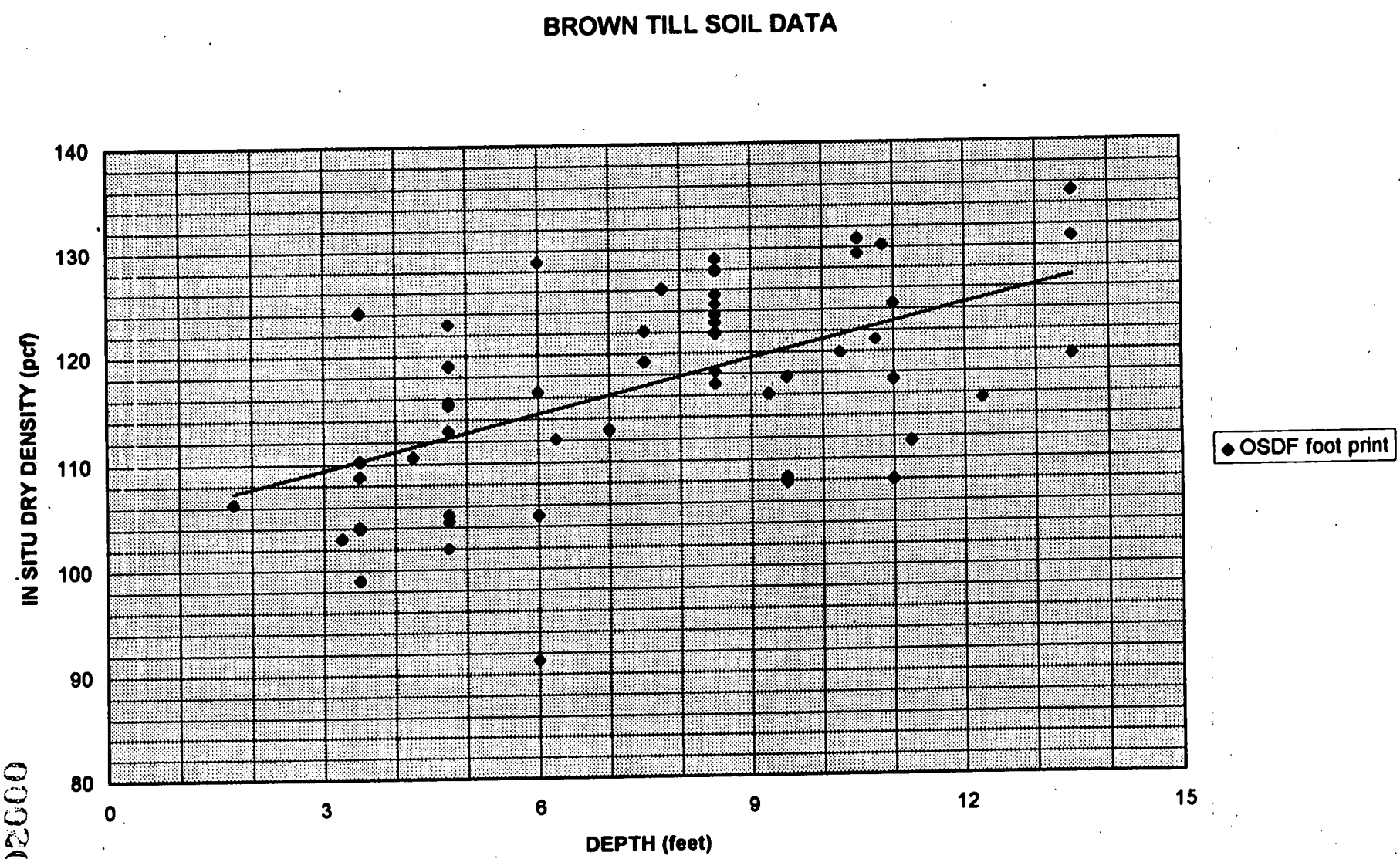

Figure 5. Brown Till In Situ Dry Density Data

[data obtained from Parsons, 1995]

APPENDIX B

SEEDING TABLES

6. RECOMMENDED SEED MIXES

Recommended seed mixes for the project are presented in Tables 4 and 5. Table 4 presents the recommendations for seasonal cover. Table 5 presents the recommendations for permanent cover. Regional suppliers of grass seed are listed in Appendix B.

Table 4. Recommended seed mixes for seasonal cover.

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

6.1 Seasonal Cover

The primary considerations for seasonal seed mixes are suitability for the site, rapid stabilization, and planting season. These plants are annuals and short-lived perennials that will die-out or be replaced by the permanent cover. Table 4 presents seeding options based on anticipated site moisture conditions and expected planting season. Moisture conditions are expected to more or less conform to site slopes. Swales, waterways, and depressions are expected to be wet, slopes from 1% to 9% are expected to be moist, and slopes from 10% to 33% are expected to be dry to droughty. The maximum slope allowed in the construction plan is 33%.

Table 5. Recommended seed mixes for permanent cover.

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

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

Rye was selected as the primary annual cover due to its adaptability to a variety of soil conditions including low fertility and acidity. Ryegrass was added to the mix for rapid stabilization and a longer growing season. Sudangrass, lespedeza and oats were selected for temporary cover in the summer due to their adaptability to the region and site conditions. Seasonal seed mix costs for the mixes shown in Table 4 are estimated at $35 to $50 per acre. Cost of site preparation., fertilizer and seeding are additional.

6.2 Permanent Cover

In addition to site and planting considerations cited for seasonal cover, a native species mix is also included as an option for permanent cover (Table 5). The native mix will provide effective erosion control and a different look than the pasture grasses. In general, native grasses are taller, more aggressive on dry sites, and require a spring or dormant season planting regime. The seed is substantially more expensive than commonly grown pasture grasses. The cost of native mixes ranges from $53 to $125 per acre while pasture mixes range from $45 to $50 per acre. Growth of native grasses occurs mainly in the summer and they are dormant in the winter.

SURFACE-WATER MANAGEMENT AND EROSION CONTROL PLAN

ON-SITE DISPOSAL FACILITY

April 1996
Revision D

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

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Under

Fernald Environmental Restoration Management Corporation
Subcontract 95PS005028

ACRONYM LIST

ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society of Testing and Materials
AWWT	Advanced Wastewater Treatment
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
O&M	Operations and Maintenance
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
SCS	Soil Conservation Service
SWMEC	Surface Water Management and Erosion Control
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
WAC	Waste Acceptance Criteria

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1. 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"* [DOE, 1995ca] (Operable Unit 2 (OU2) ROD). Those activities are to be addressed in a plan to be developed later.

1.2 Project Description

The construction, impacted material placement, and closure of the OSDF is currently anticipated 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 with the possibility of closure on an interim basis should it be required.

The design basis for the OSDF and related appurtenances is presented in the document, *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2"* [DOE, 1995b]. The design of the OSDF and related appurtenances, as currently developed, is presented in the *"Intermediate Design Package, On-Site Disposal Facility"* [GeoSyntec, 1996a]. The Design Criteria Package (DCP) [GeoSyntec, 1996b] component of the Intermediate Design Package 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 of this plan.

1.3 Plan Scope

This SWMEC Plan establishes the surface-water management, erosion minimization, and sediment control practices necessary 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

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- 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 Section 3 of this plan, in the Construction Drawings, and by the project specifications.

1.4 Plan Organization

The remainder of this SWMEC Plan is organized as follows:

- a description of the parties responsible for this plan and the plans related to this SWMEC Plan is presented in the remainder of Section 1;
- the requirements from the OSDF DCP applicable to this SWMEC Plan are described in Section 2;
- general information regarding the development of the OSDF as it relates to this SWMEC Plan is presented in Section 3;
- soil stabilization controls are described in Section 4;
- runon/runoff controls are described in Section 5;
- sediment controls are described in Section 6; and
- references are presented in Section 7.

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*. The *IMP Plan* contains the procedures to be used to place the impacted materials into the OSDF.

- *OSDF Borrow Area Management and Restoration (BAMR) Plan*. The *BAMR Plan* contains the procedures to be used to develop, manage, and restore the on-site borrow area.

- *OSDF System Plan*. The *System Plan* contains the procedures to be used to inspect and maintain the OSDF during construction, impacted material placement, and closure.

- *OSDF Construction Quality Assurance (CQA) Plan*. The *CQA Plan* contains procedures to evaluate soils conjunction and other features of the OSDF liner and final cover system.

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2. APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to the SWMEC Plan are contained in the OSDF DCP [GeoSyntec, 1996b]. These requirements take the form of applicable or relevant and appropriate requirements (ARARs) for 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

ARARs that should be addressed by the SWMEC Plan 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 run-on and run-off 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.
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 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.
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.

No.	Title	Requirement
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.
6.	Ohio Solid Waste Disposal Regulations 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. Post-closure care activities for all sanitary landfill facilities shall include, but are not limited to: • continuing operation and maintenance of the surface water management system • 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

2.3 Functional Requirements

The DCP contains a variety of functional requirements that have been established for the OSDF. The functional requirements 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 surface water management system should perform 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

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closure of the OSDF). The system should prevent stormwater runon to the OSDF and uncontrolled stormwater and wastewater runoff from the OSDF. Features of the long-term surface-water management system should be constructed to require minimal monitoring and maintenance. The system should be integrated, to the extent possible, with existing topography, features, and facilities.

2.4 General Design Criteria

The DCP also identifies a number of general design criteria for the OSDF. The general design criteria applicable to the SWMEC Plan are:

- temporary erosion and sediment (E&S) control features for the OSDF shall be designed for the 25-year, 24-hour storm event (ARARs: USEPA 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: OSC 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, other requirements that have been incorporated in to this SWMEC Plan are:

- temporary sediment basins should be cleaned out to the design capacity when the sediment retained in the basin has reduced its capacity to 60 percent of the design capacity [USDA-SCS, 1987];

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

- general practices for construction, 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].

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3. 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, impacted material placement, and closure of 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 30-year 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 controls identified on the Construction Drawings or otherwise deemed necessary 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 will 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 as soon as possible to stabilize soil and minimize erosion;

- where additional grading or reworking is not scheduled for a year or more, disturbed areas will be permanently vegetated 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 will also be used to divert stormwater away from contaminated areas, thus maintaining separation between clean and potentially contaminated water. Runon to areas under construction will be prevented by constructing runon diversion dikes and channels to route water to a natural watercourse.

The following runon/runoff control features shall be implemented during the pre-construction period:

- temporary drainage channels;
- rock, grade control structures;
- berms; and
- culverts.

Runoff from undisturbed areas should be diverted from running on to the disturbed areas using drainage channels, culverts, and diversion berms.

3.3 Cell Construction Period

Construction of the first stage of the OSDF will include the excavation and construction of the first three cells of the OSDF. The soil stabilization, runon/runoff control, and off-site sedimentation features used during this period will be the same as those used

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for the pre-construction period. The location of these features are illustrated on the Construction Drawings.

Wastewaters 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 cell placement period includes placing impacted material in the cells. Measures to manage surface water and control erosion and offsite sedimentation will be the same as those measures used during the construction of the OSDF. The locations of these features are illustrated on the Construction Drawings.

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 30-year post-closure period as they are outside the scope of this plan; those activities are to be addressed in a separate forthcoming plan. The following discussion is presented for illustrative purposes only.

During the post-closure period, stormwater from all areas of the OSDF that have been closed shall be directed to the permanent drainage system by sheet flow. After the OSDF is closed and permanent vegetation is established, sediment control should not be required. The criteria for the layout and construction materials used for the components of the OSDF final cover system are intended to minimize erosion and off-site sedimentation so that sediment removal structures will not be needed after closure

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During the post-closure period, stormwater from all areas of the OSDF that have been closed shall be directed to the permanent drainage system by sheet flow. After the OSDF is closed and permanent vegetation is established, sediment control should not be required. The criteria for the layout and construction materials used for the components of the OSDF final cover system are intended to minimize erosion and off-site sedimentation so that sediment removal structures will not be needed after closure of the OSDF. Information relevant to the inspection and maintenance of stormwater management systems in the post-closure period is contained in the *OSDF System Plan*.

The OSDF during the post-closure period is illustrated in the Construction Drawings.

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4. 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 vegetation; 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 construction contractor shall be prepared to implement other methods to control erosion of sediment at the site as deemed necessary by the Construction Contracts 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

Temporary seeding shall be applied 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.

Mulching shall be applied 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 condition at the OSDF where temporary seeding is to be applied includes soil surfaces where additional grading or reworking is not scheduled for a period of 45 days to less than one year.

Conditions where mulch is to be applied include:

- areas which have a temporary or permanent seeding;
- areas which cannot be seeded because of the season of the year and need soil/surface protection; and
- for mud and dust control.

Temporary seeding and/or mulching shall be applied in accordance with the following procedures:

Site Preparation

- Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring.

- Install the needed erosion control practices prior to seeding such as diversions, temporary waterways for diversion outlets, and sediment basins.

Seedbed Preparation

- Seedbed preparation should be done when the soil is dry enough to crumble and not form ribbons when compressed by hand.

- Lime (in lieu of a soil test recommendation) on acid soil (pH 5.5 or lower) and subsoil at a rate of 100 pounds/1,000 ft^2 or 2 tons/acre of agricultural ground limestone. For best results, the contractor shall test the area to be sealed.

- Fertilizer (in lieu of a soil test recommendation) shall be applied at a rate of 12 pounds/1,000 ft^2 or 500 pounds/acre of 10-10-10 or 12-12-12 analysis or equivalent.

- Work the lime and fertilizer into the soil with a disk harrow, springtooth harrow, or similar tools to a depth of three inches. On sloping areas the final operation shall be on the contour.

Seeding

- Select a species or mixture appropriate for the site to be seeded. The recommendations of the seed mixtures contained in Appendix A should be followed.

- Apply the seed uniformly with a cyclone seeder, drill, cultipacker seeder, or hydroseeder (slurry may include seed and fertilizer) preferably on a firm, moist seedbed. Cover to a depth of ¼ to ½ inch.

- When feasible, except where a cultipacker type seeder or hydroseeder is used, the seedbed should be firmed following seeding operations with a cultipacker, roller, or light drag. On sloping land seeding operations should be on the contour wherever possible.

- If soil moisture is deficient, supply new seedings with adequate water for plant growth until they are firmly established. This is especially true when seedings are made late in the planting season, in abnormally dry or hot seasons, or on adverse sites.

Mulching

Mulching shall be applied in accordance with the following procedures:

- Mulch shall be applied to protect the soil and provide a better environment for plant growth.

- Mulch shall consist of small grain straw (preferably wheat, barley, or rye) and shall be applied at the rate of 2 tons/acre or 90 pounds (two to three bales)/1,000 ft^2.

- Spread the mulch uniformly by hand or mechanically so the soil surface is covered in accordance with the ODNR [1996] recommendations.

- Lime and fertilizer should be incorporated and surface roughening accomplished as needed prior to mulching. Seed should also be applied prior to mulching except in the following cases: (i) where seed is to be applied as part of a hydroseeder slurry containing wood fiber mulch; (ii) where seed is to be applied following straw

mulch spread during winter months; and (iii) where a hydroseeder slurry is applied over straw.

- Straw mulch shall be anchored immediately after spreading to prevent it from becoming windblown in accordance with the ODNR [1996] recommendations.

4.2.4 Maintenance

Where seeding does not establish as expected, the area should be reseeded within 3 weeks. The cause of the failure should be ascertained and corrected 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 should be prepared in the same manner as the original installation. Once established, a regular maintenance program for fertilization and mowing of grasses should be performed.

All mulches should be inspected periodically, in particular after rainstorms, to check for rill erosion. Where erosion is observed, additional mulch should be applied. Nets used to anchor mulch should 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 ODNR [1996].

4.3 Permanent Vegetation

4.3.1 Definition

Permanent vegetation should be established 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

Permanent vegetation shall:

- 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

Conditions at the OSDF where permanent vegetation is to be applied include:

- 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 vegetation shall be applied in accordance with the following procedures:

Site Preparation

- Topsoil material shall consist of at least 25 percent silt and clay.
- Where compacted soils occur, they shall be broken up sufficiently to create a favorable rooting depth of 6-8 inches.
- Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding mulch application and anchoring, and maintenance. After the grading operation spread additional topsoil where needed.

Seedbed Preparation

- Proceed in accordance with *Seedbed Preparation* at Section 4.2.3.

Seeding

- Select a species or mixture appropriate for the site to be seeded. The recommended seed mixtures contained in Appendix B should be followed.

- Seedings should not be planted from 1 October through 20 November. During this period the seeds are likely to germinate but probably will not be able to survive the winter. The following methods may be used to make a "Dormant Seeding":

  1. From 1 October through 20 November, prepare the seedbed, add the required amounts of lime and fertilizer, then mulch and anchor. After 20 November, and before 15 March, broadcast the selected seed mixture. Increase the seeding rates by 50 percent for this type of seeding.

  2. From 20 November through 15 March, when soil conditions permit, prepare the seedbed, lime and fertilize, apply the selected seed mixture, and mulch and anchor. Increase the seeding rates by 50 percent for this type of seeding.

- Apply seed uniformly with a cyclone seeder, drill, cultipacker seeder, or hydro-seeder (slurry may include seed and fertilizer) on a firm, moist seedbed. Cover to a depth of ¼ to ½ inch.

- Where feasible, except when a cultipacker type seeder or hydroseeder is used, the seedbed should be firmed following seeding operations with a cultipacker, roller, or light drag. On sloping land, seeding operations should be on the contour where feasible.

- If soil moisture is deficient, supply new seedings with adequate water for plant growth until they are firmly established.

Mulching

- Proceed in accordance with *Mulching* under Section 4.2.3.

4.3.4 Maintenance

Slope stabilization, topsoil management, and maintenance measures are necessary in order to achieve vigorous vegetative cover. Seeded areas shall be inspected for failure and vegetation reestablished as needed. Where seeding does not establish as expected, the area should be re-seeded within three weeks. The cause of the failure should be ascertained and corrected 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 re-seeding should be prepared in the same manner as the original installation. Once established, a regular maintenance program for fertilization and other care should be performed.

4.4 Riprap

4.4.1 Definition

Riprap is an erosion-resistant ground cover 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

Riprap shall be installed at the OSDF to:

- protect the soil surface from the erosive forces of concentrated runoff;

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- slow the velocity of concentrated runoff while enhancing the potential for infiltration; and

- stabilize slopes with seepage problems and/or erosive soils.

4.4.3 Application

Riprap shall be applied to 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 flow conditions. Typical uses of riprap may be at stormdrain outlets, on channel banks and/or bottoms, roadside ditches, or at the toe of slopes.

Riprap shall be used in accordance with the following specifications:

- Riprap used at channel transitions should 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).

- Geotextile filters may be used to control piping and erosion beneath riprap in temporary facilities. Granular soils should be used for filters and bedding in permanent structures containing riprap.

"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. Riprap should, however, be inspected periodically to determine if high flows have caused scour beneath the riprap or dislodged any of the stone. If repairs are needed, they should be accomplished within the same work day.

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5. 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 diversion dikes;
- temporary drainage channels;
- permanent drainage channels;
- grade control structures;
- berms; and
- culverts.

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 construction contractor shall be prepared to implement other methods to control erosion of sediment at the site.

5.2 Temporary Diversion Dikes

5.2.1 Definition

A temporary diversion dike consists 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 an installed diversion dike is illustrated on the Construction Drawings.

5.2.2 Purpose

In general, temporary diversion dikes are intended to prevent gully 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.

Diversion dikes will specifically be used 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 sediment basin; and
- shorten the flow length within a long sloping drainage area.

5.2.3 Application

For the OSDF, temporary diversion dikes will be constructed in areas where runoff from higher-lying areas has 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 diversion dikes must have stable outlets. The side slopes and soils must be such that the diversion can be maintained throughout its planned life. Diversion dikes 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 location of the diversion dike will be dictated by outlet condition, topography, land use, soil type, and length of slope. Diversions must be located so that water will empty on established water disposal areas, a stable watercourse, waterway, or structure.

5.2.4 Maintenance

Temporary diversion dikes should be inspected regularly and maintained 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;

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- repair damage and remove deposits or sediment from the diversion; and

- reseed and fertilize as needed.

If there is no sediment protection provided on the temporary diversion, it is anticipated that periodic cleanout shall be required.

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, stone, or other material. A detail of an installed, temporary drainage channel is illustrated on the Construction Drawings.

All temporary drainage channels should have stable outlets with adequate capacity for the designed 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. Temporary drainage channels shall be constructed as per the Construction Drawings.

5.3.2 Purpose

Temporary drainage channels at the OSDF shall be used 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

Temporary drainage channels shall be used at the OSDF where added drainage capacity or vegetative protection or both are required to control erosion resulting from concentrated runoff. Whenever possible, temporary drainage channels shall be used in

such a way that preserves the drainage system. Temporary drainage channels shall generally be located in material 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 at the OSDF are shown on the Construction Drawings. Supplemental measures, such as grade control structures may be required concurrent with the use of temporary drainage channels.

5.3.4 Maintenance

Temporary drainage channels shall be maintained 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 <u>Permanent Drainage Channels</u>

5.4.1 Definition

The permanent drainage channels for the OSDF consist of a series of channels designed for conveying runon and runoff. Details of the drainage channels are shown on the

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Construction Drawings. The Construction Drawings also show the proposed location of the permanent channels for the OSDF.

5.4.2 Purpose

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

5.4.3 Application

The permanent drainage channels shall be constructed at the perimeter of the OSDF. The channels shall be constructed in such a way that preserves the natural drainage system and so that it does not make sharp, unnatural changes in direction of flow. 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 as illustrated in the Construction Drawings.

5.4.4 Maintenance

Permanent drainage channels shall be maintained 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 Grade Control Structures

5.5.1 Definitions

Grade control structures consist of a section of rocks placed at the inlet, along the length or at the outlet of a drainage feature.

Grade control structures shall be constructed as per the Construction Drawings.

5.5.2 Purpose

The purpose of grade control structures is to prevent undermining, scour, or deterioration of a drainage feature.

5.5.3 Application

The use of grade control structures applies where surface water flows at the inlet, along the length, and at the outlet of drainage features are sufficient to erode or damage the drainage feature or adjacent upstream and downstream reaches.

5.5.4 Maintenance

Grade control structures shall be maintained 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 grade control structures 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.

- Grade control structures shall be maintained as built.

5.6 Berms

5.6.1 Definition

A berm is a temporary ridge of compacted and stabilized soil. A berm shall be located in such a manner as to direct water to a desired location. A detail of a berm is shown in the Construction Drawings.

5.6.2 Purpose

Berms shall be constructed at the OSDF to:

- direct runon from the OSDF cover system;
- direct runoff to a sediment basin; and
- divert stormwater away from disturbed areas.

5.6.3 Application

Berms are often constructed across disturbed areas and around construction sites. Berms shall remain in place until the disturbed areas are permanently stabilized.

5.6.4 Maintenance

Inspection and maintenance shall be provided periodically and after each rain event. Repairs to damaged berms shall be made within the same workday.

5.7 Culverts

5.7.1 Definition

Culverts are temporary or permanent structures consisting of circular concrete or metal pipe used to convey stormwater beneath a road or other embankment. A detail of a culvert is provided on the Construction Drawings.

5.7.2 Purpose

Culverts will be used to provide:

- temporary means to convey stormwater under construction and operation-related roads; and
- permanent means to convey stormwater under OSDF access roads.

5.7.3 Application

Culverts may be used to convey stormwater beneath roadways. Permanent culverts may only be used downgradient of the OSDF.

5.7.4 Maintenance

The following maintenance practices shall be employed.

- 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.

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6. 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:

- straw bale barriers;
- 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 construction contractor shall be prepared to implement other methods to control erosion of sediment at the site.

6.2 Straw Bale Barriers

6.2.1 Definition

A straw bale barrier is a temporary sediment barrier composed of a row of straw bales across or at the toe of the slope that is entrenched and anchored to intercept or detain sediment and decrease flow velocities from drainage areas of limited size. A detail of an installed straw bale barrier is given on the Construction Drawings.

6.2.2 Purpose

Straw bale barriers are intended to be used to:

- intercept and detain small amounts of sediment from disturbed areas of limited extent in order to prevent sediment from leaving the site; and

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

6.2.3 Application

Straw bale barriers are applicable where sheet and rill erosion from low-to-moderate channel flows may be a problem. It should be noted that improper placement and installation of the barriers, such as staking the bales directly to the ground with no soil seal or entrenchment, will allow undercutting and end flow resulting in additions rather than removal of sediment from runoff waters. The application of straw bale barriers at the OSDF should be limited to the following conditions:

- below disturbed areas subject to sheet and rill erosion;
- where the size of the drainage area is no greater than ¼ acre per 100 feet of barrier length; the maximum slope length behind the barrier is 100 feet; and the maximum slope gradient behind the barrier is 50 percent (2:1);
- in minor channels where the maximum contributing drainage area is no greater than 2 acres; and
- when effectiveness is required for less than 3 months.

Under no circumstances should straw bale barriers be constructed in streams or in channels where there is the possibility of a washout.

The following project specifications should be followed to ensure an effective application of straw bale barriers.

Sheet Flow Applications

- Bales shall be placed in a single row, lengthwise on the contour, with both ends of adjacent bales tightly abutting one another.

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- All bales shall be either wire-bound or string-tied. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales (in order to prevent deterioration of the bindings).

- The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 in. After the bales are staked and chinked (filled by wedging), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 in. against the uphill side of the barrier.

- Each bale shall be securely anchored by at least two stakes or rebars driven through the bale. The first stake in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or rebars shall be driven 2 feet into the ground to securely anchor the bales.

- The gaps between bales shall be chinked with straw to prevent water from escaping between the bales. (Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase barrier efficiency).

Channel Flow Applications

- Bales shall be placed in a single row, lengthwise, oriented perpendicular to the contour, with ends of adjacent bales tightly abutting one another.

- The remaining steps for installing a straw bale barrier for sheet flow applications apply here, with the following addition.

- The barrier shall be extended to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest

middle bale to assure that sediment-laden runoff will flow either through or over the barrier but not around it.

6.2.4 Maintenance

The use of straw bale barriers at the OSDF will require that the following maintenance practices be followed.

- Inspection shall be frequent and repair or replacement shall be made promptly as needed.

- Straw bale barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall.

- Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales.

- Necessary repairs to barriers or replacement of bales shall be accomplished within the same workday as the day of discovery of the need for repairs/replacement.

- Sediment deposits should be removed after each rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.

- Straw bale barriers shall be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.

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

To ensure their useful application and effectiveness, straw bale barriers shall be diligently maintained.

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6.3 Silt Fences

6.3.1 Definition

A silt fence is a temporary sediment barrier constructed of posts, filter fabric, and in some cases a wire support fence. 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.

6.3.2 Purpose

The use of silt fences will serve a two-fold purpose at the OSDF:

- to intercept and detain small amounts of sediment from disturbed areas during construction operations in order to prevent sediment from leaving the site; and
- to decrease the velocity of sheet flows and low-to-moderate level channel flows.

6.3.3 Application

Silt fences are applicable where sheet and rill erosion or small concentrated flows may be a problem. At a minimum, silt fences should be placed on the downslope sides of areas to be disturbed until permanent drainage and erosion control structures are established. The silt fence is 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. Other applications of silt fences include:

- use where the size of the drainage area is no more than ¼ acre per 100 feet of silt fence length; the maximum slope length behind the barrier is 100 feet; and the maximum gradient behind the barrier is 50 percent (2:1); and

- use in minor channels or temporary diversion dikes and where the maximum contributing drainage area is no greater than 2 acres.

Under no circumstances should silt fences be constructed in streams or in channels where flows are likely to exceed 1 cubic foot per second (cfs).

The material specifications for silt fence, including the supporting posts and filter fabrics are provided in the OSDF project specifications. The project specifications for silt fence are provided as follows:

- Silt fences shall be provided at the locations indicated on the Construction Drawings, at any other locations where sheet flows are expected, where drainage leaves the work areas, and at any other locations identified by the Resident Engineer or Construction Contracts Manager.

- Silt fences shall be constructed by securely fastening silt fence fabric to a woven wire fence fabric with wire ties. The silt fence fabric panels shall be installed loosely with adjacent panels overlapped a minimum of 12 inches with the end stakes of each section wrapped together before driving into the ground. The top edge of the fabric shall be reinforced or shall have a 1-inch tuck.

- The fence posts shall be installed at a maximum spacing of 6 feet.

- The toe of the silt fence shall be buried a minimum of 8 inches in a trench cut a minimum of 6 inches below the ground surface.

6.3.4 Maintenance

All silt fences shall be maintained in accordance with the following:

- Regular maintenance of silt fences and work day inspection procedures require that the construction contractor use all means necessary to protect completed work. In the event of damage to prior work, the silt fence shall be repaired and/or replaced.

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- 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.

- Silt fences shall be inspected immediately (*i.e.*, that work day, or the first work day) after each rainfall and at least once each work day during prolonged rainfall. Any required repairs shall be made within the same work day.

- 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.

6.4 Temporary Sediment Basins

6.4.1 Definition

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

6.4.2 Purpose

In general, sediment basins are used as a means of trapping and storing sediment from eroding areas in order to protect downstream areas from damage resulting form sedimentation and waterborne debris. 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 should receive only stormwater runoff, not wastewater.

6.4.3 Application

Temporary sediment basins shall be constructed where physical site conditions or other restrictions preclude the installation of erosion control measures to adequately control erosion and sedimentation. They should be located downslope from construction operations which expose areas to erosion. Temporary sediment basins shall be removed after the exposed areas are adequately protected against erosion by vegetative or mechanical means.

Temporary sediment basins shall be located so as to intercept the largest possible amount of runoff from the disturbed areas. These areas are generally low areas and material drainageways below disturbed areas. The sediment basins shall not be located in a stream but should be located to trap sediment-laden runoff before it enters the stream. The basins shall not be located where failure would result in the interruption of the use or service of public utilities or roads. The proposed locations of the temporary sediment basins are shown on the Construction Drawings.

6.4.4 Maintenance

The temporary sediment basins should receive regular maintenance that will 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 capacity is reduced to 60 percent of the design volume as shown on the cleanout elevation on the staff gauge specified on the Construction Drawings. Sediment that is removed from the basins during the active life of the landfill may be used as daily or intermediate cover material; sediment

removed after the OSDF is closed will be spoiled and vegetated or used for miscellaneous areas of the facility that have been eroded and require maintenance.

6.5 Final Cover System

6.5.1 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 compacted 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 biotic barrier placed above the drainage layer to provide long-term protection from burrowing animals and vegetative root intrusion;

- granular filter layer — placed above the biotic barrier to separate the vegetative zone from the biotic barrier and prevent loss of the soil from the vegetative zone into the biotic 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.

6.5.2 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.

6.5.3 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.

6.5.4 Maintenance

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

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APPENDIX A

TEMPORARY SEEDING

APPENDIX B

PERMANENT SEEDING

SURFACE-WATER MANAGEMENT AND EROSION CONTROL PLAN

ON-SITE DISPOSAL FACILITY

April 1996
Revision D

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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ACRONYM LIST

ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society of Testing and Materials
AWWT	Advanced Wastewater Treatment
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
O&M	Operations and Maintenance
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
SCS	Soil Conservation Service
SWMEC	Surface Water Management and Erosion Control
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
WAC	Waste Acceptance Criteria

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1. 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"* [DOE, 1995ca] (Operable Unit 2 (OU2) ROD). Those activities are to be addressed in a plan to be developed later.

1.2 Project Description

The construction, impacted material placement, and closure of the OSDF is currently anticipated 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 with the possibility of closure on an interim basis should it be required.

The design basis for the OSDF and related appurtenances is presented in the document, *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2"* [DOE, 1995b]. The design of the OSDF and related appurtenances, as currently developed, is presented in the *"Intermediate Design Package, On-Site Disposal Facility"* [GeoSyntec, 1996a]. The Design Criteria Package (DCP) [GeoSyntec, 1996b] component of the Intermediate Design Package 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 of this plan.

1.3 Plan Scope

This SWMEC Plan establishes the surface-water management, erosion minimization, and sediment control practices necessary 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

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- 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 Section 3 of this plan, in the Construction Drawings, and by the project specifications.

1.4 Plan Organization

The remainder of this SWMEC Plan is organized as follows:

- a description of the parties responsible for this plan and the plans related to this SWMEC Plan is presented in the remainder of Section 1;
- the requirements from the OSDF DCP applicable to this SWMEC Plan are described in Section 2;
- general information regarding the development of the OSDF as it relates to this SWMEC Plan is presented in Section 3;
- soil stabilization controls are described in Section 4;
- runon/runoff controls are described in Section 5;
- sediment controls are described in Section 6; and
- references are presented in Section 7.

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*. The *IMP Plan* contains the procedures to be used to place the impacted materials into the OSDF.

- *OSDF Borrow Area Management and Restoration (BAMR) Plan*. The *BAMR Plan* contains the procedures to be used to develop, manage, and restore the on-site borrow area.

- *OSDF System Plan*. The *System Plan* contains the procedures to be used to inspect and maintain the OSDF during construction, impacted material placement, and closure.

- *OSDF Construction Quality Assurance (CQA) Plan*. The *CQA Plan* contains procedures to evaluate soils conjunction and other features of the OSDF liner and final cover system.

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2. APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to the SWMEC Plan are contained in the OSDF DCP [GeoSyntec, 1996b]. These requirements take the form of applicable or relevant and appropriate requirements (ARARs) for 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

ARARs that should be addressed by the SWMEC Plan 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 run-on and run-off 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.
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 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.
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.

No.	Title	Requirement
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.
6.	Ohio Solid Waste Disposal Regulations 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. Post-closure care activities for all sanitary landfill facilities shall include, but are not limited to: • continuing operation and maintenance of the surface water management system • 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

2.3 Functional Requirements

The DCP contains a variety of functional requirements that have been established for the OSDF. The functional requirements 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 surface water management system should perform 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 should prevent stormwater runon to the OSDF and uncontrolled stormwater and wastewater runoff from the OSDF. Features of the long-term surface-water management system should be constructed to require minimal monitoring and maintenance. The system should be integrated, to the extent possible, with existing topography, features, and facilities.

2.4 General Design Criteria

The DCP also identifies a number of general design criteria for the OSDF. The general design criteria applicable to the SWMEC Plan are:

- temporary erosion and sediment (E&S) control features for the OSDF shall be designed for the 25-year, 24-hour storm event (ARARs: USEPA 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: OSC 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, other requirements that have been incorporated in to this SWMEC Plan are:

- temporary sediment basins should be cleaned out to the design capacity when the sediment retained in the basin has reduced its capacity to 60 percent of the design capacity [USDA-SCS, 1987];

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

- general practices for construction, 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].

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3. 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, impacted material placement, and closure of 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 30-year 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 controls identified on the Construction Drawings or otherwise deemed necessary 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 will 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 as soon as possible to stabilize soil and minimize erosion;

- where additional grading or reworking is not scheduled for a year or more, disturbed areas will be permanently vegetated 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 will also be used to divert stormwater away from contaminated areas, thus maintaining separation between clean and potentially contaminated water. Runon to areas under construction will be prevented by constructing runon diversion dikes and channels to route water to a natural watercourse.

The following runon/runoff control features shall be implemented during the pre-construction period:

- temporary drainage channels;
- rock, grade control structures;
- berms; and
- culverts.

Runoff from undisturbed areas should be diverted from running on to the disturbed areas using drainage channels, culverts, and diversion berms.

3.3 Cell Construction Period

Construction of the first stage of the OSDF will include the excavation and construction of the first three cells of the OSDF. The soil stabilization, runon/runoff control, and off-site sedimentation features used during this period will be the same as those used

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for the pre-construction period. The location of these features are illustrated on the Construction Drawings.

Wastewaters 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 cell placement period includes placing impacted material in the cells. Measures to manage surface water and control erosion and offsite sedimentation will be the same as those measures used during the construction of the OSDF. The locations of these features are illustrated on the Construction Drawings.

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 30-year post-closure period as they are outside the scope of this plan; those activities are to be addressed in a separate forthcoming plan. The following discussion is presented for illustrative purposes only.

During the post-closure period, stormwater from all areas of the OSDF that have been closed shall be directed to the permanent drainage system by sheet flow. After the OSDF is closed and permanent vegetation is established, sediment control should not be required. The criteria for the layout and construction materials used for the components of the OSDF final cover system are intended to minimize erosion and off-site sedimentation so that sediment removal structures will not be needed after closure

During the post-closure period, stormwater from all areas of the OSDF that have been closed shall be directed to the permanent drainage system by sheet flow. After the OSDF is closed and permanent vegetation is established, sediment control should not be required. The criteria for the layout and construction materials used for the components of the OSDF final cover system are intended to minimize erosion and off-site sedimentation so that sediment removal structures will not be needed after closure of the OSDF. Information relevant to the inspection and maintenance of stormwater management systems in the post-closure period is contained in the *OSDF System Plan*.

The OSDF during the post-closure period is illustrated in the Construction Drawings.

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4. 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 vegetation; 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 construction contractor shall be prepared to implement other methods to control erosion of sediment at the site as deemed necessary by the Construction Contracts 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

Temporary seeding shall be applied 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.

Mulching shall be applied 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 condition at the OSDF where temporary seeding is to be applied includes soil surfaces where additional grading or reworking is not scheduled for a period of 45 days to less than one year.

Conditions where mulch is to be applied include:

- areas which have a temporary or permanent seeding;
- areas which cannot be seeded because of the season of the year and need soil/surface protection; and
- for mud and dust control.

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Temporary seeding and/or mulching shall be applied in accordance with the following procedures:

Site Preparation

- Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring.

- Install the needed erosion control practices prior to seeding such as diversions, temporary waterways for diversion outlets, and sediment basins.

Seedbed Preparation

- Seedbed preparation should be done when the soil is dry enough to crumble and not form ribbons when compressed by hand.

- Lime (in lieu of a soil test recommendation) on acid soil (pH 5.5 or lower) and subsoil at a rate of 100 pounds/1,000 ft^2 or 2 tons/acre of agricultural ground limestone. For best results, the contractor shall test the area to be sealed.

- Fertilizer (in lieu of a soil test recommendation) shall be applied at a rate of 12 pounds/1,000 ft^2 or 500 pounds/acre of 10-10-10 or 12-12-12 analysis or equivalent.

- Work the lime and fertilizer into the soil with a disk harrow, springtooth harrow, or similar tools to a depth of three inches. On sloping areas the final operation shall be on the contour.

Seeding

- Select a species or mixture appropriate for the site to be seeded. The recommendations of the seed mixtures contained in Appendix A should be followed.

- Apply the seed uniformly with a cyclone seeder, drill, cultipacker seeder, or hydroseeder (slurry may include seed and fertilizer) preferably on a firm, moist seedbed. Cover to a depth of ¼ to ½ inch.

- When feasible, except where a cultipacker type seeder or hydroseeder is used, the seedbed should be firmed following seeding operations with a cultipacker, roller, or light drag. On sloping land seeding operations should be on the contour wherever possible.

- If soil moisture is deficient, supply new seedings with adequate water for plant growth until they are firmly established. This is especially true when seedings are made late in the planting season, in abnormally dry or hot seasons, or on adverse sites.

Mulching

Mulching shall be applied in accordance with the following procedures:

- Mulch shall be applied to protect the soil and provide a better environment for plant growth.

- Mulch shall consist of small grain straw (preferably wheat, barley, or rye) and shall be applied at the rate of 2 tons/acre or 90 pounds (two to three bales)/1,000 ft^2.

- Spread the mulch uniformly by hand or mechanically so the soil surface is covered in accordance with the ODNR [1996] recommendations.

- Lime and fertilizer should be incorporated and surface roughening accomplished as needed prior to mulching. Seed should also be applied prior to mulching except in the following cases: (i) where seed is to be applied as part of a hydroseeder slurry containing wood fiber mulch; (ii) where seed is to be applied following straw

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mulch spread during winter months; and (iii) where a hydroseeder slurry is applied over straw.

- Straw mulch shall be anchored immediately after spreading to prevent it from becoming windblown in accordance with the ODNR [1996] recommendations.

4.2.4 Maintenance

Where seeding does not establish as expected, the area should be reseeded within 3 weeks. The cause of the failure should be ascertained and corrected 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 should be prepared in the same manner as the original installation. Once established, a regular maintenance program for fertilization and mowing of grasses should be performed.

All mulches should be inspected periodically, in particular after rainstorms, to check for rill erosion. Where erosion is observed, additional mulch should be applied. Nets used to anchor mulch should 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 ODNR [1996].

4.3 Permanent Vegetation

4.3.1 Definition

Permanent vegetation should be established 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

Permanent vegetation shall:

- 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

Conditions at the OSDF where permanent vegetation is to be applied include:

- 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 vegetation shall be applied in accordance with the following procedures:

Site Preparation

- Topsoil material shall consist of at least 25 percent silt and clay.
- Where compacted soils occur, they shall be broken up sufficiently to create a favorable rooting depth of 6-8 inches.
- Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding mulch application and anchoring, and maintenance. After the grading operation spread additional topsoil where needed.

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Seedbed Preparation

- Proceed in accordance with *Seedbed Preparation* at Section 4.2.3.

Seeding

- Select a species or mixture appropriate for the site to be seeded. The recommended seed mixtures contained in Appendix B should be followed.

- Seedings should not be planted from 1 October through 20 November. During this period the seeds are likely to germinate but probably will not be able to survive the winter. The following methods may be used to make a "Dormant Seeding":

  1. From 1 October through 20 November, prepare the seedbed, add the required amounts of lime and fertilizer, then mulch and anchor. After 20 November, and before 15 March, broadcast the selected seed mixture. Increase the seeding rates by 50 percent for this type of seeding.

  2. From 20 November through 15 March, when soil conditions permit, prepare the seedbed, lime and fertilize, apply the selected seed mixture, and mulch and anchor. Increase the seeding rates by 50 percent for this type of seeding.

- Apply seed uniformly with a cyclone seeder, drill, cultipacker seeder, or hydro-seeder (slurry may include seed and fertilizer) on a firm, moist seedbed. Cover to a depth of ¼ to ½ inch.

- Where feasible, except when a cultipacker type seeder or hydroseeder is used, the seedbed should be firmed following seeding operations with a cultipacker, roller, or light drag. On sloping land, seeding operations should be on the contour where feasible.

- If soil moisture is deficient, supply new seedings with adequate water for plant growth until they are firmly established.

Mulching

- Proceed in accordance with *Mulching* under Section 4.2.3.

4.3.4 Maintenance

Slope stabilization, topsoil management, and maintenance measures are necessary in order to achieve vigorous vegetative cover. Seeded areas shall be inspected for failure and vegetation reestablished as needed. Where seeding does not establish as expected, the area should be re-seeded within three weeks. The cause of the failure should be ascertained and corrected 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 re-seeding should be prepared in the same manner as the original installation. Once established, a regular maintenance program for fertilization and other care should be performed.

4.4 Riprap

4.4.1 Definition

Riprap is an erosion-resistant ground cover 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

Riprap shall be installed at the OSDF to:

- protect the soil surface from the erosive forces of concentrated runoff;

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- slow the velocity of concentrated runoff while enhancing the potential for infiltration; and

- stabilize slopes with seepage problems and/or erosive soils.

4.4.3 Application

Riprap shall be applied to 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 flow conditions. Typical uses of riprap may be at stormdrain outlets, on channel banks and/or bottoms, roadside ditches, or at the toe of slopes.

Riprap shall be used in accordance with the following specifications:

- Riprap used at channel transitions should 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).

- Geotextile filters may be used to control piping and erosion beneath riprap in temporary facilities. Granular soils should be used for filters and bedding in permanent structures containing riprap.

"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. Riprap should, however, be inspected periodically to determine if high flows have caused scour beneath the riprap or dislodged any of the stone. If repairs are needed, they should be accomplished within the same work day.

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5. 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 diversion dikes;
- temporary drainage channels;
- permanent drainage channels;
- grade control structures;
- berms; and
- culverts.

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 construction contractor shall be prepared to implement other methods to control erosion of sediment at the site.

5.2 Temporary Diversion Dikes

5.2.1 Definition

A temporary diversion dike consists 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 an installed diversion dike is illustrated on the Construction Drawings.

5.2.2 Purpose

In general, temporary diversion dikes are intended to prevent gully 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.

Diversion dikes will specifically be used 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 sediment basin; and
- shorten the flow length within a long sloping drainage area.

5.2.3 Application

For the OSDF, temporary diversion dikes will be constructed in areas where runoff from higher-lying areas has 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 diversion dikes must have stable outlets. The side slopes and soils must be such that the diversion can be maintained throughout its planned life. Diversion dikes 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 location of the diversion dike will be dictated by outlet condition, topography, land use, soil type, and length of slope. Diversions must be located so that water will empty on established water disposal areas, a stable watercourse, waterway, or structure.

5.2.4 Maintenance

Temporary diversion dikes should be inspected regularly and maintained 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;

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- repair damage and remove deposits or sediment from the diversion; and

- reseed and fertilize as needed.

If there is no sediment protection provided on the temporary diversion, it is anticipated that periodic cleanout shall be required.

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, stone, or other material. A detail of an installed, temporary drainage channel is illustrated on the Construction Drawings.

All temporary drainage channels should have stable outlets with adequate capacity for the designed 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. Temporary drainage channels shall be constructed as per the Construction Drawings.

5.3.2 Purpose

Temporary drainage channels at the OSDF shall be used 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

Temporary drainage channels shall be used at the OSDF where added drainage capacity or vegetative protection or both are required to control erosion resulting from concentrated runoff. Whenever possible, temporary drainage channels shall be used in

such a way that preserves the drainage system. Temporary drainage channels shall generally be located in material 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 at the OSDF are shown on the Construction Drawings. Supplemental measures, such as grade control structures may be required concurrent with the use of temporary drainage channels.

5.3.4 Maintenance

Temporary drainage channels shall be maintained 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

The permanent drainage channels for the OSDF consist of a series of channels designed for conveying runon and runoff. Details of the drainage channels are shown on the

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Construction Drawings. The Construction Drawings also show the proposed location of the permanent channels for the OSDF.

5.4.2 Purpose

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

5.4.3 Application

The permanent drainage channels shall be constructed at the perimeter of the OSDF. The channels shall be constructed in such a way that preserves the natural drainage system and so that it does not make sharp, unnatural changes in direction of flow. 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 as illustrated in the Construction Drawings.

5.4.4 Maintenance

Permanent drainage channels shall be maintained 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 Grade Control Structures

5.5.1 Definitions

Grade control structures consist of a section of rocks placed at the inlet, along the length or at the outlet of a drainage feature.

Grade control structures shall be constructed as per the Construction Drawings.

5.5.2 Purpose

The purpose of grade control structures is to prevent undermining, scour, or deterioration of a drainage feature.

5.5.3 Application

The use of grade control structures applies where surface water flows at the inlet, along the length, and at the outlet of drainage features are sufficient to erode or damage the drainage feature or adjacent upstream and downstream reaches.

5.5.4 Maintenance

Grade control structures shall be maintained 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 grade control structures 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.

- Grade control structures shall be maintained as built.

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5.6 Berms

5.6.1 Definition

A berm is a temporary ridge of compacted and stabilized soil. A berm shall be located in such a manner as to direct water to a desired location. A detail of a berm is shown in the Construction Drawings.

5.6.2 Purpose

Berms shall be constructed at the OSDF to:

- direct runon from the OSDF cover system;
- direct runoff to a sediment basin; and
- divert stormwater away from disturbed areas.

5.6.3 Application

Berms are often constructed across disturbed areas and around construction sites. Berms shall remain in place until the disturbed areas are permanently stabilized.

5.6.4 Maintenance

Inspection and maintenance shall be provided periodically and after each rain event. Repairs to damaged berms shall be made within the same workday.

5.7 Culverts

5.7.1 Definition

Culverts are temporary or permanent structures consisting of circular concrete or metal pipe used to convey stormwater beneath a road or other embankment. A detail of a culvert is provided on the Construction Drawings.

5.7.2 Purpose

Culverts will be used to provide:

- temporary means to convey stormwater under construction and operation-related roads; and
- permanent means to convey stormwater under OSDF access roads.

5.7.3 Application

Culverts may be used to convey stormwater beneath roadways. Permanent culverts may only be used downgradient of the OSDF.

5.7.4 Maintenance

The following maintenance practices shall be employed.

- 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.

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6. 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:

- straw bale barriers;
- 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 construction contractor shall be prepared to implement other methods to control erosion of sediment at the site.

6.2 Straw Bale Barriers

6.2.1 Definition

A straw bale barrier is a temporary sediment barrier composed of a row of straw bales across or at the toe of the slope that is entrenched and anchored to intercept or detain sediment and decrease flow velocities from drainage areas of limited size. A detail of an installed straw bale barrier is given on the Construction Drawings.

6.2.2 Purpose

Straw bale barriers are intended to be used to:

- intercept and detain small amounts of sediment from disturbed areas of limited extent in order to prevent sediment from leaving the site; and

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

6.2.3 Application

Straw bale barriers are applicable where sheet and rill erosion from low-to-moderate channel flows may be a problem. It should be noted that improper placement and installation of the barriers, such as staking the bales directly to the ground with no soil seal or entrenchment, will allow undercutting and end flow resulting in additions rather than removal of sediment from runoff waters. The application of straw bale barriers at the OSDF should be limited to the following conditions:

- below disturbed areas subject to sheet and rill erosion;
- where the size of the drainage area is no greater than ¼ acre per 100 feet of barrier length; the maximum slope length behind the barrier is 100 feet; and the maximum slope gradient behind the barrier is 50 percent (2:1);
- in minor channels where the maximum contributing drainage area is no greater than 2 acres; and
- when effectiveness is required for less than 3 months.

Under no circumstances should straw bale barriers be constructed in streams or in channels where there is the possibility of a washout.

The following project specifications should be followed to ensure an effective application of straw bale barriers.

Sheet Flow Applications

- Bales shall be placed in a single row, lengthwise on the contour, with both ends of adjacent bales tightly abutting one another.

- All bales shall be either wire-bound or string-tied. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales (in order to prevent deterioration of the bindings).

- The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 in. After the bales are staked and chinked (filled by wedging), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 in. against the uphill side of the barrier.

- Each bale shall be securely anchored by at least two stakes or rebars driven through the bale. The first stake in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or rebars shall be driven 2 feet into the ground to securely anchor the bales.

- The gaps between bales shall be chinked with straw to prevent water from escaping between the bales. (Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase barrier efficiency).

Channel Flow Applications

- Bales shall be placed in a single row, lengthwise, oriented perpendicular to the contour, with ends of adjacent bales tightly abutting one another.

- The remaining steps for installing a straw bale barrier for sheet flow applications apply here, with the following addition.

- The barrier shall be extended to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest

middle bale to assure that sediment-laden runoff will flow either through or over the barrier but not around it.

6.2.4 Maintenance

The use of straw bale barriers at the OSDF will require that the following maintenance practices be followed.

- Inspection shall be frequent and repair or replacement shall be made promptly as needed.

- Straw bale barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall.

- Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales.

- Necessary repairs to barriers or replacement of bales shall be accomplished within the same workday as the day of discovery of the need for repairs/replacement.

- Sediment deposits should be removed after each rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.

- Straw bale barriers shall be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.

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

To ensure their useful application and effectiveness, straw bale barriers shall be diligently maintained.

6.3 Silt Fences

6.3.1 Definition

A silt fence is a temporary sediment barrier constructed of posts, filter fabric, and in some cases a wire support fence. 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.

6.3.2 Purpose

The use of silt fences will serve a two-fold purpose at the OSDF:

- to intercept and detain small amounts of sediment from disturbed areas during construction operations in order to prevent sediment from leaving the site; and
- to decrease the velocity of sheet flows and low-to-moderate level channel flows.

6.3.3 Application

Silt fences are applicable where sheet and rill erosion or small concentrated flows may be a problem. At a minimum, silt fences should be placed on the downslope sides of areas to be disturbed until permanent drainage and erosion control structures are established. The silt fence is 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. Other applications of silt fences include:

- use where the size of the drainage area is no more than ¼ acre per 100 feet of silt fence length; the maximum slope length behind the barrier is 100 feet; and the maximum gradient behind the barrier is 50 percent (2:1); and

- use in minor channels or temporary diversion dikes and where the maximum contributing drainage area is no greater than 2 acres.

Under no circumstances should silt fences be constructed in streams or in channels where flows are likely to exceed 1 cubic foot per second (cfs).

The material specifications for silt fence, including the supporting posts and filter fabrics are provided in the OSDF project specifications. The project specifications for silt fence are provided as follows:

- Silt fences shall be provided at the locations indicated on the Construction Drawings, at any other locations where sheet flows are expected, where drainage leaves the work areas, and at any other locations identified by the Resident Engineer or Construction Contracts Manager.

- Silt fences shall be constructed by securely fastening silt fence fabric to a woven wire fence fabric with wire ties. The silt fence fabric panels shall be installed loosely with adjacent panels overlapped a minimum of 12 inches with the end stakes of each section wrapped together before driving into the ground. The top edge of the fabric shall be reinforced or shall have a 1-inch tuck.

- The fence posts shall be installed at a maximum spacing of 6 feet.

- The toe of the silt fence shall be buried a minimum of 8 inches in a trench cut a minimum of 6 inches below the ground surface.

6.3.4 Maintenance

All silt fences shall be maintained in accordance with the following:

- Regular maintenance of silt fences and work day inspection procedures require that the construction contractor use all means necessary to protect completed work. In the event of damage to prior work, the silt fence shall be repaired and/or replaced.

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- 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.

- Silt fences shall be inspected immediately (*i.e.*, that work day, or the first work day) after each rainfall and at least once each work day during prolonged rainfall. Any required repairs shall be made within the same work day.

- 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.

6.4 Temporary Sediment Basins

6.4.1 Definition

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

6.4.2 Purpose

In general, sediment basins are used as a means of trapping and storing sediment from eroding areas in order to protect downstream areas from damage resulting form sedimentation and waterborne debris. 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 should receive only stormwater runoff, not wastewater.

6.4.3 Application

Temporary sediment basins shall be constructed where physical site conditions or other restrictions preclude the installation of erosion control measures to adequately control erosion and sedimentation. They should be located downslope from construction operations which expose areas to erosion. Temporary sediment basins shall be removed after the exposed areas are adequately protected against erosion by vegetative or mechanical means.

Temporary sediment basins shall be located so as to intercept the largest possible amount of runoff from the disturbed areas. These areas are generally low areas and material drainageways below disturbed areas. The sediment basins shall not be located in a stream but should be located to trap sediment-laden runoff before it enters the stream. The basins shall not be located where failure would result in the interruption of the use or service of public utilities or roads. The proposed locations of the temporary sediment basins are shown on the Construction Drawings.

6.4.4 Maintenance

The temporary sediment basins should receive regular maintenance that will 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 capacity is reduced to 60 percent of the design volume as shown on the cleanout elevation on the staff gauge specified on the Construction Drawings. Sediment that is removed from the basins during the active life of the landfill may be used as daily or intermediate cover material; sediment

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removed after the OSDF is closed will be spoiled and vegetated or used for miscellaneous areas of the facility that have been eroded and require maintenance.

6.5 Final Cover System

6.5.1 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 compacted 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 biotic barrier placed above the drainage layer to provide long-term protection from burrowing animals and vegetative root intrusion;
- granular filter layer — placed above the biotic barrier to separate the vegetative zone from the biotic barrier and prevent loss of the soil from the vegetative zone into the biotic 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.

6.5.2 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.

6.5.3 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.

6.5.4 Maintenance

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

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7. REFERENCES

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APPENDIX A

TEMPORARY SEEDING

APPENDIX B

PERMANENT SEEDING

CULTURAL RESOURCE UNEXPECTED DISCOVERY PLAN
ON-SITE DISPOSAL FACILITY

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ACRONYMS

CFR	Code of Federal Regulations
DOE	Department of Energy
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
NAGPRA	Native American Graves Protection and Repatriation Act
NHPA	National Historic Preservation Act
OSDF	On-Site Disposal Facility
SHPO	State Historic Preservation Office
SSOP	Site Standard Operating Procedure

1.0 PURPOSE/SCOPE

The 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 to 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 Fernald Environmental Restoration Management Corporation (FERMCO) 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.

In the area of the On-Site Disposal Facility (OSDF) and support operations, cultural resource investigations (Phase I and II) were conducted prior to any ground disturbing activity. Data

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[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).

recovery (Phase III) activities are currently being conducted to ensure the safe removal and/or recording of cultural resource sites identified in these prior investigations. Data recovery activities will be completed prior to any ground disturbing activity in that area; anticipated completion of data recovery is April 1996.

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 contractor (within 4 hours) 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) 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

3.3.1 Responsible Field Representative

- Stops work upon discovery of a cultural resource (see Section 5.0)
- Notifies Cultural Resource Coordinator upon discovery of a cultural resource
- Completes and signs Unexpected Cultural Resource Discovery Form (with assistance from the Cultural Resource Coordinator)

3.1.2 Cultural Resource Coordinator

- Notifies 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

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3.1.3 Natural Resource Management Department Manager

- Notifies DOE-FN 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 State Historic Preservation Office (SHPO) of unexpected cultural resource discovery
- Negotiates mitigation
- Notifies FERMCO 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

- NHPA
- NAGPRA
- 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.

CONSTRUCTION QUALITY ASSURANCE PLAN

ON-SITE DISPOSAL FACILITY

April 1996
Revision D

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

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Under

Fernald Environmental Restoration Management Corporation
Subcontract 95PS005028

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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 Contracts Manager
COE	Corps of Engineers
CQA	Construction Quality Assurance
CQC	Construction Quality Control
CS	Confirmatory Sampling
CSS	Construction Safety and Security
DCP	Design Criteria Package
DOE	United States Department of Energy
DOT	Department of Transportation
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
QC	Quality Control
RCRA	Resource Conservation and Recovery Act

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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

1. INTRODUCTION

1.1 Overview

This Construction Quality Assurance (CQA) Plan describes the quality assurance 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 project plans and specifications. This plan addresses the CQA activities to be performed during construction and placing of the OSDF. Other activities associated with OSDF construction are as described in other related OSDF plans presented in Section 1.6.

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

- pre-construction testing and approval;
- earthwork;
- liner system;
- leachate collection and leak detection systems;
- final cover system; and
- general site work.

The specified quality assurance 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 QA 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*" [DOE, 1995b]. The design of the OSDF, as currently developed, is presented in the "*Intermediate Design Package, On-Site Disposal Facility*" [GeoSyntec, 1996]. The Design Criteria Package (DCP) component of the Intermediate 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 mechanical systems, electrical systems, and cast-in-place 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.

The construction, placing, and closure of the OSDF is currently scheduled to occur over a period of approximately 7 years, as described in the Accelerated Remediation Plan [$276 million case] (276 Plan). However, due to the potential for variations in the pace of remedial action activities, the OSDF has been designed to be constructed, placed, and closed in phases, with the possibility of closure on an interim basis should it be required. Projected phases of OSDF construction, placing, and closure are outlined in Table 1-1.

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TABLE 1-1

ON-SITE DISPOSAL FACILITY PROJECTED PHASING FOR CONSTRUCTION, MATERIAL PLACEMENT, AND CLOSURE

Phase	Liner System Construction	Impacted Material Placement	Final Closure System Construction
1	Cell 1	-	-
2	Cell 2	Cell 1	-
3	Cell 3	Cells 1,2	Cell 1
4	Cell 4	Cells 2,3	Cell 2
5	Cell 5	Cells 3,4	Cell 3
6	Cell 6	Cells 4,5	Cell 4
7	Cell 7	Cells 5,6	Cell 5
8	Cell 8	Cells 6,7	Cell 6
9	Cell 9 (if required)	Cells 7,8	Cell 7
10	-	Cells 8,9	Cell 8
11	-	Cell 9	Cell 9

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, permanent valve manhole, permanent lift station, temporary valve manhole, temporary lift station, and temporary forcemain.

- *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 are included in the OSDF design. Permanent support elements include survey benchmarks, a perimeter access corridor, and a facility access road.

LINER AND COVER SYSTEM DESIGN ON-SITE DISPOSAL FACILTY

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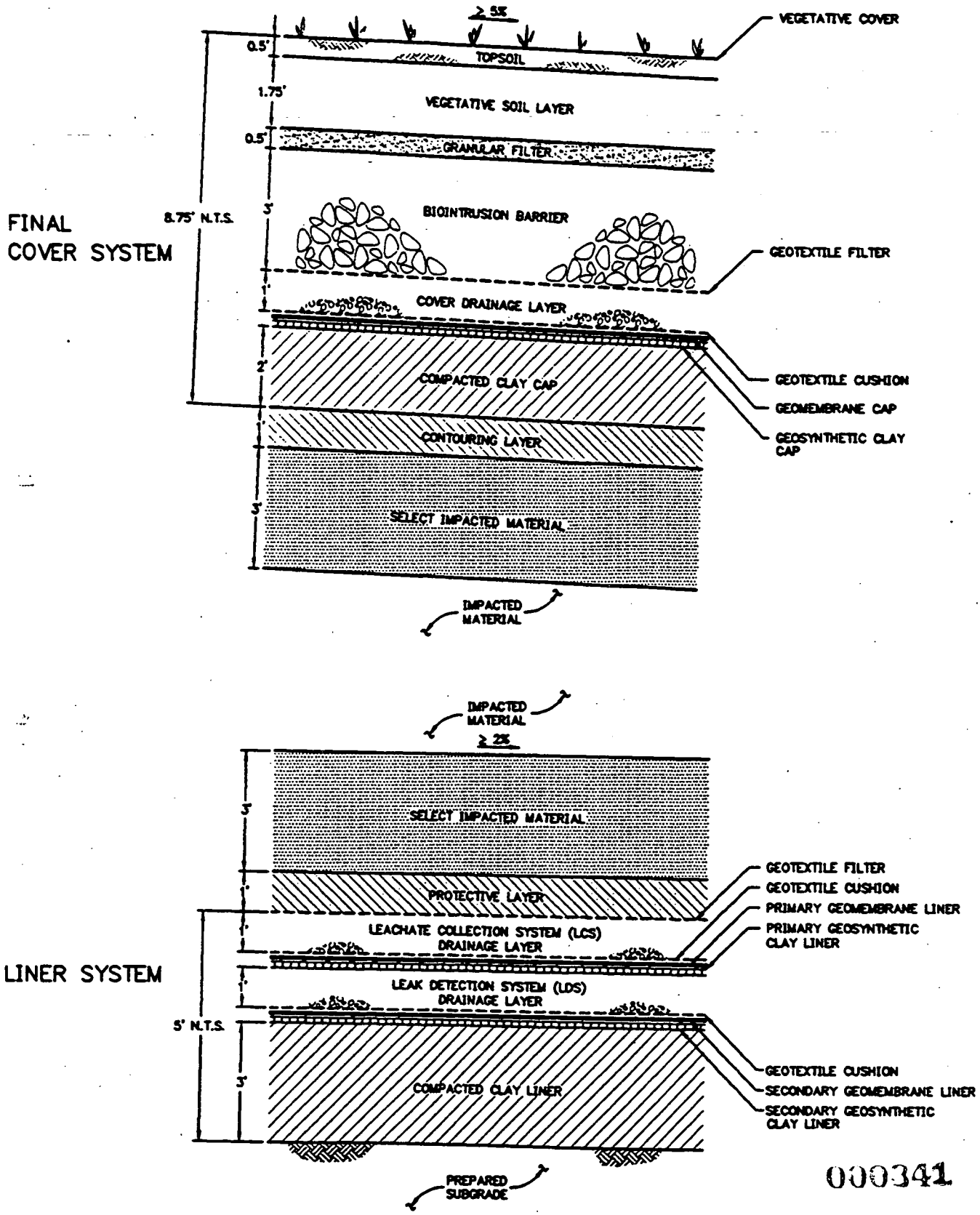

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GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

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

Temporary support elements include construction security fencing, administrative support facilities, decontamination facilities for both personnel and equipment, impacted material staging areas, temporary haul roads and construction materials staging areas. Utilities include electrical, water, telephone, and wastewater lines for the administrative support areas. The administrative support trailers are also provided with parking, security fencing, and all-weather ingress and egress.

1.4 CQA Plan Scope

The CQA Plan establishes the quality assurance 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 guidelines for construction documentation; and
- providing the means for assuring that the facilities constructed conform to the Applicable or Relevant and Appropriate Requirements (ARARs) project design plans, specifications, and construction drawings.

The CQA Plan is intended to give guidance to the selected OSDF Construction Subcontractor and CQC Consultant 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.

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;
- site and project controls are described in Section 5;
- the requirements for CQA documentation are described in Section 6;
- the CQA activities for the OSDF surveying are presented in Section 7;
- the CQA activities for the soil components of the OSDF lining and final cover systems and general soil components are presented in Section 8;
- the CQA activities for the geosynthetic geomembranes, GCL's, and geotextiles are presented in Sections 9 through 11 respectively;

- the CQA activities for the installation of HDPE manholes, pipes, fittings, and valves are presented in Section 12;

- the CQA activities for appurtenant work items such as mechanical, electrical, and cast-in-place concrete appurtenances are described in Sections 13, 14, and 15, respectively;

- the CQA activities for road construction are presented in Section 16; and

- the CQA activities for general site work are presented in Section 17.

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 System Plan.* The *System 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 location, excavation, evaluation and restoration of the on-site borrow area.

2. APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to the CQA Plan are contained in the OSDF DCP [GeoSyntec, 1996]. These requirements take the form of 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 was conducted using soil obtained from the area of soil borrow. The test pads will be constructed using equipment and/or techniques that will subsequently be used to construct the OSDF clay liner. Laboratory and field permeability testing were performed during the test pad program to define the compaction conditions that will yield a soil liner with a hydraulic conductivity of not greater than 1×10^{-7} cm/s. The test pad program met the requirements for test pads set forth in OAC 3745-27-08(C)(1)(m).

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The results of the test pad program, including all laboratory and field hydraulic conductivity test results from the program, will be presented in a report that DOE will provide to USEPA and OEPA. This report will specify 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).

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 test pad program, 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. The CQA program will also include confirmatory hydraulic conductivity testing.

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 pre-construction tests shall be performed on representative samples of the clay to be used for liner construction at a frequency not less than 1 per 1,500 yd^3 of soil, except for the hydraulic conductivity test, which shall be performed at a frequency not less than 1 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 contained in ASTM D 422 for sieve and hydrometer analyses; and

- Atterberg limits using the test method contained in ASTM D 4318.

2.2.1.2 Geosynthetic Clay Liner

The geosynthetic clay liner shall (ARAR: OAC 3745-27-08(C)(3)):

- be negligibly permeable to fluid migration (interpreted herein to require that the GCL have a maximum a hydraulic conductivity of 1 x 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 system shall:

- be placed on the compacted clay liner (ARAR: OAC 3745-27-08(C)(2)); to the extent possible and using industry construction techniques, the geomembrane shall be placed smooth and in close contact with the underlying compacted clay liner;

- 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 be tested 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 Systems

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 liner (functional requirements). The leachate collection system shall extend over all areas that will subsequently be used for impacted material disposal and function with minimal maintenance and monitoring.

The ARAR OAC 3745-27-08(D)(2) indicates that the following tests shall be performed on representative samples of the granular material at a frequency of not less than 1 per 3,000 yd^3:

- hydraulic conductivity; and
- grain-size distribution using ASTM D 422 for the sieve method.

2.2.3 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.

2.2.3.1 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)).

2.2.3.2 Vegetative Soil Layer

A vegetative soil layer will underlie the topsoil component of the OSDF final cover system. The vegetative soil layer shall be a well-graded mixture of clayey, silty, and sandy material, at least 21 in. 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)).

2.2.3.3 Granular Filter Layer

A granular filter layer will underlie the vegetative soil layer component of the OSDF final cover system. The filter shall 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.

2.2.3.4 Biointrusion Barrier

A biointrusion barrier layer shall underlie the granular filter layer 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 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.

2.2.3.5 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

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final cover system (OAC 3745-27-08(C)(15)(a)). The cover drainage layer shall consist of a 12 in. thickness of granular material, with the layer meeting the requirements of OAC 3745-27-08(C)(4)(a) (ARAR: OAC 3745-27-08(C)(16)(b)(i)).

2.2.3.6 Geotextile Cushion Layer

A geotextile cushion layer 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).

2.2.3.7 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 have a minimum thickness of 18 in. and a maximum hydraulic conductivity of 1 x 10^{-6} cm/s (ARAR: OAC 3745-27-08(C)(15)(ii)). Functional requirements require that the compacted clay component of the composite cap be at least 24 in. thick. The *Final Feasibility Study Report for Operable Unit 2* [DOE, 1995b] requires that the hydraulic conductivity of the compacted clay cap be no larger than 1 x 10^{-7} cm/s. 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 other 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 (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.

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3. CQA PLAN DEFINITIONS

3.1 Construction Quality Assurance and Construction Quality Control

This CQA plan is devoted to construction quality assurance. In the context of this document, construction quality assurance and construction quality control are defined as follows:

- *Construction Quality Assurance (CQA)* - A planned and systematic pattern of all 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 FERMCO to assure conformity of the lining and final cover system component production and installation with this CQA plan, the project plans, and the project 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 project plans and 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 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) geosynthetic clay liners used in the composite liner and cap; (iii) geotextiles used as filters or cushions; and (iv) polyethylene manholes and pipes, used to collect and convey leachate.

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4. PROJECT ORGANIZATION AND PERSONNEL

Construction of the OSDF will be accomplished though the interaction of several parties including but not limited to the Construction Contracts Manager, Resident Engineer, OSDF Construction Subcontractor, CQC Consultant, Soils CQC Laboratory, and Geosynthetics CQC Laboratory. The organization chart for the OSDF construction project is presented in Figure 4-1. The definitions, qualifications, and responsibilities of the parties responsible for construction of the OSDF are described below.

4.1 Construction Contacts Manager

4.1.1 Definition

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

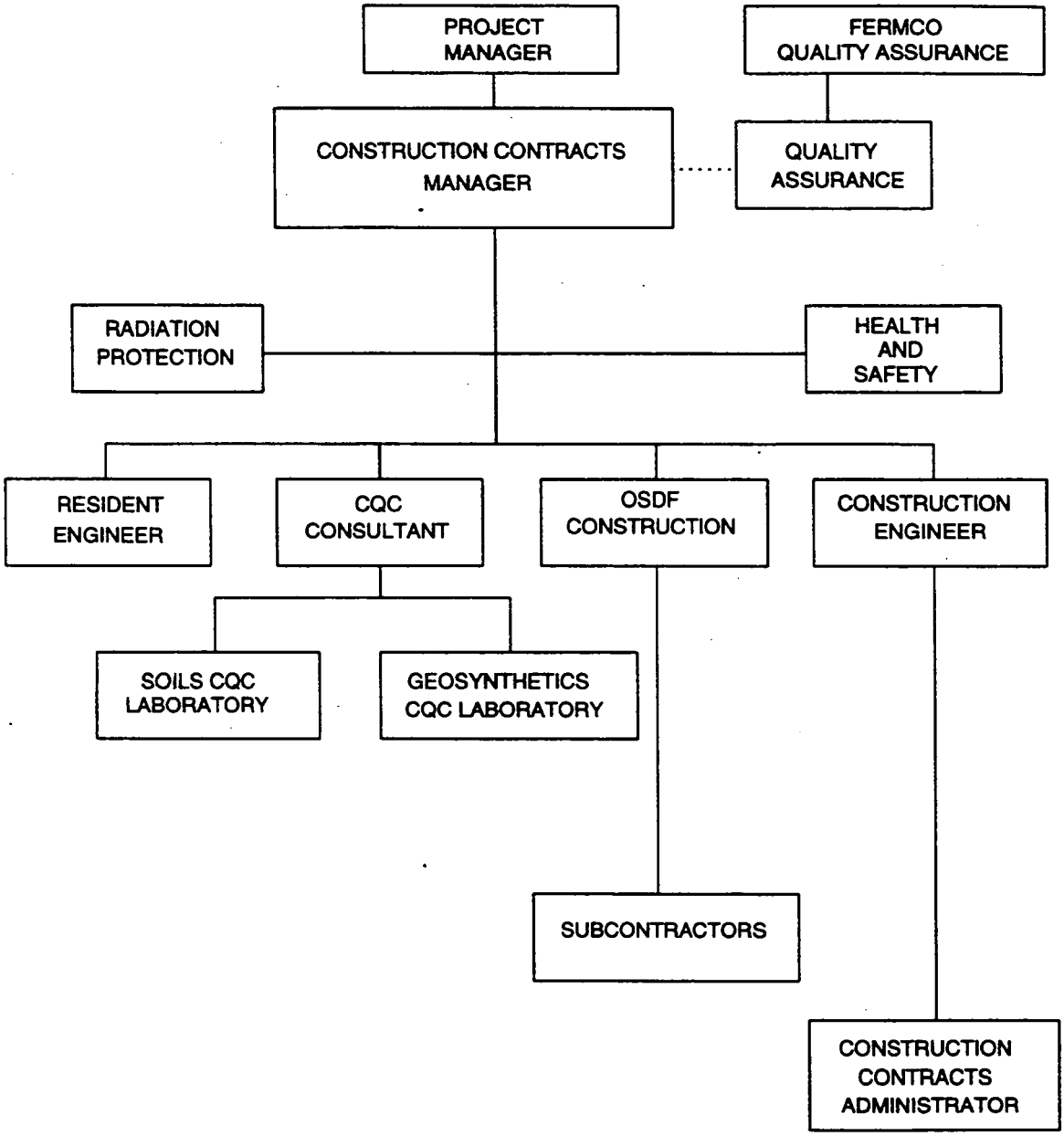
4.1.2 Qualifications

The CCM will hold a B.S. in construction management, engineering, or related field or have 10 years of construction management experience. The CCM will also have 3 years of environmental restoration plus 1 year of government experience.

4.1.3 Responsibilities

The CCM shall be responsible for coordination and oversight of all construction activities including: (i) subcontract administration; (ii) construction management; (iii) review and approval of any modifications or changes to the subcontract documents; and (iv) has final approval for subcontract submittals.

FIGURE 4-1
ORGANIZATION CHART



4.2 Resident Engineer

4.2.1 Definition

The Resident Engineer is the individual and/or firm representing the OSDF design engineer.

4.2.2 Qualifications

The Resident Engineer will hold a minimum of a B.S. engineering degree and be registered as a Professional Engineer. 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 is also responsible for reviewing and approving the OSDF Construction Subcontractor shop drawings and submittal. The Resident Engineer will be present on-site and attend the project coordination meetings outlined in the CQA Plan. 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 project specifications for approval by the Construction Contracts Manager

4.3 OSDF Construction Subcontractor

4.3.1 Definition

The OSDF Construction Subcontractor is the firm or corporations having a legally binding agreement to construct the OSDF.

4.3.2 Qualifications

The OSDF Construction Subcontractor shall be qualified as required by the subcontract to perform all aspects of work required to successfully construct the project. The OSDF Construction Subcontractor shall be registered in accordance with applicable local, state, and federal requirements and shall demonstrate significant prior related experience.

4.3.3 Responsibilities

The OSDF Construction Subcontractor is responsible for all submittal by its lower-tier subcontractors as required by the project specifications. The OSDF Construction Subcontractor is also responsible for scheduling and coordination of the required work with its lower-tier subcontractors to complete the project with construction schedule approved by the Construction Contracts Manager. The OSDF Construction Subcontractor shall provide an experienced supervisory representative at all times during any construction activity on site. The OSDF Construction Subcontractor is responsible for furnishing as-built record drawings and a copy of complete documentation for the construction of the OSDF. The OSDF Construction Subcontractor is also responsible for updating all construction drawings on a daily basis regarding any deviations from the original plans and specifications.

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4.4 OSDF Construction Subcontractor's Field Representative

4.4.1 Definition

The OSDF Construction Subcontractor's Field Representative is a qualified individual assigned as the representative of the OSDF Construction Subcontractor on site and present at all times during all construction activity

4.4.2 Qualifications

The OSDF Construction Subcontractor's Field Representative shall be qualified individual who is able to perform all tasks associated with construction activities. The OSDF Construction Subcontractor's Field Representative shall demonstrate prior and similar experience similar to the CCM. The OSDF Construction Subcontractor's Field Representative shall have the authority to direct and instruct their crew and its lower tier Subcontractors.

4.4.3 Responsibilities

The OSDF Construction Subcontractor's Field Representative is responsible for coordinating and supervising its crew and OSDF Construction Subcontractors' work on site. At a minimum, the OSDF Construction Subcontractor's Field Representative will be responsible for the following:

- informing the Construction Contracts Manager of any discrepancies between the plans and specifications and the field conditions;
- distributing submittal of all documentation required by the project specifications and this CQA Plan in a timely manner;
- attending all project coordination meetings held on site;

- scheduling of all phases of the construction;
- maintaining a daily log of all construction activities on site;
- implementing and verifying of all QC procedures required by the OSDF Construction Subcontractor and/or Subcontractors; and
- submitting proposed alternative materials or construction methods to the CCM for approval prior to acquisition and use.

4.5 CQC Consultant

4.5.1 Definition

The CQC Consultant is the party, independent from the Construction Contracts Manager and the OSDF Construction Subcontractor responsible for observing, testing, and documenting activities related to the CQC and CQA of the soil and geosynthetic earthwork components of the OSDF lining and final cover systems and other activities related to the construction, placing, and closure of the OSDF.

4.5.2 Qualifications

The CQC Consultant shall be a well established firm specializing in geotechnical sciences and/or geotechnical engineering and possess the equipment, personnel, and licenses necessary to conduct the geotechnical tests required by the project plans and specifications. The CQC Consultant shall also be experienced in the installation of 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 will provide qualified staff for the project.

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In addition, the CQC Consultant shall provide the following, in writing, to the Construction Contracts 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 20 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;
- proof of Professional Engineering registration (or ability to be registered) for the engineer to be the designated CQA Managing Engineer; and
- a summary of the firm's CQA documentation methods and procedures.

For construction of the OSDF liner and cover systems and other related appurtenances, the CQC Consultant's personnel shall include:

- the CQA 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 are located at the site.

The CQC Consultant organization will be led by the CQA Managing Engineer, who will hold a B.S. engineering degree 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 5 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 geosynthetic Field Monitor shall have managed CQA 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 Technician(s) (NICET) for the Installation Inspection of Geosynthetic Materials. The lead soils Field Monitor shall have managed CQC activities for the installation of at least 2,500,000 ft^2 of low-permeability clay liner and cover systems and hold NICET certification for soils. Other Field Monitors will be CQC personnel who have been specifically trained in the CQC of geosynthetics and low permeability clays and have documented CQC experience monitoring.

4.5.3 Responsibilities

The CQC Consultant shall be responsible for monitoring and documenting the activities of the OSDF Construction Subcontractor and its Subcontractors (e.g., the Geosynthetics Installer) relative to the installation of the lining and cover system components as well as various appurtences related to the construction, placing, and closure of the OSDF. The CQC Consultant will be responsible for monitoring the compliance of construction materials, construction methods, and workmanship in accordance with the project plans and specifications. The CQC Consultant will be responsible for obtaining samples of the various construction materials in accordance with the testing frequencies identified in this plan. The CQC Consultant shall also be responsible for obtaining labeling, and shipping samples for offsite laboratory test in accordance with the requirements of this plan.

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The CQC Consultant shall be responsible for routine soils quality control testing to be performed on site. The requirements of the on-site soils testing laboratory are described below. The CQC Consultant shall be responsible for operating and staffing the on-site soils laboratory. The on-site soils laboratory shall be equipped to perform routine index testing including:

- standard Proctor (ASTM D 698);
- particle-size analysis (ASTM D 422);
- Atterberg limits (ASTM D 4318);
- moisture content (ASTM D 2216);
- soils classification (ASTM D 2487); and
- percent passing no. 200 sieve (ASTM D 1140).

The CQC Consultant will be responsible for the quality control of its on-site laboratory testing program and for documenting the calibration of the on-site soils laboratory equipment. Equipment calibration certificates shall be maintained in the CQC Consultant's on-site project file.

All field tests will be conducted in accordance with ASTM or other applicable state or federal standards. Test results shall be submitted to the Construction Contracts Manager within a reasonable time frame which will not impede or delay construction of the lining and cover systems. The CQC Consultant shall also be responsible for issuing a final report which details the associated CQA activities. The final report will be sealed by the CQC Managing Engineer.

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

4.5.3.1 CQA Managing Engineer

The CQA Managing Engineer:

- reviews the lining and cover systems, construction plans, and project specifications;
- reviews all soils and geosynthetics-related documents; unless otherwise agreed, such reviews are for familiarization and for evaluation of constructibility only
- attends the resolution and/or pre-construction meeting;
- administers the CQA program, i.e., assigns and manages all on-site CQA personnel, reviews all field reports, and provides engineering review of all CQA related activities;
- provides quality control of CQA documentation and conducts site visits;
- reviews all changes to the lining and cover system design, construction plans, and project specifications; and
- with the CQA Site Manager, prepares the final report.

4.5.3.2 CQA Site Manager

The CQA Site Manager:

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

- manages the daily activities of the CQC Field Monitors;
- attends all CQA-related meetings (e.g., resolution, pre-construction, daily, weekly);
- oversees the ongoing preparation of the record drawings;
- reviews test results provided by OSDF Construction Subcontractor;
- assigns locations for testing and sampling;
- verifies the calibration and condition of on-site testing equipment;
- reviews all CQC Field Monitors' daily reports and logs;
- reports to the Construction Contracts 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 project specifications to the Construction Contracts Manager;
- assists with the preparation of the final report;
- reviews all certifications and documentation from the OSDF Construction Subcontractor, Manufacturer, and Installer, and makes appropriate recommendations;
- reviews the Geosynthetic Manufacturer's QC documentation;

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

- notes any on-site activities that could result in damage to the geosynthetics; and

- performs duties of Field Monitor as needed.

4.5.3.3 CQC Field Monitors

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

The duties of the Field Monitors include:

- monitoring material stockpiles for any determination of materials;

- assuring proper surface-water drainage away from 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;

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- monitoring the unloading and on-site handling and storage of the geosynthetics;
- monitoring geosynthetic repair operations;
- monitoring geosynthetic material seaming;
- collecting conformance samples for testing by the Geosynthetic CQC Laboratory; and
- monitoring geosynthetic material deployment and installation operations.

In addition to these specific duties, all CQC Field Monitors will take note of any on-site activities that could result in damage to the soils components of the lining 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 will be reported immediately to the CQC Site Manager.

4.6 Soils CQC Laboratory

4.6.1 Definition

The Soils CQC Laboratory is the party, independent from the Construction Contracts Manager and OSDF Construction Subcontractor, that is responsible for conducting geotechnical laboratory tests in accordance with standards referenced in the project plans and specifications and this CQA Plan. It is anticipated that CQC Laboratory will be required to perform the preconstruction evaluation testing of the various soils components of the OSDF and, more sensitive conformance testing required during construction such as hydraulic conductivity testing which require tightly controlled laboratory conditions.

4.6.2 Qualifications

The Soils CQC Laboratory will have considerable experience in testing of soils similar to those proposed for use in the construction of the OSDF and be very familiar with ASTM and other applicable 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 shall submit their qualifications and QA/QC procedures to the Construction Contracts 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.

4.6.3 Responsibilities

The Soils CQC Laboratory will be responsible for testing various soils components of the OSDF lining and final cover systems. These tests shall include, but not be limited to, material qualification (pre-construction) tests and material conformance (construction quality control) tests as described in project plans and specifications.

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4.7 Geosynthetic CQC Laboratory

4.7.1 Definition

The Geosynthetic CQC Laboratory is the party, independent from the Construction Contracts Manager, OSDF Construction Subcontractor, Manufacturer, and Installer, responsible for conducting tests in accordance with ASTM Standards on samples of geosynthetic materials used in construction of the liner and cover systems.

4.7.2 Qualifications

The Geosynthetic 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 Geosynthetic CQC Laboratory shall be familiar with ASTM and other applicable geosynthetic test standards. The Geosynthetic CQC Laboratory will be capable of providing test 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 shall submit their qualifications to the Construction Contracts Manager for review and approval. The qualifications presented by the Geosynthetics Laboratory shall, as a minimum, include:

- corporate background and statement of qualifications;
- listing 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.

4.7.3 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 project plans, specifications, and this CQA Plan.

4.8 Geosynthetics Manufacturers

4.8.1 Definition

The Geosynthetics Manufacturers are the firms or corporations responsible for production of the geosynthetic materials to be used in the project. The Geosynthetics Manufacturers are insures the condition of their respective geosynthetic materials until such time as materials are accepted by the OSDF Construction Subcontractor. The Geosynthetics Manufacturers shall produce a consistent product meeting the project specifications, and shall provide quality control documentation for all products supplied to the OSDF project.

4.8.2 Qualifications

The Geosynthetics Manufacturers shall be able to provide sufficient production capacity and qualified personnel to meet the demands of the project. Prior to shipment of any material to the site, each Geosynthetics Manufacturer shall be pre-qualified and approved by the Construction Contracts Manager. The qualifications presented by the Geomembrane Manufacturer shall, as a minimum, include the following:

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- corporate background and statement of qualifications;

- manufacturing capabilities;

  - information on plant size, equipment, personnel, number of shifts per day and capacity per shift;
  - daily production quantity available for this subcontract;
  - quality control manual for manufacturing;
  - list of material properties including certified test results, to which are attached geomembrane samples; and

- in the case of the Geomembrane Manufacturer a list of at least 20 completed facilities, totaling a minimum of 10,000,000 ft^2 of textured geomembrane; for each facility, the following information shall be provided:

  - name and purpose of facility, its location, and date of installation;
  - name of owner, project manager, designer, fabricator (if any), and installer;
  - telephone number of owner;
  - thickness of geomembrane and surface area of geomembrane manufactured; and
  - available information on the performance of the lining system and the facility.

4.8.3 Responsibilities

Each Geosynthetics Manufacturer is responsible for the production of its geosynthetic product. In addition each Geosynthetics Manufacturer is responsible for the condition of the geosynthetic until the material is accepted by the Construction Subcontractor. Each Geosynthetics Manufacturer shall produce a consistent product meeting the project specifications. Each Geosynthetics Manufacturer shall provide quality control documentation to the CCM for its product as required in the project specification of this CQA plan.

4.9 Geosynthetics Installer

4.9.1 Definition

The Geosynthetics Installer will be trained and qualified to install the geosynthetic materials of the type specified for this project. The Geosynthetic Installer will be approved and/or licensed by the Geosynthetic Manufacturer. A copy of the approval letter or license will be submitted by the OSDF Construction Subcontractor on behalf of the Geosynthetic Installer to the Construction Contracts Manager with its bid.

4.9.2 Qualifications

In addition, prior to confirmation of any subcontractual agreements, the Geosynthetic Installer will provide the Construction Contracts Manager with the following written information.

- corporate background and information;
- installation capabilities including:
  - information on installation equipment and personnel;
  - daily anticipated production capabilities;
  - comprehensive CQC manual for installation of geosynthetic materials; and
- a list of 20 completed cover or liner system installations, totaling a minimum of 15,000,000 ft^2 of textured geomembrane installed geosynthetic materials; for each installation, the following information must be provided:
  - name and purpose of facility, its location, and date of installation;
  - name of owner, project manager, and Geosynthetic Manufacturer(s);
  - telephone number of project manager;

- name and qualifications of the supervisor of the Installer's crew;
- surface area of the installed geosynthetic materials for each project;
- type of geosynthetic material seaming and/or type of seaming apparatus used;
- duration of installation; and
- available information on the performance of the installed liner system.

At least one seamer shall have experience seaming a minimum of 1,000,000 ft^2 of polyethylene geomembrane using the same type of seaming apparatus to be used for this project. 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. All personnel performing seaming operations will be qualified with at least 5,000 linear ft of geosynthetic materials seaming experience using the same seaming methods that will be used on this project.

The Geosynthetic Installer will provide the Construction Contracts Manager with a list of proposed seaming personnel and their qualifications. This document will be reviewed by the Resident Engineer and the CQC Consultant. Any proposed seaming personnel deemed insufficiently experienced will not be accepted.

The Installer will designate one representative as its Supervisor, who will be responsible for acting as the Installer's spokesman on site. The Supervisor will be qualified by experience and shall have previously supervised the installation of at least 10,000,000 ft^2 of geosynthetic materials using the same materials and seaming apparatus as to be used for the OSDF.

4.9.3 Responsibilities

The Installer's Supervisor will be responsible for handling installation of the geosynthetics used in construction of the OSDF. The Installer's Supervisor will be responsible for providing supervision and guidance to the installation crew. The Installer's Supervisor is also responsible for obtaining samples, as required by the CQA plan and project specifications, for field testing, and for coordinating testing activities

with the CCM. The Installer's Supervisor is responsible for documenting daily logs of all activities related to the geosynthetics installation activities, including, but not limited to, on-site personnel, material inventories, production rates, test results, installation deficiencies, and resolution to construction problems.

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 activities. The CQC Consultant will document that all quality control requirements have been addressed and satisfied.

The CQC Site Manager will provide the Construction Contracts Manager descriptive daily field reports, data sheets, and logs to verify that all monitoring activities have been carried out. The CQC Site Manager will also maintain at the job site a complete file of plans and specifications, this CQA plan, the OSDF Construction Subcontractor's Quality Control Plan(s), checklists, test procedures, daily logs, and other pertinent documents.

5.1 Daily Recordkeeping

Daily reporting procedures will include: (i) daily summary report; (ii) testing data sheets; and (iii) when appropriate, problem identification and corrective measures reports.

5.1.1 Daily Summary Reports

The CQC Consultant 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;
- equipment and personnel in each work area;
- 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; and
- signature of the respective CQC Site Manager and/or the CQC Field Monitor.
- any corrections to the Daily Summary Reports shall be single line crossed out, initialed by the correcting personnel, and dated

5.1.2 Test Data Sheets

All observations and field and/or laboratory tests shall be recorded on an appropriate test data sheet. The CQC Consultant shall utilize the CQA monitoring logs

and test data sheets to ensure that all aspects of the required CQA activity are verified. Any corrections to the Test Data Sheets shall be single line crossed out, initialed by the correcting personnel and dated.

At a minimum, the test data sheets shall include the following information:

- a unique identifying sheet number for cross-referencing and document control;
- description or title of the inspection activity;
- location of the inspection activity or location from which the sample increment was obtained;
- type of inspection activity or procedure used (reference to standard method when appropriate);
- recorded observation or test data, with all necessary calculations;
- results of the inspection activity and comparison with specification requirements; and
- personnel involved in the inspection activity;
- Date of Activity

5.1.3 Problem Identification and Corrective Measures Report

A problem is defined herein as material or workmanship that does not meet the specified requirement(s). Problems Identification and Corrective Measures Reports should be cross-referenced to specific summary reports or test data sheets where the problem was identified. At a minimum, they should include the following information:

- 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 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 problems could help to avoid similar problems in the future.

Upon receiving the CQC Site Manager's written concurrence, copies of the report should be submitted to the Resident Engineer and the Construction Contracts Manager for their comments and acceptance.

5.2 Photographic Documentation

The CCM will be responsible for obtaining photographic documentation of the OSDF Construction 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, CQA 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 file.

5.3 Design and/or Specifications Changes

Design and/or specifications changes may be required during construction. In such cases, the OSDF Construction Subcontractor must submit written requests for such changes to the CCM. 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 agreement and written authorization of the Construction Contracts Manager and the Resident Engineer. Such changes will take the form of an amendment to the specifications.

The Construction Contracts Manager will be made aware of any significant recurring nonconformance with the construction plans, project specifications or CQA plan by the CQC Consultant. The cause of the nonconformance will be determined by the CQC Consultant. The OSDF Construction Subcontractor will be directed by the Construction Contracts 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 Contracts Manager.

5.4 Final Documentation

At the completion of construction phases the CQC Consultant will submit a construction phase final report to the Construction Contracts Manager. This report will acknowledge: (i) that the work has been performed in compliance with the plans and 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 all CQC activities;
- monitoring logs and testing data sheets including sample location plans;
- problem identification and corrective measures reports;
- a descriptive summary of any changes from design and material specifications;
- record drawings; and
- a summary statement indicating compliance with project plans and specifications which is signed and sealed by a registered Professional Engineer (i.e., Resident Engineer).

The OSDF Construction Subcontractor's record drawings will 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.). The geomembrane panel record drawing will be prepared by the CQC Consultant and included as part of the final certification report.

5.5 Storage of Records

Storing during the construction of the OSDF, the CQC Site Manager will be responsible for all facility CQC documents. This includes the CQC Consultant's copy of the plans and 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 CQA document originals will be organized and submitted to the Construction Contracts 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. SURVEYING

6.1 Introduction

Survey during construction of the OSDF will be the responsibility of the OSDF Construction Subcontractor. Surveying of lines and grades is conducted on an ongoing basis during all phases of the OSDF construction. Close interaction between the Surveyor and the CCM is essential to ensure that construction of the OSDF is completed in accordance with the plans and specifications.

6.2 Related Project Specifications

The OSDF Construction Subcontractor shall comply with the project specification. This specification shall be referenced for pertinent survey requirements.

6.3 Survey Control

6.3.1 Survey Benchmarks

At least three permanent third order survey benchmarks shall be installed on separate sides of the OSDF within easy access of the limits of impacted material placement. The benchmarks shall be constructed in accordance with the following requirements (ARAR: OAC 3745-27-08(7)(a)-(c)).

- Survey marks shall be referenced horizontally to the 1927 North American Datum, 1983 North American Datum, or State Plane Coordinate System and vertically to the 1929 or 1988 North American Vertical Sea Level Datum as identified on the 7.5 minute series quadrangle sheets published by the United States Geological Survey.

- Survey marks shall be at least as stable as a poured concrete monument 10 in. in diameter installed to a depth of 42 in. below the ground surface. Each survey mark shall include a corrosion resistant metallic disk which indicates horizontal and vertical coordinates of the survey mark. Each survey mark shall also contain a magnet or ferromagnetic rod to allow identification through magnetic detection method.

- Survey control standards for the survey marks shall be in accordance with the following:

  - for the first facility survey mark established from the known control point, minimum horizontal distance accuracy shall be one foot horizontal to 2,500 ft horizontal;

  - for each facility survey mark established from the first facility survey mark, minimum horizontal accuracy shall be one foot horizontal distance to 5,000 ft horizontal; and

  - for the first facility survey mark established from the known control point and for each facility survey mark established from the first facility survey mark, minimum vertical accuracy shall be one inch to 5,000 ft horizontal.

6.3.2 Grids

During the initial phase of construction the OSDF Construction Subcontractor shall establish a survey grid to the satisfaction of the Construction Contracts Manager. This grid shall be used to establish cut and fill requirements, control material placement operations, locate field tests, and aid in the development of material quantities.

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6.4 Surveying Personnel

All Surveying shall be performed under the direct supervision of a registered Professional Land Surveyor. This Professional Land Surveyor shall sign and seal all construction survey record drawings. All surveying personnel shall be experienced in the provision of these services, including detailed, accurate documentation.

6.5 Precision and Accuracy

A wide variety of survey equipment is available for the surveying requirements for these projects. The survey instruments used for this work should be sufficiently precise and accurate to meet the needs of the projects. All survey instruments should be capable of reading to a precision of 0.001 ft and with a setting accuracy of $\pm$ 0.8 sec. (2.2×10^{-3} degrees).

6.6 Lines and Grades

The following surfaces shall be surveyed to verify the lines and grades achieved during soil placement and compaction:

- for the berms and other earthworks:
  - original grade surface;
  - compacted surface of cut slopes; and
  - finished grade surface;
- for the compacted clay liner:
  - prepared subgrade surface; and
  - finished compacted soil liner surface;
- for the LDS, LCS, and cover drainage layer:

- top surface of preceding layer; and
- finished grade surface;

- for the biointrusion barrier, granular filter, vegetative soil, and top soil layers;

  - top surface of preceding layer; and
  - finished grade surface; and

- for the compacted clay cap:

  - prepared contouring layer surface; and
  - finished compacted clay cap surface.

6.7 Frequency and Spacing

All surveying should be carried out immediately upon completion of a given installation to facilitate progress and avoid delaying commencement of the next installation. In addition, spot checks during placement and compaction will be necessary to assist the OSDF Construction Subcontractor in compliance with required grades.

At least the following minimum spacings and locations should be provided for survey points:

- all "flat" surfaces with gradients less than 10 percent, should be surveyed on a square grid not spaced wider than 50 ft;

- on all slopes greater than 10 percent, a square grid not spaced wider than 50 ft should be used, but in any case, a line at the crest, midpoint, and toe of the slope should be taken;

- a line of survey points spaced not more than 50 ft apart must be taken along any slope break (this will include the inside edge and outside edge of any bench on a slope);

- a line of survey points spaced not more than 50 ft apart must be taken at the invert of any pipes or other appurtenances to the liner;

- at the corners and midpoints of the top and bottom of all sumps; and

- at the midpoint of the crest of the outside berms.

6.8 Survey As-Built and Record Drawings

During construction of the OSDF, all field survey notes should be retained by the Professional Land Surveyor. During construction of the OSDF, the Surveyor shall routinely submit working surveys used to determine location of work, percent of work completed, layer thickness, or final grades to the CCM for review and approval. Prior to the placement of successive soil or geosynthetic layers the OSDF Construction Subcontractor shall submit a written statement certifying compliance of the preceding layer thickness to the CCM. In all cases, as-built surveys will be required from the OSDF Construction Subcontractor prior to approval for the placement for overlying materials by the CCM.

A table of survey points, obtained in accordance with the requirements described in the preceding sections, which lists the elevation of the top of the supporting layer surface, top of the final layer surface, and the overall thickness (to the nearest 0.1 ft) shall be provided on all relevant survey record drawings. One complete set of sealed survey record drawings shall be submitted to CCM within 30 days of completion of the project. The surveyor shall also provide the CCM with a electronic file in DXF format or AutoCAD® Version 12 or 13 upon final submittal of the record drawings. Additional copies of the sealed survey record drawings may be required by FERMCO or conclusion in the final certification report.

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7. SOILS CONSTRUCTION QUALITY ASSURANCE

7.1 Introduction

CQA monitoring and testing shall be performed during installation of the various soil lining and final cover system components. Criteria to be used for determination of acceptability of the various soil layers are identified in the project specifications and this CQA plan.

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

- a 1-ft thick granular LCS layer having a hydraulic conductivity of 1×10^{-1} cm/s or less;
- a 1-ft thick granular LDS layer having a hydraulic conductivity of 1×10^{-1} cm/s or less; 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 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 less; 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 clearing, grubbing, excavation, grading, placing, and compaction prior to the placement of any of the liner system materials. The OSDF prepared subgrade layer will generally be comprised of in situ materials, or borrow area materials.

7.2 Related Project Specifications

The OSDF Construction Subcontractor shall comply with the project specifications. These project specifications shall be referenced for pertinent material physical properties and construction requirements.

7.3 Subgrade Preparation

Prior to the start of subgrade preparation operations, the OSDF Construction Subcontractor shall submit to the CCM for review a letter describing the proposed equipment for and methods of construction, including placing, compaction, and backfilling for the various portions of work. The OSDF Construction Subcontractor shall not undertake this work until the required submittal have been reviewed and approved by the CCM. The review shall be for method only. The OSDF Construction Subcontractor shall remain responsible for the adequacy and safety of the methods.

During construction, compaction testing of the subgrade soil shall be performed by the CQC Consultant. The subgrade shall be prepared, in accordance with the specifications as a foundation for placement and compaction of soil material. Compliance with the specifications shall be determined by the CCM.

In areas where dewatering is required, the OSDF Construction Subcontractor shall take measures to remove water form the subgrade in accordance with Section 02200, of the project specifications. The resulting subgrade surface shall be free of standing water and shall be suitable as a foundation for compaction of fill material, as determined by the CCM. Dewatered areas shall be maintained in this condition until the appropriate fill material is placed in the area.

Material placed to achieve grades indicated on the Construction Drawings shall be tested in accordance with the tests methods and frequencies shown in Table 7-1 through 7-4, to verify that the fill material was compacted in accordance with the specific material specification. Areas that do not meet this requirement will be recompacted and retested until the area is adequately compacted, as indicated by retest results.

The CCM shall be responsible for determination that the subgrade has become damaged by excess moisture (causing softening) and insufficient moisture (causing desiccation and shrinkage), or by freezing. At a minimum, the CQC Consultant shall evaluate the suitability of the subgrade by the following methods:

- 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 7-1 through 7-4 as deemed appropriate.

7.4 Conformance Testing

It will be necessary for the CQC Consultant to visually inspect and test the soil components of the OSDF lining and cover systems to ensure they are uniform and conform to the requirements of the project specifications. The CCM shall also evaluate

the procedures, methods, and equipment used by the OSDF Construction Subcontractor to install the various soil components.

For soil materials obtained from the on-site borrow area, visual inspections and conformance tests shall be performed as the materials are excavated and stockpiled. 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 OSDF Construction Subcontractor and the CQA personnel to coordinate excavation and supervise the segregation of substandard materials. All unsuitable materials shall be rejected by the CCM. The OSDF Construction Subcontractor and CQC Consultant shall reference the *BAMR Plan* for specific details of the on-site borrow area evaluation and testing.

Initial evaluation of various soil types by CQC personnel 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 or observed 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.

7.4.1 Test Methods

Conformance tests used to evaluate the suitability of soil materials during construction shall be performed in accordance with the current ASTM test procedures. The test methods indicated in Tables 7-1 and 7-2 are those which shall be used by the CQC Consultant for conformance testing unless the test methods are updated or revised subsequent to the issuance of this plan. Any revisions to the test methods shall be reviewed and approved by the CCM prior to their use. Documentation and reporting

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of the test results shall be performed in accordance with the requirements identified in Section 8.10.

For the purpose of this CQA plan, the Standard Proctor Test (ASTM D 698) shall be used for the determination of moisture/density relationships unless otherwise indicated. Nuclear surface moisture/density test methods (ASTM D 3017 and D 2922) shall be used for in-situ field and testing. The sand cone test method (ASTM D 1556) or drive cylinder test method (ASTM D 2937) shall be used to establish correlations of moisture and density in cases of uncertainty, or as a check of the nuclear surface moisture/density gauge calibration. Any conflict regarding acceptance of test results shall be resolved by the CCM.

7.4.2 Test Frequency

The frequency of conformance test shall conform to the minimum frequencies presented in Tables 7-1 and 7-2. The frequency of testing may be increased at the discretion of the CCM or if variability of the materials is observed.

7.5 Construction Monitoring

During installation of the various soil components, the CQC Consultant shall visually observe and document the OSDF Construction Subcontractor's earthwork procedures. The CQC Consultant shall also be responsible for performing soils construction quality control tests to ensure compliance of the materials with the project specifications.

The CQC Consultant shall monitor the OSDF Construction Subcontractors earthwork activities for the following:

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

- 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.

7.6 Hydraulic Conductivity Testing Evaluations

As shown in Tables 7-1 through 7-4, hydraulic conductivity (permeability) conformance tests shall be conducted on all 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. All hydraulic conductivity testing of clay liner and cap shall be accomplished in accordance with ASTM 5084 at a confined stress of 5 psi. Laboratory remolded samples shall be used for conformance evaluation of the clay liner and cap materials. In addition, permeability tests shall be performed on undisturbed samples obtained directly from the constructed clay liner and cap. Thin-walled tube samples shall be taken from the in-place clay liner and cap materials after installation for performance evaluation and acceptance. Thin walled samples shall be obtained by the CQC Consultant and transported to the Soils CQC Laboratory in accordance with the methods in ASTM D 1587. The hydraulic conductivity criteria to be used for determination of acceptability are presented in Tables 7-5 and 7-6. The CQC Consultant shall be responsible for documenting each sample including the date sampled, sample number, and grid location. Other tests to be conducted by the Soil CQC Laboratory on all permeability samples shall be dry unit weight and as received moisture content.

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7.7 Performance

7.7.1 Test Methods

All Performance testing shall be conducted in accordance with the project specifications or as directed by the Construction Contracts 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. The test methods indicated in Tables 7-3 and 7-4 are those which shall be used by the CQC Consultant for performance testing unless the test methods are updated or revised subsequent to the issuance of this plan. All the test methods shall be reviewed and approved the CCM prior to their use. Documentation and reporting of test results shall be in accordance with the requirements identified in Section 7.10.

7.7.2 Test Frequency

Performance testing shall be conducted during the course of the work. The minimum construction performance testing frequencies are presented in Tables 7-3, and 7-4. The frequency may be increased at the discretion of the CCM or if variability of the materials is observed.

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 Contracts 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;
- less than 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 Contracts Manager

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

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

7.8 Clay Liner and Cap Perforations

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

- nuclear density test probe locations;

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- hydraulic conductivity sampling locations;
- sand cone or drive test locations;
- survey stake locations; and
- test pit locations.

Perforations in the compacted clay liner and cap resulting from nuclear density tests shall be filled by the CQC Consultant. Perforations in the clay liner resulting from construction activities and from the Shelby tube sampling, sand-cone or drive cylinder tests, and test pits shall be filled by the OSDF Construction Subcontractor. The CQC Consultant shall provide the OSDF Construction Subcontractor with the locations of any perforations which results from routine CQC or hydraulic conductivity tests.

Unless otherwise noted in the project specifications, perforations in the compacted clay liner and cap from nuclear density tests will be backfilled with bentonite (sodium montmorillonite) powder or pellets or a soil-bentonite mixture and compacted by hand tamping. Perforations from thin-wall tube sample, test pit, sand-cone, or drive cylinders locations shall be backfilled by the OSDF Construction Subcontractor with suitable, properly moisture conditioned clay liner material containing about 10 percent bentonite. In these areas the clay materials shall be placed and compacted in accordance with the requirements of the project specifications and this CQA Plan. Testing of these areas shall be conducted at the discretion of the CCM.

7.9 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.

Prior to any soil sampling activity the CQC Consultant shall be responsible for submitting site specific plan which will determine and document the effectiveness of the field testing and sampling equipment decontamination process. The OSDF Construction Subcontractor shall also be responsible for submitting, to the CCM, site specific plan which will determine and document the effectiveness of the decontamination processes used for heavy equipment, tools, pumps, hoses, etc. The plans shall include the collection and analysis of samples to evaluate the completeness of the contamination prevention and decontamination procedures. At a minimum, these plans shall comply with the requirements of ASTM D 5608.

7.10 Deficiencies

If a defect is discovered in the earthwork product, 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.

7.10.1 Notification

Within 24 hours 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, in writing, the Construction Contracts Manager and OSDF Construction Subcontractor and schedule appropriate retests when the work deficiency is to be corrected.

7.10.2 Repairs and Retesting

The OSDF Construction Subcontractor shall correct all noted deficiencies to the satisfaction of the CCM. If a project specification criterion cannot be met, or unusual weather conditions hinder work, the OSDF Construction Subcontractor shall submit suggested solutions or alternatives to the CCM for review.

At locations where the field testing indicates in-situ density or hydraulic conductivity which does not comply with the requirements of the project specifications, the failing area shall be reworked to the satisfaction of the CCM. At a minimum, the area shall be scarified, moisture conditioned, and recompacted. Alternatively, at the CCM's option, undisturbed samples of in-place material shall be obtained for permeability testing. All retests performed by the CQC Consultant must verify that the defect has been corrected before any additional work is performed by the OSDF Construction Subcontractor in the area of the deficiency.

7.11 Documentation

The documentation of Soils CQC Testing activities is an important factor to ensure the successful construction, performance, and approval of the OSDF soil lining and closure system components. The CQC monitoring observations, sample location descriptions, and field test results, and on-site laboratory test results shall be documented by the CQC Consultant. Forms to be used by the CQC Consultant shall include, but not be limited to, the following:

- Daily Field Reports;
- Soil Sample Logs;
- Nuclear Moisture/Density Test Logs;
- Particle-Size Distribution Curves;

- Moisture/Density Relationship Curves;
- Test Data Sheets; and
- Result Summary Sheets.

The CQC Consultant shall submit updated soils CQC documents to the Construction Contracts Manager on a weekly basis as requested.

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TABLE 7-1
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS

TEST NAME/TEST METHOD	SOIL TYPE			
	COMPACTED FILL	COMPACTED CLAY LINER	LDS DRAINAGE LAYER	LCS DRAINAGE LAYER
SPECIFICATION SECTION	02200	02225	02710	02710
Particle Size Analysis/ASTM D 422	1 test per 5,000 yd^3	1 test per 1,500 yd^3 (including hydrometer)	1 test per 3,000 yd^3	1 test per 3,000 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	1 test per 5,000 yd^3	1 test per 1,500 yd^3	N/A	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 3,000 yd^3
Standard Proctor/ASTM D 698	1 test per 5,000 yd^3	1 test per 3,000 yd^3	N/A	N/A
Hydraulic Conductivity/ASTM D 5084	N/A	1 test per 3,000 yd^3 (remold sample)	N/A	N/A
Hydraulic Conductivity/ASTM D 2434	N/A	N/A	1 test per 3,000 yd^3	1 test per 3,000 yd^3
Carbonate Content/ASTM D 3042	N/A	N/A	N/A	N/A
Organic Content/ASTM D 2974	N/A	N/A	N/A	N/A

NA = Not Applicable

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TABLE 7-2
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	1 test per 1,500 yd^3 (including hydrometer)	1 test per 3,000 yd^3	N/A	N/A	1 test per 5,000 yd^3	1 per 5,000 yd^3	1 per 5,000 yd^3
Particle Size Analysis/ASTM C 136	N/A	N/A	N/A	1 test per 10,000 yd^3	N/A	N/A	N/A
Moisture Content/ASTM D 2216	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	N/A
Standard Proctor/ASTM D 698	1 test per 3,000 yd^3	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3	N/A
Relative Density/ ASTM D 4253 and D 4254	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3	N/A	N/A
Hydraulic Conductivity/ASTM D 5084	1 test per 3,000 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	N/A	1 test per 3,000 yd^3	N/A	N/A	N/A	N/A	N/A
Organic Content/ASTM D 2974	N/A	N/A	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3

NA = Not Applicable

TABLE 7-3
MINIMUM PERFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS

TEST NAME/TEST METHOD	SOIL TYPE			
	COMPACTED FILL	COMPACTED CLAY LINER	LDS DRAINAGE LAYER	LCS DRAINAGE LAYER
SPECIFICATION SECTION	02200	02225	02710	02710
In-situ Moisture/ASTM D 3017	2 test per acre per lift[1]	5 test per acre lift[1]	N/A	N/A
In-situ Density/ASTM D 2922	2 test per acre per lift[1]	5 tests per acre per lift[1]	N/A	N/A
Lift Thickness/Direct Measurement	N/A	As necessary, verify thickness by survey as-builts	As necessary, verify thickness by survey as-builts	As necessary, verify thickness by survey as-builts
Sand Cone/ASTM D 1556 or Drive Cylinder/ASTM D 2937	1 test per 25 nuclear tests[2]	1 test per 25 nuclear tests[2]	N/A	N/A
In-situ Hydraulic Conductivity/ASTM D 5084	N/A	1 test per acre per lift	N/A	N/A

N/A = Not Applicable

NOTE: [1] A minimum of two nuclear moisture and density tests each day of active soils construction

[2] A minimum of one sand cone test each day of active soils construction

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TABLE 7-4
MINIMUM PERFORMANCE 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
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
Lift Thickness/Direct Measurement	As necessary, verify thickness by survey as-builts	As necessary, verify thickness by survey as-builts	As necessary, verify thickness by survey as-builts	As necessary, verify thickness by survey as-builts	As necessary, verify thickness by survey as-builts	As necessary, verify thickness by survey as-builts	N/A
Sand Cone/ASTM D 1556 or Drive Cylinder ASTM D 2937	1 test per 25 nuclear tests[2]	N/A	N/A	N/A	N/A	N/A	N/A
In-situ Hydraulic Conductivity/ASTM D 5084	1 test per acre per lift	N/A	N/A	N/A	N/A	N/A	N/A

N/A = Not Applicable

NOTE [1] A minimum of two nuclear moisture and density tests each day of active soils construction

[2] A minimum of one sand cone test each day of active soils construction

TABLE 7-5
ACCEPTANCE CRITERIA FOR LINER SYSTEM COMPONENTS

ACCEPTANCE CRITERIA	SOIL TYPE					
	COMPACTED FILL	PIPE BEDDING MATERIAL	TRENCH BACKFILL	COMPACTED CLAY LINER	LDS DRAINAGE LAYER	LCS DRAINAGE LAYER
Pre-compaction Max. Clod Size	2 in.	N/A	N/A	3 in.	N/A	N/A
Compacted Lift Thickness	≤ 6 in.	≤ 6 in.	≤ 6 in.	≤ 6in.	≥ 12 in.	≥ 12 in.
Max. Dry Density	95%	95%	95%	95% of ASTM D 698 90% of ASTM D 1557	N/A	N/A
Moisture Content Range	≤ 3% above OMC	≤ 4% above OMC	≤ 4% above OMC	As per Test Pad Evaluation	N/A	N/A
Max. Particle Size	N/A	2 in.	2 in.	2 in.	3/4 in.	3/4 in.
Carbonate Content	N/A	N/A	N/A	N/A	< 5%	< 5%
Soil Classification	SP, SW, SM, SC, ML, or CL	N/A	N/A	N/A	GW or GP	GW or GP
Sieve Analysis	N/A	Max. 25% passing No. 200	Max. 25% passing No. 200	See Section 02225 Part 2.01, B	See Section 02710 Part 2.01, B	See Section 02710 Part 2.01, B
Hydraulic Conductivity	N/A	N/A	N/A	$\leq 1 \times 10^{-7}$ cm/s	$\geq 1 \times 10^{-1}$ cm/s	$\geq 1 \times 10^{-1}$ cm/s
Layer Thickness	Varies	Varies	Varies	≥ 3 ft	1 ft	1 ft
Final Grade tolerance	± 0.1 ft	± 0.2 ft	± 0.2 ft	+ 0.1 ft	+ 0.1 ft	+ 0.1 ft

OMC = Optimum Moisture Content
N/A = Not Applicable

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TABLE 7-6
ACCEPTANCE CRITERIA FOR COVER SYSTEM COMPONENTS

ACCEPTANCE CRITERIA	SOIL TYPE						
	COMPACTED CLAY CAP	COVER DRAINAGE LAYER	BIOINTRUSION BARRIER		GRANULAR FILTER	VEGETATIVE SOIL LAYER	TOPSOIL
			PRIMARY BIOINTRUSION BARRIER	CHOKE STONE			
Pre-compaction Max. Clod Size	3 in.	N/A	N/A	N/A	N/A	N/A	N/A
Compacted Lift Thickness	≤ 6 in.	≥ 12 in.	N/A	N/A	≤ 6 in.	7 in. (± 1 in)	≤ 6 in.
Max. Dry Density	95% of ASTM D 698	N/A	N/A	N/A	N/A	90% of ASTM D698	N/A
Moisture Content Range	As per Test Pad Evaluation	N/A	N/A	N/A	N/A	N/A	N/A
Max. Particle Size	2 in.	3/8 in.	≥ 4 in. ≤ 18 in.	4 in.		2 in.	
Carbonate Content	N/A	< 10%	< 10%	< 10%	< 10%	N/A	N/A
Soil Classification	N/A	GW, GP	GW, GP	GW, GP	GW, GP	SM, SC, ML, CL	See Section 02920 Part 2.01
Sieve Analysis	See Section 02225 Part 2.01, C	See Section 02710 Part 2.01, D	D_{50} = 12 in.	See Section 02280 Part 2.01, C	See Section 02712 Part 2.01, B	N/A	See Section 02920, Part 2.01
Hydraulic Conductivity	$\leq 1 \times 10^{-7}$ cm/s	$\geq 1 \times 10^{-1}$ cm/s	N/A	N/A	N/A	N/A	N/A
Layer Thickness	≤ 2 ft	1 ft	3 ft (overall)	0.5 ft	0.5 ft	1.75 ft	0.5 ft
Final Grade tolerance	+ 0.1 ft	+ 0.1 ft	+ 0.1 ft (overall)	N/A	+ 0.1 ft	± 0.1 ft	± 0.1 ft

OMC = Optimum Moisture Content
N/A = Not Applicable

8. GEOMEMBRANE LINER AND COVER

8.1 Introduction

This section focuses on the CQC aspects of geomembrane manufacturing, testing and installation. High density polyethylene (HDPE) geomembrane will be used in the construction of the OSDF lining and final cover system. The HDPE geomembrane will be made of HDPE resin, carbon black and additives.

8.2 Related Project Specifications

The OSDF Subcontractor shall comply with the project specification titled "*Geomembrane Liner and Cover.*" This specification shall be referenced for the various physical properties and installation requirements of the geomembrane materials:

The testing used to evaluate the suitability or conformance of geosynthetics shall be carried out in accordance with the current versions of the corresponding American Society for Testing and Materials (ASTM) test procedures. The test methods indicated in Tables 8-1 through 8-2 are those which shall be used for this testing unless the test methods are updated or revised subsequent to the issuance of this CQA plan and prior to bid. All test methods shall be reviewed and approved by the Construction Contracts Manager prior to their usage.

8.3 Manufacturing and Quality Control

8.3.1 Raw Material

The raw material used to manufacture geomembranes shall be first quality polyethylene resin containing no more than two percent clean recycled polymer by weight, and meeting the following specifications:

Specific Gravity: 0.94 minimum (ASTM D 792 Method A, or ASTM D 1505)

Melt Index: 1.0 g/10 min., maximum (ASTM D 1238 Condition E, 190°C, 2.16 Kg)

The Resin Supplier shall sample and test the resins used in the manufacturing of the geomembrane supplied for the OSDF project. Quality control tests shall be performed by the Resin Supplier at a minimum frequency of once per railcar or other bulk unit of shipment to the Geomembrane Manufacturer to demonstrate that properties conform to the minimum values for specific gravity and melt index as described above. At the Construction Contracts Manager's discretion, additional testing of the resin may be carried out for purposes of conformance by the Geosynthetics CQC Laboratory, and paid for by the FERMCO. If the results of the Resin Supplier and the Geosynthetics CQC Laboratory's testing differ, the testing shall be repeated by the Geosynthetics CQC Laboratory, and the Resin Supplier shall be allowed to monitor this testing. The results of this latter series of tests will prevail, provided that the applicable test methods have been followed.

Prior to shipment of the geomembrane materials to the site, the Resin Supplier shall provide the Construction Contracts Manager with the following information:

- a copy of the quality control certificates issued by the Resin Supplier to include specific gravity (ASTM D 792, Method A or ASTM D 1505) and melt index (ASTM D 1238 Condition E) test results and the origin (Resin Supplier's name and resin production plant), identification (brand name, number) and production date of the resin; and

- a statement that no reclaimed polymer is added to the resin (however, the use of polymer recycled during the manufacturing process may be permitted if done with appropriate cleanliness and if recycled polymer does not exceed 2 percent by weight).

The CQC Consultant shall review these documents and shall report any discrepancies with the above requirements to the Construction Contracts Manager.

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8.3.2 Geomembrane Manufacturing

The Geomembrane Manufacturer shall continuously monitor geomembranes for defects during the manufacturing process. Quality control testing shall be carried out by the Geomembrane Manufacturer to demonstrate that the products meet specifications. The Geomembrane Manufacturer shall sample and test the geomembrane rolls at a minimum frequency of once every 40,000 ft^2 to demonstrate that its properties conform to the values presented in Appendix A. As a minimum, the following tests shall be performed:

Test	Procedure	
specific gravity	ASTM D 792	Method A or ASTM D 1505
thickness	ASTM D 5199	GRI-GM8
yield strength	ASTM D 638	Modified by NSF 54 Annex A
yield elongation	ASTM D 638	Modified by NSF 54 Annex A
tensile strength	ASTM D 638	Modified by NSF 54 Annex A
tensile elongation	ASTM D 638	Modified by NSF 54 Annex A
carbon black	ASTM D 1603	Modified by NSF 54 Annex A
carbon black dispersion	ASTM D 596	

Any geomembrane sample that does not comply with the Specifications will result in rejection of the roll from which the sample was obtained. If a geomembrane sample fails to meet the quality control requirements outlined in this Section, the Geomembrane Manufacturer shall sample and test each roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.

The following tests need not be run at the 1 per 40,000 ft^2 frequency, however, the Geomembrane Manufacturer shall certify that these tests have been performed on a sample geomembrane that is identical to the geomembrane to be used on this project:

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

The Geomembrane Manufacturer shall sample and test the geomembrane rolls at a minimum frequency of once every 40,000 ft^2 to demonstrate that its properties conform to values specified in Table 02770-1 presented in Appendix A.

The Geomembrane Manufacturer shall provide the Construction Contracts Manager with the following:

- a properties sheet including, at a minimum, all specified properties, measured using test methods indicated in the specifications, or equivalent;
- a list of quantities and descriptions of materials other than the base polymer which comprise the geomembrane;
- manufacturing quantity control certificates indicating the sampling procedure, sample frequency and results of testing; and
- a certification that property values given in the properties sheet are guaranteed by the Geomembrane Manufacturer.

The CQC Consultant shall verify that:

- the property values certified by the Geomembrane Manufacturer meet all of the specifications; and
- the measurements of properties by the Geomembrane Manufacturer are properly documented and that the test methods used are acceptable.

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8.3.3 Quality Control Certifications

Prior to shipment, the Geomembrane Manufacturer shall provide the Construction Contracts Manager with a quality control certificates representing all rolls of geomembrane provided. The quality control certificate shall be signed by a responsible party employed by the Geomembrane Manufacturer, such as the production manager. The quality control certificate shall include:

- roll numbers and identification; and
- sampling procedures and results of quality control tests - as a minimum, results shall be given for thickness, tensile strength, and tear resistance, evaluated in accordance with the methods indicated in the specifications or equivalent methods approved by the CCM.

The CQC Consultant shall:

- verify that the quality control certificates have been provided at the specified frequency, and that each certificate identifies the roll(s) related to it; and
- review the quality control certificates and verify that the certified roll properties meet the specifications.

8.3.4 Manufacturing Plant Visit

The Geomembrane Manufacturer shall agree to allow FERMCO to visit the manufacturing plant for a project specific visit. If possible, such a visit shall be performed prior to or during the manufacturing of the geomembrane rolls for the OSDF project. The CQC Consultant shall review the manufacturing process, quality control procedures, laboratory facilities, and testing procedures.

During the project specific plant visit, the CQC Consultant shall:

- verify that properties guaranteed by the Geomembrane Manufacturer meet all specifications;

- verify that the measurements of properties by the Geomembrane 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 submitted to the Construction Contracts Manager.

8.4 Labeling

The CQC Consultant shall verify that the geomembrane Manufacturer has identified all rolls of geomembrane with the following information:

- thickness of the material;

- length and width of the roll;

- name of Geomembrane Manufacturer;

- product identification;

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- lot number; and
- roll number.

8.5 Transportation, Handling and Storage

The Installer shall be responsible for the storage of the geomembrane on site. The Construction Contracts Manager shall provide storage space in a location (or several locations) such that on-site transportation and handling are optimized if possible. Storage space should be protected from theft, vandalism, passage of vehicles, etc.

Transportation of the geomembrane is the responsibility of the Geomembrane Manufacturer, Installer, or other party as agreed upon. All handling on site is the responsibility of the Installer.

The CQC Consultant shall verify the following:

- handling equipment used on the site is adequate and does not pose any risk of damage to the geomembrane; and
- the Installer's personnel handle the geomembrane with care.

Upon delivery at the site, the Installer and the 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 Contracts 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.

8.6 Conformance Testing

8.6.1 Test

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

8.6.2 Sampling Procedures

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 specified, samples shall be 3 ft long by the roll width. The required minimum sampling frequencies are provided in Table 8-1. 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;
- roll number;
- sample number; and
- CQC personnel identification.

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8.6.3 Test Results

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

8.6.4 Conformance Test Failure

In the case of failing test results, the Manufacturer may request that another sample from the failing roll be retested by the Geosynthetics CQC laboratory with the Manufacturer's technical representative present during the test 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 CCM. The Geomembrane Manufacturer shall replace all rejected rolls. The CQC Consultant shall document all actions taken in conjunction with geomembrane conformance failures.

8.7 Subgrade Surface Preparation

The CQC Consultant shall ensure that:

- a qualified land surveyor has verified the lines and grades of the area over which the geosynthetics are to be installed;
- the supporting soil meets the requirements of the project specifications;

- the surface to be lined has been rolled and compacted so as to be free of irregularities, protrusions, loose soil, and abrupt changes in grade;

- construction equipment deploying the rolls shall not deform the soil subgrade excessively; tire track deformation shall not be greater than 1 inch in depth;

- the surface of the supporting soil does not contain particles larger than 0.5 inches (in largest dimension) which may be damaging to the overlying geosynthetics;

- the geosynthetics shall not be deployed on frozen subgrade where ruts are greater than 0.5 inches in depth; and

- there is no area excessively softened by high water content.

Geosynthetics shall not be placed on subgrade area softened due to high water content or which have cracked due to desiccation. The soil surface shall be observed daily by the CQC Consultant to evaluate the effects of desiccation cracking and/or softening on the integrity of the soil subgrade.

The Geosynthetics Installer shall certify in writing that the surface on which the geosynthetics will be installed is acceptable. The Installer shall submit a certificate of subgrade surface acceptance to the Construction Contracts Manager prior to commencement of the geosynthetics installation in the area under consideration.

After the subgrade has been accepted by the Installer, it shall be the responsibility of the Installer or CQC Consultant to notify the Construction Contracts Manager of any observed change in the supporting soil condition that may require repair work. It shall be the responsibility of the CCM to verify that subgrade repair work is completed in accordance with the requirements of the project specifications and this CQA Plan.

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8.8 Anchorage Trench

The anchor trench shall be excavated by the OSDF Construction Subcontractor (unless otherwise specified) to the lines, depths, and widths shown on the design drawings immediately prior to geomembrane placement. The CQC Consultant shall verify and document that the anchor trench has been constructed according to design 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 CCM. Plastic safety fencing shall be temporarily installed around open portions of the anchor trench to restrict access and protect against injury.

The anchor trench shall be backfilled with suitable material as indicated in the plans and specifications. Backfill shall be placed in maximum 6 in. compacted lifts. The backfill shall be compacted to 95 percent standard Proctor maximum dry density, as determined by ASTM D 698. Nuclear moisture/density of the compacted anchor trench backfill shall be performed at the discretion of the CCM.

The anchor trench shall be constructed with a slightly rounded inside corner where the geosynthetics enter the trench. The anchor trench shall be constructed with a flat bottom and no loose soil shall be allowed to underlie the geosynthetics in the anchor trench.

All temporary ballast (i.e., sandbags) and deleterious materials shall be removed from the anchor trench prior to backfilling. Backfilling of the anchor trench shall be conducted when the geomembrane is in its most subcontracted state. Extreme care shall be taken by the OSDF Construction Subcontractor when backfilling and compacting the anchor trench to prevent any damage to the geosynthetic materials.

8.9 Geomembrane Placement

8.9.1 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.

It shall be the responsibility of the CQC Consultant to ensure 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 Contracts Manager, Installer and CQC Consultant. This field panel identification code shall be as simple and logical as possible. (Note that roll numbers established in the manufacturing plant must be traceable to the field panel identification code.)

The CQC Consultant shall establish documentation showing 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.

8.9.2 Field Panel Placement

8.9.2.1 Location

The CQC Consultant shall verify that field panels are installed at the location indicated in the Installer's layout plan, as approved or modified.

8.9.2.2 Installation Schedule

Field panels may be installed using any one of the following schedules:

- all field panels are placed prior to field seaming in order to protect the GCL and underlying subgrade from damage;

- field panels are placed one at a time and each field panel is seamed immediately after its placement (in order to minimize the number of unseamed field panels exposed to wind); and

- any combination of the above.

If a decision is reached to place all field panels prior to field seaming, it is usually beneficial to begin at the high point area and proceed toward the low point with "shingle" overlaps to facilitate drainage in the event of precipitation. It is also usually beneficial to proceed in the direction of prevailing winds. Accordingly, an early decision regarding installation scheduling should be made if and only if weather conditions can be predicted with reasonable certainty. Otherwise, scheduling decisions must be made during installation, in accordance with varying conditions. In any event, the Installer is fully responsible for the decision made regarding placement procedures.

The CQC Consultant shall evaluate every change in the schedule proposed by the Installer and advise the Construction Contracts Manager on the acceptability of that change. The CQC Consultant shall verify that the condition of the supporting soil has not changed detrimentally during installation.

The CQC Consultant shall record the identification code or roll number, location, date of installation, and dimensions of each field panel.

8.9.2.3 Weather Conditions

Geomembrane placement shall not proceed at an ambient temperature below 40°F or above 104°F unless otherwise authorized by the CCM. Geomembrane placement shall not be done 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 verify that the above conditions are fulfilled. Additionally, the CQC Consultant shall verify that the supporting soil has not been

damaged by adverse weather conditions. The CQC Site Manager shall inform the Construction Contracts Manager if the above conditions are not fulfilled.

8.9.2.4 Method of Placement

The CQC Consultant shall verify 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 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);

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- 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 CQA Manager shall inform the Construction Contracts Manager if the above conditions are not fulfilled.

8.9.2.5 Damage

The CQC Consultant shall inspect each panel, after placement and prior to seaming, for damage. The CQC Manager shall advise the Construction Contracts 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 Section 8.11.3.

8.10 Field Seaming

8.10.1 Seam Layout

At the Pre-Construction meeting the Geosynthetics Installer shall provide the Construction Contracts Manager with a geomembrane seam layout drawing, i.e., a drawing of the facility or area to be lined showing all expected seams. The CQC Consultant shall review the seam layout drawing and verify that it is consistent with accepted state of practice. In addition, panels not specifically shown on the seam layout drawing shall not be used without the CCM prior approval.

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 CCM. A seam numbering system compatible with the panel numbering system shall be agreed upon prior to any seaming.

8.10.2 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 Contracts Manager and the CQC Consultant for approval. Only apparatus which have been specifically approved by make and model shall be used. All seaming apparatus shall be permanently marked with an identification number.

8.10.2.1 Filet Extrusion Process

The filet extrusion-welding apparatus shall be equipped with gauges giving the temperature in the apparatus and at the nozzle.

The Installer shall provide documentation regarding the extrudate to the Construction Contracts Manager , and shall certify that the extrudate is compatible with the specifications, and in any event is comprised of the same resin as the geomembrane sheeting.

The CQC Consultant shall log apparatus seaming technician identification, seaming apparatus identification, temperatures, extrudate temperatures, ambient temperatures, and geomembrane surface temperatures at appropriate intervals.

The CQC Consultant shall verify that:

- the Installer maintains on-site the number of spare operable seaming apparatus agreed to by the CCM and Installer;
- 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;

- a smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage; and

- the geomembrane is protected from damage in heavily trafficked areas.

8.10.2.2 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 log seaming technician identification, seaming apparatus identification, ambient temperatures, and apparatus temperatures.

The CQC Consultant shall also verify that:

- the Installer maintains on-site the number of spare operable seaming apparatus agreed to by the CCM and Installer;

- 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;

- the geomembrane is protected from damage in heavily trafficked areas; and

- a movable protective layer may be used directly below each overlap of geomembrane that is to be seamed to prevent build-up of moisture between the sheets.

8.10.3 Seam Preparation

The CQC Consultant shall verify that:

- prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material;

- seams shall be overlapped a minimum of 4 inches;

- if seam overlap grinding is required, the process is completed according to the Geomembrane Manufacturer's instructions within one hour of 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 0.25 inches of the extrudate after it is placed; and

- seams are aligned with the fewest possible number of wrinkles and "fishmouths".

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8.10.4 Weather Conditions for Seaming

The normally required weather conditions for seaming are as follows:

- Unless authorized in writing by the Construction Contracts 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.

- Above an ambient temperature of 50°F, no preheating is required unless specified by the Manufacturer or Installer.

- In all cases, the geomembrane seam areas shall be dry and protected from wind.

If the Installer wishes to use methods which may allow seaming at ambient temperatures below 40°F or above 104°F, the Installer shall demonstrate and certify that such methods produce seams which are entirely equivalent to seams produced at ambient temperatures between 40°F and 104°F, and that the overall quality of the geomembrane is not adversely affected. In addition, an addendum to the OSDF Construction Subcontract is required which specifically states that the seaming procedure does not cause any physical or chemical modification to the geomembrane that will generate any short or long term damage to the geomembrane. Then, the temperatures in the above quality assurance procedure shall be modified accordingly.

The CQC Consultant shall verify that seaming conducted during abnormal weather conditions is performed in accordance with approved methods as stated above and will advise the Construction Contracts Manager if they are not. The Construction Contracts Manager shall then decide if the installation shall be stopped or postponed.

8.10.5 Overlapping and Temporary Bonding

The CQC Consultant shall verify 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 Contracts Manager (samples shall be submitted to the Construction Contracts 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.

The CQC Consultant shall document the date and time the seam was constructed, the seaming unit used, the seaming technician identification, and other appropriate temperatures and conditions as required by the Construction Contracts Manager, and shall report any non-compliances to the Construction Contracts Manager.

8.10.6 Trial Seams

Trial seams shall be made on fragment pieces of geomembrane liner to verify that seaming conditions are adequate. Such trial seams shall be made at the beginning of each seaming period, and at least once each 4 hours, for each seaming apparatus used that day. Trial seams shall also be made whenever the original testing conditions change, e.g., changes in weather, equipment, or personnel. Also, each seamer shall make at least one trial seam each day. Trial seams shall be made under the same conditions as actual seams. In any event, the CCM has the option of requesting a trial seam test from any field seaming crew or device at any time.

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Extrusion welded trial seam samples shall be at least 3 ft long by 1 ft wide (after seaming) with the seam centered lengthwise. Fusion welded trial seam samples shall be at least 15 ft long by 1 ft wide (after seaming) with the seam centered lengthwise.

Four specimens, each 1 in. wide, shall be cut from the trial seam sample by the Installer. Two specimens shall be tested for shear strength and two specimens shall be tested for peel adhesion using a gauged tensiometer. All specimens tested shall exhibit a Film Tear Bond (FTB) and shall not fail in the seam. In addition, all specimens shall meet or exceed the minimum strength requirements described in Appendix A. If any of the four specimens fails, the entire trial seaming operation shall be repeated. If any of the four additional specimens fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful full trial seams achieved.

The CQC Consultant shall observe the trial seam procedures. The trial seam samples shall be assigned a number and marked accordingly by the CQC Consultant. The Installer shall mark each sample with the date, time, machine temperature(s) and setting(s), number of seaming unit, and name of seaming technician. The sample shall be cut into two pieces, one to be retained in the Construction Contracts Manager's archives, one to be given to the Installer for on-site testing. The archive sample may be tested by the Geosynthetics CQC Laboratory if required by the CCM.

After completion of the above described tests, the remaining portions of the trial seam sample can be discarded. Alternatively, if agreed upon between the parties involved and documented by the CQC Site Manager in his daily report, the Geosynthetic CQC archive portion of the trial seam sample can be subjected to laboratory testing. If a trial seam sample fails a test conducted by the Geosynthetics CQC Laboratory, then a destructive test seam sample shall be taken from each of the seams completed by the seaming technician during the shift related corresponding to the trial seam test. These samples shall be forwarded to the Geosynthetics CQC Laboratory and, if the test fails, the procedure indicated in Section 8.11.3 shall apply.

8.10.7 General Seaming Procedures

Unless otherwise specified, the general seaming procedure used by the Installer shall be 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 OSDF Construction Subcontractor to the satisfaction of the CCM.

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

The CQC Consultant shall verify that the above seaming procedures are followed, and shall inform the Construction Contracts Manager of any non-compliance.

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8.10.8 Nondestructive Seam Continuity Testing

8.10.8.1 Concept

The Installer shall nondestructively test all field seams over their full length using a vacuum test unit, air pressure test (for double fusion seams only). Spark testing shall 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. It does not provide any information on seam strength. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

The CQC Consultant shall:

- observe all continuity testing;
- record location, date, name of tester, and outcome of all testing; and
- inform the Installer and Construction Contracts Manager of any required repairs.

The Installer shall complete any required repairs in accordance with Section 8.11.3.

The CQC Consultant shall:

- observe the repair and re-testing of the repair;
- mark on the geomembrane that the repair has been made; 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.

8.10.8.2 Vacuum Testing

The equipment shall be comprised of the following:

- a vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge;
- a steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections;
- a rubber pressure/vacuum hose with fittings and connections;
- an approved applicator; and
- a soapy solution.

The following procedures shall be followed:

- energize the vacuum pump and reduce the tank pressure to approximately 5 psi gauge;
- wet a strip of geomembrane approximately 12 in. by 48 in. with the soapy solution;
- place the box over the wetted area;
- close the bleed valve and open the vacuum valve;

- ensure that a leak tight seal is created;

- for a period of not less than 10 seconds, examine the geomembrane through the viewing window for the presence of leaks indicated by soap bubbles;

- if no leaks appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 in. overlap, and repeat the process; and

- all areas where soap bubbles appear shall be marked and repaired in accordance with Section 8.11.3.

8.10.8.3 Air Pressure Testing (For Double-Track Fusion Seam Only)

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

The equipment shall be comprised of the following:

- an air pump (manual or motor driven) equipped with pressure gauge capable of generating and sustaining a pressure of 30 psi and mounted on a cushion to protect the geomembrane;

- a rubber hose with fittings and connections;

- a sharp hollow needle, or other approved pressure feed device.

The following procedures shall be followed:

- seal both ends of the seam to be tested;

- insert needle or other approved pressure feed device into the tunnel created by the fusion weld;

- insert a protective cushion between the air pump and the geomembrane;

- energize the air pump to a pressure between 25 and 30 psi, close valve, and sustain pressure for approximately 5 minutes;

- if loss of pressure exceeds 3 psi or does not stabilize, locate faulty area and repair in accordance with Section 8.11.3;

- cut end of tested seam area, opposite the location of the pressure gauge, after completion of the 5 minute pressure hold period to verify complete testing of the seam. If the pressure gauge does not indicate a release of pressure, locate blockage of the air channel and retest until entire seam is tested.

- remove needle or other approved pressure feed device and repair any holes in the geomembrane resulting from the air pressure testing procedure in accordance with Section 8.11.3.

8.10.9 Destructive Testing

8.10.9.1 Concept

Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

8.10.9.2 Location and Frequency

The CQC Consultant shall select locations where seam samples will be cut out for laboratory testing. Those locations shall be established as follows.

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- 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 Installer shall not be informed in advance of the locations where the seam samples will be taken.

8.10.9.3 Sampling Procedures

Samples shall be cut by the Installer as the seaming progresses in order to have laboratory test results before the geomembrane is covered by another material. 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 sampling shall be immediately repaired in accordance with repair procedures described in Section 8.11.3. The continuity of the new seams in the repaired area shall be tested according to Section 8.10.9.

8.10.9.4 Size of Samples

At a given sampling location, two types of samples (field test samples and laboratory test samples) shall be taken by the Installer.

First, 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 Section 8.12.10.5, 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 portion to the Installer for laboratory testing, 12 in. by 12 in.;
- one portion to the Construction Contracts Manager for archive storage, 12 in. by 12 in.; and
- one portion for Geosynthetics CQC Laboratory testing, 12 in. by 18 in.

Final determination of the sample sizes shall be made at the Pre-Construction Meeting.

8.10.9.5 Field Testing

The two 1 in. wide strips mentioned in Section 8.10.10.4 shall be tested by the Installer in the field, for peel adhesion, using gauged tensiometer. In addition to meeting the strength requirements outlined in Appendix A, 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, then the procedures outlined in Section 8.10.10.8 shall be followed.

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.

8.10.9.6 Geosynthetics CQC Laboratory Testing

Destructive test samples shall be packaged and shipped, if necessary, under the direction of the CQC Consultant in a manner which will not damage the test sample. The Construction Contracts Manager will be responsible for storing the archive samples. This procedure shall be fully outlined prior to shipment. 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 given in the specifications. 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 fushion 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 Contracts Manager.

8.10.9.7 Installer's Laboratory Testing

The Installer's laboratory test results shall be presented to the Construction Contracts Manager for comments.

8.10.9.8 Procedures for Destructive Test Failure

The following procedures shall apply whenever a sample fails a destructive test, whether that test conducted by the Geosynthetics CQC Laboratory, the Installer's laboratory, or by gauged tensiometer. The Installer has two options:

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

- The 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 test in accordance with Section 8.10.10.5 at each location. If these additional isolation samples pass the test, then full laboratory samples are taken at both locations. If these laboratory samples pass the tests, 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 acceptable 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 Section 8.11.3.

The CQC Consultant shall document all actions taken in conjunction with destructive test failures.

8.11 Defects and Repairs

8.11.1 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 geomembrane surface shall be broomed or washed by the Installer if the amount of dust or mud inhibits examination.

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8.11.2 Evaluation

Each suspect location both in seam and non-seam areas shall be repaired by the Geosynthetic Installer in accordance with methods described in Section 8.11.3 and non-destructively tested using the methods described in Section 8.10.9 as appropriate. Each location which fails the nondestructive testing shall be marked by the CQC Consultant and repaired by the Installer. Work shall not proceed with any materials which will cover locations for which passing test results have not been verified by the CQC Consultant.

8.11.3 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Installer and CCM. The procedures available include:

- patching, used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter;
- grinding and rewelding, used to repair small sections of extruded seams;
- spot welding or seaming, used to repair minor, localized flaws;
- capping, used to repair large lengths of failed seams;
- removing a failed seam and replacing with a strip of new material welded into place (used with large lengths of fusion seams).

In addition, the following provisions shall be satisfied:

- 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 in advance of the specific repair by the CCM and Installer;
- 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.

8.11.4 Verification of Repairs

Each repair shall be numbered and logged. Each repair shall be non-destructively tested using the methods described in Section 8.11.9 as appropriate. 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 CCM. Failed destructive tests will be isolation as described in Section 8.10.9.8. The CQC Consultant shall observe all non-destructive testing of repairs and shall record the number of each repair, date, and test outcome.

8.11.5 Expansion and Subcontraction

The following procedures shall be implemented during the geomembrane installation in order to address the effects of expansion and subcontraction when placing, seaming, or backplacing the geomembrane. The Installer shall consider the following during the geomembrane installation:

- sufficient slack shall be placed in the geomembrane to compensate for the coldest temperatures envisioned so that no tensile stresses are generated in the

geomembrane or in its seams either during installation or subsequently after the geomembrane is covered;

- the geomembrane shall have adequate slack such that it does not lift up off the subgrade or substrate material at any location within the facility, i.e., no "trampolining" of the geomembrane shall be allowed to occur at any time;

- the geomembrane shall not have excessive slack to the point where creases fold over upon themselves either during the placement and seaming, or when the protective soil or drainage materials are placed on the geomembrane;

- permanent (fold-over type) creases in the covered geomembrane should not be permitted at any time; and

- the amount of slack to be added to the deployed and seamed geomembrane should be carefully considered and calculated by the Installer and Resident Engineer, taking into account the type of geomembrane and the geomembrane's temperature during installation versus its final temperature in the completed facility.

8.12 Liner system Acceptance

The Installer and the Manufacturers shall retain all ownership and responsibility for the geosynthetics in the liner system until acceptance by the Construction Contracts Manager.

The geosynthetic liner system shall be accepted by the Construction Contracts Manager when:

- the installation is finished;

- verification of the adequacy of all seams and repairs, including associated testing, has been completed by the CQC Consultant;

- all documentation of installation is completed including the CQC Consultant's final report; and

- certification, including record drawing(s), sealed by a registered professional engineer has been received by the Construction Contracts Manager.

The CQC Engineering Manager shall certify that installation has been constructed in accordance with the project plans and specifications.

8.13 Materials in Contact with the Geomembrane

The quality assurance procedures indicated in this section are only intended to assure that the installation of these materials does not damage the geomembrane. Additional quality assurance procedures are necessary to assure that systems built with these materials will be constructed in such a way to ensure proper performance.

8.13.1 Soils

The OSDF Construction Subcontractor shall take 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 verify the following:

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

- during soil placement operations above the geomembrane all attempts shall be made by the OSDF Construction 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 of soil is specified 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 specified between rubber-tired vehicles and the geomembrane;

- in heavily trafficked areas such as access ramps, soil thickness should be at least 3 ft; and

Unless otherwise approved by the CCM, all equipment used to spread and compact soils directly overlying the geomembrane shall comply with the following requirement:

Maximum Allowable Equipment Ground Pressure (psi)	Initial Lift Thickness of Overlying Compacted Fill (in)
<5	12
<10	18
<20	24
>20	36

8.13.2 Appurtenances

The CQC Consultant shall verify that:

- installation of the geomembrane in appurtenant areas, and connection of geomembrane to sumps and appurtenances have been made according to specifications;

- extreme care is taken while seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and

- the geomembrane has not been visibly damaged while making connections to sumps and appurtenances;

The CQC Consultant shall inform the Construction Contracts Manager if the above conditions are not fulfilled.

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TABLE 8-1:

GEOMEMBRANE CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY
Specific Gravity	ASTM D792 Method A or ASTM D1505	1 test per 100,000 ft^2
Thickness	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

TABLE 8-2:

GEOMEMBRANE SEAM TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY
Peel Adhesion	ASTM D4437 (as modified in NSF 54, Appendix A)[1,3]	1 test every 500 ft of seam length
Bonded Seam Strength	ASTM D4437 (as modified in NSF 54, Appendix A)[2,3]	1 test every 500 ft of seam length
Vacuum Testing	—	100 percent of extrusion welded seams
Air Pressure Testing	---	100 percent of wedge welded seams

[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.

9. GEOSYNTHETIC CLAY LINER

9.1 Introduction

The geosynthetic clay liner specified for the OSDF project shall consists of an internally-reinforced bentonite clay material (sodium montmorillonite) core with a geotextile backing on each side. The hydraulic conductivity of the GCL shall by no greater than 3 x 10^{-9} cm/s. The bentonite component of the GCL shall be applied at a minimum concentration of 1 pound per square foot, when measured at a water content of less than or equal to 22 percent. The GCL shall be manufactured with continuous waterproof overlap marks or lines on each side of the roll which indicate the minimum required overlap.

9.2 Related Project Specifications

The OSDF Subcontractor shall comply with the project specification titled "*Geosynthetic Clay Liner.*" This specification shall be referenced for the various physical properties and installation requirements of the GCL materials.

9.3 Manufacturing and Quality Control

The GCL Manufacturer will provide the CCM with a list of guaranteed minimum average roll value properties (defined as the mean less two standard deviations) for the type of GCL to be delivered. The GCL Manufacturer will also provide the CCM with a written certification signed by a responsible party that the materials actually delivered have minimum average roll value properties which meet or exceed all property values guaranteed for that type of GCL.

The GCL Manufacturer shall submit quality control documentation to the CCM upon delivery of the materials to the site. The CQC Consultant will examine all manufacturer certifications to ensure that the property values listed on the certifications meet or exceed those specified for the particular type of GCL. Any deviations will be reported to the Construction Contracts Manager.

At a minimum, the quality control certifications shall include the following:

- roll identification numbers;
- sampling frequencies; and
- quality control test results.

The GCL Manufacturer shall provide, as a minimum, the following quality control test results:

- moisture content(ASTM D 4643);
- free swell (GRI-GCL1);
- hydraulic conductivity (ASTM D 5084);
- thickness (ASTM D 5199); and
- mass per unit area (ASTM D 5261).

In addition, the GCL Manufacturer shall verify that:

- the geotextiles use to manufacture the GCL meet the manufactures specifications; and
- needle punched nonwoven geotextiles have been inspected continuously for broken needles using an in-line metal detector.

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Quality control tests shall be performed by the GCL Manufactures at a minimum frequency of once every 40,000 ft^2. The CQC Consultant shall examine the GCL Manufacturer's certifications to ensure that the property values reported meet or exceed those specified for the GCL. The CQC Consultant shall verify that measurements of properties by the GCL Manufacturer are properly documented, test methods acceptable and the certificates have been provided at the specified frequency. Any deviations shall be reported to the Construction Contracts Manager.

9.4 Labeling

The CQC Consultant shall verify that the GCL Manufacturer has identified all rolls of GCL in accordance with the standards described in ASTM D 4873 and, as a minimum with the following:

- GCL Manufacturer's name;
- product identification;
- lot or batch number;
- roll number;
- roll weight; and
- roll dimensions.

Additionally, if any special handling of the GCL is required, it will be so marked on the top surface of the geotextile, (e.g., "This Side Up").

The CQC Consultant will examine rolls upon delivery and any deviation from the above requirements will be reported to the Construction Contracts Manager.

9.5 Shipment and Storage

The OSDF Construction Subcontractor shall follow the material handling and storage requirements presented in ASTM D 4873. Handling of the rolls shall be performed in a competent manner such that damage does not occur to the GCL or its protective wrapping. Any protective wrapping that is damaged or stripped off the rolls shall be repaired immediately to the satisfaction of the CCM. During transportation, handling, and storage the GCL rolls will be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

Geosynthetic clay liner shall not be exposed to precipitation. All GCL shall be installed and covered with the overlying geosynthetics daily, in accordance with the project specifications.

The CQC Consultant will observe and document the GCL rolls delivered to the site. Any deviation from the above requirements will be reported to the Construction Contracts Manager. The OSDF Construction Subcontractor shall provide the equipment to offload the rolls of GCL from the transport equipment. All damaged GCL roll will be replaced at the OSDF Construction Subcontractor's expense.

9.6 Conformance Testing

9.6.1 Tests

Upon delivery of the rolls of GCL, the CQC Consultant will ensure that, samples are removed and forwarded to the Geosynthetic CQC Laboratory for testing to ensure conformance to both the design specifications and the list of guaranteed properties provided by the manufacturer. Mass per unit area (ASTM D 3776) and hydraulic conductivity (ASTM D 5084) tests shall be performed for each conformance sample.

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9.6.2 Sampling Procedures

Samples will be taken across the entire width of the roll. Unless otherwise specified, 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. Samples will be taken at a rate of one per lot or one per 100,000 ft^2 whichever yields the greater number of samples. The rolls shall be immediately re-wrapped and replaced in their shipping trailers or in the temporary Field Storage area.

9.6.3 Test Results

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

9.6.4 Conformance Test Failure

The following procedure will apply whenever a GCL conformance sample fails a conformance test that is conducted by the Geosynthetics CQC Laboratory. In the case of failing test results, the GCL Manufacturer may request that another sample from the failing roll be retested by the Geosynthetics CQC laboratory with the Manufacturer's technical representative present during the test 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 CCM. The GCL Manufacturer shall replace all rejected rolls. The CQC Consultant shall document all actions taken in conjunction with GCL conformance failures.

9.7 Surface Preparation

The Geosynthetics Installer will certify in writing that the surface on which the GCL will be installed is acceptable. The subgrade surface preparation and acceptance requirements identified in Sections 7.3 and 8.7 of this CQA Plan shall apply. The certificate of acceptance will be given by the Installer to the CCM prior to commencement of GCL installation in the area under construction.

After the supporting materials have been accepted by the Installer, it will be the responsibility of the Installer and CQC Consultant to notify the Construction Contracts Manager of any change in the supporting materials condition that may require repair work.

9.8 Handling and Placement

The Geosynthetics Installer shall take all necessary precautions to protect the underlying subgrade during GCL deployment operations. The Installer will handle all GCL in such a manner as to ensure they are not damaged in any way, and the following will be complied with:

- on slopes, the GCL will be secured and then rolled down the slope in such a manner as to continually keep the GCL panel in tension;
- in the presence of wind, all GCL will be weighted with sandbags or the equivalent;
- GCL will be kept continually under tension to minimize the presence of wrinkles;
- if in place, special care must be taken to protect other materials from damage which could be caused by the cutting of the GCL;

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- GCL should be cut using a utility blade in a manner recommended by the Manufacturer;

- during placement of GCL, care will be taken not to entrap fugitive clay, sand, stones other debris under the GCL;

- the exposed GCL shall be protected from damage in heavily trafficked areas;

- a visual examination of the GCL shall be carried out by the CQC Consultant over the entire surface, after installation, to ensure that damaged areas, if any, are identified and repaired;

- if a white colored GCL is used, precautions will be taken against "snowblindness" of personnel;

- if soil is to cover the GCL the soil placement activities shall be performed in such a manner that the GCL or underlying materials are not damaged; and

- the direction of soil placement shall proceed in the direction of the downgradient shingling of the GCL overlaps.

The CQC Consultant will note any non-compliance and report it to the Construction Contracts Manager.

9.9 Overlaps

GCL panels shall be overlapped at a minimum of 6 in. along panel lengths and a minimum of 12 in. along panel ends. Dry bentonite powder shall be applied, at a minimum concentration of 1 lb/ft, around pipe penetrations or other perforations of GCL which may be required. The CQC Consultant shall monitor and verify the Geosynthetics Installers GCL overlapping procedures conform to the requirements of this section.

9.10 Repair

Any holes or tears in the GCL or the geotextile backing will be repaired by placing a patch made from the same type GCL 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 CCM to avoid shifting during backplacing with soil or covering with another geosynthetic.

The CQC Consultant will observe the GCL repair, procedures and report any non-compliance with the above requirements to the Construction Contracts Manager.

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TABLE 9-1:

GCL CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY
Mass Per Unit Area	ASTM D3776	1 test per 100,000 ft^2
Hydraulic Conductivity	ASTM D5084	1 test per 100,000 ft^2

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10. GEOTEXTILE FILTER AND CUSHION

10.1 Introduction

Geotextiles consisting of nonwoven polymeric fibers shall be installed over the primary and secondary geomembranes as well as the geomembranes cover of the OSDF. These geotextiles are intended to cushion the underlying geomembranes from the overlying granular drainage materials. Nonwoven geotextiles shall also be used to separate materials of different grain size and hydraulic conductivity. These types of geotextiles are intended to filter liquids while restricting the movement of particles from one soil layer to another. CQA monitoring, testing and documentation will be required for all geotextiles used on the OSDF project.

10.2 Related Project Specifications

The OSDF Subcontractor shall comply with the OSDF project specifications. These specifications shall be referenced for specific details of the geotextile material properties and installation requirements.

10.3 Manufacturing Quality Control

The Geotextile Manufacturer shall provide the CCM with a list of guaranteed minimum average roll value properties (defined as the mean less two standard deviations), for each the type of geotextile on the OSDF Project. The Geotextile Manufacturer shall also provide the CCM with a written quality control certification signed by a responsible party employed by the manufacturer that states the materials intended for use on the OSDF project have properties (minimum average roll values) which meet or exceed all property values guaranteed for that type of geotextile. The CQC Consultant shall, in turn, verify that the Geotextile Manufacturers minimum average roll values meet or exceed the requirement of project specifications. At a minimum, the Geotextile Manufacturers/Quality Control certificates shall include the following:

- roll identification numbers;
- sampling frequencies; and
- quality control test results.

The Geotextile Manufacturer shall provide, as a minimum, quality control test results for the following:

- mass per unit area (ASTM D 5261);
- grab tensile strength (ASTM D 4632);
- trapezoidal tear strength (ASTM D 4533);
- burst strength (ASTM D 3786);
- puncture resistance (ASTM D 4833);
- thickness (ASTM D 5199);
- apparent opening size (ASTM D 4751); and
- permitivity (ASTM D 4491).

Quality control tests shall be performed by the Geotextile Manufacturer in accordance with the test methods described above for every 50,000 ft^2 of geotextile produced for the OSDF project. The Geotextile Manufacturer shall also provide a written certification that the nonwoven, needle-punched geotextiles are continuously inspected and found to be needle-free.

The CQC Consultant shall review the Geotextile Manufacturer certifications to ensure that the property values listed on the certifications meet or exceed those specified for the particular type of geotextile. The CQC Consultant shall verify that the measurements of properties by the Geotextile Manufacturer are properly documented,

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test methods acceptable and the certificates have been provided at the specified frequency. Any deviations shall be reported to the Construction Contracts Manager.

10.4 Labeling

The Geotextile Manufacturer shall identify all rolls of geotextile in accordance with the standards set forth in ASTM D 4873 and the following minimum requirements with the following:

- manufacturer's name;
- product identification;
- lot number;
- roll number; and
- roll dimensions.

Additionally, if any special handling of the geotextile is required, it shall be so marked on the top surface of the geotextile, e.g., "This Side Up". The CQC Consultant shall examine rolls upon delivery and any deviation from the above requirements shall be reported to the Construction Contracts Manager.

10.5 Transportation, Handling and Storage

All rolls of geotextiles shall be enclosed by the Geotextile Manufacturer in a protective wrapping that is opaque and waterproof. The protective wrapping is intended to prevent degradation from atmospheric exposure (ultraviolet light zone, ozone, etc.) moisture uptake (rain, snow) and to a limited extent accidental damage. The OSDF Construction Subcontractor shall recognize that the geotextiles are the most sensitive of all geosynthetics to ultraviolet light exposure and must therefore take all necessary precautions against prolonged exposure. 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 or more than 30 days, unless otherwise specified by the CCM and guaranteed by the Geotextile Manufacturer.

Outdoor storage of rolls shall not exceed the Geotextile 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 of the ground to prevent water from ponding.

The CQC Consultant shall observe rolls upon delivery to the site and again immediately prior to use. Any deviation from the above requirements shall be reported to the Construction Contracts Manager. Any damaged rolls shall be rejected and replaced at no cost to FERMCO.

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10.6 Conformance Testing

10.6.1 Tests

Upon delivery of the rolls of geotextiles and geogrids, the CQC Consultant shall ensure that test samples are obtained. These sample are than to be forwarded to the Geosynthetics CQC Laboratory for testing to ensure that the supplied geotextile conforms to the project plans and specifications.

As a minimum, the following conformance tests shall be performed on geotextiles used for both filter and cushion applications:

- mass per unit area (ASTM D 5261);
- grab tensile strength (ASTM D 4632);
- trapezoidal tear strength (ASTM D 4533);
- burst strength (ASTM D 3786); and
- puncture resistance (ASTM D 4833).

In addition, the following conformance tests will be performed on geotextiles used for filter applications only:

- apparent opening size (ASTM D 4751); and
- permittivity (ASTM D 4491).

10.6.2 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 CQC Consultant shall mark the machine direction on the samples with a waterproof

marker and otherwise label each sample with the appropriate conformance sample number, lot or batch number, roll number, date sampled, and CQC Personnel identification.

Unless otherwise specified, samples shall be taken at a rate of one per lot or one per 100,000 ft^2, whichever results in the greater number of samples. The geotextile rolls which are samples shall be immediately rewrapped in their protective coverings to the satisfaction of the CCM.

10.6.3 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 C. Any non-conformance shall be reported to the Construction Contracts Manager.

10.7 Placement

The Geosynthetics Installer shall place all geotextiles in such a manner as to ensure they are not damaged in any way, and the following shall be complied with.

- 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 or other device recommended by the Geotextile Manufacturer. Special care must be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.

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- The Installer shall take any 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.

The CQC Consultant shall note any non-compliance and report it to the Construction Contracts Manager.

10.8 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 observe the geotextile seaming procedures and report any non-compliance to the Construction Contracts Manager.

10.9 Repair

Any holes or tears in the geotextile shall be repaired as follows:

- On slopes: A patch made from the same geotextile shall be double seamed into place (with each seam 1/4 in. to 3/4 in. apart and no closer than 1 in. from any edge). 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 shall be 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 any repair, note any non-compliance with the above requirements and report them to the Construction Contracts Manager.

10.10 Placement of Soil Materials

The OSDF Construction Subcontractor shall place all soil materials located on top of a geotextile, in such a manner as to ensure:

- that no damage occurs to the geotextile;

- that no shifting of the geotextile from its intended position occurs and underlying materials are not exposed or damaged;

- that excess tensile stress does not occur in the geotextile.

Soil backfilling or covering of the geotextile with another geosynthetic shall be completed within 30 days or otherwise specified by the CCM. On side slopes soil backfill shall be placed over the geotextile from the bottom of the slope upward. Unless otherwise specified by the CCM, soil materials shall be placed in conformance with the following guidelines:

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Equipment Ground Pressure psi	Minimum Loose Lift Thickness in.
< 5	12
< 10	18
< 20	24
> 20	36

Any non-compliance shall be noted by the CQC Consultant and reported to the Construction Contracts Manager.

TABLE 10-1:

GEOTEXTILE FILTER CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY1[1]
Mass per Unit Area	ASTM D5261	1 test per 100,000 ft^2
Grab Strength	ASTM D4632	1 test per 100,000 ft^2
Trapezoidal Tear Strength	ASTM D4533	1 test per 100,000 ft^2
Burst Strength	ASTM D3786	1 test per 100,000 ft^2
Puncture Resistance	ASTM D4833	1 test per 100,000 ft^2
Thickness	ASTM D5199	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

[1] Testing shall be carried out at a frequency of one per lot or at listed frequency, whichever results in the greater amount of samples.

TABLE 10-2:

GEOTEXTILE CUSHION CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[1]
Mass per Unit Area	ASTM D5261	1 test per 100,000 ft^2
Grab Strength	ASTM D4632	1 test per 100,000 ft^2
Trapezoidal Tear Strength	ASTM D4533	1 test per 100,000 ft^2
Burst Strength	ASTM D3786	1 test per 100,000 ft^2
Puncture Resistance	ASTM D4833	1 test per 100,000 ft^2
Thickness	ASTM D5199	1 test per 100,000 ft^2

[1] Testing shall be carried out at a frequency of one per lot or at listed frequency, whichever results in the greater amount of samples.

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11. HDPE MANHOLES, PIPES, FITTINGS AND VALVES

11.1 Introduction

This section of the CQA plan is devoted toward ancillary materials such as manholes and pipes for leachate collection, transmission and removal.

11.2 Related Project Specifications

The OSDF Subcontractor shall comply with the project specifications. These specifications shall be referenced for specific details regarding the requirements for HDPE manholes, pipes, placings and valves.

11.3 Material Requirements

11.3.1 Polyethylene Compound

The HDPE manholes, pipes, and fittings shall be manufactured using resins with typical densities ranging between 0.950 and 0.960 g/cc and shall conform to the requirements of ASTM D 1248, Type III. The HDPE material shall contain 97 to 98 percent resin approximately 2 percent carbon black and up to 1 percent additives.

The polyethylene compound will have a minimum resistance of 125 hours when tested for environmental stress crack in accordance with requirements of ASTM D 1693, Procedure B. Compliance with the above requirements must be certified by the pipe supplier.

11.3.2 Pipe and Fittings

The pipe and fittings will have a cell classification of PE 355434C under ASTM D 3350 and meet or exceed all the requirements of ASTM D 3350. Pipes will be of uniform color and thickness.

Each length of pipe will be suitably marked as to its pressure rating for water at 73.4°F. Pipe will have a minimum Standard Diameter Ratio (SDR) stated on the Drawings. All pipe fittings will be furnished by the manufacturer of the pipe shall comply with ASTM F 714. Compliance with the above requirements must be certified by the pipe supplier. All certifications shall be submitted to the CCM for review and approval. The CQC Consultant shall inform the Construction Contracts Manager of any non-compliance.

11.3.3 Joints

Lengths of pipe will be assembled 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. This process will be applied by personnel experienced with the process. The Pipe Installer shall provide certifications which state that the person performing this work is qualified by experience and instruction in the butt-fusion procedure to be used on the project. All pipe so joined will be made from the same class and type of raw material made by the same raw material supplier.

All stub ends for attachment to the polyethylene pipe will be made from the same type and grade of polyethylene, from the same raw material supplier as the pipe, and will be butt-fused to the pipe ends.

The polyethylene stub ends at joints will be backed up by nylon-coated steel flanges conforming to ANSI B16.1 and shaped as necessary to suit the outside dimensions of the pipe. The stub ends will be connected with corrosion resisting bolts and nuts of Type 316 Stainless Steel as specified in ASTM A 726 and ASTM A 307.

Flat gaskets of 1/8 in. black reinforced rubber conforming to ANSI B16.21 will be installed between the opposing ends of the stub ends.

In no case will threaded male or female adapters of any plastic material be used for adapting polyethylene pipe to systems, fitting or auxiliary equipment of other materials, or for joining the installation lengths to each other.

Termination to pipes, valves, or fittings made of other material will be by the flanged joints outlined above. The pipe adjacent to these joints and to the joints themselves must be rigidly supported for a distance of one pipe diameter beyond the flange.

11.4 Manufacturing and Quality Control

Prior to the installation of HDPE manholes and pipes, the Manufacturers shall provide to the Construction Contracts Manager:

- a properties' sheet including, at a minimum, all specified properties, measured using test methods indicated in the specifications, or equivalent;
- a summary of the butt fusion welding personnel training requirements;
- a list of quantities and descriptions of materials other than the base polymer which comprise the pipe;
- a listing of the quality control sampling procedures and test results;
- the manufacturer's recommended butt-fusion welding procedures;
- a listing of welding personnel along with a summary of each individual's experience with materials similar to those proposed for use on the OSDF; and

- a certification that property values given in the properties sheet are minimum values and are guaranteed by the Manufacturer.

The CQC Consultant will verify that:

- the personnel designated to perform butt-fusion welding procedures are properly trained and certified by the Manufacturer;

- the property values certified by the Manufacturer meet all of the specifications; and

- the measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.

Prior to shipment, the Manufacturer will provide the Construction Contracts Manager with a quality control certificate for each lot/batch of HDPE pipe supplied. The quality control certificate will be signed by a responsible party employed by the Pipe Manufacturer, such as the Production Manager. The quality control certificate will include:

- lot/batch numbers and identification; and

- sampling procedures and results of quality control tests.

The CQC Consultant will:

- verify that the quality control certificates have been provided at the specified frequency for all lots/batches of pipe, and that each certificate identifies the pipe lot/batch related to it; and

- review the quality control certificates and verify that the certified properties meet the specifications.

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11.5 Transportation, Handling and Storage

The HDPE pipe shall be manufactured in lengths approximately 20 ft. The pipe is to be segregated by wall thickness and diameter. 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. Large size pipeover 24 in. in diameter shall be handled individually.

Offloading of the palletized pipe shall be the responsibility of the OSDF Construction Subcontractor. Handling of the pallets shall be done in a competent manner and shall not be 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.

11.6 Conformance Testing

11.6.1 Tests

If deemed necessary, the CCM will select one sample of each size of pipe, at least 3 ft in length, and forward that sample to the Geosynthetic CQC Laboratory for conformance testing. The samples will be taken from sections of pipe which are predetermined to have excess lengths. Any samples failing to conform to the original specifications will result in rejection of all pipe of that size.

As minimum the following conformance tests shall be performed on the HDPE pipe supplied to the project:

- physical dimensions (ASTM D 2122);

- density (ASTM D 1505);
- plate bearing test (ASTM D 2412); and
- impact resistance (ASTM D 2444).

11.6.2 Sampling Procedures

Conformance samples of the HDPE pipe shall at least be 3 ft in length. All samples shall be labeled by the CQC Consultant with the appropriate conformance sample number, lot or batch number, date sampled, and CQC personnel identification. Unless stated otherwise, conformance samples shall be obtained at a frequency of once sample per lot, not to exceed one sample per 1000 liner ft of pipe.

11.6.3 Test Results

The CQC Consultant shall be responsible for reviewing all HDPE pipe conformance test results. The CQC Consultant shall verify compliance of the test results with the requirements of project plans and specification. Any non-conformance shall be reported to the CCM.

11.7 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 OSDF Construction Subcontractor when installing manholes and pipes. Chains, cables, or hooks inserted into the pipe ends will not be used. Two slings spread apart shall be used for lifting lengths of pipe.

The CQC Consultant shall verify that installation of the manholes and pipe will be in such a manner that the materials are not damaged by dragging it over sharp and cutting objects. Slings for handling the pipeline will not be positioned at butt-fused joints. Sections of the pipes with deep cuts and/or gouges will be removed and the ends of the pipeline rejoined. Care will be exercised when lowering pipe into the trench to prevent damage or twisting of the pipe.

Butt-fusion of pipes and fittings will be performed in accordance with the pipe manufacturer's recommendations as to equipment and technique. Depending on site conditions, butt-fusion joining will be performed in or outside of the excavation.

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12. MECHANICAL CQA

12.1 Introduction

This Section includes all the general requirements for the CQA of materials and workmanship in the installation of mechanical systems for the following:

- temporary lift station pumps, check valve, manual valves, flowmeter, pump enclosure piping, pumps control panel, associated instrumentation, radio receiver, radio transmitter, radio antennae, trouble strobe lights, and all other work indicated on Construction Drawings or as specified;

- permanent lift station electrically actuated isolation valve, lift station control panel, associated instrumentation, radio transmitters, radio antenna, trouble strobe light, and all other work indicated on Construction Drawings or as specified;

- leak detection manholes control panels and associated instrumentation, trouble strobe lights, and all other work indicated on Construction Drawings or as specified; and

- leachate collection manholes manual valves, and all other work indicated on Construction Drawings or as specified.

12.2 Related Project Specifications

The OSDF Subcontractor shall comply with the project specifications. These specifications shall be referenced for specific details of the mechanical equipment requirements and installation.

12.3 Submittal

At least 10 working days prior to the start of installation of mechanical equipment, the OSDF Construction Subcontractor shall submit for review, details of all materials, equipment, and systems to be furnished in accordance with the plans and specifications. Shop drawings shall include dimensions, ratings, mounting requirements, clearances, components interface, wiring diagrams, and other information required for proper evaluation and complete installation. "Record" copies of all shop drawings shall be submitted to the CCM before final inspection and acceptance. No material shall be ordered or shop work started until the Resident Engineer's review of shop drawings has been completed.

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

The approval of systems, equipment, and shop drawings is a general approval subject to the subcontract drawings, specifications, and verification of all measurements at the job site. Approval does not relieve the OSDF Construction Subcontractor from the responsibility of shop drawing errors. The OSDF Construction Subcontractor shall carefully check and correct all shop drawings prior to submission for approval. The Resident Engineer shall notify the CCM upon the approval of the mechanical submittal.

12.4 Codes, Rules, Inspections, and Workmanship

The CQC Consultant shall verify that mechanical appurtenances are installed in accordance with Standard Mechanical and Plumbing Codes (the latest edition at time of bid) and regulations or authorities having jurisdiction over the work. The CQC Consultant shall observe and document construction acceptance testing procedures performed by the OSDF Construction Subcontractor. The CQC Consultant shall also observe and document operational testing performed by the OSDF Construction Subcontractor. The certificates of final inspection and certificates of approval of all

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authorities shall be submitted by the OSDF Construction Subcontractor to the CCM upon completion of the work.

The CQC Consultant shall verify that all electrical appurtenances are installed in accordance with applicable codes and regulations. The CQC Consultant shall observe and document construction acceptance testing procedures performed by the OSDF Construction Subcontractor. The certificates of final inspection and certificates of approval of all authorities shall be submitted by the OSDF Construction Subcontractor to the CCM upon completion of the work.

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13. ELECTRICAL CQA

13.1 Introduction

This Section includes the general requirements for the CQA of materials and workmanship in the installation of electrical systems including the following: power wiring, including power circuit connections for pump motors, radio transmitter, radio receivers, and telephone system raceways and equipment mounting boards as indicated in the plans and specifications.

13.2 Related Project Specifications

The OSDF Subcontractor shall comply with the project specifications. These specifications shall be referenced for specific details of the electrical equipment requirements and installation.

13.3 Submittal

At least 10 working days prior to the start of installation of mechanical equipment, the OSDF Construction Subcontractor shall submit for review by the CCM, details of all materials, equipment, and systems to be furnished in accordance with requirements of the plans and specifications.

The OSDF Construction Subcontractor shall submit a listing of all the materials indicated below, with the type of material, manufacturer, and catalog or model number for each. This will include: junction boxes, pull boxes, wireways, raceways, wire, cables, wiring devices, plates, nameplates, and alarm devices.

The OSDF Construction Subcontractor shall submit complete shop drawings of dry type transformers, panelboards, cabinets, and pump controllers. Shop drawings shall include dimensions, weight, ratings, mounting requirements, clearances, components interface, wiring diagrams, and other information required for proper

evaluation and complete installation. "Record" copies of all shop drawings shall be submitted to the CCM before final inspection and acceptance. No material shall be ordered or shop work started until the Resident Engineer's review of shop drawings has been completed.

The approval of systems, equipment, and shop drawings is a general approval subject to the subcontract drawings, specifications, and verification of all measurements at the job site. Approval does not relieve the OSDF Construction Subcontractor from the responsibility of shop drawing errors. The OSDF Construction Subcontractor shall carefully check and correct all shop drawings prior to submission for approval. The Resident Engineer shall notify the CCM upon approval of the electrical submittal.

13.4 Record Drawings

The OSDF Construction Subcontractor shall provide and maintain at the site a set of prints on which the actual installation of all work under this Section shall be accurately shown, indicating any variation from subcontract drawings. Changes in circuitry shall be clearly and completely indicated as the work progresses. These progress prints shall be available for inspection by the Resident Engineer and CCM and shall be used to determine the progress of electrical work.

At the completion of the work, the OSDF Construction Subcontractor shall prepare a new set of record drawings, of the work actually noted on the marked-up prints, including the dimensioned location of all underground conduit. The OSDF Construction Subcontractor shall furnish these record drawings to the CCM for approval.

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14. CAST-IN-PLACE CONCRETE CQA

14.1 Introduction

This Section addresses the general requirements for the CQA of Cast-in-Place Concrete materials and workmanship.

14.2 Project Related Specifications

The OSDF Construction Subcontractor shall comply with the OSDF project specifications. These specifications shall be referenced for specific details of the cast-in-place concrete requirements and installation.

14.3 Submittal

Prior to placing any concrete, the OSDF Construction Subcontractor shall submit all information required by the project specifications to the Construction Contracts Manager. Placement of concrete shall be prohibited until the OSDF Construction Subcontractor has satisfied all submittal requirements and received the approval Construction Contracts Manager.

14.4 Inspections

The OSDF Construction Subcontractor shall 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 CCM. The OSDF Construction Subcontractor will be responsible for notifying the CCM at least 24 hours in advance of all concrete placement activities and scheduling the inspections activities described above.

14.5 Field Quality Control Testing

Concrete conformance testing is the responsibility of the OSDF Construction Subcontractor. The OSDF Construction Subcontractor shall meet the following requirements:

- The OSDF Construction Subcontractor shall furnish molds and concrete required for casting specimens and testing. Samples will be obtained 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 six standard cylinders from a batch. At least two specimens of the set will be tested for 2-day, 7-day, and 28-day compressive strength.

- The OSDF Construction Subcontractor shall determine compressive strengths from standard test specimens taken according to ASTM C 31 and ASTM C 172, and cured and tested in accordance with ASTM C 39 by the laboratory. Core drilling, if required, and testing will be in accordance with ASTM C 94.

- Slump, air content, cement factor, and concrete unit weight will 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. Cement factor and unit weight shall be determined in accordance with ASTM C 138.

The OSDF Construction Subcontractor shall be responsible for documenting all test results. The test results shall be submitted daily to the CCM for review. The CCM has the option of requiring the OSDF Construction Subcontractor to obtain duplicate test specimens for testing by an independent CQC laboratory. The CQC Consultant shall verify the concrete conformance tests are performed in accordance with ASTM or ACI procedures and that test results meet or exceed the requirements of the project specifications. Materials which fail to meet the requirements of this section or the requirements of the plans and specifications shall be rejected.

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15. ROAD CONSTRUCTION

15.1 Introduction

This section of the CQA plan describes the activities which are to be performed during construction of the various haul roads and paved surfaces for the OSDF project.

15.2 Project Related Specifications

The OSDF Construction Subcontractor shall comply with the project specifications. These shall be referenced for specific details regarding the labor materials, supervision, and installation of roads and paved surfaces, respectively.

15.3 Submittal

A minimum of 10 days prior to start of road and/or paved surface construction, the OSDF Construction Subcontractor shall submit all information required by the specifications described above to the resident engineer for review. The CCM shall be responsible for notifying the CCM upon approval of the OSDF Construction Subcontractor's submittal.

15.4 Quality Assurance/Quality Control

The CQC Consultant shall verify that the materials and methods used for the construction meet the requirements of the plan and specifications. Any material or method which does not conform to these documents shall be rejected. All rejected items shall be replaced by the OSDF Construction Subcontractor at no additional cost to FERMCO.

15.5 Subgrade Preparation

Nuclear moisture/density testing (ASTM D3017 and D2922) shall be performed by the CQC Consultant for all compacted fill materials and cut sections. Fill placement and compaction shall be conducted in accordance with Section 02200 of the project specifications. For road subgrades nuclear moisture/density tests shall be performed at a minimum frequency of 1 test per 10,000 ft^2 and 1 test per lift.

15.6 Geotextile Conformance Testing and Placement

Conformance testing placement of the geotextile shall be in accordance with Section 02714 of the project specifications. The CQC Consultant shall monitor the OSDF Construction Subcontractors geotextile installation methods and procedures. The CQC Consultant shall monitor the sewing or thermal bonding of the geotextile seams. In the case of thermal bonding, the CQC Consultant shall verify that use of the heating equipment does not result in damage to the geotextile. All holes in the geotextile shall be patched in accordance with Section 02714 of the project specifications. The CQC Consultant shall verify that the minimum overlap of 6 in between adjacent geotextile panels is maintained during placement of overlying materials.

15.7 Subbase Aggregate

The subbase aggregate shall be placed directly on top of the geotextile separator and compacted to the satisfaction of the CCM. The subbase aggregate shall be placed in lifts with a compacted thickness of not greater than 8 inches. The CQC Consultant shall verify the subbase aggregate is constructed to the thickness, grades, and limits shown on the construction drawings.

15.8 Base Aggregate

The base aggregate shall be placed in lifts with a compacted thickness of not greater than 6 inches. When the required compacted thickness of the base aggregate

exceeds 6 inches, the base shall be constructed in two or more layers of approximately equal thickness. The base aggregate shall be compacted using vibratory equipment to a density that meets the satisfaction of the CCM.

15.9 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 CQA testing for all granular materials is as follows:

- particle size analysis (ASTM D422 or C136) at a frequency of one test per 5,000 yd^3; and

- soil classification tests (ASTM D2487) at a frequency of one test per 5,000 yds^3

The frequency of testing for earthwork and the geotextile shall be as described above and in accordance with the requirements of the project specifications.

15.10 Repairs

If a defective area is discovered, the CQC Consultant will evaluate the extent and nature of the defect. After this determination the OSDF Construction Subcontractor shall correct the deficiency to the satisfaction of the CCM. The OSDF Construction Subcontractor shall not perform additional work in the area until the CCM approves the correction of the defect. In the event of damage, the Subsubcontractor shall immediately make repairs and replacements as necessary to the satisfaction of the CCM.

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16. GENERAL SITE WORK

16.1 Introduction

This section of the CQA plans describes 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.

16.2 Related Project Specifications

The OSDF Construction Subcontractor shall comply with the project specifications. These specifications shall be referenced for specific details regarding all labor, tools, supervision, and installation equipment necessary to perform the work.

16.3 Submittal

A minimum of 10 days prior to the start of work the OSDF Construction Subcontractor shall submit all information required by the specifications described above to the CCM for review. The Resident Engineer shall be responsible for notifying the CCM upon approval of the OSDF Construction Subcontractor's submittal.

16.4 Quality Assurance / Quality Control

The CQC Consultant shall verify that the materials and methods used for construction of the various general site work items described above meet the requirements of the plans and specifications. Any material or method that does not conform to these documents, or to alternatives approved by the Resident Engineer, shall be rejected by the CCM. All rejected items shall be replaced by the OSDF Construction Subcontractor.

16.5 Conformance Testing

Conformance testing of materials to ensure compliance with the plans and specifications shall be performed by the CQC Consultant at the discretion of the Construction Contracts Manager. If nonconformances or other deficiencies are found by the CQC Consultant in the OSDF Construction Subcontractors materials or completed work, the Subsubcontractor will be required to repair or replace the deficiency at not cost. Any noncompliance shall be reported to the Construction Contracts Manager.

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APPENDIX A

TABLE 02770-1
REQUIRED TEXTURED
HDPE GEOMEMBRANE PROPERTIES

TABLE 02770-1

REQUIRED TEXTURED HDPE GEOMEMBRANE PROPERTIES

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

TABLE 02770-2

REQUIRED HDPE TEXTURED GEOMEMBRANE SEAM PROPERTIES

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

Notes: 1. Also called "Bonded Seam Strength".
2. FTB = Film Tear Bond. (Maximum 10 percent seam separation)

[END OF SECTION]

TABLE 02772-1

REQUIRED GEOSYNTHETIC CLAY LINER PROPERTY VALUES

PROPERTIES	QUALIFIERS	UNITS	SPECIFIED[1] VALUES	TEST METHOD
GCL Properties				
Bentonite Content	minimum	lb/ft^2	1.0	ASTM D 5261
Hydraulic Conductivity (Bentonite)	minimum	cm/s	5×10^{-9} @ 5 psi	GRI GCL-2
Moisture Content (Bentonite)	maximum	percent	25	ASTM D 2216
Textured HDPE Geomembrane Properties				
Thickness	average	mils	40	ASTM D 5199
	minimum	mils	36	ASTM D 5199
Specific Gravity		N/A	0.940 to .960	ASTM D 792
Melt Flow Index	maximum	g/10 min	1.0	ASTM D 1238
Elongation at Yield	minimum	percent	13	ASTM D 638
Elongation at Break	minimum	percent	100	ASTM D 638
Strength at Yield	minimum	lb/in	95	ASTM D 638
Strength at Break	minimum	lb/in	50	ASTM D 638
Tear Resistance	minimum	lbs	12	ASTM D 1004 Die C puncture
Puncture Resistance	minimum	lb	25	ASTM D 4833
Carbon Black Content	range	%	2-3	ASTM D 1603
Carbon Black Dispersion	N/A	none	Category 1 or 2	ASTM D 5596

TABLE 02772-1
(continued)

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

Notes: 1. All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).
2. Minimum value measured in machine and cross machine direction.

[END OF SECTION]

APPENDIX B

TABLE 02772-1
REQUIRED GEOSYNTHETIC CLAY LINER PROPERTY VALUES

APPENDIX C

TABLE 02714-1
REQUIRED PROPERTY VALUES FOR GEOTEXTILE FILTER

TABLE 02714-1

REQUIRED PROPERTY VALUES FOR SUPPLEMENTAL GEOTEXTILE CUSHION IN LINER SYSTEM[5]

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 (i.e., any roll in a lot should meet or exceed the values in this table).
(5) Supplemental geotextile cushion to be used in leachate collection and leak detection corridor.

TABLE 02714-2

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).

[END OF SECTION]

IMPACTED MATERIALS PLACEMENT PLAN

ON-SITE DISPOSAL FACILITY

Revision D
April 1996

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

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Under

Fernald Environmental Restoration Management Corporation
Subcontract 95PS005028

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ACRONYM LIST

ACM	Asbestos Containing Material
AEDO	Assistant Emergency Duty Officer
ASTM	American Society for Testing and Materials
AWWT	Advanced Wastewater Treatment
CFC	Certified for Construction
CFR	Code of Federal Regulations
COC	Constituents of Concern
CQA	Construction Quality Assurance
D&D	Decontamination & Decommissioning
DCP	Design Criteria Package
DOE	United States Department of Energy
E&S	Erosion and Sediment
FEMP	Fernald Environmental Management Project
FS	Feasibility Study
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operation
HWMU	Hazardous Waste Management Unit
HVAC	Heating Ventilation and Air Conditioning
LCS	Leachate Collection System
LDS	Leak Detection System
LTS	Leachate Transmission System
MSW	Municipal Solid Waste
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
PCB	Polychlorinated Biphenyl
PPE	Personnel Protective Equipment
pCi	picoCurie
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
USEPA	United States Environmental Protection Agency
WAC	Waste Acceptance Criteria

ACRONYM LIST (continued)

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1. INTRODUCTION

1.1 Overview

This Impacted Materials Placement (IMP) Plan describes the impacted materials acceptance, placement, compaction, and quality assurance/quality control (QA/QC) activities that will be undertaken throughout construction, placing and closure of the On-Site Disposal Facility (OSDF) at the Fernald Environmental Management Project (FEMP), Fernald, Ohio.

1.2 Project Description

The OSDF will be constructed to contain impacted materials derived from remediation of the operable units at the FEMP. These materials will be required to meet OSDF waste acceptance criteria (WAC) prior to disposal in the OSDF. The estimated total volume of impacted 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 debris, flyash, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials.

The construction, placing, and closure of the OSDF is currently scheduled to occur over a period of approximately 7 years, as described in the Accelerated Remediation Plan [$276 million case] (276 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 for up to 25 years, with the possibility of closure on an interim basis should it be required. Projected phases of OSDF construction, placement, and closure are outlined in Table 1-1.

The design approach for the OSDF is presented in the document, "*Final Remedial Design Work for Remedial Actions at Operable Unit 2*" [DOE, 1995c]. The design of the OSDF, as currently developed, is presented in the "*Intermediate Design Package, On-Site Disposal Facility*" [GeoSyntec, 1996c]. The design of the OSDF includes liner system, final cover system, leachate management system, surface-water management

1

TABLE 1-1

ON-SITE DISPOSAL FACILITY PROJECTED PHASING FOR CONSTRUCTION, FILLING, AND CLOSURE

Phase	Liner System Construction	Impacted Material Placement	Final Closure System Construction
1	Cell 1	-	-
2	Cell 2	Cell 1	-
3	Cell 3	Cells 1,2	Cell 1
4	Cell 4	Cells 2,3	Cell 2
5	Cell 5	Cells 3,4	Cell 3
6	Cell 6	Cells 4,5	Cell 4
7	Cell 7	Cells 5,6	Cell 5
8	Cell 8	Cells 6,7	Cell 6
9	Cell 9 (if required)	Cells 7,8	Cell 7
10	-	Cells 8,9	Cell 8
11	-	Cell 9	Cell 9

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system.

1.3 IMP Plan Scope

This IMP Plan establishes the operational procedures to be used to by the OSDF Construction Subcontractor to place, compact, and protect impacted material disposed in the OSDF. The scope of this IMP Plan includes:

- presenting radiological/chemical and physical waste acceptance criteria applicable to OSDF impacted materials;
- categorizing impacted material types based on handling, placement, and compaction requirements;
- developing acceptable proportions of the various impacted material types to be placed within any area of the OSDF to achieve satisfactory OSDF performance;
- developing procedures for placing and compacting impacted materials in the OSDF; and
- developing QA/QC procedures for impacted material placement in the OSDF.

1.4 IMP Plan Organization

The remainder of this IMP Plan is organized as follows:

- the criteria used in establishing the requirements of this IMP Plan are presented in Section 2;
- the design features of the OSDF applicable to this IMP Plan are presented in Section 3;

- impacted material waste acceptance criteria are described in Section 4;

- descriptions of the impacted materials to be placed in the OSDF are presented in Section 5;

- general procedures for handling, placement, and compaction of impacted materials in the OSDF are presented in Section 6;

- specific procedures for handling, placement, and compaction of soil and soil-like impacted materials are presented in Section 7;

- specific procedures for handling and placement of special impacted materials are presented in Section 8;

- measures to be taken for the control of impacted runoff and fugitive emissions related to, or resulting from, the placement of impacted materials are described in Section 9;

- required documentation procedures are presented in Section 10; and

- regulatory and technical references cited in this plan are listed in Section 11.

Appendix A to this IMP Plan contains an Impacted Materials Placement (IMP) Quality Assurance Plan. The IMP Quality Assurance Plan describes those monitoring, testing, and documentation activities that the CQC Consultant will undertake to establish that the OSDF Construction Subcontractor complies with this IMP Plan.

1.5 IMP Plan Responsibilities

This IMP Plan describes work to be conducted by three separate organizations:

- *OSDF Construction Contracts Manager (CCM)* - responsibilities include: overall coordination between all the parties to the FEMP; contractual management responsibility over the OSDF Construction Subcontractor;

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specifying the materials requiring OSDF disposal; providing security for OSDF operations; and providing emergency health and safety response teams;

- *OSDF Construction Subcontractor* - responsibilities include: separating impacted materials into categories; loading and hauling impacted materials to the OSDF; routing impacted materials within the OSDF battery limit; placing impacted material in the OSDF; obtaining final grade lines as shown on the certified-for-construction (CFC) Drawings; compacting (or compacting around and over) impacted material in the OSDF; and controlling the generation of fugitive emissions and managing impacted stormwater runoff; and

- *CQC Consultant* - responsibilities include: checking the OSDF Construction Subcontractor's impacted material category classification; spot-checking impacted material shipments for conformance with OSDF WAC prior to those shipments arriving at the OSDF battery limit; verifying the OSDF Construction Subcontractor's choice of location for impacted material placement; documenting that the OSDF Construction Subcontractor followed the placement and compaction procedures required by this IMP Plan; and conducting compaction tests of disposed materials in the OSDF.

1.6 Related Plans

Several other plans have been prepared and should be used in conjunction with this IMP Plan. The other plans containing information relevant to this IMP Plan are listed below along with a brief statement of the relationship to this plan.

- *OSDF Construction Quality Assurance (CQA) Plan.* The OSDF CQA Plan describes the quality assurance procedures that will be followed by CQC Consultant during construction, placing impacted material, and closure of the OSDF;

- *OSDF Air Monitoring Plan.* The OSDF Air Monitoring Plan establishes procedures to measure and evaluate potential fugitive dust and radioactive

particulate matter emissions during construction, placing, and closure of the OSDF;

- *OSDF System Plan.* The OSDF System Plan contains procedures for inspecting and monitoring the OSDF including the leachate management system, final cover system, seasonal cover, and temporary facilities; and

- *OSDF Surface Water Management and Erosion Control (SWMEC) Plan.* The OSDF SWMEC Plan provides procedures for the management of surface water in and around the OSDF and details of temporary and permanent erosion and sediment controls for the OSDF.

The OSDF Construction Subcontractor shall be responsible for preparing an IMP health and safety (H&S) 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 OSDF Construction 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.

In addition to H&S personnel assigned to the project, the OSDF Construction Subcontractor will be required to provide a H&S field representative who will be responsible for the OSDF Construction Subcontractor's compliance with all H&S requirements. The OSDF Construction Subcontractor H&S representative will be required to report all safety concerns and incidents to the H&S Officer.

Radiological technician(s) 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 includes the radiological monitoring of equipment and materials entering and leaving the job site, radiological monitoring of soil during excavations to help ensure proper segregation, storage, or disposition; radiation work permit compliance, routine inspection, monitoring, and recording of area radon monitors and/or other

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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.

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2. APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory, DOE, and other requirements applicable to the IMP Plan are contained in the OSDF Design Criteria Package (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 criteria. In general, these criteria are intended to result in impacted material management activities that: (i) are protective of the OSDF liner system, leachate management system, and final cover system; (ii) result in an OSDF waste mass that is stable and does not undergo unacceptable levels of differential settlement; and (iii) provides acceptable management of the generation of fugitive emissions and the routing and containment of impacted runoff. The DCP requirements applicable to the IMP Plan are described below.

2.2 Applicable or Relevant and Appropriate Requirements

ARARs that are specifically addressed by the IMP Plan are:

- OAC 3745-17-08 - requires the use of reasonably available dust control measures to prevent fugitive dust from becoming airborne and defines "reasonably achievable" control measures;

- OAC 3745-27-08(C)(6) - requires placement of impacted materials to be performed such that the cell always store runoff from active and open portions of the cell resulting from the 25-year, 24-hour storm event; and

- DOE Order 5400.5, Chapter I(4) and II(2) - requires application of "As Low As Reasonably Achievable" (ALARA) goals to all activities in the excavation, removal, handling, and placement of impacted materials.

2.3 Functional Requirements

A variety of functional requirements have been established by DOE for the OSDF. The functional requirements applicable to the IMP Plan are:

- facilities for impacted material management should:
  - be located in areas that can easily and efficiently accommodate receipt of impacted material from the various FEMP operable units;
  - be separated from clean areas;
  - limit the uncontrolled discharge of fugitive emissions to acceptable levels;
  - limit the generation of wastewaters to acceptable levels;
  - comply with project health and safety requirements;
  - be removed at the completion of impacted material management activities, with the disposal of affected materials in the OSDF; and
  - be designed to minimize the generation of new impacted material;
- impacted materials should be placed in the OSDF in a safe and cost-effective manner that prevents the uncontrolled release of impacted materials to the environment;
- the IMP Plan, in conjunction with the various operable unit remedial action planning documents, must only allow the placement of material satisfying the OSDF WAC.

2.4 General Design Criteria

A number of general design criteria have also been identified for the OSDF. The general design criteria applicable to the IMP Plan are:

- to the extent the stockpiling of impacted soil is necessary, the soil should be stockpiled in the FEMP former production area in order to use the existing storm drainage control system;

- procedures should be employed that reduce the need for the use of respirators by on-site workers;

- material transport procedures should cause minimal disturbance to the site and work area and be coordinated with impacted material removal and placement activities;

- material transport equipment requirements should address the need to transport a variety of materials so that the number of pieces of equipment required to implement the design is minimized and should address the control of airborne particulate emissions;

- the OSDF Construction Subcontractor must control the release of fugitive emissions (including dust, radiological, chemical, and asbestos materials) so that air quality standards are not violated on the site and so that releases are controlled to acceptable levels at the fence line;

- acceptable emission control methods during placement operations include:

  - transport in tarped dump trucks or closed containers with metal or tarp lids;

  - keeping impacted material moist; and

  - spraying earthen material with a crusting agent;

- impacted material placement procedures should take into account:
  - the rate and time at which impacted material will be available for placement in the cell;
  - the types of impacted material available for disposal (i.e., soil, flyash, lime sludge, solid waste, or building demolition debris);
  - the potential for bulking/shrinkage of impacted material during placement;
  - the availability of temporary stockpile capacity;
  - the extent to which the disposal cell is constructed and available to receive impacted material; and
  - the need for suspended or reduced impacted material placement activities during winter and the need for seasonal (winter) cover; and
- impacted material placement activities should be organized to achieve the following:
  - impacted material should be placed in a manner that is protective of the liner system and final cover system;
  - impacted material should be placed to minimize differential settlement to the extent reasonably achievable;
  - A minimum of 3 ft (0.9 m) of select impacted material should be placed directly over the protective layer component of the liner system, and beneath the contouring layer component layer of the final cover system, to provide protection of these systems from damage by impacted materials. The thickness of select impacted material over the protective layer may be decreased to 2 ft (0.6 m) if the first lift of material to be

placed over the select impacted material consists of soil or small size debris that can be placed in controlled lifts.

- to limit particulate emissions, generation of wastewaters, and erosion of impacted material, the sequence of placement should minimize the area of exposed impacted material;

- materials should be placed in a manner that results in a disposal pile with relatively homogenous large-scale mechanical properties (i.e., compressibility and shear strength), to the extent possible; homogeneity should be achieved by uniformly distributing impacted materials throughout the OSDF to avoid large pockets or distinct concentrations of any one type of impacted material in a particular area; the objective of achieving a homogenous disposal pile is to minimize the potential for differential settlement; and

- at the end of each work day, the impacted material surface should be graded and maintained to control precipitation runoff and impacted material erosion.

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3. OSDF FEATURES

3.1 General

The primary features of the OSDF related to the placement of impacted materials are the liner and final cover systems and certain support elements. These features are briefly described in this section. The OSDF Construction Subcontractor shall be responsible for implementing the requirements of this section and for the protection and safety of the systems described in this section during OSDF construction, placing, and closure.

3.2 Impacted Materials Placement Zones

Control of the placement of impacted material in the OSDF during construction, placing, and closure is required in order to: (i) protect the OSDF liner system, final cover system, and leachate management system from damage; (ii) maintain the impacted material in a stable configuration; (iii) limit fugitive emissions to an acceptable level; (iv) allow containment of impacted runoff within the active OSDF cell; and (v) limit differential settlement of the OSDF final cover system to an acceptable level. Details of the liner system and final cover system proposed for the OSDF are shown on the Construction Drawings.

Within each OSDF cell, four zones exist in which impacted material may be placed. These zones and their relative locations with respect to the OSDF liner system and final cover system are shown in Figure 3-1. The four zones are as follows:

- *protective layer* - a protective layer of impacted soil material shall be placed directly over the primary leachate collection system on the base of each OSDF cell; the soil used for the protective layer shall be either: (i) on-site till material with a maximum particle size of 3 in. (75 mm); or (ii) granular drainage material meeting the material requirements of Section 02240 of the project specifications and placed in specified areas of each cell to facilitate vertical percolation of impacted runoff into the underlying leachate collection system;

IMPACTED MATERIAL ZONES

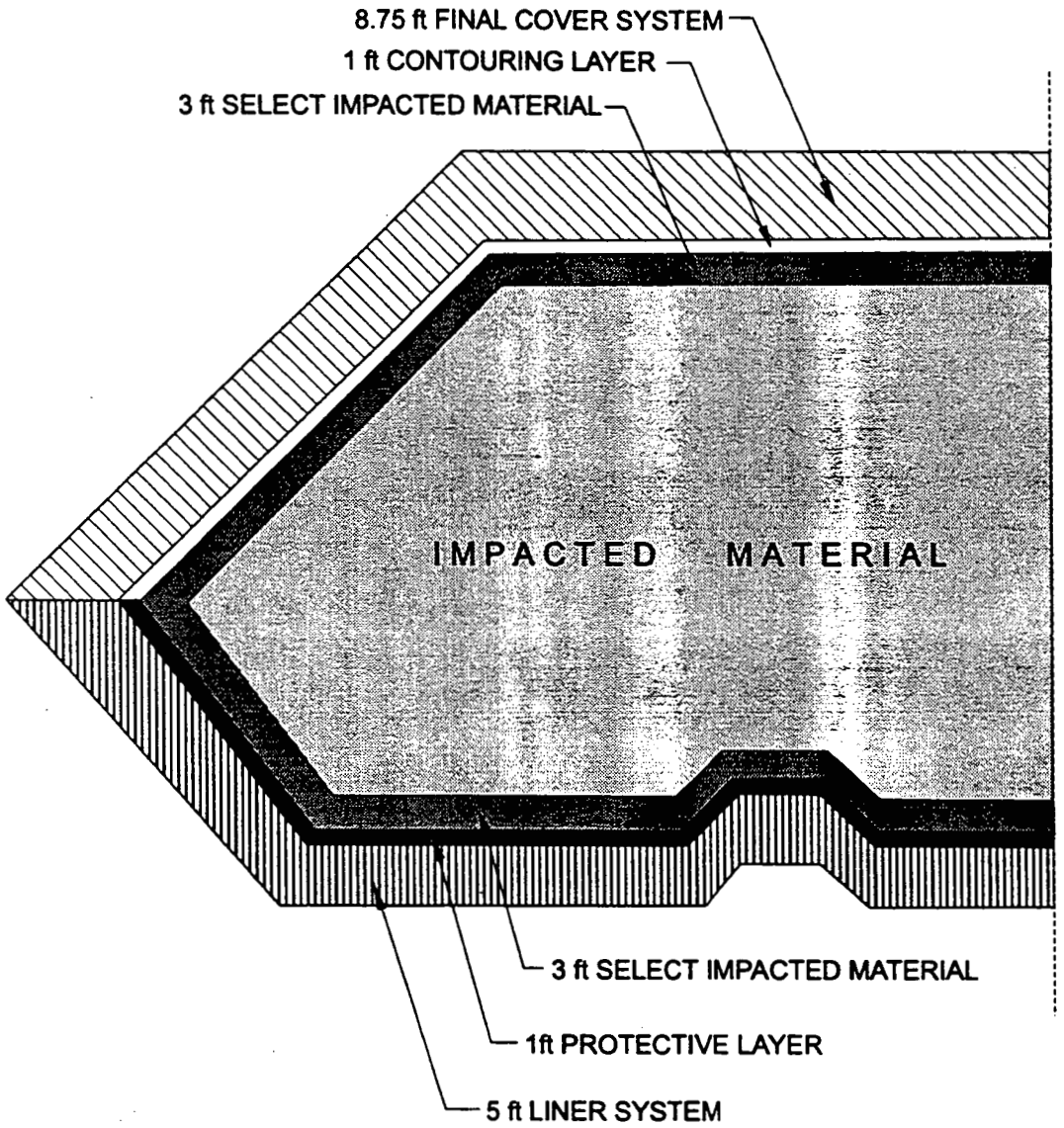

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FIGURE NO.	3-1
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDC
FILE NO.	FIG-6-3.CDR

- *select impacted material layer* - select impacted material shall be placed both on top of the protective layer and beneath the contouring layer to provide a physical barrier between debris and other "large-size" impacted material and the OSDF liner and final cover systems; the select impacted material shall consist of impacted soil or soil-like material with a maximum particle size of 6 in. (150 mm);

- *impacted material layers* - a variety of different impacted materials can be placed on top of the select impacted material layer in the central portions of an OSDF cell; the impacted material in this zone need only meet the radiological/chemical waste acceptance criteria established for the OSDF, the physical waste acceptance criteria established in this IMP Plan, and the placement and compaction criteria established in this IMP plan; and

- *contouring layer* - a contouring layer of impacted soil material shall be placed directly over the select impacted material layer, prior to installation of the OSDF final cover system; the soil used for the contouring layer shall be a till material with a maximum particle size of 3 in. (75 mm).

3.3 OSDF Support Facilities

3.3.1 Impacted Material Haul Roads

The impacted material haul roads within the OSDF battery limit are designed to laterally contain material that may spill from trucks during transportation and also impacted runoff resulting from precipitation falling onto the roads. Trucks used for impacted material transport shall be suitable for the roadway design. Surfacing for the impacted material haul roads is designed to provide adequate support to the hauling units and a relatively tight texture to promote runoff. Surfacing materials used in the construction of impacted material haul roads shall be removed and disposed in the OSDF when the segment of roadway is no longer needed for impacted material placement activities.

Runoff from impacted material haul roads within the OSDF battery limit shall be managed as impacted runoff (i.e., a form of wastewater). This water shall be contained, collected, and discharged to the storm drainage control system of the FEMP former production area, or to other on-site wastewater collection/conveyance points acceptable to the CCM. Impacted material haul roads outside the OSDF battery limit are addressed as part of other plans prepared for the integrated FEMP remediation.

3.3.2 Impacted Soil Stockpile Areas

During initial construction of the OSDF, and periodically during placing and closure, it will be necessary to temporarily stockpile impacted soil resulting from OSDF excavation activities. An impacted soil stockpile area shall be developed to temporarily stockpile this material. The area used for stockpiling shall be graded flat and separated from surrounding areas by a 24 in. (300 mm) high soil berm. At the end of each day, the impacted soil stockpile shall be lightly compacted and rolled smooth to reduce precipitation infiltration into the pile and control fugitive emissions. Any stockpile that will remain inactive for more than 30 days shall be covered with either a crusting agent or geosynthetic cover. Runoff from the stockpile shall be controlled and routed to the FEMP former production area storm drainage control system, or to other on-site wastewater collection/conveyance points acceptable to the CCM.

Impacted soil excavated during construction of the first and subsequent OSDF cells and related support facilities shall be used for construction of the liner system protective layer and the select impacted material layer for those cells if meeting the requirements for those layers. Any geosynthetic cover used in the impacted soil stockpile area and other impacted soils from the operation shall be disposed in the OSDF as part of the impacted material placement activities described later in this plan.

3.3.3 Impacted Debris Staging Areas

Impacted debris staging areas consist of gravel hardstands constructed to temporarily store impacted structural members and other building demolition debris. These areas will be used to temporarily stage any material not able to go directly from

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the material source to an active OSDF cell. Impacted debris staging areas constructed outside the limits of the FEMP former production area shall have positive runoff control. Any runoff from these areas will be directed to the storm drainage control system of the FEMP former production area or to other on-site wastewater collection conveyance points acceptable to the CCM.

4. WASTE ACCEPTANCE CRITERIA

4.1 General

This section of the IMP Plan presents information regarding the waste acceptance criteria applicable to the OSDF. Radiological/chemical waste acceptance criteria developed by the individual operable units at the FEMP are identified and made a part of this plan. Physical waste acceptance criteria are established in this plan.

4.2 Chemical/Radiological Waste Acceptance Criteria

The Operable Unit 2 Record of Decision (ROD) has 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 [DOE, 1995a] for all material destined for the OSDF. Additional radiological and chemical waste acceptance criteria have been established for Operable Unit 5 soils destined for the OSDF (Table 4-1). Operable Unit 3 has established tentative radiological waste acceptance criteria for debris materials destined for the OSDF of 105 grams technetium-99 (Table 4-1). The materials sent to the OSDF from Operable Unit 3 may also include small material contributions from Operable Units 1 and 4. Any material from these latter operable units destined for the OSDF must meet the Operable Unit 3 waste acceptance criteria.

4.3 Physical Waste Acceptance Criteria

The physical waste acceptance criteria that shall be applied to material destined to the OSDF are:

- materials from various building components (i.e., steel, concrete, masonry rubble, finish components, etc.) shall be segregated by the OSDF Construction Subcontractor at the source to the extent practical;

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TABLE 4-1

ON-SITE DISPOSAL FACILITY WASTE ACCEPTANCE CRITERIA

Constituent of Concern	Maximum Concentration		
	Soil		Debris
	OU2	OU5	OU3
Radionuclides:			
Neptunium-237		3.12×10^9 pCi/g	
Strontium-90		56.7×10^9 pCi/g	
Technetium-99		29.1 pCi/g	105 g
U-238	346 pCi/g		
Total Uranium	1030 mg/kg	1030 mg/kg	
Organics:			
Carbazole		72.7×10^3 mg/kg	
Bis(2-chlorisopropyl)ether		2.44×10^2 mg/kg	
Alpha-chlordane		2.89×10^0 mg/kg	
Bromodichloromethane		9.03×10^{-1} mg/kg	
4-Nitroaniline		4.42×10^{-1} mg/kg	
Chloroethane		3.92×10^{-2} mg/kg	
Vinyl chloride[a]		1.51×10^0 mg/kg	
Tetrachloroethene[a]		128 mg/kg	
Trichloroethene[a]		128 mg/kg	
1,1-Dichloroethene[a]		114 mg/kg	
1,2-Dichloroethene[a]		114 mg/kg	
Toxaphene[a]		106×10^3 mg/kg	
Inorganics:			
Boron		1.04×10^3 mg/kg	
Mercury[a]		56.6×10^3 mg/kg	

Note: (a) RCRA-based constituent of concern

SOURCES OF INFORMATION - Operable Unit 2 Record of Decision
Operable Unit 5 Feasibility Study
Operable Unit 3 Remedial Investigation/Feasibility Study Report

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- the maximum length of irregularly shaped metals or other components of a building superstructure or finish components shall be 10 ft (3 m);

- the maximum thickness of irregularly shaped metals or other components of a building superstructure or finish components shall be 18 in. (460 mm);

- the maximum dimension of regular, rectangularly shaped metals or other components of a building superstructure or finish material when handled individually is limited only by the ability to handle and transport the material;

- the maximum thickness of concrete or other components of a building slab or substructure shall be 18 in. (460 mm) when the materials are part of a load of similar material;

- the maximum thickness of an individual concrete member or other component of a building slab or substructure shall be 4 ft (1.2 m) when the item is handled individually and is a regular, rectangular shape having no concrete protrusions greater than 18 in. (460 mm);

- concrete reinforcement bars shall be cut within a nominal 12 inches in. (305 mm) of the mass concrete;

- the maximum thickness of uniform pallets of building cladding (i.e. transite panels) properly banded into rectangular shapes shall be 4 ft (1.2 m);

- regulated asbestos containing material (ACM) shall be double-bagged at the source and delivered unmixed with other materials;

- piping having insulation of ACM shall be segregated at the source and delivered unmixed with other materials;

- tires from passenger size automobiles shall be cut radially and tires from larger vehicles will be cut in sections;

- general building rubble consisting of wood, drywall, HVAC systems, electrical systems, plumbing systems, and minor equipment shall be sufficiently reduced in size to be gradable into a 18 in. (460 mm) lift by equipment similar to a Caterpillar D8 bulldozer;

- equipment shall be drained of all oils and liquids;

- piping with a nominal diameter of 12 inches or greater will be split in half; and

- the maximum dimension of general building rubble consisting of concrete, masonry, and other similar materials shall be 18 in. (460 mm).

Impacted materials brought to the OSDF should not be at such a high moisture content that impacted material placement and compaction activities are impeded. Generally, soil should have a moisture content that allows the material to be compacted to the required relative compaction using standard soil compaction equipment and procedures. Soil should also have a moisture content that does not result in excessive "bleeding" of liquids. As necessary, however, the CCM Consultant will direct the OSDF Construction Subcontractor to dry the soil by dicing and air drying, by blending with drier soil, or by other means so that the soil can be compacted to the required dry density. The OSDF Construction Subcontractor shall limit the use of in-cell drying to the extent necessary to not restrict the placement of impacted material in the OSDF.

Special handling, placement, and compaction limitations and procedures apply to objects having a thickness or height larger than 4 ft (1.2 m). These special handling, placement, and compaction limitations and procedures are discussed in Section 8 of this IMP Plan.

4.4 Prohibited Items

The following items are specifically prohibited from disposal in the OSDF:

- impacted material exceeding WAC;

- impacted material from any off-site source, including any other DOE site, except as provided in the OU5 ROD;
- equipment larger than 4 ft (1.2 m) high which cannot be placed such that impacted soil can be placed around the sides and bottom of the equipment (except as provided in Section 8 of this IMP Plan);
- pressurizable gas cylinders;
- process related metals;
- product, residues, and other special materials;
- materials containing free liquids;
- intact drums (i.e., drums must be empty and crushed);
- acid brick;
- transformers, which have not been either crushed or filled with grout;
- used oils; and
- materials not accompanied by the transportation manifest specified in this plan.

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5. IMPACTED MATERIAL DESCRIPTIONS

5.1 General

The OSDF will be the final repository for a majority of the impacted material from the five operable units of the integrated FEMP remediation. Construction debris (i.e., waste originating during the construction of the OSDF) will also be disposed in the OSDF. The materials requiring OSDF disposal are expected to vary considerably in their composition, handling, placement, and compaction characteristics. Given this variability, it is useful to develop a categorization framework wherein materials with similar characteristics are assigned to the same category. The purpose of this section of the IMP is to describe and categorize the various impacted materials using a common categorization framework.

5.2 Impacted Material Categories

Impacted materials to be disposed in the OSDF shall be assigned to one of five categories, depending on the procedures that will be used to place them into the OSDF:

- Category 1 - impacted materials that are soils and soil-like and that do not contain hard agglomerations greater than 12 in. (305 mm) in greatest dimension. If the material is other than till or ash from the FEMP site, the material in this category must also have the vast majority of its particles finer than a 1 in. (25 mm) particle size. If this latter criteria is not met, the material should be classified as a Category 2 material. These impacted materials are expected to be readily compactible using standard construction equipment.

- Category 2 - impacted materials that can be transported, placed, spread, and compacted *en masse*. These impacted materials can be spread in lifts no more than 18 in. (460 mm) thick and are expected to be moderately compactible under the action of equipment similar to the Caterpillar D-8 dozer or 815C compactor. Examples of these materials include broken-up

concrete foundations or building demolition debris that has been reduced to the point that individual components do not effect compactibility.

- Category 3 - impacted materials that must be individually handled and placed in the OSDF, and that are suitable for having material placed around and against them. These impacted materials have a maximum height of no more than 4 ft (1.2 m), are oddly shaped that impacted soil cannot be compacted around and against them, and are essentially incompactible. Examples of these materials are steel beams and stacks of building cladding, (e.g., transite panels).

- Category 4 - impacted materials that are high in organic content and very compressible. Examples of these materials are municipal solid wastes from the Solid Waste Landfill and green waste from clearing, stripping and grubbing operations around the FEMP.

- Category 5 - impacted materials that require special handling due to either their large size or their special nature. Examples of these materials include furnaces, and railroad rolling stock.

The categories given above shall be used by the OSDF Construction Subcontractor to categorize each load of impacted material brought to the OSDF for disposal. The CCM will use this categorization in establishing disposal limitations and instructions for each truck load of material destined for the OSDF.

5.3 Specific Impacted Materials

5.3.1 General

This section of the IMP Plan contains background information on the types and quantities of specific impacted materials that may require special handling and/or placement activities. These impacted materials primarily consist of landfill waste, water treatment plant sludge, and demolition debris. The purpose of this section of the IMP

Plan is to provide the OSDF Construction Subcontractor with a physical description of these specific materials.

5.3.2 Solid Waste Landfill

The Solid Waste Landfill is a rectangular disposal area of approximately one acre (0.4 ha) that has been inactive since 1986. A soil cover has been placed over the disposal area. A drainage ditch serving the northwest portion of the former production area is located in the northern portion of the Solid Waste Landfill. The volume of waste material in the landfill is estimated to be approximately 14,400 yd^3 (11,000 m^3).

The operational history of the Solid Waste Landfill is not well documented. It is thought that the landfill was organized with one to five individual waste disposal cells and an evaporation pond which also served as a surface-water management basin. Materials reportedly buried at the Solid Waste Landfill include non-burnable and nonradioactive solid wasted generated on FEMP property, nonradioactive construction-related rubble, and double bagged and bulk quantities of nonradioactive asbestos. Field investigation results, however, indicate that some process waste may have been placed in the landfill. The following wastes were encountered during a trenching investigation in 1992:

- burnable wastes - bagged trash and wood;
- possibly burnable wastes - respirator cartridges, asphalt roofing materials, medical wastes, firehoses, and rubber hoses/belts; and
- non-burnable wastes - unidentified high-activity waste, medicine vials, bagged asbestos, ceramic tiles, possible magnesium fluoride, glass acid bottles, steel cables/cans, paint cans, and copper tubing.

5.3.3 Lime Sludge Ponds

The Lime Sludge Ponds are two unlined, rectangular ponds, each measuring approximately 125 by 225 ft (38 by 69 m). Wastes that were disposed in the Lime Sludge Ponds originated from water treatment plant operations, coal pile stormwater runoff, and boiler plant blowdown. Although this waste is from three distinct waste streams, the bulk of the slurry is lime sludge from the water treatment process. Over time, the solids in the slurry settled in the Lime Sludge Ponds and the remaining decant was pumped from the ponds. The lime sludge is, therefore, considered to be relatively homogenous.

The volume of sludge and berm material contained within the two lime sludge ponds is estimated to be approximately 16,500 yd^3 (12,500 m^3) of lime sludge and 5,600 yd^3 (4,300 m^3) of berm material making a total of 22,100 yd^3 (17,100 m^3) of material. The South Lime Sludge Pond is full and has been inactive since the mid-1960's; it is now overgrown with grasses and shrubs. The North Lime Sludge Pond is not currently active, but was in use as late as January 1995. The west side of the North Lime Sludge Pond is usually covered with 1 to 2 ft (0.3 to 0.6 m) of water, depending mainly on precipitation. The remaining area is dry and covered with sparse vegetation.

5.3.4 Building Debris

Debris from demolition of buildings in the FEMP former production area is expected to constitute the largest volume of impacted material for OSDF disposal after soil and soil-like material. The feasibility study (FS) for Operable Unit 3 [DOE, 1995e] indicates that impacted debris can be assigned to one of ten material categories. Only material from seven of these categories will be disposed in the OSDF. The seven material categories of impacted debris are defined in Table 5-1 which also gives descriptions of the materials making up the categories.

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TABLE 5-1

MATERIAL CATEGORIES AND DESCRIPTION OF DEMOLITION DEBRIS FOR ON-SITE DISPOSAL

Material Categories	Descriptions
A. Accessible Metals	Structural steel and steel decking have large accessible surface areas and thicknesses which are greater than 1/4 inch. The surface of accessible metals can be decontaminated using physical surface decontamination techniques and subsequently radiologically surveyed prior to disposition.
B. Inaccessible Metals	Non-process piping, equipment in non-process areas, decontaminated process equipment, conduit/wire, electrical fixtures, miscellaneous electrical items, doors, and other miscellaneous metals are included in this category. These materials have surfaces which cannot be easily decontaminated or surveyed, and thus are considered inaccessible.
D. Painted Light-Gauge Metals	Painted Light-Gauge Metals: Ductwork, louvers, metal wall and roof panels, and sheet lead are painted metals less than 1/8 inch thick. Metals in this category are assumed to be painted with lead-based paint or, in the case of lead sheeting, to be made of lead themselves. Based on the possible presence of lead and other metals regulated by the Resource Conservation and Recovery Act (RCRA), these materials may be designated as hazardous/mixed waste.
E. Concrete	Concrete, masonry, asphalt, and clay piping are all porous construction materials.
G. Non-Regulated Asbestos Containing Materials (ACM)	Transite walls and roofs, refractory (fire brick and insulating brick) materials, ceiling demolition, floor tile, and feeder cable are materials which are non-friable.
H. Regulated ACM	Piping insulation, ductwork insulation, and personal protective equipment (PPE), which are classified as regulated ACM because either the material matrix is potentially friable ACM (e.g., insulation), or in the case of PPE, contaminated with asbestos fibers during asbestos abatement activities.
I. Miscellaneous Materials	Other miscellaneous items present in the structures and building in OU3 including windows, wood, built-up roofing, building insulation (non-ACM), drywall, process and non-process trailers, polyvinyl chloride (PVC) pipe, fabric roofs and walls, PPE, and other miscellaneous debris. Neither the characteristics nor the volume of material indicate a need to categorize these materials separately.

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6. GENERAL PLACEMENT PROCEDURES

6.1 Introduction

This section of the IMP Plan describes the general procedures that the OSDF Construction Subcontractor shall follow for placement of impacted material in the OSDF. Specific procedures for placement of Category 1 materials (soil and soil-like) are presented in Section 7 of this IMP Plan. Specific placement procedures for Category 2 through 5 materials (non soil-like materials) are addressed in Section 8 of this IMP Plan.

6.2 Manifesting

The OSDF Construction Subcontractor shall prepare an impacted material transportation manifest for each load of material to be transported to the OSDF. The purpose of the manifest is to provide a tracking mechanism for impacted material disposed in the OSDF. The manifest shall include a description of the impacted material in the load, the operable unit of the impacted material, classification of the impacted material into one of the five material categories, and documentation that the material meets the radiological/chemical and physical waste acceptance criteria.

The OSDF Construction Subcontractor shall develop a system acceptable to the CCM for identifying the category of impacted material being hauled. This system shall indicate the category of material in the truck and whether the truck is carrying special items such as asbestos, extremely heavy items, extremely compressible items, impacted materials requiring special dust mitigation procedures, sludge, or landfill waste.

At the OSDF battery limit, each truck load of impacted material will be monitored by the CQC Consultant in accordance with Appendix A of this plan. The monitoring will include spot-checking for prohibited material, monitoring for asbestos, visual verification that the impacted material matches the description on the manifest, visual check that the material meets the OSDF physical waste acceptance criteria, and visual checking that prohibited items are not included in the load. The CQC Consultant will be required to sign the manifest and retain a copy. The OSDF Construction

Subcontractor shall be aware of these quality control activities and account for them in its planning and scheduling.

After trucks are cleared at the OSDF battery limit, the OSDF Construction Subcontractor shall route the impacted material to a location within the OSDF (e.g. the active face, a stockpile area, or an area where further screening will take place) for disposal. The OSDF Construction Subcontractor will be provided with flexibility in routing trucks for efficient operations. However, the CCM will provide the OSDF Construction Subcontractor with specific instructions for routing of Category 2 through 5 impacted materials. The OSDF Construction Subcontractor shall be responsible for following these instructions.

The placement and compaction procedure to be used by the OSDF Construction Subcontractor for each load of impacted material shall be based on the impacted material category. Placement and compaction procedures for the five material categories listed in Section 5.2 of this IMP Plan are presented in Sections 7 and 8 of this plan.

6.3 Protection of Facilities

Impacted material placement activities shall be conducted in a manner that protects and maintains the integrity of the OSDF liner system, leachate management system, and final cover system, and all OSDF ancillary facilities and equipment. Impacted material placement activities shall not commence in a cell until liner system construction has been completed in accordance with the contract documents and only after cell construction has been certified in accordance with the requirements of the CQA Plan and all other subcontract requirements.

6.4 Placement Oversight and Quality Assurance

Impacted material placement for all categories of material shall be conducted under the direct oversight of an OSDF Construction Subcontractor Supervisor versed in all aspects of this plan and having qualifications meeting the requirements of the CQA

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Plan. The OSDF Construction Contractor's Supervisor shall be assisted by on-the-ground spotters who shall observe each load that is placed to monitor that the work is performed in compliance with the requirements of this plan. The OSDF Construction Contractor's Supervisor shall be assisted by surveyors and quality control personnel, as required, to control lift thickness and grades, record the coordinates of the impacted material placement, and perform other necessary functions.

The OSDF Construction Subcontractor shall be aware that monitoring of the placement, and monitoring and testing of the compaction, of impacted material in the OSDF will be performed by the CQC Consultant in accordance with the requirements of Appendix A of this IMP Plan.

6.5 Conformance with OSDF Specifications

The OSDF Construction Subcontractor shall comply with the project specifications which shall be used in conjunction with this plan and these shall be referenced for specific details regarding the labor, material, and supervision at the OSDF.

The OSDF Construction Subcontractor shall be aware that the CQC Consultant will monitor impacted material placement and compaction activities for conformance with the project specifications of this IMP Plan.

6.6 Standard Operations Procedures

6.6.1 General

The CCM will have the authority to halt impacted material placement operations if placement operations are not in accordance with the project specifications and this IMP Plan.

Salvaging of materials being deposited in the OSDF is strictly prohibited. FERMCO personnel will examine, on a random basis, trucks leaving the OSDF for salvaged materials.

Placement of impacted materials shall only occur during daylight hours unless specifically approved by the CCM . The last unit load of waste will not be accepted less than 45 minutes prior to sundown.

Impacted material placement activities shall cease for the winter when the CCM determines that satisfactory compaction of impacted material and/or safe working conditions, is no longer possible due to weather conditions.

6.6.2 Inclement Weather Operations

Placement of impacted material in the OSDF shall cease when the average wind speed measured at the working face of the active OSDF cell is in excess of 15 mph (25 kph) or when wind gusts exceed 25 mph (40 kph) for more than one minute in the previous 60 minutes. The CQC Consultant will maintain a weather station near the active working face of the OSDF. The weather station will provide a continuous record of windspeed, temperature, and will be equipped with a rain gauge. The CCM will determine when unacceptable wind conditions exist.

Impacted material shall not be placed during periods of significant precipitation. Significant precipitation will be determined by the CCM in consultation with the CQC Consultant.

The OSDF Construction Subcontractor may prepare an inclement weather deck within the OSDF active cell. The purpose of this deck is to provide an area where placement activities can occur when precipitation has left other areas of the OSDF unsuitable (due to mud or soft surfaces) for impacted materials placement activities. The inclement weather deck may be used for placement of Category 2 materials (*en masse* placement).

Impacted material placement activities shall not restart after an inclement weather shutdown until approval to do so is provided by the CCM. Factors that will be considered by the CCM in restarting operations include:

- condition of OSDF haul roads;
- if operations could lead to additional erosion of impacted materials;
- weather forecasts;
- ability to decontaminate impacted material hauling trucks;
- nature of impacted materials to be placed; and
- conditions within the OSDF.

6.6.3 As-Placed Plans

The OSDF Construction Subcontractor shall be aware that the CCM will maintain plans showing the locations of placement of all Category 2 through 5 impacted material. The plans will provide the disposal grid coordinates for each load of material placed in the OSDF (referenced to the load manifest number), the category of material in the load, and other information. The CCM will use this plan to decide where subsequent loads of special category waste can be placed. For example, the OSDF Construction Subcontractor will not be allowed to compact multiple lifts of Category 4 (organic) impacted material on top of each other so as to avoid creating a compressible zone in the OSDF that could induce future differential settlements in the OSDF final cover system.

6.7 Spreading and Grading

The OSDF Construction Subcontractor shall be aware that an important objective of this IMP Plan is to achieve uniform settlement of the impacted materials placed within the OSDF. Thus, the OSDF Construction Subcontractor shall, as much as possible, maintain homogeneity of the physical characteristics of the impacted materials placed across horizons of the OSDF. The OSDF Construction Subcontractor will be directed by the CCM to route impacted materials in such a fashion that each lift is

relatively uniform over its lateral extent. To the extent possible, compressible materials (such as green wastes, double bagged asbestos, and Solid Waste Landfill materials) shall be spread laterally and not piled vertically. Incompressible materials (such as furnaces or other large items of equipment) shall not be placed directly above other incompressible items. Materials of higher permeability (such as demolition debris) shall not be placed directly above other high permeability materials or without intervening ones of lower permeability materials.

Impacted material placement shall generally proceed from east to west and north to south within each OSDF cell. Maximum compacted lift thicknesses for soil, soil-like-materials, and other impacted materials shall be 12 in. (300 mm), except as provided in Section 8 of this IMP Plan. Each lift of topmost select impacted material shall be controlled to line and grade such that cell perimeter contours are within 2 in. (50 mm) of the design grade for the bottom of the contouring layer.

Figure 6-1 illustrates the sequencing of impacted material placement and slope development within the first OSDF cell. Select impacted material layers on the cell base and sideslopes shall be advanced at least 2 ft (0.6 m) ahead of general impacted material layers. Figure 6-2 illustrates the sequencing of impacted material placement and slope development in subsequent cells.

6.8 Compaction

Each lift of soil or soil-like impacted material placed in the OSDF shall be compacted by the OSDF Construction Subcontractor to the minimum criteria given in Sections 7 and 8 of this IMP Plan. The OSDF Construction Subcontractor shall be aware of the quality assurance monitoring and testing activities that will be performed by the CQC Consultant. These monitoring and testing activities are described in Appendix A of this IMP Plan.

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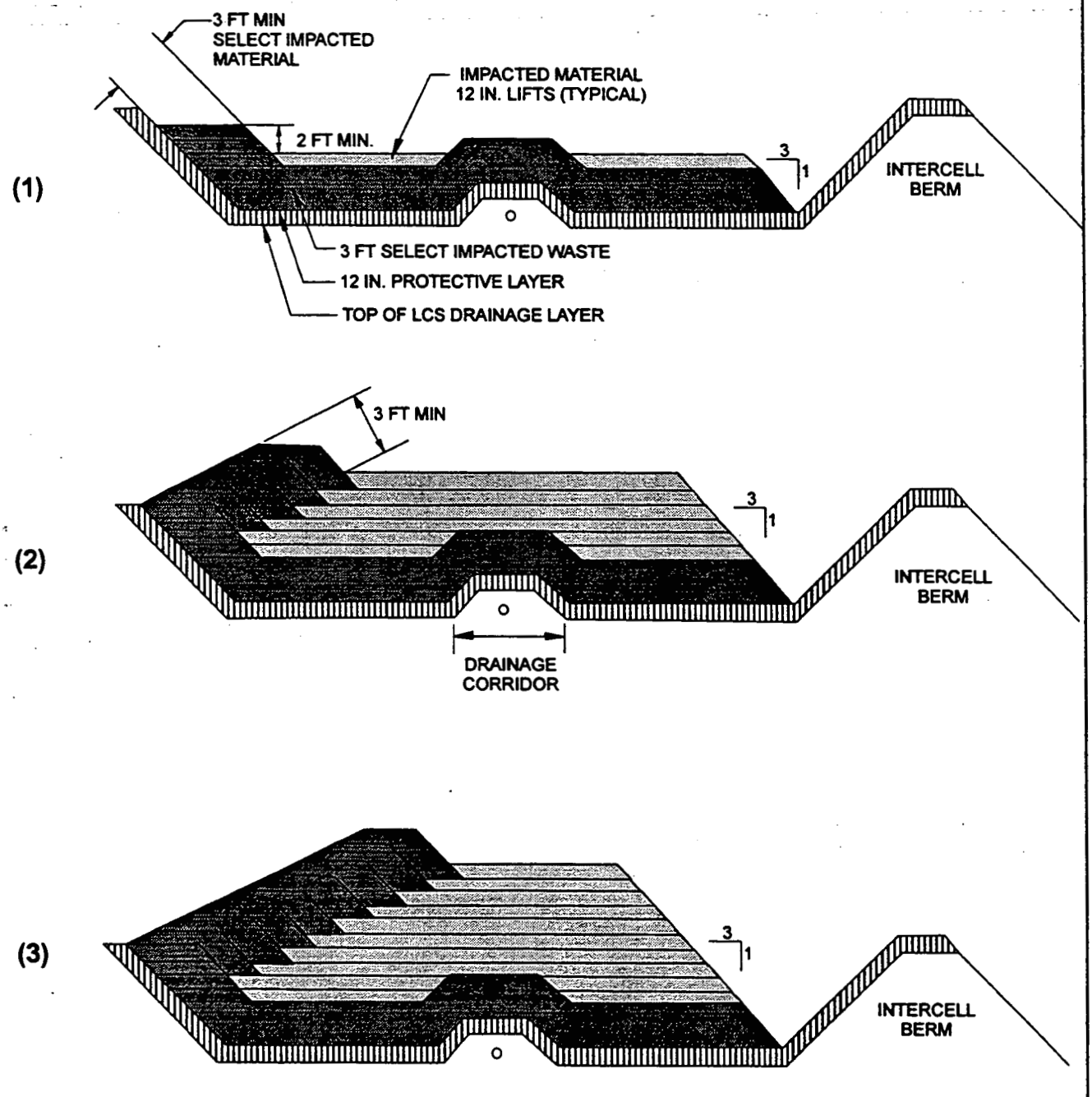
IMPACTED MATERIAL PLACEMENT SEQUENCE - CELL1



GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	6-1
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDC
FILE NO.	FIG-6-1.CDR

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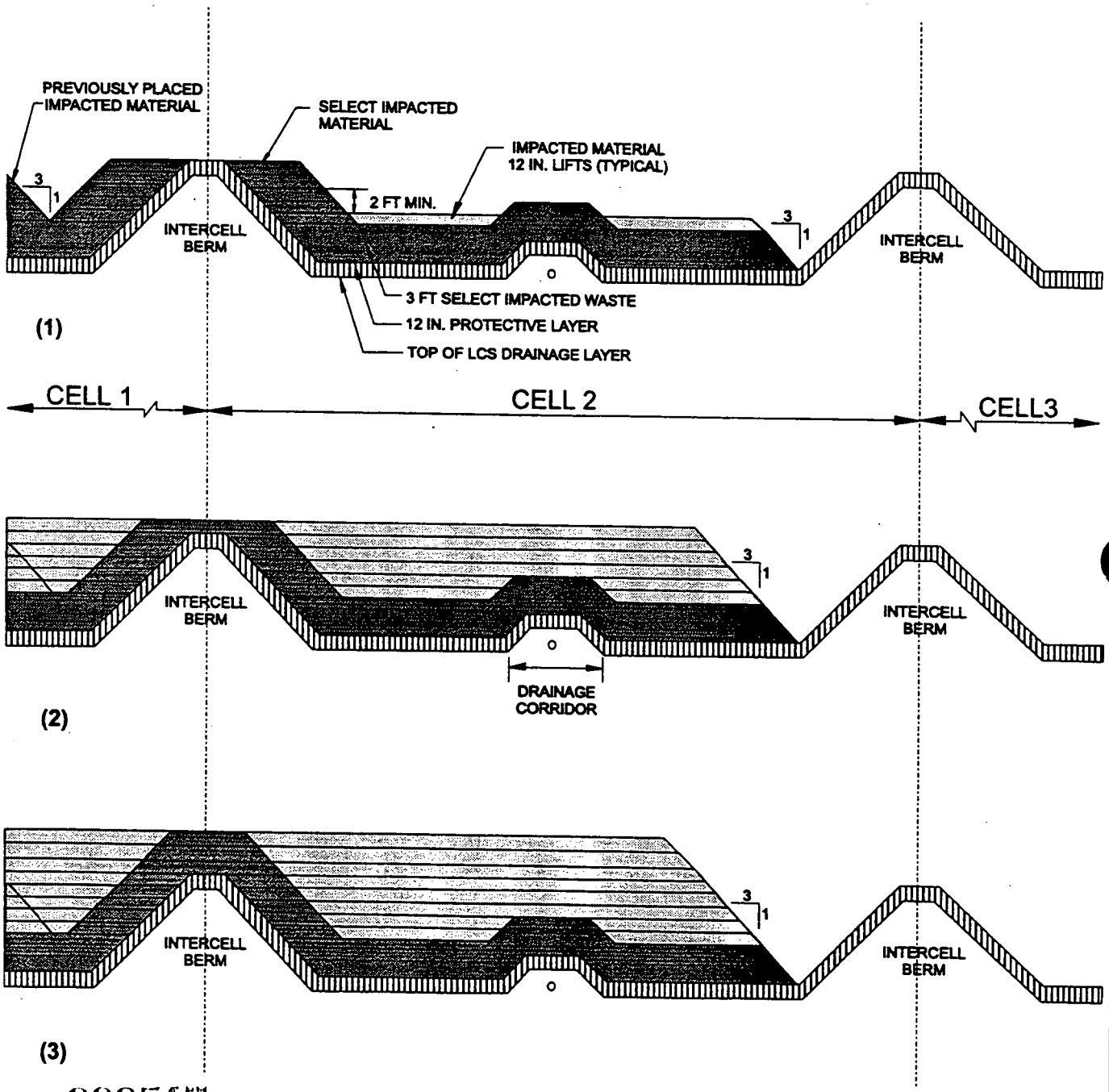
IMPACTED MATERIAL PLACEMENT SEQUENCE - INTERIOR CELLS



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GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	6-2
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDC
FILE NO.	FIG-6-1.CDR

6.9 Daily Surface Conditions and Drainage

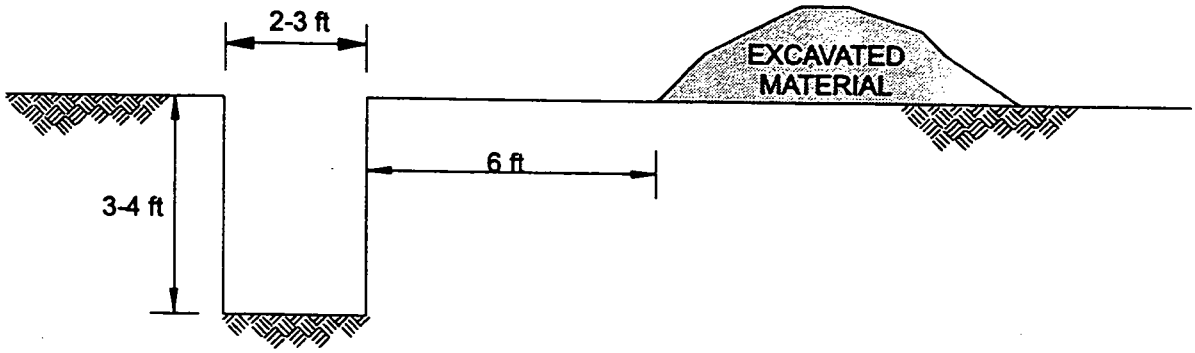
On a daily basis, the OSDF Construction Subcontractor shall maintain the impacted material surface in active OSDF cells to limit fugitive emissions and control and detain impacted runoff. The OSDF Construction Subcontractor shall establish stormwater runoff routing in each active cell to convey runoff to the impacted runoff catchment area within the cell. The OSDF Construction Subcontractor shall use smooth rolling to seal the surface, silt fences, and other means to limit impacted material erosion. At the end of each working day, the uppermost layer of impacted material shall be sloped at a minimum grade of 2 percent to the south. The southern impacted material face shall be constructed to a slope not steeper than 3H:1V (horizontal:vertical). Other applicable requirements of the SWMEC Plan shall be observed.

At the end of each working day, the OSDF Construction Subcontractor shall prepare exposed impacted material surfaces in a manner that satisfactorily controls the generation of fugitive emissions. Preparation may include smooth rolling to seal the surface, application of water, application of crusting agents, or covering with geosynthetics. The nature and extent of the fugitive emission control actions shall be a function of the results of air monitoring conducted by FERMCO in accordance with the OSDF Air Monitoring Plan. Fugitive emission control actions shall be sufficient to achieve compliance with the OSDF Air Monitoring Plan. At all times, the OSDF Construction Subcontractor shall be prepared to implement the measures mentioned in this paragraph to reduce fugitive emissions based on the OSDF Construction Subcontractor's approved fugitive emissions plan or as directed by the CCM.

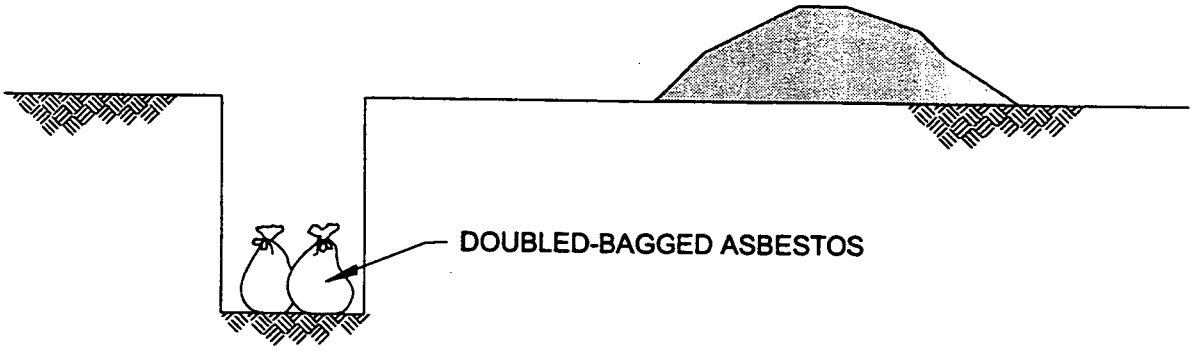
The final daily lift on areas of active impacted material placement shall consist of a 12 in. (300 mm) thick soil layer (Category 1) spread and compacted as described in Section 7 for Category 1 material placement. The final compaction pass of this layer shall be made using a smooth-drum roller to seal the surface against excessive infiltration and to control fugitive emissions. Smooth-rolled surfaces shall be disced, tracked, or otherwise broken up prior to placement of subsequent lifts.

Impacted material slopes shall be protected from excessive material erosion through the use of silt fences spaced at a maximum vertical spacing of 10 ft (3 m) as shown in Figure 6-3. The base of the slope of impacted material, along the perimeter

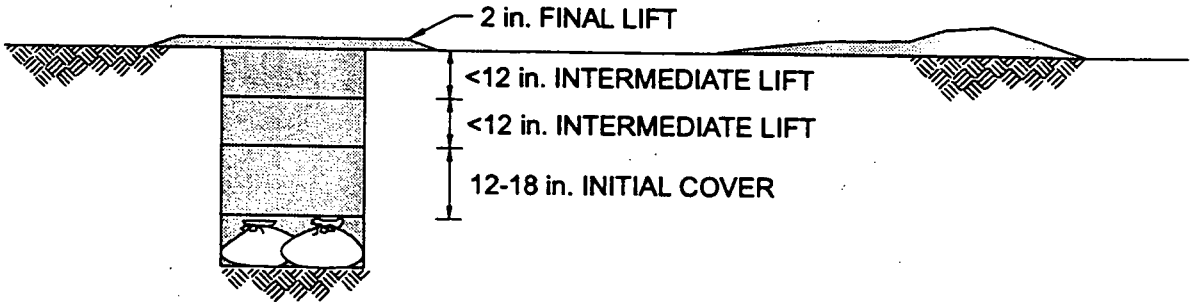
CATEGORY 5 MATERIAL PLACEMENT SEQUENCE



1. TRENCH DUG AND EXCAVATED MATERIAL STOCKPILED



2. CATEGORY 5 MATERIAL DEPOSITED IN TRENCH



3. FINAL TRENCH LIFT PLACED

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GEOSYNTEC CONSULTANTS ATLANTA, GEORGIA	FIGURE NO.	8-2
	PROJECT NO.	GE3900-10.2
	DOCUMENT NO.	F9620002.CDC
	FILE NO.	FIG-6-3.CDR

of the impacted runoff catchment area in the cell shall be lined with hay bales to limit the washing of fines into the cell impacted runoff detention area. The impacted runoff catchment area at the southwest corner of each cell has been sized to provide adequate capacity for the detention of the impacted runoff from the 25-year, 24-hour storm event, with 6 in. (150 mm) of freeboard.

Runoff in this area may be pumped into the FEMP former production area stormwater management system or be allowed to percolate through the granular protection lager into the underlying cell leachate collection system. Requirements for this area to maintain unimpeded infiltration into the leachate collection system are given in the OSDF System Plan.

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7. SOILS AND SOIL-LIKE MATERIAL PLACEMENT

7.1 General

Approximately 85 percent of the impacted material volume to be placed in the OSDF will be Category 1 material (soil and soil-like). Category 1 material may be further divided into: (i) protective and contouring layer soils; (ii) select impacted material layer soils; and (iii) general soil and soil-like material. The placement of this material is expected to be accomplished in a manner similar to the spreading, grading, and compaction of other soils associated with OSDF construction. This section of the IMP Plan addresses those activities associated with the placement and compaction of these soils and soil-like materials within the OSDF.

7.2 Protective and Contouring Layers

7.2.1 Placement Procedures

As indicated in Section 3.2 of this IMP Plan, the protective and contouring layers shall consist of on-site impacted till having a maximum particle size of 3 in. (75 mm). The protective and contouring layers shall also meet the requirements for compacted fill given in Section 02200, of the project specifications. Topsoil shall not be used for either the protective or contouring layers.

The protective layer shall be placed in a 12- to 15-in. (300- to 375-mm) thick loose lift. The contouring layer shall be placed in a two 6- to 8-in. (150- to 200-mm) thick loose lifts.

7.2.2 Compaction Procedures

The protective layer shall not be compacted with conventional compaction equipment but rather tracked with a medium-sized bulldozer such as a Caterpillar D5 (or lighter). The protective layer shall be constructed in conformance with all other requirements of Section 02240, of the project specifications.

The contouring layer shall be compacted to at least 95 percent relative compaction based on standard Proctor compaction effort (ASTM D 698). A standard Proctor maximum dry density and optimum moisture content will be established by the CQC Consultant for each impacted material type used in the contouring layer. These parameters will be obtained by the CQC Consultant in an on-site geotechnical laboratory established for OSDF construction. Each lift of the contouring layer shall be compacted by multiple passes of a self-propelled static pad-foot compactor (i.e., a Caterpillar 815C, or equivalent). It is anticipated that the required compaction moisture content will be within ± 2 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the CCM during construction. The contouring layer shall be constructed in conformance with all other requirements of Section 02240, of the project specifications.

7.3 Select Impacted Material Layers

7.3.1 Placement Procedures

As indicated in Section 3.2 of this IMP Plan, select impacted material shall have a maximum particle size of 6 in. (150 mm) and, if other than on-site impacted till, have the vast majority of the material finer than a 1 in. (25 mm) particle size. Impacted topsoil may be included in the select impacted material layer but it should not be placed in quantities that deleteriously affects compaction.

The select impacted material layer at the base of the landfill shall be placed in 12- to 15-in. (300- to 375-mm) thick loose lifts and compacted to a minimum total thickness of 3 ft (0.9 m) (i.e., three lifts of roughly equal thickness). The thickness of select impacted material over the protective layer may be decreased to 2 ft (0.6 m) if the first

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lift of material to be placed over the select impacted material is either Category 1 or Category 2 impacted materials. The upper select impacted material layer shall be placed in a similar manner to a minimum total thickness of 3 ft (0.9 m) measured perpendicular to the exterior slope (see Figure 6-1).

7.3.2 Compaction Procedures

The select impacted material layer shall be compacted in a manner that conforms with Section 02200, of the project specifications. A standard Proctor (ASTM D 698) maximum dry density and optimum moisture content will be established for each impacted material type used in the select impacted material layers. These parameters will be obtained by the CQC Consultant in an on-site geotechnical laboratory established for OSDF construction. Each lift of select impacted material shall be compacted to 85 percent of the standard proctor maximum dry density if adjacent to the protective layer and 90 percent of the standard Proctor maximum dry density if adjacent to the contouring layer. It is anticipated that the compaction moisture content will be within ± 2 percentage points of the optimum moisture content. Specific requirements for compaction moisture content will be established by the CCM during construction.

7.4 General Soil and Soil-Like Material

7.4.1 Placement Procedures

Category 1 (soil and soil-like) material shall be placed and compacted in conformance with the procedures described in Section 02200, project specifications except as modified by this IMP Plan. Material shall be placed in 12- to 15-in. (300- to 375-mm) thick loose lifts and then compacted as indicated below.

Prior to placement of a new lift of soil or soil-like material, the previous lift shall be disced or tracked to leave the surface in a rough condition. The purpose of this preparation is to promote adhesion of the previous and new lifts and to mitigate preferential seepage pathways forming between adjacent lifts.

7.4.2 Compaction Procedures

Category 1 (soil and soil-like) material shall be compacted to at least 85 percent relative compaction based on the standard Proctor compaction test. The CQC Consultant will establish the standard Proctor maximum dry density and optimum moisture content for each Category 1 material requiring compaction. These parameters will be obtained by the CQC Consultant in an on-site geotechnical laboratory established for OSDF construction. It is anticipated that the compaction moisture content of the Category 1 material will be within ± 4 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the CQC Consultant during construction. These requirements will take into account the workability of the material, the required shear strength to obtain adequate levels of OSDF stability, moisture contents needed to achieve dust and other fugitive emission control, and material trafficability.

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8. SPECIAL PLACEMENT REQUIREMENTS

8.1 Introduction

This IMP Plan requires special procedures for the placement of: (i) the non-soil-like materials (Categories 2 through 5). The non-soil-like materials consist primarily of impacted materials from the Solid Waste Landfill, the Lime Sludge Ponds, and impacted debris resulting from demolition of structures within the FEMP former production area. The impacted debris consists primarily of building superstructure (i.e., steel, masonry, transite, and other finish components), concrete floor slabs, and building substructure (i.e., concrete footings, pads, and other components).

8.2 Surveying

The OSDF Construction Subcontractor shall survey the locations of placement of each zone or horizon of Categories 2 through 5 impacted material as it is placed in the OSDF. For each zone or horizon or other placement unit, the OSDF Construction Subcontractor shall establish the coordinates (to the nearest 12 in. (300 mm) in two horizontal directions and the nearest 1 in. (25 mm) vertically) of the limits of material disposal. The coordinates used for survey shall be with respect to the permanent coordinate system established for the OSDF. Where appropriate, sketches of disposal of Category 3 and 5 materials should be provided to show the general orientation and layout of individual and special items.

8.3 Category 2 Material (*En Masse* Placement)

8.3.1 Placement Procedures

Materials conforming to the Category 2 (*en masse* placement) definition shall be placed in the OSDF in loose lifts not exceeding 18 in. (450 mm) in thickness. Prior to placement of a lift of Category 2 material, the placement area shall be designated such that the area can be isolated on all sides with a minimum of 10 ft (3m) of

Category 1 soil. Category 2 material shall then be placed within the disignated area to a loose thickness of not more than 18 in. (460 mm). Compaction shall be accomplished first with a bulldozer as the material is spread. After spreading and initial compaction, soil (of a granular nature when available) shall be spread over the Category 2 material to bring the layer thickness to approximately 21 in. (535 mm). Prior to placement of a second lift of Category 2 material, Category 1 soil shall be constructed at the perimeter of Category 2 material to the height of the Category 2 material.

As Category 2 material is expected to be less compressible than the majority of the materials contained in the OSDF, the material should be spread laterally prior to placing the material vertically above other Category 2 material. However, as Category 2 material is also expected to be more permeable than other OSDF material, it shall not be spread laterally more than 100 ft (30 m) in any direction without surrounding the material with at least 10 ft (3 m) of less permeable Category 1 soil. This will reduce the potential for significant lateral migration of leachate. Not more than two lifts of Category 2 material shall be placed in a horizon. Category 2 horizons shall be separated vertically by a minimum 4-ft (1.2-m) thick horizon of Category 1 material.

The OSDF Construction Subcontractor shall mix soil or soil-like material as much as practicable with the Category 2 material during excavation and placement activities. The objective of this mixing is to fill voids within the Category 2 material, increase the density of the material placed in the OSDF, and aid in the homogenizing of demolition debris.

8.3.2 Compaction Procedures

After each lift of Category 2 material is placed, the material shall be compacted by four passes of a self-propelled, static pad-foot compactor (e.g., Caterpillar 815C, or equivalent). Soil spread on top of the Category 2 material will be compacted to a relative density of at least 90 percent based on the standard Proctor compaction test (ASTM D 698). It is anticipated that the compaction moisture content will be within ±2 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the CQA

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Consultant during construction. These requirements will take into account the workability of the soil, the required soil shear strength to obtain adequate levels of OSDF stability, moisture contents needed to achieve dust and other fugitive emission control, and material trafficability. Any soft spot indicated by tire ruts (from a tire exerting a ground pressure of at least 65 psi (450 kPa)) more than 0.5 in. (13 mm) or visible deflection under a rolling vehicle which cannot be stabilized with further compactive effort shall be cause for additional treatment. This treatment shall consist of removal, replacement, and recompaction of the soil material, and, if needed, infilling (with grout or other material approved by the CCM) soft areas in the Category 2 material. Areas requiring this additional treatment will be identified by the CCM.

8.4 Category 3 Items (Individual Placement)

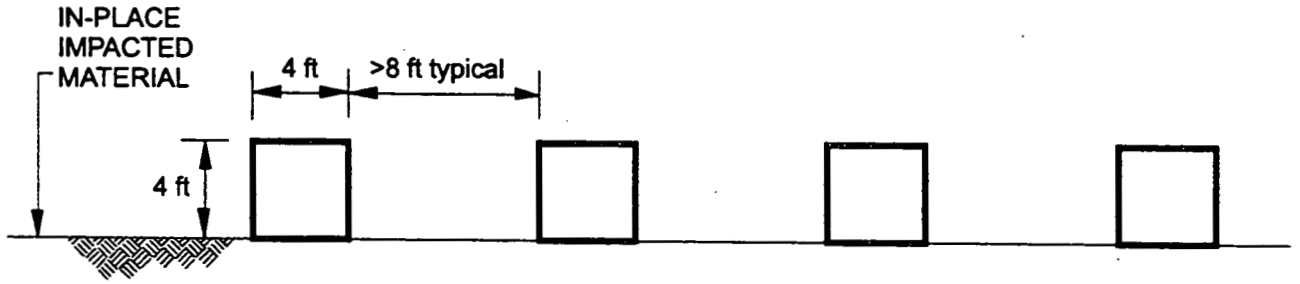
8.4.1 Placement Procedures

Items no more than 4 ft (1.2 m) high and of regular geometry can be placed as individual members or packages in the OSDF. As much as possible, groups of individual members or packages shall be similarly and regularly sized to enable their placement in the OSDF in regular patterns. Figure 8-1 illustrates the placement of several bundles of packaged transite panels.

Hollow items shall be filled with flowable cohesionless material or a quick set grout (or possibly lime sludge). The grout, or lime sludge, shall be allowed to set for a minimum of 4 hours prior to the commencement of placement operations around the piece of equipment.

Prior to placement of the Category 3 items, the surface of the in-place impacted material shall be prepared by rolling with a smooth-drum roller in the area of item placement. The Category 3 items or packages shall be placed on the surface in a regular pattern with an adequate spacing between individual members or packages to allow Category 1 material placement and compaction with available equipment. The space between each member or package shall be filled with Category 1 material placed in 12 in. (305 mm) thick compacted lifts. A final 12-in. (305 mm) thick compacted lift of Category 1 material shall be placed over each grouping of Category 3 items.

CATEGORY 3 MATERIAL PLACEMENT SEQUENCE



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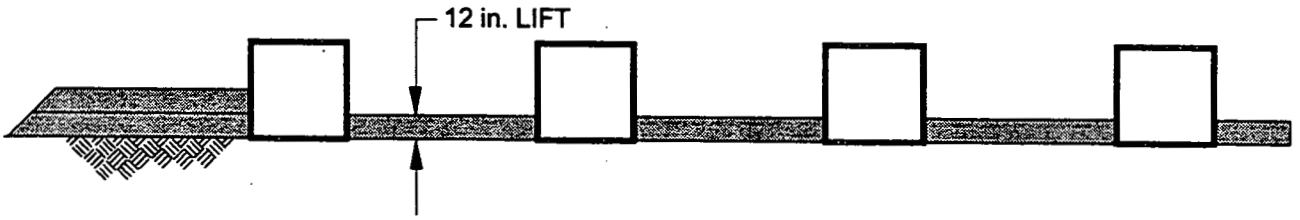
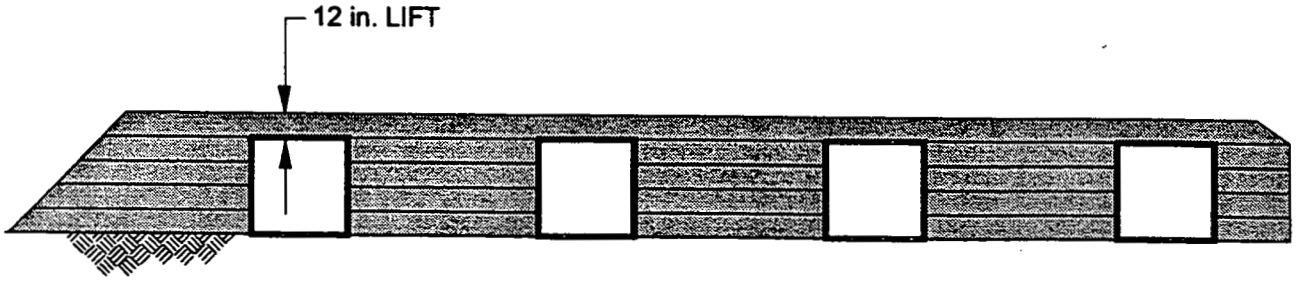


2. SPACE FILLED WITH 12 in. LIFTS



3. FINAL 12 in. LIFT PLACED ABOVE GROUPS

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FIGURE NO.	8-1
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDC
FILE NO.	FIG-6-3.CDR

As the Category 3 materials are expected to be less compressible than the majority of the impacted materials placed in the OSDF, the Category 3 items should be placed toward the center of the OSDF and not in the same horizon with more compressible materials. Horizons of Category 3 materials shall be separated by at least a 4-ft (1.2-m) thick horizon of Category 1 material.

8.4.2 Compaction Procedures

Each lift of soil between the Category 3 items shall be compacted using equipment capable of achieving a relative compaction of 90 percent based on the standard Proctor compaction test (ASTM D 698). It is anticipated that the compaction moisture content for this Category 1 material will be within ± 2 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the CQA Consultant during construction. These requirements will take into account the workability of the soil, the required soil shear strength to obtain adequate levels of OSDF stability, moisture contents needed to achieve dust and other fugitive emission control, and material trafficability.

The final compacted lift of Category 1 material placed above the Category 3 material shall be proof-rolled with a vehicle having a minimum tire pressure of 65 psi (450 kPa). Any soft spot indicated by tire ruts greater than 0.5 in. (13 mm) or visible deflections under rolling which cannot be stabilized with further compactive effort shall be cause for additional treatment. This additional treatment shall consist of removal, replacement, and recompaction of the Category 1 material, and, if needed, infilling the soft areas around the Category 3 material. Areas requiring this additional treatment will be identified by the CCM.

8.5 Category 4 Materials (Organics)

8.5.1 Placement Procedures

Prior to placement of the initial lift of Category 4 material, the surface of in-place impacted material shall be prepared with starter berms which are a minimum of 12 in. (0.3 m) high. Category 4 material shall be placed within the starter berms to a loose thickness of approximately 18 in. (0.45 m). Compaction shall be accomplished first with a bulldozer as the material is spread. Prior to placement of the succeeding lifts of Category 4 material, a 12-in. (0.3-m) thick loose lift of Category 1 material shall be placed over the Category 4 material and compacted as indicated below. Compaction of succeeding lifts of Category 4 materials shall be identical to the first lift. Not more than two lifts of Category 4 material shall be placed in a horizon. Category 4 horizons shall be separated vertically by a minimum 4-ft (1.2-m) thick Category 1 material.

8.5.2 Compaction Procedures

The Category 4 materials shall be mixed as much as possible with soils during excavation activities. The objective of this mixing is to stabilize the organics, minimize the potential for anaerobic decomposition (and, thus, landfill gas generation potential), and improve the compactability characteristics of the materials. After spreading and initial compaction, the material shall be compacted by minimum of four passes of a self-propelled, static pad-foot compactor having a minimum weight of 45,000 pounds (200 kN) (e.g., Caterpillar 815C, or equivalent). After each sequence of Category 4 material compaction and covering soil placement, the cover soil shall be proof-rolled with a vehicle having a minimum tire pressure of 65 psi (450 kPa). Any soft spot indicated by tire ruts greater that 0.5 in. (13 mm) or visible deflection under rolling which cannot be stabilized with further compactive effort shall be cause for special treatment. This special treatment shall consist of removal, replacement, and recompaction of the Category 1 material, and, if needed, infilling soft spots in the Category 4 material with grout or other material approved by the CCM. Areas requiring additional treatment will be identified by the CCM.

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8.6 Category 5 Materials (Special Handling)

8.6.1 General

Impacted materials suitable for placement in the OSDF that require special handling include:

- oversized impacted materials;
- double-bagged asbestos;
- sludges
- piping insulated with ACM; and
- highly-compressible impacted materials not suitable for lateral spreading as a Category 4 material.

Placement and compaction procedures for these types of impacted materials are presented below.

8.6.2 Oversized Impacted Materials

Placement

Oversized objects shall be placed in the OSDF such that if the object's height is X, the distance from the bottom of the object to the top of the select impacted material layer at the base of the OSDF shall be greater than 0.5 X and the distance between the top of the object and the bottom of the select impacted material layer near the top of the OSDF shall be greater than X. For example, an 8 ft (2.4 m) tall furnace cannot be placed within 4 ft (1.2 m) of the top of the select impacted material layer at the bottom of the OSDF or within 8 ft (2.4 m) of the bottom of the select impacted material layer at the top of the OSDF.

To the maximum extent possible, over-sized objects shall be placed near the center of the OSDF cell, but not directly above other over-sized objects. Oversized objects shall not be placed closer than 12 ft (3.6 m) to each other.

To reduce the potential for differential settlements, voids larger than 1 ft^3 (28 liters) in volume within oversized objects shall be filled with a flowable cohesionless material or grout (or possibly lime sludge) prior to placement. The grout, or lime sludge, shall be allowed to set for a minimum of 4 hours prior to the commencement of placing operations around the piece of equipment.

Oversized objects shall not be placed directly above double-bagged asbestos, sludge, or other materials significantly more compressible than impacted soils unless the oversized objects are less dense than the majority of the impacted materials in the OSDF.

Compaction

Impacted soil shall be compacted around and against oversized objects. The impacted soil shall be placed around the oversized objects in loose lifts of not more than 12 in. (300 mm). Prior to placement of a new lift of soil around the oversized object, the previous lift shall be tracked with a self-propelled, static pad-foot roller to leave the surface in a dimpled condition. The purpose of this pass is to promote adhesion of the previous and new lifts and the mitigate against the formation of preferential seepage pathways between adjacent lifts.

A standard Proctor (ASTM D 698) maximum dry density and optimum moisture content will be established for each impacted soil type to be used for placing around over-sized objects. These parameters will be obtained by the CQC Consultant in an on-site geotechnical laboratory established for OSDF construction. Impacted soil materials to be compacted around oversized objects shall be compacted to a relative compaction of at least 90 percent based on the standard Proctor compaction test, at a moisture content suitable for the attainment of the required density. It is anticipated that the moisture content will be within ± 2 percentage points of the optimum moisture content. Specific requirements from moisture content will be established by the CCM during

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construction. These requirements will take into account the workability of the soil, the required soil shear strength to obtain adequate levels of OSDF stability, moisture contents needed to achieve dust and other fugitive emission control, and material trafficability.

Surveying

The location of the center top of the oversized object shall be surveyed to the nearest 12 in. (300 mm) in two horizontal directions and to the nearest 1 in. (25 mm) vertically. If the object is greater than 200 ft^2 (18.6 m^2) in plan area, the four corners of the object shall be surveyed.

8.6.3 Highly Compressible Materials

Placement

The volume of highly compressible material, such as double bagged asbestos, requiring OSDF disposal is very limited. The primary criterion regarding the placement of asbestos is that the material be placed and compacted in a manner protective of the health of OSDF personnel and the public. A secondary criterion is to prevent significant differential settlement of the OSDF final cover system resulting from compression of this material.

Prior to placement of any highly compressible material in the OSDF, a trench shall be dug into previously placed and compacted Category 1 material. Material excavated from this trench shall be stockpiled a minimum of 6 ft (1.8 m) from the trench opening. No trenches shall be dug into layers containing Category 2 through 5 material, nor through the protective, contouring, or select impacted material layers. Trenches shall be of uniform width (between 24 and 36 in. (600 and 900 mm) wide) and of a uniform depth between 3 and 4 ft (0.9 and 1.2 m). The final sizing of the trench shall depend on the nature and size of the material to be disposed. Highly compressible material, such as double-bagged asbestos, shall be deposited in the lower half of the trench.

Compaction

An initial soil cover between 12 and 18 in. (305 and 450 mm) thick shall be placed on top of the highly-compressible material in the trench. The initial soil cover layer shall be compacted with four passes of a portable flat-plate or miniature roller compactor. Intermediate 6- to 12 in. (150 and 305 mm) loose soil lifts shall be placed in the trench and then compacted to a relative compaction of 90 percent based on the standard Proctor compacted test (ASTM D 698). A final trench lift shall be placed to a compacted height of 2 in. (50 mm) above the trench shoulders. The sequencing of material placement is illustrated in Figure 8-2.

Surveying

The coordinates of the ends of the trenches shall be surveyed to the nearest 12 in. (305 mm) in two horizontal directions and to the nearest 1 in. (25 mm) vertically.

8.6.4 Piping Containing ACM Insulation

Placement

The disposal of piping insulated with ACM in the OSDF shall be performed in a manner protective of the health of OSDF personnel and the public. These materials must be segregated from other demolition debris at the source and delivered to the OSDF in a condition suitable for placement in an excavation dug into previously placed and compacted Category 1 material. The size and shape of the excavation will be based on the predominant dimension and condition of the piping. If the piping comes to the OSDF in relatively straight lengths, the pipes shall be placed in trenches similar to those required for double bagged asbestos. If the piping comes to the OSDF in random shapes, bends, or curvatures, the pipes hall be placed in a rectangular excavation sized to accommodate the pipe but not larger than 12 ft (3.6 m) square and 4 ft (1.2 m) deep. The piping insulated with ACM shall be placed in the lower half of the excavation.

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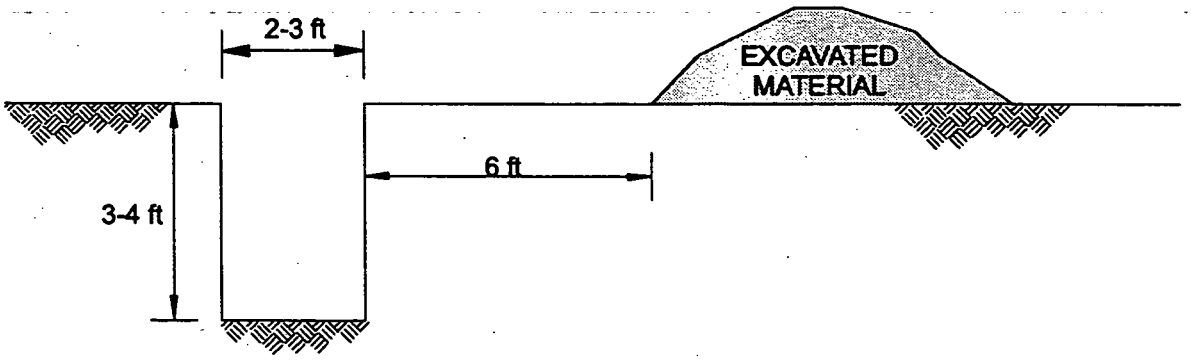
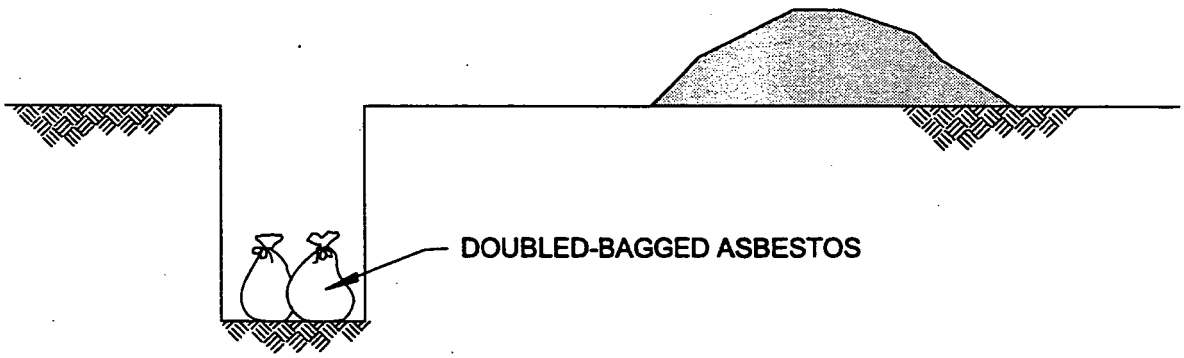
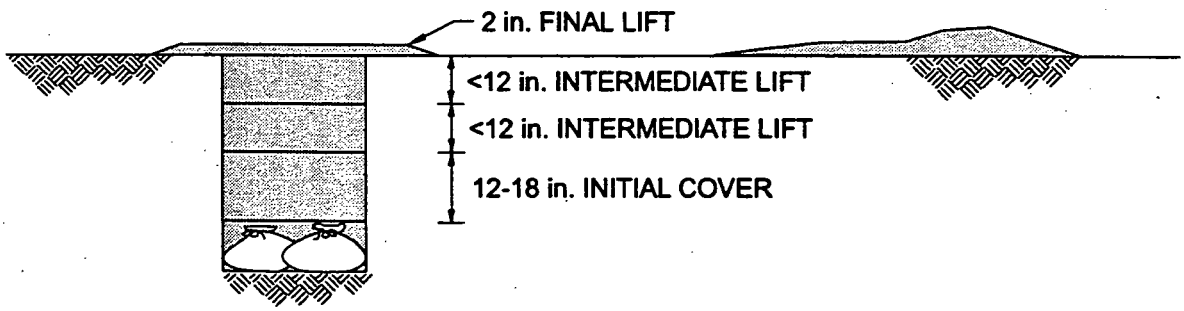
CATEGORY 5 MATERIAL PLACEMENT SEQUENCE



1. TRENCH DUG AND EXCAVATED MATERIAL STOCKPILED



2. CATEGORY 5 MATERIAL DEPOSITED IN TRENCH



3. FINAL TRENCH LIFT PLACED

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	8-2
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDC
FILE NO.	FIG-6-3.CDR

Compaction

An initial soil cover between 12 and 18 in. (305 and 460 mm) thick shall be placed on top of the piping insulated with ACM in the excavation. The initial soil cover layer shall be compacted with four passes of a portable flat-plate or miniature roller compactor or a padded-foot compactor such as the Caterpillar 815C as appropriate. Intermediate 6- to 12-in (150 and 305 mm) loose soil lifts shall then be placed in the excavation and compacted to a relative compaction of 90 percent based on the standard Proctor compacted test (ASTM D 698). A final excavation lift shall be placed to a compaction height of 2 in. (50 mm) above the excavation shoulders.

Surveying

The coordinates of the ends of the trenches or excavation corners shall be surveyed to the nearest 12 in. (305 mm) in two horizontal directions and to the nearest 1 in. (25mm) vertically.

8.6.5 Sludges

Placement

The placement, spreading, and compaction of the material from the Lime Sludge Ponds will depend on the water content of the sludge when delivered to the OSDF. The materials from the Lime Sludge Ponds shall be mixed with soils from the berms of the ponds as much as practicable during excavation or drying until excessive moisture is removed. The objective of this activity is to decrease the moisture content of the sludges and thereby improve their handling and subsequent compaction characteristics. The following procedure assumes the lime sludge has been mixed to the extent that it can be placed and compacted with conventional construction equipment.

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Prior to placement of the first lift of materials from the Lime Sludge Ponds, the surface of in-place impacted material shall be prepared with starter berms which are 12 in. (305 mm) high. Materials from the lime sludge ponds shall be placed within the starter berms to a loose thickness of 12 in. (305 mm).

Compaction

Compaction shall be accomplished first with a bulldozer as the material is spread. After spreading and initial compaction, the material shall be compacted to 90 percent of the sludge's standard Proctor maximum dry density using a self-propelled pad-foot roller (e.g., Caterpillar 815C , or equivalent). Prior to placement of the second and succeeding lifts of materials from the lime sludge ponds, a 12-in. (305 mm) thick lift of soil or soil-like material shall be placed above the sludge lift and compacted to a relative compaction of 85 percent based on the standard Proctor compaction test. After placement of the soil lift, another starter berm shall be constructed as with the first lift of stabilized sludge material. Compaction of all succeeding lifts of sludge materials shall be identical to the first lift. Not more than two lifts of sludge material shall be placed in a horizon. Sludge horizons shall be separated vertically by a minimum 4-ft (1.2-m) thick horizon of Category 1 material.

After each sequence of lime sludge and covering soil placement, the cover soil shall be proof-rolled with a vehicle having a minimum tire pressure of 65 psi (450 kPa). Any soft spot indicated by tire ruts greater that 0.5 in. (13 mm) or visible deflections under rolling which cannot be stabilized with further compactive effort shall be cause for special treatment. This special treatment shall consist of removal, replacement, and recompaction of the Category 1 material, and, if needed, infilling soft spots in the Category 5 material. Areas requiring additional treatment will be identified by the CCM.

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9. IMPACTED RUNOFF AND FUGITIVE EMISSIONS CONTROL

9.1 General

This section of the IMP Plan provides the requirements for impacted runoff and fugitive emissions control within the OSDF battery limit as it relates to impacted material placement. Within the OSDF battery limit, all impacted material placement activities will be confined to within the OSDF cell lined area. Activities related to the collection, handling, staging, loading, and transportation of impacted materials outside the OSDF battery limit will be addressed as part of other work plans prepared as a part of the integrated FEMP remediation.

9.2 Runoff Control

9.2.1 Within the OSDF Cell

Impacted runoff will be generated whenever precipitation comes in contact with impacted materials. Impacted runoff generated within the OSDF cell shall be managed as stated in this plan and the SWMEC Plan. Impacted runoff shall be conveyed using temporary surface-water management structures to the impacted-runoff catchment area in the southwest corner of each active cell. As previously described in this plan, layers of impacted material shall be placed from north to south and east to west within each cell. As these layers are placed, the impacted-runoff catchment area shall be preserved.

9.2.2 From the Impacted Material Haul Road

Impacted runoff from an impacted material haul road shall be contained within the boundaries of the road until it enters the sump at the western most end of the road. From this sump, the impacted runoff shall be routed to the storm drainage control of

the FEMP former production area, or to other on-site wastewater collection/conveyance points acceptable to the CCM.

9.3 Fugitive Emissions Control

9.3.1 General

Fugitive emissions may result from impacted material handling and placement activities. Material handling covers such activities as excavation, transporting, dumping, spreading, compacting, and short-term storage. These activities may generate fugitive emissions in the form of particulate matter released to the air (i.e., dust).

As appropriate, the OSDF Construction Subcontractor shall use one or more of the following engineering controls for the control of fugitive emissions from the OSDF:

- covers and physical barriers;
- water sprays;
- crusting agents;
- operational controls; and
- wind screens.

Each of the above controls is briefly discussed in the following subsections.

9.3.2 Covers and Physical Barriers

The OSDF Construction Subcontractor shall control fugitive emissions while hauling impacted materials to the OSDF.

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If visible emissions are in excess of the limit discussed in the OSDF Air Monitoring Plan, the CCM will direct the OSDF Construction Subcontractor to provide a correction plan.

9.3.3 Water Sprays

The OSDF Construction Subcontractor shall use water distributors and spray trucks to control fugitive dust emissions in active OSDF cells and along impacted-material haul roads within the battery limit. The frequency of water application should be weather dependent and be adjusted based on the appearance of visible dust and the results of air monitoring conducted as described in the OSDF Air Monitoring Plan.

9.3.4 Crusting Agents

The OSDF Construction Subcontractor shall consider the use of crusting agents whenever water is not effective or when a particular area will not be disturbed for long enough to justify the additional cost of the crusting agent. The OSDF Construction Subcontractor shall demonstrate, to the CCM, the compatibility of any crusting agent with components of the OSDF liner system prior to use.

9.3.5 Operational Controls

The OSDF Construction Subcontractor may use operational controls to limit fugitive emissions. Limiting the dumping of impacted material to days when the wind is calm is an example of an operational control. The OSDF Construction Subcontractor shall work closely with the CCM in the development and implementation of other beneficial operational controls to be implemented both on a daily and overall basis.

9.3.6 Wind Screens

The OSDF will be elevated above surrounding lands during its operational life. Increased winds at the higher elevation may cause additional fugitive emissions during periods of operation at the higher elevations. Silt fence on impacted material slopes installed for the control of surface erosion caused by precipitation may provide a measure of protection from winds. The OSDF Construction Subcontractor shall consider the use of additional wind screens when other methods of fugitive emissions control prove ineffective.

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10. REQUIRED DOCUMENTATION

10.1 General

This section of the IMP Plan contains information on the documentation required for each truck load of impacted materials to be placed in the OSDF.

10.2 Manifesting System

No impacted material will be accepted at the OSDF without an accompanying impacted material transport manifest. The purpose of the manifest is to provide a tracking mechanism for impacted material from the operable unit of origin to disposal in the OSDF.

Information to be included on the manifests include:

- generating remediation project;
- date/time of generation (loading for debris, excavation for other materials);
- weather conditions;
- visual description (i.e., soil, debris, railway locomotive);
- truck identification information (e.g., I.D. number);
- generating remedial project representative signature;
- OSDF Construction Subcontractor (transporter) signature;
- material category (1 - 5);
- date/time of disposal;

- CQC Consultant signature.

10.3 Impacted Materials Tracking

To aid in tracking impacted material, each impacted material transport manifest will have a unique serial number and one carbon copy. The carbon copy will be kept by the CCM representative in the operable unit. The original manifest will be retained by the CQC Consultant certifying that the impacted material has been disposed in the OSDF.

10.4 Records Procedures

FERMCO will be responsible for establishing the procedures and requirements for 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 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 collection forms, equipment calibration records, cost data, drawings, transport manifests maintenance records, and all associated reports.

All original data collected in the field 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 initialized and dated by the person making the correction.

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APPENDIX A

IMPACTED MATERIALS PLACEMENT QUALITY ASSURANCE PLAN

Fernald Environmental Management Project
Fernald, Ohio

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A.1 INTRODUCTION

A.1.1 Overview

This IMP Quality Assurance (QA) Plan describes the activities which shall be undertaken throughout the construction, filling, and closure of the OSDF to assure the acceptance, placement, and compaction of the impacted materials in the OSDF are in accordance with the procedures established in the *IMP Plan* and *CQA Plan*. This plan contains requirements and procedures specifically applicable to impacted materials after they are brought into the OSDF battery limit.

A.1.2 Plan Scope

This IMP QA Plan establishes the QA/QC procedures and documentation practices to be used by the CQC Consultant to monitor and test impacted materials which are transported, placed, and compacted by the OSDF Construction Subcontractor within the OSDF battery limits. The scope of this plan includes:

- additional CQC Consultant duties related to impacted materials;
- monitoring, testing, and documentation procedures to be used by the CQC Consultant in assuring impacted material placement is in accordance with the requirements of the *IMP Plan*; and
- dispute resolution procedures.

A.1.3 Plan Organization

The remainder of this plan is organized as follows:

- the job descriptions, qualifications, and required training of personnel involved in IMP QA are presented in Section A.2;

- specific monitoring procedures are presented in Section A.3;
- specific compaction testing requirements for each impacted material category are presented in Section A.4;
- requirements for as-placed plans are presented in Section A.5; and
- procedures to be used for dispute resolution are presented in Section A.6

Appendix A1 to this IMP QA Plan contains the manifest to be used in tracking impacted material placement in the OSDF.

A.2 IMP QA PERSONNEL

A.2.1 Staffing Requirements

Monitoring and testing of the acceptance, placement, and compaction of impacted materials at the OSDF shall be the responsibility of the CQC Consultant. The following personnel shall have responsibilities related to the impacted materials placement QA activities at the OSDF:

- CQC Managing Engineer;
- CQC Site Manager;
- CQC Field Monitor; and
- Impacted Materials Monitors;

The CQC Consultant shall maintain sufficient CQC personnel on site to monitor a steady flow of impacted materials into the OSDF.

A.2.2 CQC Managing Engineer

The CQC Managing Engineer shall be in overall charge of the QA activities related to impacted material placement. In addition to the duties described in the *CQA Plan*, the CQC Managing Engineer shall also be responsible for monitoring of the impacted materials placement and compaction in the OSDF. The required qualifications of the CQC Managing Engineer are contained in the *CQA Plan*.

A.2.3 CQC Site Manager

A.2.3.1 Job Description

The CQC Site Manager shall be in direct day-to-day charge of the QA monitoring conducted at the OSDF during impacted materials placement. In addition to the duties described in the *CQA Plan*, the Site Manager shall also be responsible for:

- monitoring impacted materials suitability for disposition in the OSDF;
- evaluating the compaction of the impacted materials in the OSDF;
- assigning Impacted Materials Monitors and supervising their performance;
- forwarding required documentation to the CQC Managing Engineer;
- instructing Impacted Materials Monitors regarding the use of proper health and safety procedures; and
- holding regular health and safety meetings at which attendance by Impacted Materials Monitors will be mandatory.

A.2.3.2 Required Job Qualifications

The qualifications of the CQC Site Manager are contained in the *CQA Plan*.

A.2.4 CQC Field Monitor

A.2.4.1 Job Description

In addition to the duties described in the *CQA Plan*, the CQC Field Monitor shall perform placement monitoring and supervise compaction testing of impacted materials in the OSDF. Placement monitoring and compaction testing shall include

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documentation that the OSDF Construction Subcontractor is performing in accordance with the procedures specified in the *IMP Plan*.

A.2.4.2 Required Job Qualifications

The qualifications of the CQC Field Monitor are contained in the *CQA Plan*.

A.2.5 Impacted Materials Monitor

A.2.5.1 Job Description

Impacted Materials Monitors shall perform placement monitoring and compaction testing of impacted materials in the OSDF in accordance with this IMP QA Plan. Monitors shall also classify, as necessary, the impacted materials for the purposes of assigning a compaction method to the impacted materials.

A.2.5.2 Required Job Qualifications

Impacted Materials Monitors shall have experience in performing QA/QC in earthwork construction, demolition, or solid waste industries or in an equivalent industry.

A.2.6 Training

Training requirements for personnel employed at the FEMP are contained in the Fernald Site Wide Training Plan -- PL-3032 [FERMCO, 1995]. Personnel engaged in impacted materials QA activities at the OSDF shall be trained in accordance with this plan.

Each CQC Consultant employee shall have OSHA 40-Hour Hazardous Waste Workers' Health and Safety Training (HAZWOPER) conducted in accordance with 29 CFR 1910.120. Each employee shall also take an 8-Hour Hazardous Waste Workers' Health and Safety Training refresher course each year, and no more than one

year from the date of completion of the 40-Hour HAZWOPER training. Each CQC Site Manager and the CQC Managing Engineer shall receive 8-Hour HAZWOPER Supervisory training.

Each new employee shall receive 3 days of on-the-job training as required by 29 CFR 1910.120. On-the-job training will include, at a minimum, a discussion of site specific health and safety features, a walk-through of the areas in which the new employees will be working with a discussion of possible hazards in the area, a discussion of job duties and potential hazards associated with the duties, and a discussion regarding appropriate personal protective equipment (PPE) including minimum requirements for work clothing in accordance with the site specific health and safety plan.

A.3 IMPACTED MATERIALS MONITORING

A.3.1 Required Documentation

Upon entering the OSDF battery limits, the CQC Consultant shall check that the impacted materials are accompanied by a manifest and that the hauling truck has been properly identified as to the impacted material category. A transportation manifest is attached to this report in Appendix A1. Impacted material categories are defined in Section 5.2 of the *IMP Plan*. The CQC Consultant shall verify that the manifest contains all information relating to the impacted material origin as specified by Section 10.2 of the *IMP Plan*. The CQC Consultant shall complete the manifest by recording the date, time, and location of disposal within the OSDF as well as any pertinent notes, comments, or observations about the load. The CQC Consultant shall finally affix a signature to the manifest verifying that the load has been disposed in accordance with the *IMP Plan*.

A.3.2 Visual Inspection

The CQC Consultant shall perform a visual review of the impacted materials entering the OSDF. The contents of each hauling truck shall be viewed to assure that the contents of the truck match the visual description entered on the manifest and that the impacted materials in each truck have been assigned to one of the five categories listed in Section 5.2 of the *IMP Plan*. If no material category has been entered onto the manifest, the CQC Consultant shall attempt to categorize the impacted material. If the impacted material cannot be readily categorized, it will automatically be assigned as Category 5 materials (special handling).

A.3.3 Monitoring for Moisture Content

Impacted materials accepted at the OSDF shall be at a moisture content suitable for placement and compaction in accordance with the *IMP Plan*. If the CQC Consultant determines that impacted materials are too wet, the OSDF Construction

Subcontractor shall dry the material to a condition allowing placement and compaction in accordance with the *IMP Plan*.

A.3.4 Demolition Debris Monitoring

General

The CQC Consultant shall monitor demolition debris transported into the OSDF. Additional information regarding waste classification and special handling of specific types of demolition debris is presented in the following sections.

Asbestos

Trucks carrying double bagged asbestos must display asbestos warning signs. The OSDF Construction Subcontractor shall comply with [later] relating to the handling and transportation of asbestos products.

Broken Concrete

Most concrete demolition debris will fall into Category 2. Loads of concrete containing concrete pieces that cannot be spread into 18 in. (460 mm) lifts will be classified as Category 5 materials (special handling).

Steel Sidings

Steel sidings that arrive at the OSDF in neatly packaged stacks less than 4 ft high, will be classified as Category 3 Items (individual placement). Loose truck loads of miscellaneous demolition debris containing steel sidings that can be spread in lifts not higher than 18 in. (460 mm) will be classified as Category 2 materials (*en masse* placement). Other steel siding will be classified as Category 5 materials (special handling).

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Steel Beams

Steel beams which can be spread or placed into a lift no higher than 18 in. (460 mm) will be classified as Category 2 materials (*en masse* placement). Steel beams that cannot be placed in a lift no higher than 18 in. (460 mm) but which can be placed individually such that the highest part of the beam is not more than 4 ft (12 m) above the ground surface will be classified as Category 3 items (individual placement). Other beams will be classified as Category 5 materials (special handling).

Wood

Loads of demolition debris consisting primarily of wood and that can be spread in lifts no higher than 18 in. (460 mm) will be classified as Category 4 materials (organics).

Miscellaneous Demolition Debris

Loads of miscellaneous demolition debris (doors, plumbing, wiring, et cetera) that can be spread in lifts no higher than 18 in. (460 mm) will be classified as Category 2 materials (*en masse* placement). Miscellaneous demolition debris that can be placed individually such that the highest part of the debris is not more than 4 ft (1.2 m) above the ground surface will be classified as Category 3 items (individual placement). Other debris will be classified as Category 5 materials (special handling).

Tanks

Tanks that cannot be placed such that soil or soil-like materials can be placed and compacted within and around them shall not be accepted at the OSDF. Pressurized or pressurizable cylinders which have not been cut in half such that they cannot contain pressurized materials will not be accepted at the OSDF. Tanks acceptable for placement in the OSDF and which are less than 4 ft (1.2 m) high will be classified as Category 3 items (individual placement). Other acceptable tanks will be classified as Category 5 materials (special handling)

Pipes

Steel pipes which can be spread or placed into a lift no higher than 18 in. (460 mm) will be classified as Category 2 materials (*en masse* placement). Steel pipes larger that cannot be placed in a lift no higher than 18 in. (460 mm) but which can be placed individually such that the highest part of the pipe is not more than 4 ft (1.2 m) above the ground surface will be classified as Category 3 items (individual placement). Other pipes will be classified as Category 5 materials (special handling).

Furnaces

Furnaces which will be wholly entombed within the OSDF will be classified as Category 5 materials (special handling).

Miscellaneous Equipment

It is expected that most other equipment will be classified as Category 5 materials (special handling). Monitors will use their best judgment to evaluate miscellaneous equipment and attempt to classify it (for compaction purposes) in accordance with the guidelines presented herein.

A.3.5 Prohibitions

Items specifically prohibited from disposal in the OSDF are listed in Section 4.4 of the *IMP Plan*.

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A.4 IMPACTED MATERIAL PLACEMENT AND COMPACTION

A.4.1 Category 1 Materials (Soils and Soil-Like)

General Monitoring Requirements

Monitoring the placement and compaction of impacted soil and soil-like materials includes the following:

- testing to determine the water content and other physical properties of the impacted soil materials during processing, placement, and compaction;
- monitoring the thickness of lifts as loosely placed and as compacted;
- monitoring the action of the compaction and heavy hauling equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc.); and
- monitoring the number of passes used to compact each lift.

Placement and Compaction Quality Control

The standard Proctor test (ASTM D 698) shall be used for the determination of moisture/density relationships on each separate type of soils and soil-like material to be disposed in the OSDF. The standard Proctor tests will be performed in the on-site geotechnical laboratory established per the *CQA Plan*.

The dry density, moisture content, and lift thickness of soil and soil-like materials shall be measured at a minimum frequency of four times per acre per lift in accordance with ASTM Methods D 2922 and D 3017 (nuclear methods). The sand cone test method (ASTM Method D 1556) shall be used once per day, when soils or soil-like materials are placed, to establish correlations of moisture and density with the nuclear methods. The sand cone correlation will also be used to evaluate the effect impacted materials may have on the nuclear densitometer.

Compaction testing for Category 1 materials will be documented in accordance with procedures established in the *CQA Plan*. At locations where the field testing indicates densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

Lines and Grades

Surveying of lines and grades shall be conducted by the OSDF Construction Subcontractor on an ongoing basis during the deposition of the impacted materials. The CQC Consultant shall monitor the surveying to ensure that slopes are properly constructed to promote proper drainage and assure that required separation distances are maintained.

A.4.2 Category 2 Materials (*En Masse* Placement)

Placement Quality Control

The CQC Consultant shall monitor and document that the placement of Category 2 materials (*en masse* placement) is in accordance with the *IMP Plan*.

Monitoring of placement by the CQC Consultant shall include verification that:

- starter berms are in place;
- lift thickness are no more than 18 in. (450 mm);
- soils or soil-like materials are worked into the lift as much as practical;
- horizontal lift extent is no more than 100 ft (30 m) without surrounding the lift with 10 ft (3 m) of less permeable soil; and
- horizons are limited to two lifts and separated by 4 ft (1.2 m) of Category 1 materials.

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Compaction Quality Control

The CQC Consultant shall monitor and document that the Category 2 materials have received the compaction effort specified by the *IMP Plan*. Soil used to cap each lift of Category 2 material shall be tested for dry density and moisture content in accordance with ASTM Methods D 2922 and D 3017.

Compaction testing of soils capping the Category 2 material shall be documented in accordance with procedures established in the *CQA Plan*. At locations where the field testing indicated densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

A.4.3 Category 3 Items (individual placement)

Placement Quality Control

The CQC Consultant shall monitor and document that the placement procedures presented in Section 8 of this *IMP Plan* are followed by the OSDF Construction Subcontractor in the placement of Category 3 items (individual placement). Monitors will observe and document that the maximum lift thicknesses of soil and soil-like materials placed around the individually placed items are maintained.

Compaction Quality Control

The standard Proctor test (ASTM D 698) shall be used for the determination of moisture/density relationships of soils and soil-like material to be compacted around Category 3 items in the OSDF. The standard Proctor tests will be performed in the on-site geotechnical laboratory established per the *CQA Plan*.

The dry density and moisture content of the soil and soil-like materials being compacted around the individually placed items will be determined at a frequency of once per lift per 200 ft (60 m) of row length; testing will be in accordance with ASTM Methods D 2922 and D 3017 (nuclear methods).

Compaction testing for Category 1 materials shall be documented in accordance with procedures established in the *CQA Plan*. At locations where the field testing indicates densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

A.4.4 Category 4 Materials (Organics)

Placement Quality Control

The CQC Consultant shall observe and document that the placement procedures presented in Section 9 of the *IMP Plan* are followed by the OSDF Construction Subcontractor in the placement of Category 4 materials (organics). Monitors shall observe and document that maximum lift thicknesses are maintained.

Compaction Quality Control

The CQC Consultant shall monitor and document that the Category 4 materials have received the compaction effort specified by the *IMP Plan*. Category 1 materials capping the Category 4 lift shall be tested for dry density and moisture in accordance with ASTM Methods D 2922 and D 3017. Four compaction tests per acre shall be performed on the soil cover for every lift of Category 4 materials. The standard Proctor test (ASTM D 698) shall be used for the determination of moisture/density relationships on each separate type of soils and soil-like material to be used to cover Category 4 materials in the OSDF. The standard Proctor tests will be performed in the on-site geotechnical laboratory established per the *CQA Plan*.

Compaction testing for Category 1 materials will be documented in accordance with procedures established in the *CQA Plan*. At locations where the field testing indicates densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

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A.4.5 Category 5 Materials (Special Handling)

Placement Quality Control

The CQC Consultant shall observe and document that the placement procedures listed in Section 9 of the *IMP Plan* are followed by the OSDF Construction Subcontractor and that maximum lift thicknesses and trench depths are maintained.

Compaction Quality Control

Oversized Objects

The compaction and lift thickness of the impacted soil shall be monitored for every third lift placed around the oversized object using methods in accordance with the procedures identified in the *CQA Plan*. The standard Proctor test (ASTM D 698) shall be used for the determination of moisture/density relationships on each separate type of soils and soil-like material to be compacted around oversized objects in the OSDF. The standard Proctor tests will be performed in the on-site geotechnical laboratory established per the *CQA Plan*.

Double Bagged Asbestos

One compaction density check per lift shall be performed on the soil cover for every 200 ft (60 m) of trench. The standard Proctor test (ASTM D 698) shall be used for the determination of moisture/density relationships shall be run on each separate type of soils and soil-like material to be compacted over double bagged asbestos trenches in the OSDF. The standard Proctor tests will be performed in the on-site geotechnical laboratory established per the *CQA Plan*.

Sludges

The compaction and lift thickness of sludges will be tested at a minimum frequency of four times per acre per lift in accordance with the procedures identified

for Category 1 materials. The standard Proctor test (ASTM D 698) shall be used for the determination of moisture/density relationships on each separate type of stabilized sludge to be placed in the OSDF. The standard Proctor tests will be performed in the on-site geotechnical laboratory established per the *CQA Plan*.

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A.5 AS-PLACED PLANS

The CQC Consultant shall prepare as-placed plans for the completed impacted-materials placement activities. The OSDF Construction Subcontractor shall allow for this activity in the scheduling of impacted materials placement and shall promptly furnish survey notes to the CQC Consultant.

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A.6 DISPUTE RESOLUTION

In the event that a dispute arises between the OSDF Construction Subcontractor and the CQC Consultant regarding an interpretation of this *IMP QA Plan*, the two parties shall submit the dispute to the CCM for resolution. The CCM will, in consultation with the Resident Engineer, resolve the dispute. The decision of the CCM will be binding on both parties.

For health & safety or environmental monitoring and protection matters, the decision of the CCM will be binding on all parties. No dispute of a decision made by the CCM in health and safety or environmental monitoring and protection matters shall be allowed.

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APPENDIX A1

IMPACTED MATERIALS MANIFEST

MANIFEST TO BE DEVELOPED

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Systems Plan

ON-SITE DISPOSAL FACILITY

April 1996
Revision D

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

GeoSyntec Consultants
1100 Lake Hearn Drive, NE, Suite 200
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Under

Fernald Environmental Restoration Management Corporation
Subcontract 95PS005028

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1. INTRODUCTION

1.1 Overview

This System 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 systems, final cover systems, seasonal landfill cover, temporary facilities, and access roads within the battery limit of the OSDF.

This plan addresses Systems activities 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* [DOE, 1995a] (Operable Unit 2 ROD) will be addressed in the Post-Closure Plan. Inspection, monitoring, and maintenance activities beyond the 30-year post-closure monitoring period will be addressed through future amendments to this plan and the Post-Closure Plan.

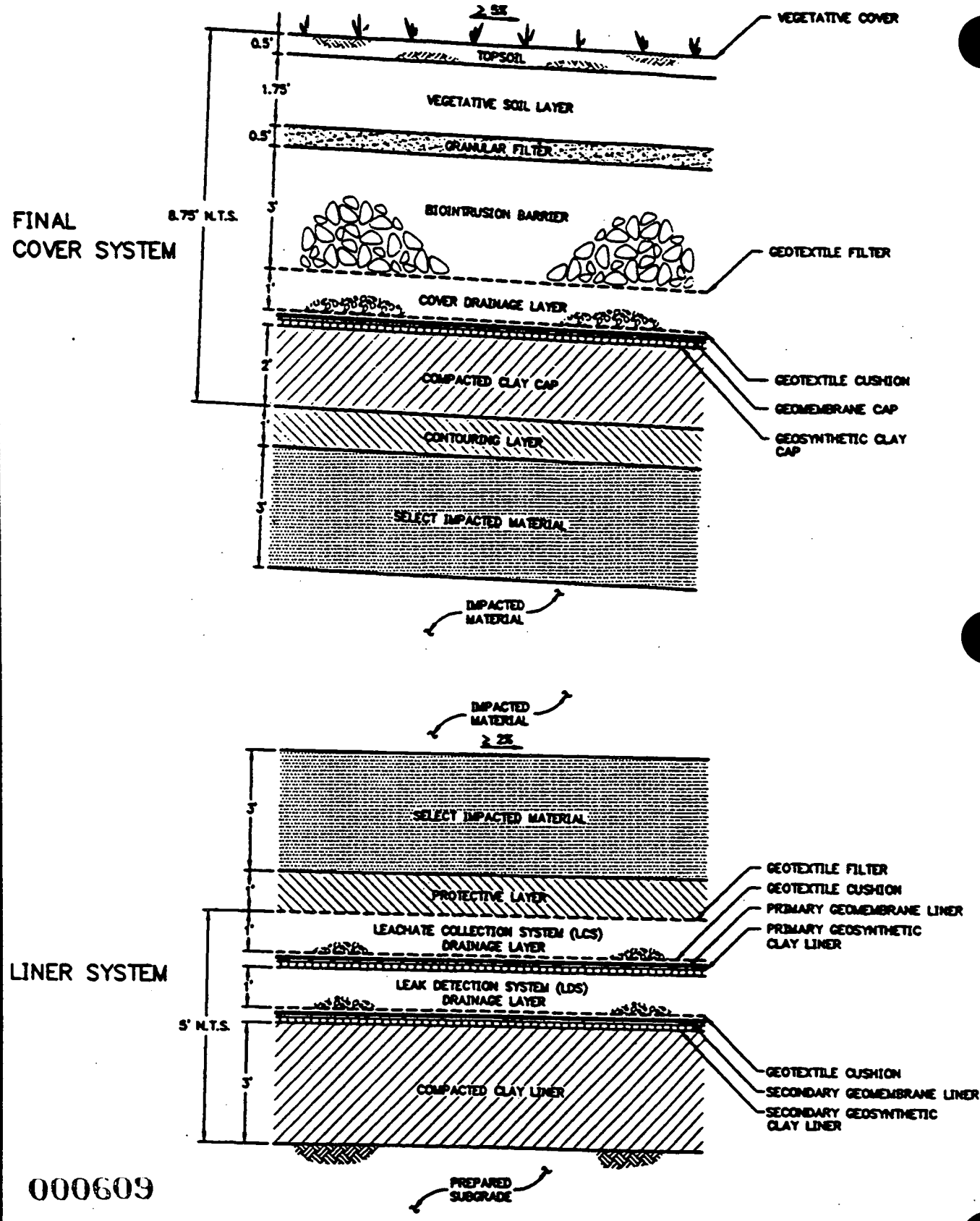
1.2 Project Description

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 Operable Unit 2 ROD has established an initial WAC for the OSDF of 346 picoCuries/gram (pCi/g) of uranium-238 (U-238) or 1030 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 OSDF is designed to be constructed, material placed, and closed in phases. Projected phases of the OSDF construction, placement of impacted material and closure are outlined in Table 1-1.

The design approach for the OSDF is presented in the document, "*Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2*" [DOE, 1995c]. The design of the OSDF, as currently developed, is presented in the "*Intermediate Design Package, On-Site Disposal Facility*" [GeoSyntec, 1996]. 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.CDC
FILE NO.	F95a001.DWG

ON-SITE DISPOSAL FACILITY PROJECTED STAGES FOR CONSTRUCTION, MATERIAL PLACEMENT, AND CLOSURE

Stage	Liner System Construction	Impacted Material Placement	Final Closure System Construction
1 early	Cell 1	-	-
2 early	Cell 2	Cell 1	-
3 early	Cell 3	Cells 1,2	Cell 1
4 mid	Cell 4	Cells 2,3	Cell 2
5 mid	Cell 5	Cells 3,4	Cell 3
6 mid	Cell 6	Cells 4,5	Cell 4
7 mid	Cell 7	Cells 5,6	Cell 5
8 mid	Cell 8	Cells 6,7	Cell 6
9 mid	Cell 9 (if required)	Cells 7,8	Cell 7
10 mid	-	Cells 8,9	Cell 8
11 mid	-	Cell 9	Cell 9

Note: Cell 9 is a contingency cell and will only be constructed if required based on the actual quantities of material sent to the OSDF.

1.3 System 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, whose post closure activities are presented for illustrative purposes only, as post closure activities will be addressed in a separate forthcoming post-closure plan;

- inspecting, and monitoring, the leachate management systems;

- stabilizing the final cover systems 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.

1.4 System Plan Organization

The remainder of this OSDF 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;

- activities for the OSDF leachate management systems are presented in Section 3;

- activities for the OSDF final cover systems are contained in Section 4;

- activities for the OSDF seasonal cover are described in Section 5;

- activities for the OSDF temporary support facilities, utilities, and site security fence are addressed in Section 6;

- activities for the permanent access roads are presented in Section 7; and

- procedures and recordkeeping requirements are presented in Section 8.

1.5 Systems Plan Responsibilities

Implementation responsibilities for this Systems Plan are as follows:

- *Construction Contracts Manager (CCM):* 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 OSDF Construction Subcontractor, and requesting involvement of Resident Engineer, as required;

- *OSDF Construction Subcontractor:* responsible for construction, impacted material placement, and closure of the OSDF facility. The OSDF Construction Subcontractor shall implement this plan until the OSDF is fully closed.

The OSDF Construction 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 OSDF Construction 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 OSDF Construction Subcontractor will be required to provide a H&S field representative who will be responsible for the OSDF Construction Subcontractor's compliance with all H&S requirements. The OSDF Construction 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 Plan:* provides procedures to strip, develop, maintain, and restore the OSDF soil borrow area.

- *OSDF Construction Quality Assurance Plan:* 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*: outlines impacted material acceptance criteria (WAC) and provides procedures for impacted materials disposal in the OSDF.

- *OSDF Surface-Water Management and Erosion Control Plan:* provides details of temporary and permanent E&S controls for the OSDF (including maintenance requirements for channels and sediment control).

- *OSDF Air Monitoring Plan:* provides for monitoring potential fugitive dust emissions and potential radionuclide particulate matter that may occur during construction, impacted material placement, and closure of the OSDF.

- *OSDF Post-Closure Plan:* will describe post-closure inspection, operation and maintenance activities, and will provide required response actions for various contingencies at the OSDF, including exceedance of the action leakage rate (ALR) in the leak detection systems of an OSDF cell.

This Systems Plan has been prepared for regulatory review. The plan describes the basic inspection, monitoring, maintenance and operational activities that will be undertaken for the OSDF system. 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 OSDF Construction 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.

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2. APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory, DOE, and other requirements applicable to this Systems Plan are contained in the OSDF 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 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.

- OAC 3745-27-14(A)(1)(2): Following completion of final closure activities in accordance with rule 3745-27-011 of the OAC, post-closure care activities shall be conducted at the disposal facility for a minimum of 30 years.

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

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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 specified 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 systems are provided in Section 2.5 of the DCP. Criteria relevant to the final cover systems 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.

3. LEACHATE MANAGEMENT SYSTEM

3.1 Overview of System

The double-liner systems of each OSDF cell contains a leachate collection systems (LCS) and a leak detection (LDS) systems (see Figure 1-1). These system are designed to convey any liquids that enter the system through pipes (i.e., the LDS pipes and the LCS pipes) to manholes located outside each cell. Liquids that enter the LCS include: (i) leachate generated in the impacted material which infiltrates 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 top 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 systems (LTS) gravity line which conveys leachate from the LCS pipe outlets in the manholes via gravity flow to a temporary or a permanent lift station. Leachate conveyed to the temporary lift station is pumped through a temporary double-wall forcemain to the permanent lift station. From the permanent lift station, leachate is pumped through a permanent double-wall forcemain to the Biodenitrificatication Surge Lagoon (BSL)

The locations of the LCS, LDS, and LTS pipes, manholes, and gravity lines are presented on the Construction Drawings.

This Systems Plan addresses all leachate management systems components up to the LTS gravity line or temporary forcemain 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 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 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. 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 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 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 temporary lift station and secondary containment structure.

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- 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 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 temporary lift station contains a pump suction box into which the LTS gravity line discharges. Prior to discharging into the pump suction box, liquids first pass through a motor operated inflow valve. The secondary containment temporary lift station will be equipped with a liquid level transmitter which is activated when the liquid level in the secondary containment exceeds 2 in. (50 mm) from the floor of the station. The inflow valve is a fail-closed valve which closes in the event of a power failure. The motor will close the valve when the liquid level alarm is activated. The pump suction box is a 6-ft (1.8-m) long, 16-in. (400-mm) diameter HDPE pipe flanged on both ends. The box stands on the bottom of the temporary lift station and contains an air release valve at its top. A pump enclosure located outside the temporary lift station contains two centrifugal pumps and two associated globe valves, a flow meter, and a motor-operated valve. The pumps take suction from the box and pump it through the temporary forcemain to the permanent lift station.

- The pump suction box contains a liquid level transducer which activates one of two centrifugal pumps and opens the associated motor-operated outflow valve when the liquid level in the box exceeds 3.5 ft (1 m) above the bottom of the pump suction box. The pumps and the valve are turned off when the liquid level is 1.5 ft (0.5 m) from the bottom of the pump suction box.

- The pump enclosure will include a liquid indicator alarm to detect potential leaks.

- The centrifugal pumps pull the liquid from the pump suction box and push it through the temporary forcemain to the permanent lift station. Globe valves located between the pumps and the forcemain in conjunction with the flow meter control the rate of flow into the forcemain. The temporary lift station pump control systems is designed to pump at a rate no greater than the storm design flow rate, which has been established as 80 gallons per minute (gpm) (300 liters per minute (lpm)).

- Unneeded portions of the temporary forcemain are to be taken out of service as part of each subsequent stage of construction. The temporary lift station shall be disassembled into the pump suction box component, the pump enclosure component, and a 2-in. (50-mm) diameter PVC pipe connecting these two components by disconnecting the quick connects between them. At that time, the LTS gravity line should be extended either to the next temporary lift station location and the temporary lift station will be reassembled or to the permanent lift station, as appropriate.

- The temporary forcemain between the temporary and the permanent lift stations consists of double-wall HDPE pipe. The inner carrier pipe is 3 in. (75 mm) in diameter and the outer containment pipe is 6 in. (150 mm) in diameter. The temporary forcemain has a negative slope and will be capable of draining into the temporary lift station at a slope of at least 0.25 percent. During winter months, the temporary forcemain must be covered by at least a 1 ft (0.3-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). 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 equipped with a pumping systems 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 OSDF Construction 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

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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 OSDF Construction Subcontractor in conformance with the requirements of this section.

- Systems shall not be accepted for operation until the OSDF Construction Subcontractor has completed all the requirements of the Construction Acceptance Testing.

- Prior to the start of active operations of a cell, the OSDF Construction 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 OSDF Construction Subcontractor shall set the level transmitter for the primary containment vessel of the LDS manholes to activate the alarm (strobe light and radio signal) 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 OSDF Construction 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 OSDF Construction Subcontractor personnel shall respond within one hour to assess the reasons for the alarm sounding and to take corrective actions.

- Throughout active operations of the cell, the OSDF Construction Subcontractor shall daily measure and record the liquid quantity in, and flow rate into, the primary containment vessel of the 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 vessel shall be evacuated as often as necessary to prevent overtopping of the vessel.

- 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 OSDF Construction 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.

- After impacted material placement begins in a cell, all water in the cell may be pumped 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.

- The valve on the redundant LCS carrier pipe shall be maintained closed at all times.

- 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 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, OSDF Construction Subcontractor personnel shall respond within one hour to assess the problem and to take appropriate corrective actions.

- The OSDF Construction Subcontractor shall provide the CCM with whatever equipment or assistance the CCM may periodically request in connection with obtaining samples of liquids from the LCS and LDS sampling or monitoring ports.

The OSDF Construction 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 activity schedule has been approved by EPA and OEPA. Specific details of the required inspection and maintenance activities are given below.

According to ARAR (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 OSDF Construction 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

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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 • leakage from primary containment vessel • liquid in LDS containment pipe	• check level transmitter operations (e.g., operating temperature range, accuracy, etc.), electrical connections, and alarm light. • check for source of leak; if source identified then take appropriate corrective measures (i.e., spot-seal vessel, replace vessel, etc.) • 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 • condition of shutoff valve • liquid in LCS containment pipe • liquid in redundant LCS carrier pipe	• check level transmitter operations (e.g., operating temperature range, accuracy, etc.), electrical connections, strobe light, and radio transmission • check valve operability; correct any deficiencies • keep monitoring port drained; perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects • 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.

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, et 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 on a case by case basis. Any procedure proposed by the OSDF Construction Subcontractor other than flushing with water must be pre-approved by the CCM.

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.

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 CCM.

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3.5 LTS Operation Procedures

The OSDF LTS shall be operated by the OSDF Construction Subcontractor in conformance with the requirements of this section.

- Systems shall not be accepted for operation until the OSDF Construction Subcontractor has completed the requirements of the Construction Acceptance Testing.

- Prior to the start of active operations of the OSDF, the OSDF Construction Subcontractor shall set the level transmitter for the temporary lift station secondary containment vessel to set off the alarm for a liquid level 2 in. above the bottom of the vessel.

- The OSDF Construction Subcontractor shall set the level transmitter for the intake of the temporary lift station to activate the centrifugal pumps and the motor-operated valve for a liquid level of 3.5 ft (1 m) above the bottom of the intake and to turn off the pumps and close the valve for a liquid level of 1.5 ft (0.5 m) above the bottom of the intake.

- The OSDF Construction Subcontractor shall adjust the temporary lift station globe valves to control the flow rate out of the lift station to a maximum of 80 gpm (300 lpm).

- Before taking the temporary lift station out of service, the OSDF Construction Subcontractor shall manually turn off the inflow valve to the temporary lift station and the temporary lift station shall be disassembled.

3.6 LTS Inspection and Maintenance Activities

- The leachate transmission systems 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

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 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 designated 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
LTS Gravity Line	Weekly	Monthly	• liquid in LTS gravity line containment pipe	• 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
			• inspection of pipe for clogging or crushing (annual only)	• 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.

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TABLE 3-3

LTS TEMPORARY LIFT STATION AND FORCEMAIN INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy
	Active Period	Closure Period		
Temporary Lift Station	Weekly	N/A	• record accumulated flow at disc flow meter; check that flow meter is operational[3]	• repair, replace as necessary
			• leakage from temporary lift station intake and plumbing	• investigate source of leakage, repair as necessary
			• make sure throttling valves are in operating condition	• repair, replace as necessary
			• pump operability	• check pump electrical connections and controls
			• condition of liquid transmitter for temporary lift station pump secondary containment system	• check sensor operations, electrical connections, and alarm light
			• confirm availability of back-up pump	• obtain pump; confirm it is in operating condition
Temporary Forcemain	Weekly	N/A	• frost protection soil cover	• increase soil cover if inadequate cover exists
			• liquid in temporary forcemain containment pipe	• 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) LTS temporary lift station and forcemain shall be inspected after the occurrence of major earthquakes.
(3) The flow meter shall be calibrated using procedures and frequencies in accordance with the manufacturer's recommended procedures.

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 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; and
- confirm adequate protection is provided around the temporary forcemain.

3.7 Emergency Procedures for Spills

The OSDF leachate management systems 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 systems. These safeguards and redundancies include the following:

- The LDS primary containment will be equipped with a level

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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 and the temporary lift station will include level transmitters which will activate an alarm if the liquid level exceeds 2 in. (50 mm) from the bottom of the containment.

- A liquid indicator will be placed in the temporary lift station pump enclosure which sets off an alarm if any leaks are detected in the enclosure.

- 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 programmable logic controller concludes the liquid level exceeds the maximum preset value, it activates the alarm light.

- The OSDF Construction Subcontractor personnel shall respond to the alarm within one hour to assess the problem and to take appropriate corrective actions. An OSDF Construction Subcontractor representative shall be "on call" 24 hours a day.

3.8 Recordkeeping

The OSDF Construction Subcontractor shall maintain written records of all monitoring activities, inspections, and maintenance repairs in accordance with the recordkeeping and reporting requirements of Section 8 of this plan.

4. FINAL COVER SYSTEM

4.1 Overview of 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 systems will be installed over that cell. Figure 1-1 of this plan presents the final cover systems cross section. As seen in this figure, the topmost surface of the final cover systems 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 base 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 requires inspection and maintenance with respect to the potential for surface erosion, gully formation, and settlement and subsidence.

The final cover systems 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 systems that maintains its effectiveness and performs as intended. In addition, the inspections are designed to detect any significant deterioration in the final landfill cover systems components.

The inspections shall consist of a walkover survey of the entire OSDF final cover systems. The visual inspection shall be conducted by traversing the cover systems 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);

TABLE 4-1

FINAL COVER SYSTEM INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections Closure Period	Condition	Remedy	Maintenance
Vegetation	Monthly for at least 6 months	• stressed vegetation	• evaluate cause; vegetate or remedy	• analyze soil and fertilize
		• erosion, bare spots, and poor performing vegetation	• remove sediment; reseed and mulch	• revegetate as needed
		• unwanted (i.e., deep) rooted plants, weeds or saplings	• remove as necessary	• mechanically, chemically or by controlled burn
Topsoil	Monthly for at least 6 months	• topsoil erosion or drainage gullies	• replace topsoil; reseed and mulch; utilize non-vegetative stabilization (e.g., jute mat) if necessary	• revegetate and refertilize
		• topsoil settlement or subsidence	• add topsoil and regrade	• reconstruct
		• burrowing animals	• implement program (e.g., catch/release) to eradicate	• fill in holes • maintain as necessary
Cover Drainage Layer	Monthly for at least 6 months	• seepage erosion of drainage material	• CCM will evaluate placing coarser granular "cap" over cover drainage outlet and develop corrective action plan	• replace, regrade material
		• clogging or covering of cover drainage layer outlet by topsoil	• remove topsoil, replace granular soil at outlet as necessary	• replace, regrade material

Note: See Section 4.2 of the OSDF O&M Plan for requirements related to grass mowing.

(1) Frequencies of inspection and maintenance activities are preliminary. These frequencies will be finalized as manufacturer's equipment operating and maintenance instructions are available.

(2) Final cover system shall be inspected after the occurrence of major earthquakes.

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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 6 months	• toe bulges • tension cracks	• notify the CCM to investigate and develop corrective action plan • notify the CCM 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 6 months	• leachate seep	• notify the CCM and develop corrective action plan to investigate	• contain leachate; cordon off the affected area; maintenance/repair activities will be defined by the investigation results
Surveying	Monthly for at least 6 months	• survey monuments	• N/A	• obtain survey data

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) Final cover system shall be inspected after the occurrence of major earthquakes.

- erosion, bare spots, poor performing vegetation;
- unwanted (i.e., deep) 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;
- tension cracks which may be indicative of cover systems instability;
- toe bulges which may be indicative of cover systems instability; 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 systems. Mowing shall occur at least once annually (in the late fall) at a time when the final cover systems 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 System Plan based on the final seed mix selected for the OSDF.

Maintenance activities for the OSDF final cover systems shall include surveying of settlement monuments placed on the OSDF final cover systems. 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 CCM. 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 reproduction that develops in 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 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 woody control, 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 OSDF Construction Subcontractor based on available equipment, expertise, and cost.

It is noted that additional System requirements for the OSDF project, which the OSDF Construction 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 OSDF Construction 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 of this Systems Plan.

5. SEASONAL COVER

5.1 Description of System

The construction, placement of impacted material and closure of the OSDF is scheduled to occur over a 7-year period. As discussed in Section 4 of this Systems Plan, a permanent final cover will be placed on each cell after it reaches final grade. In addition, at the end of each construction season and in any area where impacted material will not be placed for at least 30 days, a seasonal cover will be required over any area that has not received final cover. The seasonal cover will consist of natural or impacted soil with suitable surface protection (e.g., commercially-available crusting agents) or geosynthetic erosion control surface matting.

5.2 Seasonal Cover Inspection and Maintenance Activities

The seasonal cover shall be inspected and maintained in accordance with the schedule and activity requirements presented in Table 5-1. The purposes of the inspection and maintenance activities are to: (i) ensure the seasonal cover prevents excessive fugitive emissions and slope erosion; (ii) provide adequate and efficient management of impacted runoff within a cell; and (iii) provide adequate protection of liner systems components from freeze/thaw and mechanical damage.

Inspections of the seasonal cover shall consist of a survey of the seasonally-covered area. The visual inspection shall be conducted by either traversing the cover systems on a 100 ft (30 m) grid pattern or by using binoculars to inspect areas where surface or crusting agents have been applied. Suspect areas shall be delineated on a plan of the site. The inspections shall result in evaluation of the seasonal cover for excessive erosion or gullying. Should such conditions be observed, the OSDF Construction Subcontractor shall implement maintenance activities to reduce such erosion or gullying, including regrading the eroded area, compacting exposed soil surfaces, rerouting runoff from the area to promote sheet flow, applying additional surface crusting agent, or installing geosynthetic erosion-control surface matting.

The seasonal cover inspections shall also include observation of the area within the active OSDF cell being used for impacted runoff retention. The inspection shall confirm that runoff into the area can infiltrate in an unimpeded manner into the cell LCS. The inspection shall also confirm that excessive sedimentation is not occurring. Should the depth of sedimentation exceed 6 in. (0.15 m) in any portion of this area, the sediment should be excavated and transported to an area of the cell outside of the impacted runoff retention area. Any excavation of sediment within the cell shall be performed with

TABLE 5-1

SEASONAL COVER INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections Seasonal-Closure Period	Condition	Maintenance
Seasonal Cover	Bi-weekly	• erosion or gullying	• regrade area; compact exposed impacted material surfaces; reroute runoff; compacted soil surface; apply crusting agents or geosynthetic erosion control matting
		• unacceptable fugitive emissions	• compact soil surface; apply crusting agent or geosynthetic erosion control matting; install wind screen fencing
Impacted-Runoff Retention Area (in cell)	Bi-weekly	• excessive sedimentation;	• excavate excess sedimentation and deposit it outside of retention area
		• lack of timely percolation of drainage into the LCS	• replace clogged protective layer granular material with new clean material; replace clogged geotextile filter layer
Protection of Liner System	Bi-weekly	• the compacted clay component of the liner system must be protected against frost and mechanical damage by at least 2 ft Category 1 material	• check soil cover over anchor trench geosynthetics

N/A - Not Applicable

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) Seasonal cover shall be inspected after the occurrence of major earthquakes.

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extreme care so as not to damage the underlying liner systems. Should the granular protective layer or geotextile LCS filter in the stormwater retention area of the cell become clogged and impede stormwater percolation into the LCS, the CCM may instruct the OSDF Construction Subcontractor to replace the granular material, and possibly the geotextile filter as well.

Repairs to a cell stormwater retention area shall not be made unless it is part of a plan provided by the CCM. Any repair activity involving any component of the liner systems or final cover systems shall be in full conformance with the original OSDF Project Specification for that component.

5.3 Recordkeeping

The OSDF Construction Subcontractor shall maintain written records of all monitoring, inspections, and maintenance repairs in accordance with recordkeeping and reporting requirements of Section 8 of this Systems Plan.

6. TEMPORARY SUPPORT FACILITIES, UTILITIES, AND SITE SECURITY FENCE

6.1 Description of Systems

The function of the temporary support facilities and utilities is to provide support for of 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 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.

6.2 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 6-1. During winter shutdown, unoccupied facilities shall be inspected. The purpose of the inspections to detect any breach or damage to the systems contained in the facilities and to ensure the systems are functioning properly.

TABLE 6-1

TEMPORARY SUPPORT FACILITIES AND SITE SECURITY FENCE INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections Closure Period	Condition	Remedy	Maintenance
Temporary Facilities (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 lock-out program
Storage areas/stockpiles/ temporary decontamination facilities	Daily	• ponding of water • protection from elements • adequate storage or disposal of contaminated equipment	• 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.

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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 CCM 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.

Equipment decontamination facilities will require routine maintenance of pumps and valves and cleaning out of sump areas and grates. 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. (Note: Attachment B will contain manufacturer's instructions for the equipment).

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 OSDF Construction Subcontractor shall notify the CCM. The CCM will evaluate the situation and issue a plan for corrective actions.

Utilities shall be inspected to ensure that no deterioration has occurred and that the 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 a necessary. All new materials and installation work for repair or maintenance activities shall be in full conformance with the original Project Specifications.

All inspection, maintenance, or repair activities will be documented. Reporting procedures are described in Section 8.

6.3 Recordkeeping

The OSDF Construction Subcontractor shall maintain written records of all monitoring, inspections, and maintenance repairs in accordance with recordkeeping and reporting requirements of Section 8 of this Systems Plan.

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7. OSDF ACCESS ROADS

7.1 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 OSDF Construction Subcontractor.

The layout of the roads providing access to the Construction Drawings.

7.2 Access Roads Inspection and Maintenance Activities

Access roads to the OSDF shall be inspected and maintained in accordance with the schedule and activity requirements present in Table 7-1. The OSDF Construction Subcontractor shall be responsible for safe, efficient OSDF access road operations during OSDF construction, filling, and closure. The OSDF Construction Subcontractor shall maintain all road signage in a clearly visible state. Road signage shall be increased if needed to achieve safe, efficient traffic operations. If necessary, the OSDF Construction 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 OSDF Construction Subcontractor shall maintain OSDF access roads free of snow accumulations that would interfere with OSDF activities. The OSDF

TABLE 7-1

ACCESS ROADS INSPECTION AND MAINTENANCE ACTIVITIES

Component	Frequency		Condition	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	• grading as necessary, to provide positive drainage
			• roadway inundation	• improve stormwater 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 CCM 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.

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Construction Subcontractor shall prevent the generation of excessive road dust such that fugitive emission levels remain in full compliance with the *OSDF Air Monitoring Plan*. 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 CCM.

Any repair activity to roadways within the OSDF battery limit shall utilize materials and procedures in full conformance with the original Project Specifications.

8. RECORDKEEPING AND REPORTING

The OSDF Construction Subcontractor shall be responsible for preparing and maintaining accurate and complete records of all inspection, operation, and maintenance activities. The OSDF Construction Subcontractor is also responsible for reporting these activities to the CCM.

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 OSDF Construction Subcontractor reporting requirements.

8.1 Recordkeeping Procedures

The OSDF Construction 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 OSDF Construction 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.

8.2 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 CCM 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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9. REFERENCES

FERMCO, "*Air Monitoring Plan*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996.

FERMCO, "*Emergency Response Plan*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996.

FERMCO, "*Physical Protection Security Plan*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996.

FERMCO, "*Stormwater Pollution Prevention Plan*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996.

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GeoSyntec Consultants, "*Intermediate Design Package, On-Site Disposal Facility*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996.

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GeoSyntec Consultants, "*OSDF Impacted Materials Placement (IMP) Plan*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996.

GeoSyntec Consultants, "*OSDF Surface-Water Management and Erosion Control Plan*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996.

GeoSyntec Consultants, "*OSDF Post-Closure Plan*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996.

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

U.S. Department of Energy (DOE), "*Final Record of Decision for Remedial Actions at Operable Unit 5*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996.

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)

GROUNDWATER MONITORING PLAN (OUTLINE)

ON-SITE DISPOSAL FACILITY

1.0. Introduction

2.0. OSDF Groundwater Monitoring Program Overview

- 2.1 Regulatory Requirements for the OSDF.
- 2.2 Principles of Detection Monitoring.

3.0 Geology/Hydrogeology

- 3.1 Geology
- 3.2 Hydrogeology
  - 3.2.1 GMA Hydrogeology
  - 3.2.2 Till Hydrogeology

4.0 Well Location Selection

- 4.1 Introduction
- 4.2 Regulatory Requirements
- 4.3 Sample Collection and Analysis
- 4.4 Existing and Future Hydrogeological Conditions
- 4.5 Summary

5.0 Parameter Selection

- 5.1 Introduction
- 5.2 Scope of Detection Parameters
- 5.3 Selection Process
- 5.4 Summary

6.0 Integration with I.E.M.P.

POST-CLOSURE CARE AND INSPECTION PLAN (OUTLINE)

ON-SITE DISPOSAL FACILITY

POST-CLOSURE CARE AND INSPECTION PLAN (OUTLINE)

1.0 Introduction

This section will discuss the concept and contingencies of a post-closure care period.

2.0 Institutional Controls

This section will discuss the institutional controls (*e.g.*, fencing, deed restrictions, *etc.*)

3.0 Post-Closure Facilities

This section will identify the facilities covered under this plan. These will include such as:

- leak detection system
- leachate collection system
- On-Site Disposal Facility (OSDF) cover
- OSDF benchmarks
- OSDF run-on/run-off controls
- others as necessary

4.0 Post-Closure Inspection

This section will establish:

- inspection techniques,
- inspection frequency, and
- action levels.

This section will also:

- discuss trend analysis, and
- identify notification requirements.

5.0 Post-Closure Corrective Actions

This section will discuss the steps necessary to evaluate and correct items of concerns. Those steps include:

- engineering evaluations of alternatives,
- regulatory evaluations of alternatives,
- public involvement, and
- implementation of preferred alternative.

6.0 Modifications of Post-Closure Plan