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FINAL

DESIGN CRITERIA PACKAGE

ON-SITE DISPOSAL FACILITY

REVISION 0
MAY 1997

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

prepared by

GEOSYNTEC CONSULTANTS
1100 Lake Hearn Drive, NE, Suite 200
Atlanta, Georgia 30342

under

Fluor Daniel Fernald
Subcontract 95PS005028

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743 No. 02

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FINAL
DESIGN CRITERIA PACKAGE
ON-SITE DISPOSAL FACILITY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

ISSUED FOR USE

Approved by:

Rudolph Bonaparte 13 May 97

Rudolph Bonaparte, Ph.D., P.E., GeoSyntec OSDF Project Manager Date

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ACRONYM LIST

ACI	American Concrete Institute
ALARA	As Low As Reasonably Achievable
ALR	Action Leakage Rate
ANSI	American National Standards Index
ARAR	Applicable or Relevant and Appropriate Requirement
AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASTM	American Society of Testing and Materials
AWWT	Advanced Wastewater Treatment
CAD	Computer-Aided Design
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	Certified for Construction
CFR	Code of Federal Regulations
CSI	Construction Specifications Institute
CQA	Construction Quality Assurance
DCP	Design Criteria Package
DOE	United States Department of Energy
DSIWM	Department of Solid and Industrial Waste Management
E&S	Erosion and Sediment
FDF	Fluor Daniel Fernald
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FS	Feasibility Study
GCL	Geosynthetic Clay Liner
LCS	Leachate Collection System
LDS	Leak Detection System
LTS	Leachate Transmission System
NRC	Nuclear Regulatory Commission
NEC	National Electrical Code
OAC	Ohio Administrative Code
ODOT	Ohio Department of Transportation
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
RA	Remedial Action

ACRONYM LIST

RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SCS	Soil Conservation Service
SDR	Standard Dimension Ratio
SDRI	Sealed Double-Ring Infiltrometer
UMTRA	Uranium Mill Tailings Remedial Action
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
WAC	Waste Acceptance Criteria

DCP GLOSSARY

Applicable or Relevant and Appropriate Requirements (ARARs)	Requirements set forth in regulations that implement environmental and public health laws must be attained or exceeded by a selected remedy unless a waiver is invoked. ARARs are divided into three categories: chemical-specific, location-specific, and action-specific, depending on whether the requirement is triggered by the presence or emission of a chemical, by a vulnerable or protected location, or by a particular action.
Aquifer	A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield economical quantities of water to wells and springs.
Battery Limit	The designated boundary of construction activities for specific contracts. The battery limit defines the area for which the construction contractor is responsible for all operations related to the contract to include any temporary erosion and sediment control features required to assure discharge permits are not violated. The battery limit also defines the point of interface between separate design engineers or construction contractors.
Chemical Compatibility	A material is defined as being compatible with a chemical, or with a suite of chemicals such as in a leachate, if its physical and mechanical properties are not changed or adversely affected by prolonged exposure to the chemical or suite of chemicals.
Factor of Safety	A measure of the degree of stability of an earthen (soil or rock) slope or foundation. Mathematically, it is defined as the factor by which the shear strength of the material along a potential slip surface through the slope or foundation must be divided to bring the slope or foundation to a state of barely stable equilibrium (i.e., incipient failure).

Feasibility Study (FS) The study that fully evaluates and develops remedial action alternatives to prevent or mitigate the migration or release of hazardous substances, pollutants, contaminants, or hazardous constituents at and from the site. The FS is generally performed in conjunction with the remedial investigation (RI) and uses data gathered during the RI to develop remedial action alternatives and to undertake an initial screening and detailed analysis of the alternatives. The RI data are used to define the objectives of the response action, to develop remedial action alternatives, and to undertake an initial screening and detailed analysis of the alternatives. The FS includes a report that describes remedial action alternatives and that documents the selection process.

FEMP The Fernald Environmental Management Project, the present name (beginning August 23, 1991) for the former Feed Materials Production Center near Fernald, Ohio.

Geotextile Any permeable textile used with foundation, soil, rock, earth, or any other geotechnical or environmental engineering material as an integral part of a project, structure, or system.

Geomembrane An essentially impermeable membrane used with foundation, soil, rock, earth, or any other geotechnical or environmental engineering material as an integral part of a project, structure, or system.

Geonet A 3-dimensional netlike polymeric material used for in-plane drainage with foundation, soil, rock, earth, or any other geotechnical or environmental engineering material as an integral part of a project, structure, or system.

Great Miami Aquifer Glaciofluvial sand and gravel deposited by the meltwaters of Pleistocene glaciers within the entrenched ancestral Ohio and Miami rivers. This is also termed a buried channel or sand and gravel aquifer.

Ground Water Water in a saturated zone or stratum beneath the surface of land.

Hydraulic Conductivity A parameter that describes the rate at which water can move through a porous medium. This parameter may vary with the direction of the flow.

Impacted Material This term refers to that material at the FEMP meeting OSDF waste acceptance criteria (WAC) as defined in the operable unit Records of Decision (RODs).

Leachate Liquid that has come in contact with, or been released from, solid waste. In the case of the OSDF, this refers to liquid that has come in contact with, or been released from, the impacted material that will be disposed in the facility.

Operable Unit A discrete action that comprises an incremental step toward a comprehensive site-wide remediation. This discrete portion of a remedial response is intended to eliminate or mitigate a release, threat of a release, or pathway of exposure. The cleanup of a site can be divided into a number of operable units, depending on the complexity of the problems associated with the site. Operable units may address geographical portions of a site, specific site problems, or initial phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site.

Perched Ground Water Perched ground water exists in geologic environments where a low permeability clay overlies a more permeable sand which leads to the formation of an unsaturated zone both above and below a saturated zone within the clay.

Remedial Investigation (RI) The investigation conducted to fully evaluate the nature and extent of the release or threat of release of hazardous substances, pollutants, contaminants, or hazardous constituents. The RI emphasizes data collection and site characterization. The RI, which includes sampling and monitoring, as necessary, also includes the gathering of sufficient information to support the feasibility studies and the risk assessments.

DCP GLOSSARY
(continued)

Select Impacted Material	Soil-like impacted material with a maximum particle size of 3 in. (75 mm) and with 90 percent of the particles finer than 1 in. (25 mm).
Shear Strength	A parameter widely used in engineering analyses of the stability of soil slopes and foundations. It is defined as the shear force required to cause a unit area of material to fail in shear.
Surface Water	All water that is open to the atmosphere and subject to surface runoff
Till	A mixture of boulders, cobbles, sand, silt, and clay deposited directly from glacial ice; generally of low permeability.
Undisturbed	An adjective used to describe a soil sample obtained in a manner that results in minimal disturbance to the soil's structure and strength-deformation characteristics. It is important to obtain "undisturbed" samples of a soil slope or foundation if it is necessary to evaluate the strength, compressibility, or permeability of that slope or foundation.
Water Table	The surface of an unconfined aquifer at which the pressure in the water is equal to the atmospheric pressure. This usually occurs at or near the top of the saturated subsurface materia.

TABLE OF CONTENTS

TABLE OF CONTENTS

Approval Sheet i

Acronym List ii

Glossary iv

Table of Contents viii

List of Tables xv

List of Figures xv

1. GENERAL DESCRIPTION 1-1

1.1 Purpose and Organization 1-1

1.1.1 Purpose 1-1
1.1.2 Organization 1-3

1.2 Project Scope 1-3

1.2.1 Introduction 1-3
1.2.2 Design Steps 1-3
1.2.3 Schedule for Design and Support Activities 1-5

1.3 Major Components of the OSDF 1-6
1.4 Design Interfaces 1-8
1.5 Sources of Information 1-9

1.5.1 Information Categories 1-9
1.5.2 CERCLA-Related Documents 1-10

TABLE OF CONTENTS (continued)

1.5.3 DOE/USEPA/OEPA Orders/Standards/Guidance 1-10
1.5.4 Site-Specific Design Documents 1-11
1.5.5 Standard Building Codes 1-13
1.5.6 General Technical Information 1-13

1.6 Project Deliverables 1-13
1.7 Revision of this DCP 1-21
1.8 Documentation of Compliance with DCP 1-21
1.9 References 1-21

2. DESIGN CRITERIA 2-1

2.1 OSDF Location 2-1

2.1.1 General Design Criteria 2-1
2.1.2 Specific Location Criteria 2-1

2.2 OSDF Layout 2-4

2.2.1 General Design Criteria 2-4
2.2.2 Specific Layout Criteria 2-5

2.2.2.1 Horizontal Limits 2-5
2.2.2.2 Final Height and Slope Limits 2-5
2.2.2.3 Foundation Grade and Slope Limits 2-6
2.2.2.4 Perimeter Features 2-7

2.2.3 Calculations 2-7
2.2.4 References 2-7

TABLE OF CONTENTS (continued)

2.3 OSDF Performance 2-7

2.3.1 Design Life 2-7
2.3.2 Geotechnical Stability and Settlement 2-12

2.3.2.1 Static Slope Stability 2-12
2.3.2.2 Seismic Slope Stability 2-15
2.3.2.3 Foundation Settlement 2-19
2.3.2.4 Impacted Material Settlement 2-20

2.3.3 References 2-22

2.4 Liner System 2-26
2.4.1 General Design Criteria 2-26
2.4.2 Hydrostatic Uplift 2-28
2.4.3 Compacted Clay Liner 2-28
2.4.4 Geosynthetic Clay Liner 2-32
2.4.5 Geomembrane Liner 2-34
2.4.6 Geotextile Cushion 2-36
2.4.7 Geosynthetic Tension and Anchor Trench Capacity 2-36
2.4.8 Frost Protection 2-37
2.4.9 Chemical Compatibility 2-38
2.4.10 References 2-39

2.5 Leachate Management 2-40

2.5.1 Leachate Collection System 2-40
2.5.2 Leak Detection System 2-47
2.5.3 Leachate Transmission System 2-49
2.5.4 Till Monitoring System 2-59
2.5.5 References 2-61

TABLE OF CONTENTS (continued)

2.6 Final Cover System 2-64

2.6.1 General Design Criteria 2-64
2.6.2 Final Cover Vegetation 2-65
2.6.3 Topsoil 2-66
2.6.4 Vegetative Soil Layer 2-68
2.6.5 Granular Filter Layer 2-69
2.6.6 Biointrusion Barrier 2-70
2.6.7 Cover Drainage Layer 2-72
2.6.8 Geotextile Cushion Layer 2-73
2.6.9 Composite Cap 2-74
2.6.10 References 2-76

2.7 Test Pad Program 2-78

2.7.1 General Design Requirements 2-78
2.7.2 Clay Borrow Material Criteria 2-79
2.7.3 Test Pad Layout and Construction Criteria 2-80
2.7.4 Field Test Pad Program Evaluation 2-83
2.7.5 Work Plan 2-84
2.7.6 Cost Estimate 2-85
2.7.7 Report 2-85
2.7.8 Schedule 2-85
2.7.9 References 2-85

2.8 Surface-Water Management 2-86

2.8.1 Categories of Surface Water 2-86
2.8.2 General Design Criteria 2-87
2.8.3 Stormwater Management During OSDF Construction/Filling/Closure 2-88
2.8.4 Stormwater Management After OSDF Closure 2-94

TABLE OF CONTENTS (continued)

2.8.5 Wastewater Management 2-98
2.8.6 References 2-99

2.9 Support Facilities and Utilities 2-101

2.9.1 General Design Criteria 2-101
2.9.2 Specific Criteria 2-102

2.9.2.1 Survey Benchmarks 2-102
2.9.2.2 Utilities 2-103
2.9.2.3 Construction Administration Area 2-104
2.9.2.4 Equipment Decontamination Facility 2-105
2.9.2.5 Material Storage Areas 2-106
2.9.2.6 Access Control 2-106
2.9.2.7 Construction Haul Roads and LTS Access Corridor 2-107
2.9.2.8 Calculations 2-109

2.9.3 References 2-110

2.10 Borrow Area 2-111

2.10.1 General Design Criteria 2-111
2.10.2 Specific Criteria 2-112

2.10.2.1 Location of Borrow Area 2-112
2.10.2.2 Layout of Borrow Area 2-113
2.10.2.3 Development of Borrow Area 2-115
2.10.2.4 Surface-Water Management for Borrow Area . . . 2-116
2.10.2.5 Restoration 2-119

2.10.3 References 2-120

TABLE OF CONTENTS (continued)

2.11 Impacted Material Management 2-120

2.11.1 General Design Criteria 2-120
2.11.2 Specific Design Criteria 2-121

2.11.2.1 Impacted-Material Haul Roads 2-121
2.11.2.2 Impacted Material Staging Areas 2-123
2.11.2.3 Impacted Material Excavation, Removal, and Handling 2-125
2.11.2.4 Impacted Material Transport 2-127
2.11.2.5 Impacted Material Placement 2-128
2.11.2.6 Seasonal (Winter) Shutdown 2-130

2.11.3 Radon Emission and Gas Generation 2-132
2.11.4 References 2-134

3. PROJECT DELIVERABLES 3-1

3.1 General Requirements 3-1

3.1.1 Introduction 3-1
3.1.2 Reports 3-1
3.1.3 Calculations 3-1
3.1.4 Drawings 3-2
3.1.5 Specifications 3-2
3.1.6 Cost Estimates 3-3
3.1.7 Value Engineering 3-3

3.2 Description of Design Deliverables 3-3

3.2.1 Design Criteria Package 3-3
3.2.2 Calculations, Drawings, and Specifications 3-4

TABLE OF CONTENTS (continued)

3.2.3 Leachate/Liner Compatibility Study Work Plan Report 3-5
3.2.4 Soil Liner Test Pad Program Report 3-6
3.2.5 Soil-Geosynthetic Interface Testing Report 3-6
3.2.6 Project Support Plans 3-7

3.2.6.1 Construction Quality Assurance Plan 3-7
3.2.6.2 Impacted Material Placement Plan 3-8
3.2.6.3 Impacted Material Quality Assurance Plan 3-9
3.2.6.4 Surface-Water Management and Erosion Control Plan 3-10
3.2.6.5 Borrow Area Management and Restoration Plan . . . 3-11
3.2.6.6 Systems Plan 3-12
3.2.6.7 Construction Site Safety and Security Plan 3-13
3.2.6.8 Air Monitoring Plan 3-14

3.2.7 Cost Estimates 3-15
3.2.8 Value Engineering Documentation 3-15
3.2.9 Design Documentation 3-15
3.2.10 Response Documents 3-15

APPENDIX A: OPERABLE UNIT 2 RECORD OF DECISION (SECTIONS 9 AND 10)

APPENDIX B: DRAFT DETAILED FACILITY DESCRIPTION/ FUNCTIONAL REQUIREMENTS

APPENDIX C: ARARs FOR OPERABLE UNIT 2

APPENDIX D: ARARs FOR OPERABLE UNIT 5

APPENDIX E: FERMCO BASELINE OSDF COST ESTIMATE

LIST OF TABLES

Table 1-1: List of Anticipated Calculations

Table 1-2: List of Anticipated Drawings

Table 1-3: List of Anticipated Specifications

Table 2-1: Functional Requirement - Design Feature Matrix

LIST OF FIGURES

Figure 1-1: Preliminary Liner and Cover System Design

SECTION 1

1. GENERAL DESCRIPTION

1.1 Purpose and Organization

1.1.1 Purpose

This Design Criteria Package (DCP) identifies Comprehensive Environmental Restoration, Compensation and Liability Act (CERCLA) applicable or relevant and appropriate requirements (ARARs), U.S. Department of Energy (DOE) functional requirements, and general design criteria that will be used as the basis for design of the Fernald Environmental Management Project (FEMP) On-Site Disposal Facility (OSDF).

The conceptual design for a FEMP OSDF was developed as an alternative in the Operable Unit 2 (OU2) feasibility study (FS) and identified as the selected remedial alternative in the OU2 Record of Decision (ROD) [DOE, 1995c]. On-site disposal of impacted material is also the preferred alternative for Operable Unit 3 and Operable Unit 5 at the FEMP. In addition, the material sent to the OSDF by OU3 may include contributions from OU1 and OU4. All material destined for OSDF disposal must meet the OSDF waste acceptance criteria (WAC). The OU2 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.

DOE intends to build only one on-site disposal facility. Therefore, the OSDF will be designed to accommodate all or any portion of the total volume of impacted material meeting the WAC that results from remediation of the FEMP operable units. The total volume of such material from these operable units is estimated to be 2.5 million cubic yards (1.9 million cubic meters) bank/unbulked.

The construction, filling, and closure of the OSDF is scheduled to occur over a period of approximately 7 years, as described in the Accelerated Remediation Plan [$276 million case]. However, due to the potential for variations in funding (which would lead to variations in the pace of remedial action activities), the OSDF must be 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. In the context of this

DCP, any interim closure of the OSDF is understood to be the same standards and configurations as final closure.

The design approach for the OSDF, as well as the other portions of the operable unit selected remedy, are presented in the document, "*Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2*" [DOE, 1995d]. The design will be implemented in the following three phases:

- *Phase 1:* design of an impacted material haul road from the south field and inactive and active fly ash pile areas to the OSDF:
- *Phase 2:* design of the OSDF; and
- *Phase 3:* design of the excavation and restoration of the waste unit areas.

This DCP addresses design activities associated with Phase 2 of the *Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2*. The DCP provides criteria for the design of each element of the OSDF that is located within the OSDF battery limit. The elements in the OSDF battery limit include the OSDF structure, soil liner test pads, perimeter drainage structures, roads, berms, temporary and permanent surface-water management and erosion control features, and temporary construction features such as soil stockpile areas, impacted material staging areas, equipment decontamination facility, and other features. Other design packages consistent with the integrated approach to FEMP remediation will be prepared for features of the OSDF that are to be located beyond the battery limit, such as the forcemain from the leachate transmission lift station manhole to the biosurge lagoon. "Design interfaces" exist for those locations where a design component crosses the battery limit.

1.1.2 Organization

This DCP is organized as follows.

- The remainder of Section 1 presents additional information on the project scope and design.
- In Section 2, specific design criteria for each component of the OSDF are presented.
- In Section 3, the design deliverables are identified and brief descriptions of the contents of the deliverables are described.

1.2 Project Scope

1.2.1 Introduction

The purpose of this section of the DCP is to briefly describe the major design steps for the OSDF elements described in Section 1.1 above. These steps include, but are not limited to: finalization of this DCP; preparation of preliminary (30%), intermediate (60%), prefinal (90%), and final (100%) design packages; preparation of a certified-for-construction (CFC) package; development and implementation of a soil liner test pad program; development and implementation of a geomembrane liner compatibility study; and interface activities.

1.2.2 Design Steps

The major design steps for the OSDF project are summarized below.

- *Preparation of Design Criteria Package.* This DCP identifies the criteria that will be used to design the OSDF.

- *Development and Implementation of Soil Liner Test Pad Program.* The soil liner test pad program will be used to evaluate the performance of candidate materials and construction methods for the clay components of the liner and final cover systems of the OSDF.

- *Development and Implementation of Geomembrane Liner Compatibility Study.* The geomembrane liner compatibility study will be used to evaluate the durability characteristics of the geomembrane materials that will be used in the liner and final cover systems of the OSDF.

- *Preparation of Preliminary Design Package.* The preliminary design package will be prepared in a manner that addresses the design criteria identified in this DCP and that illustrates the concepts of the design for review by DOE, USEPA, and OEPA.

- *Preparation of Intermediate Design Package.* The intermediate design package will contain the same elements as the preliminary design package, plus: (i) revisions based on USEPA, and OEPA comments on the preliminary design; (ii) revisions based on the results of the value engineering session; and (iii) notes added to the preliminary design drawings that are necessary to describe the proposed plan for construction of the OSDF.

- *Preparation of Prefinal Design Package.* The prefinal design package will contain the same elements as the intermediate design package, plus: (i) revisions based on DOE, USEPA, and OEPA comments on the detailed design; (ii) all drawings and calculations essentially complete; and (iii) prefinal design construction cost estimate.

- *Preparation of Final Design Package.* The final design package will include the elements of the prefinal design package, plus: (i) revisions based on DOE, USEPA, and OEPA comments on the prefinal design; and (ii) final design cost estimate.

- *Preparation of CFC Design Package.* The CFC design package will include the elements of the final design package as well as revisions to the drawings based on comments on the final design package, engineer's certification of the drawings, and certified specifications that are suitable for construction purposes.

- *Preparation of Work Plans.* A number of OSDF-specific work plans will be prepared as part of the OSDF design effort. These work plans, coupled with the OSDF drawings and specifications, will dictate actions related to the OSDF that will be undertaken during the OU2 remedial action (RA).

- *Interface Activities.* Interfaces between the design of the OSDF and other design activities at the FEMP are described in Section 1.4 of this DCP.

1.2.3 Schedule for Design and Support Activities

The schedule for design of the OSDF is presented in the *Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2* [DOE, 1995d]. The amended consent agreement milestones and dates for the OSDF given in this DCP are as follows:

- submit OSDF Preliminary Design Package to USEPA: 22 December 1995;

- submit OSDF Prefinal Design Package to USEPA: 28 June 1996;

- submit OSDF Final Design Package/CFC to USEPA: 14 October 1996;

- submit Draft OSDF Remedial Action Work Plan to USEPA: 12 April 1996; and

- submit Final OSDF Remedial Action Work Plan to USEPA: 28 June 1996.

1.3 Major Components of the OSDF

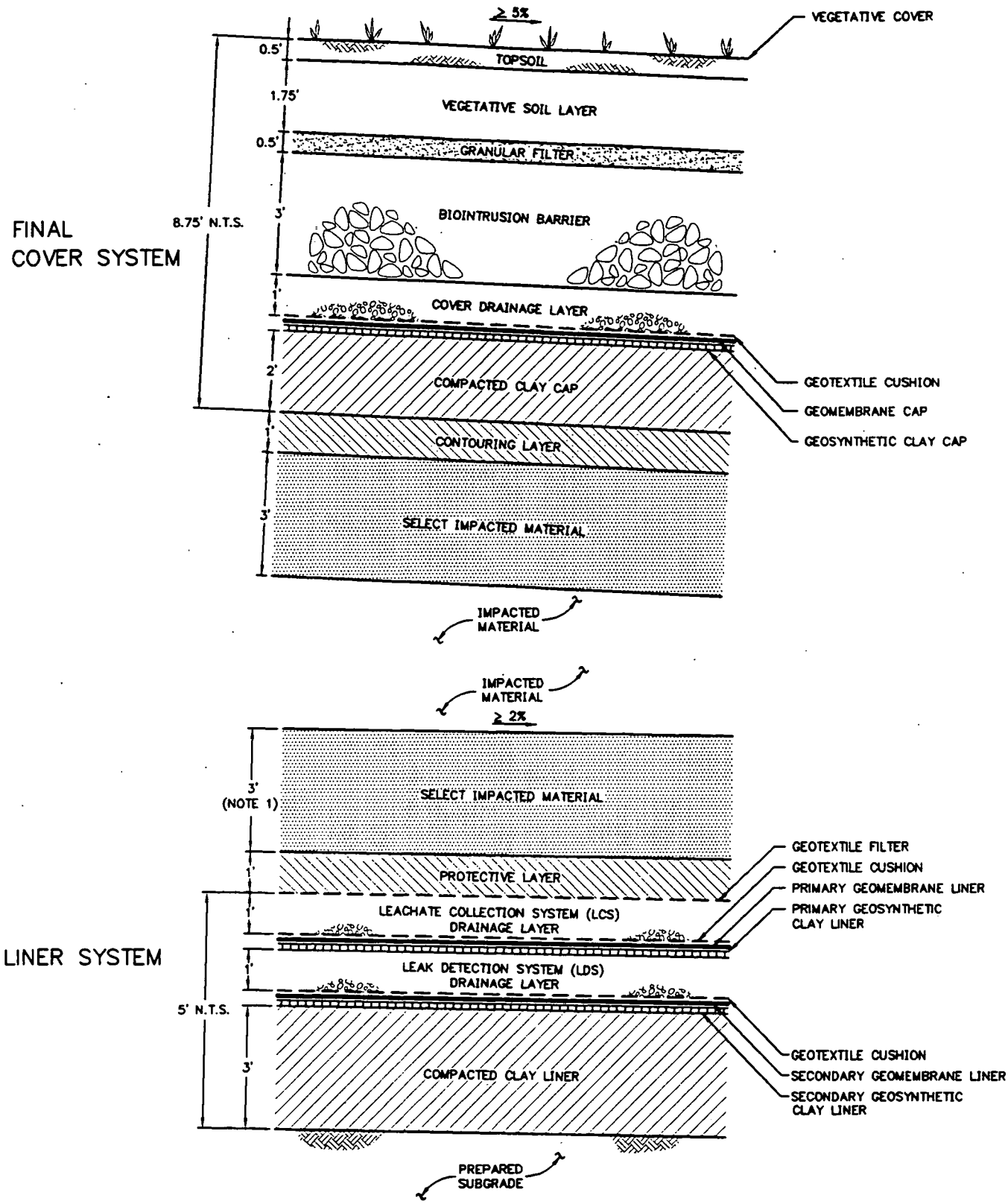
The major components of the OSDF, as identified in the *Detailed Facility Description/Functional Requirements* (presented in Appendix B of this document), are the liner system, final cover system, leachate management system, surface-water management system, support elements, utilities, and temporary support facilities.

- *Liner and Final Cover Systems.* The liner and final cover systems will be constructed using both soil and geosynthetic components. The conceptual design of the liner and final cover systems are presented in Appendix B. The preliminary designs for these systems, as currently developed, are shown in Figure 1-1. As shown in this figure, the liner system will consist of a double-composite liner that will have a leachate collection system (LCS) above the primary liner and a leak detection system (LDS) between the primary and secondary liners. The final cover system will include a composite cap overlain by the following layers: drainage layer; biointrusion barrier; granular filter layer; vegetative soil layer; and topsoil. The liner system and final cover system designs will be prepared considering material borrow requirements, seasonal (i.e., winter) closure, and site preparation requirements.

- *Leachate Management System.* The leachate management system will be designed to collect leachate generated by the OSDF and convey it to the biosurge lagoon. Components of the leachate management system within the battery limit will 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 double-walled gravity transmission pipe to convey leachate to the permanent lift station prior to the complete construction of the permanent gravity transmission pipe, and a till monitoring system.

- *Surface-Water Management System.* The surface-water management system will be designed to manage surface water under both short-term (i.e., during construction and impacted material placement) and long-term (i.e., after

LINER AND COVER SYSTEM DESIGN
ON-SITE DISPOSAL FACILTY



NOTE:

1. SELECT IMPACTED MATERIAL THICKNESS ABOVE LINER SYSTEM MAY BE DECREASED TO 2 FEET IF THE FIRST LIFT OF MATERIAL TO BE PLACED OVER THE SELECT IMPACTED MATERIAL CONSISTS OF SOIL OR RELATIVELY SMALL SIZE DEBRIS THAT CAN BE PLACED IN CONTROLLED LIFTS.

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA 000024

FIGURE NO.	1-1
PROJECT NO.	GE3900-16.4
DOCUMENT NO.	F9650002.CD0
FILE NO.	F95C001.DWG

OSDF closure) conditions. The design will address stormwater runon and runoff, perched ground water, construction water, and wastewater from various sources such as the equipment decontamination facility.

- *Support Elements and Utilities.* Both permanent and temporary support elements will be designed for the OSDF. Permanent support elements include survey benchmarks and a leachate transmission system access corridor. Temporary support elements may include security fencing, an administrative support area, equipment decontamination facility, one or more impacted material staging areas, construction materials staging areas, and construction haul roads. Required utilities may include electrical, water, and wastewater for the administrative support area, and water and power for other specified areas.

1.4 Design Interfaces

There are a number of issues and activities at the FEMP site that will be impacted by the design, construction, filling, and closure of the OSDF. The identified design interfaces are:

- the capacity and treatment capability of the AWWT facility, the capacity of the biosurge lagoon, and the piping tie-in by forcemain from the OSDF permanent lift station to the biosurge lagoon;

- tie-in of required new utilities at the battery limit, including:
  - power;
  - water;
  - security system wiring;
  - wastewater; and
  - telephone;

- relocation of existing utilities within the battery limit;

- design and construction of the haul roads and leachate transmission system access corridor, and relocation of the north entrance road;
- remediation of the FEMP operable units and coordination of traffic from the operable units and staging areas within the former production facility to the OSDF;
- environmental safety and health during OSDF construction, filling, and closure;
- landscape design for the OSDF; and
- stakeholder communication and input.

1.5 Sources of Information

1.5.1 Information Categories

Information from a variety of sources should be used to design the OSDF. These sources include:

- project documents prepared as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation process now underway at the FEMP; ARARs in these documents are particularly relevant to the design of the OSDF;
- DOE/USEPA/OEPA orders, standards, and guidance;
- FEMP site-specific pre-design investigations and studies;
- standard building codes such the National Electric Code, National Fire Prevention Code, and the Uniform Building Code; and
- general technical literature.

1.5.2 CERCLA-Related Documents

The CERCLA-related documents relevant to design of the OSDF are:

- *Final Remedial Investigation Report for Operable Unit 2* [DOE, 1995a];
- *Final Feasibility Study Report for Operable Unit 2* [DOE, 1995b];
- *Final Record of Decision for Remedial Actions at Operable Unit 2* [DOE, 1995c];
- *Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2* [DOE, 1995d];
- *Final Feasibility Study Report for Operable Unit 5* [DOE, 1995e]; and
- *Draft Record of Decision for Remedial Actions at Operable Unit 5* [DOE, 1995f].

Select portions of the *Final Record of Decision for Remedial Actions at Operable Unit 2* are included in Appendix A of this document. The OU2 Record of Decision also contains the Applicable or Relevant and Appropriate Requirements (ARARs) for OU2. These ARARs are presented in Appendix C. The ARARs for OU5, which are contained in the *Draft Record of Decision for Remedial Actions at Operable Unit 5*, are presented in Appendix D.

1.5.3 DOE/USEPA/OEPA Orders/Standards/Guidance

The primary DOE, USEPA, and OEPA orders, standards, and guidance relevant to the design of the OSDF are:

- *Uranium Mill Tailings Remedial Approach Document, Revision II* [DOE, 1989];

000027

- *Project Management System* [DOE, 1992];
- *Natural Phenomena Hazards Mitigation* [DOE, 1993];
- *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* [DOE, 1994];
- *Requirements for Hazardous Waste Landfill Design, Construction, and Closure* [USEPA, 1989];
- *Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties* [USEPA, 1990];
- *Design and Construction of RCRA/CERCLA Final Covers* [USEPA, 1991];
- *RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities* [USEPA, 1995]; and
- *Ohio EPA Division of Solid and Infectious Waste Guidance, Interpretations, and Communications* [various dates].

1.5.4 Site-Specific Design Documents

The primary site-specific predesign studies and investigations are:

- "*Predesign Investigation and Site Selection Report for the On-Site Disposal Facility*" [DOE, 1995g]. This report contains data and information on subsurface conditions within the portion of the FEMP property (east of the former production area) having favorable hydrogeology for siting the OSDF.
- "*100- and 500-Year Flood Plain Determination Sitewide*" [Parsons, 1993]. This report establishes the floodplain boundaries of Paddys Run within the FEMP property as a result of the 100- and 500-year rainfall events.

- "*On-Site Disposal Cell Pre-Design Activities Engineering Report*" [Parson, 1994]. This report presents results of a subsurface investigation in the currently-proposed area at the southeast corner of the FEMP property that will be developed for soil borrow to be used in OSDF (which, at the time of the report, was a candidate location for the OSDF).

- "*2,000-Year Flood and Probable Maximum Flood Sitewide Flood Plain Determination*" [Parsons, 1995a]. This report establishes the 2,000-year and probable maximum precipitation events and the corresponding sitewide floodplain boundaries.

- "*Geotechnical Investigation Report, On-Site Disposal Facility*" [Parsons, 1995b]. This report contains geotechnical data for the subsurface soils in the OSDF area, including data compiled from previous investigations performed at the FEMP.

- "*Disposal Facility Pre-Design Geotechnical Investigation, Soil Investigation Data Report, CERCLA/RCRA Unit 2*" [Science Applications International, 1995]. This report presents geotechnical data for the subsurface soils in the OSDF area. The report contains data that is subsequently summarized and presented by Parsons [1995b].

- "*Geotechnical Data and Evaluation Report for East and South Field Borrow Areas*" [Parsons, 1996a]. This report contains geotechnical data for the subsurface soils in the East Field borrow area. This borrow area will be developed as part of the OSDF project.

- "*Off-Site Borrow Materials Evaluation*" [Parsons, 1996b]. This report presents geotechnical data for potential off-site borrow sources for OSDF construction materials, including fine and coarse concrete aggregates, pea gravel, and riprap.

1.5.5 Standard Building Codes

The primary standard codes used in the design of the OSDF are:

- *National Electric Safety Code (NESC), C2-93*
  by Institute of Electrical and Electronic Engineers (IEEE);

- *National Electric Code (NEC), NFPA 70-96*
  by National Fire Protection Association (NFPA);

- *American Concrete Institute Building Code, ACI 318*
  by American Concrete Institute (ACI);

- *UL Standard for Safety Grounding and Bonding Equipment, UL 467-93*
  by Underwriters Laboratories, Inc. (UL); and

- *Building Services Piping, ASME B31.9*
  by American Society of Mechanical Engineers (ASME).

1.5.6 General Technical Information

In addition to the project-specific information described above, a significant body of general technical information (e.g., textbooks, technical manuals, computer software) will be used in preparation of the OSDF design. This information is referenced where cited throughout this DCP.

1.6 Project Deliverables

The design of the OSDF will be documented in the project deliverables, including calculations, drawings, specifications, and reports. The DCP identifies the contents of these deliverables and establishes the criteria to be considered in preparing each deliverable. Lists of anticipated CFC calculations, drawings, and specifications are

presented in Tables 1-1, 1-2, and 1-3, respectively. It is noted that drawings and specifications that primarily present construction details and contractor instructions need not be included in the design package submittals (preliminary, intermediate, prefinal, and final) for regulatory review.

Reports that will be prepared as part of the design process for the OSDF and which are addressed by this DCP are:

- design criteria package (DCP);
- preliminary, intermediate, prefinal, final, and CFC design packages to include: drawings, technical specifications, and calculations;
- geomembrane liner compatibility study work plan and report;
- soil liner test pad work plan and report;
- soil-geosynthetic interface testing work plan and report;
- construction quality assurance (CQA) plan;
- impacted material placement plan;
- impacted material quality assurance plan;
- surface-water management and erosion control plan;
- borrow area management and restoration plan;
- systems plan;
- air monitoring plan;
- ground-water monitoring plan;

TABLE 1-1

LIST OF ANTICIPATED CALCULATIONS
On-Site Disposal Facility
Fernald Environmental Management Project

1. INTRODUCTION
   - 1.1 Design Parameter Summary
   - 1.2 Computer Program Validation
   - 1.3 Select Technical References
   - 1.4 Geotechnical Data Points

2. OSDF LAYOUT
   - 2.1 Required Volume
   - 2.2 Capacity Verification
   - 2.3 Earthwork Required Volume

3. GEOTECHNICAL - STATIC SLOPE STABILITY
   - 3.1 OSDF Foundation
   - 3.2 Liner System
   - 3.3 Impacted Material Configurations
     - 3.3.1 Interim
     - 3.3.2 Final
   - 3.4 Intercell Berm
   - 3.5 Final Cover System
   - 3.6 Access Corridor
   - 3.7 Borrow Area Cut Slopes

4. GEOTECHNICAL - SEISMIC SLOPE STABILITY
   - 4.1 Hazard Assessment
   - 4.2 Site Response Analysis
   - 4.3 Performance Analysis
     - 4.3.1 Pseudo-Static Stability
     - 4.3.2 Deformation Analysis

5. GEOTECHNICAL - SETTLEMENT
   - 5.1 Foundation Settlement
   - 5.2 Localized Impacted Material Settlement
   - 5.3 Overall Impacted Material Settlement

6. LINER SYSTEM
   - 6.1 Hydrostatic Uplift
   - 6.2 Liner Geosynthetics Selection
     - 6.2.1 Geosynthetic Clay Liner
     - 6.2.2 Geomembrane Liner
     - 6.2.3 Geotextile Cushion
     - 6.2.4 Geosynthetic Selection to Preclude Tension
   - 6.3 Liner Frost Protection

7. LEACHATE MANAGEMENT - LEACHATE GENERATION
   - 7.1 Calculated Rates
     - 7.1.1 During Filling
     - 7.1.2 After Closure
   - 7.2 Required Cell Storage

8. LEACHATE MANAGEMENT - LEACHATE COLLECTION SYSTEM
   - 8.1 Maximum Head in LCS
     - 8.1.1 Maximum Head in LCS Drainage Layer
     - 8.1.2 Maximum Head in LCS Drainage Corridor
   - 8.2 Geotextile Filter Design
     - 8.2.1 Geotextile Filtration
     - 8.2.2 Geotextile Biological Clogging Potential
   - 8.3 LCS Pipe Design
     - 8.3.1 LCS Pipe Flow Capacity
     - 8.3.2 LCS Pipe Perforation Sizing
     - 8.3.3 LCS Pipe Structural Stability

TABLE 1-1 (continued)

9. LEACHATE MANAGEMENT - LEAK DETECTION SYSTEM
   - 9.1 Migration through Primary Liner
   - 9.2 Maximum Head in LDS
     - 9.2.1 Maximum Head in LDS Drainage Layer
     - 9.2.2 Maximum Head in LDS Drainage Corridor
   - 9.3 Time of Travel in LDS
   - 9.4 LDS Pipe Design
     - 9.4.1 LDS Pipe Flow Capacity
     - 9.4.2 LDS Pipe Perforation Sizing
     - 9.4.3 LDS Pipe Structural Stability
   - 9.5 Action Leakage Rate

10. LEACHATE MANAGEMENT - LEACHATE TRANSMISSION SYSTEM
   - 10.1 LTS Gravity Line Design
     - 10.1.1 LTS Gravity Line Flow Capacity
     - 10.1.2 LTS Gravity Line Structural Stability
     - 10.1.3 LTS Gravity Line Frost Protection
   - 10.2 Temporary Gravity Line Design
     - 10.2.1 Temporary Gravity Line Flow Capacity
   - 10.3 LCS and LDS Manhole Design
     - 10.3.1 LCS and LDS Manhole Uplift
     - 10.3.2 LCS and LDS Manhole Structural Design
   - 10.4 Permanent Lift Station Design
     - 10.4.1 Permanent Lift Station Storage Volume
     - 10.4.2 Permanent Lift Station Manhole Uplift
     - 10.4.3 Permanent Lift Station Structural Design
   - 10.5 LTS Pipe Hydrograph

11. FINAL COVER SYSTEM
   - 11.1 Temporary Erosion Mat Design
   - 11.2 Vegetation Design
   - 11.3 Cover System Erosion Resistance
   - 11.4 Cover Frost Penetration Depth
   - 11.5 Granular Filter Layer Design
   - 11.6 Biointrusion Barrier Design
   - 11.7 Drainage Layer Design
     - 11.7.1 Cover System Water Balance
     - 11.7.2 Cover Drainage Layer Maximum Head
   - 11.8 Cover Geosynthetics Selection
     - 11.8.1 Geotextile Cushion
     - 11.8.2 Geomembrane Cap
     - 11.8.3 Geosynthetic Clay Cap

12. SURFACE-WATER MANAGEMENT DURING OSDF CONSTRUCTION/ FILLING/CLOSURE
   - 12.1 Stormwater Runon/Runoff and Drainage Control Structures
   - 12.2 OSDF Sediment Basins

TABLE 1-1 (continued)

13. SURFACE-WATER MANAGEMENT AFTER OSDF CLOSURE
    - 13.1 Stormwater Runon/Runoff and Drainage Control Structures
        - 13.1.1 Northern Area
        - 13.1.2 Eastern Area
        - 13.1.3 Southern Area
        - 13.1.4 Western Area
    - 13.2 Drainage Control Structure Erosion Resistance
14. SUPPORT FACILITIES
    - 14.1 Electrical Power Demand
    - 14.2 Potable Water Demand
    - 14.3 Sanitary Wastewater Discharge
    - 14.4 Construction Water Demand
    - 14.5 Decontamination Facility Water Demand
    - 14.6 Decontamination Facility
    - 14.7 Construction Admin Area Surfacing
    - 14.8 Construction Haul Road
    - 14.9 Leachate Transmission System Access Corridor
15. BORROW AREA
    - 15.1 Borrow Area Required Volume
    - 15.2 Borrow Area Capacity Verification
    - 15.3 Borrow Area Water Demand
    - 15.4 Stormwater Runoff Routing
    - 15.5 Borrow Area Sediment Basin
16. IMPACTED MATERIALS MANAGEMENT
    - 16.1 Haul Road Design
    - 16.2 Impacted Runoff from Haul Road
    - 16.3 OSDF Methane Generation
    - 16.4 OSDF Radon 222 Release
17. HORIZONTAL MONITORING WELL
    - 17.1 Differential Settlement and Tensile Strain
    - 17.2 Structural Stability

TABLE 1-2

LIST OF ANTICIPATED DRAWINGS
On-Site Disposal Facility
Fernald Environmental Management Project

GENERAL DRAWING

Drawing X-1:	Title Sheet
Drawing X-2:	Legend and Symbols
Drawing X-3:	Facility Plot Plan
Drawing X-4:	Site Plan
Drawing X-5:	Not Used
Drawing X-6:	Surrounding Land Use Map
Drawing X-7:	Geotechnical Data Point Location Plan
Drawing X-8:	Great Miami Aquifer Ground-Water Contour Map
Drawing X-9:	Perched Zone Potentiometric Surface Map
Drawing X-10:	Brown Till/Gray Till Interface Contour Map
Drawing X-11:	Gray Till Isopach Map
Drawing X-12:	Surface Geology Map
Drawing X-13:	Geologic Section A-A
Drawing X-14:	Geologic Section B-B
Drawing X-15:	Geologic Sections C-C and D-D

CIVIL

Drawing G-1:	Surficial Impacted Material Removal Plan within Battery Limit
Drawing G-2:	Site Development Plan
Drawing G-3:	Not Used
Drawing G-4:	Not Used
Drawing G-5:	Subgrade Grading Plan
Drawing G-6:	Compacted Clay Liner Grading Plan
Drawing G-7:	Leak Detection System Grading Plan
Drawing G-8:	Leachate Collection System Grading Plan

CIVIL (continued):

Drawing G-9:	Cell Outlet Grading Plans
Drawing G-10:	Contouring Layer Grading Plan
Drawing G-11:	Final Cover System Grading Plan
Drawing G-12:	Borrow Area Restoration Plan
Drawing G-13:	Not Used
Drawing G-14:	Not Used
Drawing G-15:	North-South Section
Drawing G-16:	West-East Section at Cell 1 and Cell 2 Intercell Berm
Drawing G-17:	West-East Section at Cell 4 Base
Drawing G-18:	West-East Section at Cell 7 Drainage Corridor
Drawing G-19:	Borrow Area Sections and Details
Drawing G-20:	Cell Perimeter Details I
Drawing G-21:	Cell Perimeter Details II
Drawing G-22:	Liner System Details I
Drawing G-23:	Liner System Details II
Drawing G-24:	Liner System Details III
Drawing G-25:	Liner System Details IV
Drawing G-26:	Cover System Details I
Drawing G-27:	Cover System Details II
Drawing G-28:	Cover System Details III
Drawing G-29:	Cover System Details IV
Drawing G-30:	Stormwater Management System Details I
Drawing G-31:	Stormwater Management System Details II
Drawing G-32:	Stormwater Management System Details III
Drawing G-33:	Not Used
Drawing G-34:	Not Used

TABLE 1-2 (continued)

CIVIL (continued):

Drawing G-35:	Not Used
Drawing G-36:	Not Used
Drawing G-37:	Equipment Decontamination Facility Details
Drawing G-38:	Construction Control Points I
Drawing G-39:	Construction Control Points II
Drawing G-40:	Horizontal Monitoring Well Details

ELECTRICAL:

Drawing E-1:	Not Used
Drawing E-2:	Not Used
Drawing E-3:	Not Used
Drawing E-4:	Leachate Transmission System Electrical Details I
Drawing E-5:	Not Used
Drawing E-6:	Not Used
Drawing E-7:	Leachate Transmission System Electrical Details IV
Drawing E-8:	Not Used

MECHANICAL:

Drawing M-1:	Not Used
Drawing M-2:	Leachate Transmission System Piping and Instrumentation Diagram

MECHANICAL (continued):

Drawing M-3:	Not Used
Drawing M-4:	Leachate Transmission System Gravity Line and Manhole Mechanical Details I
Drawing M-5:	Leachate Transmission System Gravity Line and Manhole Mechanical Details II
Drawing M-6:	Leachate Transmission System Gravity Line and Manhole Mechanical Details III
Drawing M-7:	Not Used
Drawing M-8:	Not Used
Drawing M-9:	Leachate Transmission System Lift Station Mechanical Details III

STRUCTURAL:

Drawing S-1:	Leachate Transmission System Structural Details I
Drawing S-2:	Not Used
Drawing S-3:	Leachate Transmission System Structural Details III
Drawing S-4:	Not Used
Drawing S-5:	Chain Link Fence and Gate Details

TABLE 1-3

LIST OF ANTICIPATED SPECIFICATIONS
On-Site Disposal Facility
Fernald Environmental Management Project

DIVISION 2: SITE WORK

Section 02100 -	Surveying
Section 02110 -	Clearing, Grubbing, and Stripping
Section 02200 -	Earthwork
Section 02215 -	Trenching
Section 02225 -	Compacted Clay Liner and Cap
Section 02230 -	Road Construction
Section 02240 -	Protective and Contouring Layers
Section 02250 -	Vegetative Soil Layer
Section 02270 -	Erosion and Sediment Control
Section 02271 -	Riprap
Section 02280 -	Biointrusion Barrier
Section 02605 -	HDPE Manholes, Pipe, and Fittings
Section 02710 -	Granular Drainage Layer
Section 02712 -	Granular Filter
Section 02714 -	Geotextiles
Section 02721 -	Culverts
Section 02770 -	Geomembrane Liner and Cap
Section 02772 -	Geosynthetic Clay Liner and Cap
Section 02831 -	Chain Link Fence and Gates
Section 02920 -	Topsoil
Section 02930 -	Vegetation

DIVISION 3: CONCRETE

Section 03100 -	Concrete

DIVISION 13: SPECIAL CONSTRUCTION

Section 13000 -	Borrow Area Management
Section 13005 -	Liner Penetration Boxes
Section 13010 -	Impacted Material Placement
Section 13020 -	Construction Phase Leachate Management
Section 13030 -	Seasonal Closure
Section 13040 -	Control of Fugitive Emissions

DIVISION 15: MECHANICAL

Section 15000 -	Mechanical

DIVISION 16: ELECTRICAL

Section 16000 -	Electrical
Section 16100 -	Basic Materials
Section 16110 -	Raceways
Section 16120 -	Conductors and Terminations
Section 16130 -	Outlet, Junctions, and Pull Boxes
Section 16400 -	Overhead Services
Section 16450 -	Grounding
Section 16500 -	Lighting

000037

- OSDF construction cost estimate;
- value engineering documentation;
- design documentation; and
- responses to DOE, OEPA, and USEPA comments on project deliverables.

Additional discussion of the required project deliverables is given in Section 3 of this DCP.

1.7 Revision of this DCP

Compilation, review, and acceptance of this DCP initially precedes preparation of the other design deliverables. As design and review proceed, better approaches, details, etc. are identified. As a result, this DCP is modified with each design package to reflect these changes. This DCP is a controlled document.

1.8 Documentation of Compliance with DCP

Documentation must be prepared to demonstrate that all OSDF design criteria contained in this DCP are satisfied. This documentation should be prepared after completion and submittal of the final design.

1.9 References

Fernald Environmental Restoration Management Corporation, "*On-Site Disposal Facility, Detailed Facility Description/Functional Requirements*" (draft), Fernald, OH, October 1995.

Ohio Department of Natural Resources - Division of Soil and Water Conservation (ODNR-DSWC), *"Rainwater and Land Development"*, 2nd Edition, 1996.

Parsons, "*100- and 500-Year Flood Plain Determination Sitewide*", CERCLA/RCRA Unit 2, Project Order 91, Fernald Environmental Management Project, Rev. 0, Fairfield, OH, September 1993.

Parsons, *"On-Site Disposal Cell Pre-Design Activities Engineering Report"*, Operable Unit 2, Project Order 101, Fernald Environmental Management Project, Rev. 0, Fairfield, OH, April 1994.

Parsons, *"2,000-Year Flood and Probable Maximum Flood Sitewide Flood Plain Determination"*, CERCLA/RCRA Unit 2, Project Order 148, Fernald Environmental Management Project, Rev. A, Fairfield, OH, August 1995a.

Parsons, *"Geotechnical Investigation Report, On-Site Disposal Facility"*, Operable Unit 2, Project Order 140, Fernald Environmental Management Project, Rev. 0, Fairfield, OH, September 1995b.

Parsons, "*Geotechnical Data and Evaluation Report for East and South Field Borrow Areas*", Operable Unit 2, Project Order 154, Fernald Environmental Management Project, Rev. A, Fairfield, Ohio, March 1996a.

Parsons, "*Off-Site Borrow Materials Evaluation*", Operable Unit 2, Project Order 154, Fernald Environmental Management Project, Rev. A, Fairfield, Ohio, March 1996b.

Science Applications International Corp., *"Disposal Facility Pre-Design Geotechnical Investigation, Soil Investigation Data Report"*, Vol. 1, CERCLA/RCRA Unit 2, Project Order 132, Fernald Environmental Management Project, Rev. 1, Golden, CO, 7 July 1995.

U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS), "*Water Management and Sediment Control for Urbanized Areas*", U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., 1987.

000039

U.S. Department of Energy (DOE), "*Uranium Mill Tailings Remedial Action Project, Technical Approach Document, Revision II*", UMTRA-DOE/AL 050425.0002, DOE UMTRA Project Office, Albuquerque, New Mexico, December 1989.

U.S. Department of Energy (DOE), "*Project Management System*", DOE Order 4700.1, DOE Office of Procurement, Assistance, and Program Management, Washington, D.C., June 1992.

U.S. Department of Energy (DOE), "*Natural Phenomena Hazards Mitigation*", DOE Order 5480.28, Washington, D.C., 1993.

U.S. Department of Energy (DOE), "*Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*" (DOE-STD-1020-94) DOE, Washington, D.C., 1994.

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

U.S. Department of Energy (DOE), "*Final Feasibility Study Report for Operable Unit 2*, Fernald Environmental Management Project", DOE Fernald Area Office, Fernald, OH, 1995b.

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, 1995c.

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

U.S. Department of Energy (DOE), "*Final Feasibility Study Report for Operable Unit 5*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995e.

U.S. Department of Energy (DOE), "*Draft Record of Decision for Remedial Actions at Operable Unit 5*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995f.

U.S. Department of Energy (DOE), "*Pre-Design Investigation and Site Selection Report for the On-Site Disposal Facility*", Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995g.

U.S. Environmental Protection Agency (USEPA), "*Requirements for Hazardous Waste Landfill Design, Construction, and Closure*", EPA/625/4-89/022, Office of Research and Development, August 1989.

U.S. Environmental Protection Agency (USEPA), "*Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties*", Interim Final, Office of Solid Waste and Emergency Response, Directive 9355.5-01, EPA/540/G-90/001, April 1990.

United States Environmental Protection Agency (USEPA), "*Design and Construction of RCRA/CERCLA Final Covers*", EPA/625/4-91/025, Office of Research and Development, May 1991.

United States Environmental Protection Agency (USEPA), "*RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities*", EPA/600/R-95/051, Office of Research and Development, April 1995.

SECTION 2

2. DESIGN CRITERIA

2.1 OSDF Location

2.1.1 General Design Criteria

The general design criteria for the location of the OSDF are as follows (design considerations).

- The location should result in safe construction (to include impacted material placement) and long-term performance of the OSDF.
- The location should result in protection of human health and the environment and cost-effective development of the OSDF.
- The location should comply with ARARs.
- The location should minimize interference with remediation and decommissioning activities in the former production area.

The OSDF should be located entirely within the FEMP property in the area of most favorable hydrogeology (functional requirement). The general area identified as such is located east of the former production area, is rectangular in shape, and has approximate dimensions of 800 ft by 4,300 ft (240 m by 1,310 m). This area is shown in Figure 1 of Appendix B.

2.1.2 Specific Location Criteria

The OU2 ARARs (Appendix C) provide siting criteria for the OSDF derived primarily from the Ohio Administrative Code (OAC) 3745-27-07(H). These criteria require that the disposal facility not be located within the following areas:

- within 300 ft (90 m) of the property boundary to the limit of waste placement ((H)(4)(b));

- within 1,000 ft (300 m) of an existing domicile, existing water supply well, or developed spring ((H)(4)(c) and (H)(3)(c));

- within 200 ft (60 m) of a stream, lake, or natural wetland ((H)(4)(d));

- within 15 ft (4.5 m) of the elevation of the uppermost aquifer;

- within a regulatory floodplain;

- within the surface and subsurface areas surrounding a public water supply well through which contaminants may move toward and reach the public water supply well within a period of 5 years ((H)(3)(c));

- within a 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 is not administered by the Secretary of the United States Department of the Interior ((H)(1)(a)-(d));

- in a sand or gravel pit where the sand or gravel deposit has not been completely removed ((H)(2)(a));

- within a limestone quarry or sandstone quarry ((H)(2)(b)); and

- within an area of potential subsidence due to an underground mine ((H)(3)(b)).

It is noted that DOE has obtained a CERCLA waiver for two location-specific ARARs based on an equivalent standard of performance [40 CFR §300.430(f)(1)(ii)(C)(4)]. The two location-specific ARARs for which a waiver has been obtained require that a disposal facility not be located:

- above an aquifer declared by the federal government under the Safe Drinking Water Act to be a sole source aquifer ((H)(2)(c)); and

- above an unconsolidated aquifer capable of sustaining a yield of 100 gallons/minute (6.3 liter/second) for a 24-hour period to an existing or future water supply well located within 1,000 ft (300 m) of the limits of waste placement ((H)(2)(d)).

The proposed OSDF location does not satisfy these criteria as it is underlain at depth by the Great Miami Aquifer (GMA). A discussion of the basis of the waiver for these two ARARs is contained in the "*Final Record of Decision for Remedial Actions at Operable Unit 2*" [DOE, 1995c]. This discussion indicates that the basis for an equivalent standard of performance is a combination of engineering controls and existing site hydrogeology. This hydrogeology includes at least a 12 ft (3.7 m) thickness of gray till beneath the entire OSDF footprint. It is noted that the aforementioned CERCLA ARAR waiver applies only to the on-site disposal of OU2 impacted material. Separate waivers from the two subject ARARs will be required for OSDF disposal of impacted materials from other operable units [DOE, 1995c].

In addition of the OU2 ARARs cited above, the OU5 ARARs (Appendix D) require that a disposal facility not be located within 200 ft (60 m) of a fault that has undergone displacement during the Holocene Epoch (ARAR: OAC 3745-27-20(C)(3)).

Other criteria that should be considered in locating the OSDF on the FEMP property are given below.

- The centerline of the relocated north entrance road should be offset approximately 150 ft (45 m) from the property line on the eastern side of the site to: (i) provide clearance for the power transmission corridor; and (ii) optimize the civil site layout of the road. The OSDF (including any required access corridor, stormwater management structure, or other OSDF-related structure) should not interfere with the ditch or shoulder of the relocated north access road (design consideration).

- The limit of the OSDF (including any required access corridor, stormwater management structure, or other OSDF-related structure) on the western side of the site should be located to provide sufficient area for impacted material removal traffic between this limit and the eastern fence line (northeast corner) of the FEMP former production area (design consideration).

- The OSDF should be sited such that any perimeter areas or stormwater management structures can be constructed around the OSDF and within the battery limit (design consideration).

2.2 OSDF Layout

2.2.1 General Design Criteria

The OSDF will be a new feature of the FEMP property and must resist degradation during its design life due to wind, precipitation, temperature, runoff, runon, erosion, and other natural influences. A primary design criterion is therefore to appropriately lay out the OSDF as a stable, geomorphologic landform resistant to the natural influences present in an around the FEMP property (design consideration).

In addition, the layout of the OSDF must be such that the features of the design (e.g., liner system, final cover system, drainage channel) function as an integrated unit that completely isolate impacted material from the surrounding environment and that result in a constructable, maintainable, and cost effective facility (design consideration).

Lastly, the OSDF should be laid out so that it can be progressively developed in phases, utilizing contiguous cells that can be constructed, filled, and closed on a flexible schedule consistent with the final schedule for remediation of the FEMP operable units. The design of the OSDF must be flexible to accommodate an active life ranging from 7 to 25 years (functional requirement).

000045

2.2.2 Specific Layout Criteria

2.2.2.1 Horizontal Limits

- The length and width of the OSDF shall result in a facility that satisfies the siting ARARs identified in Section 2.1 of this DCP (ARARs).

- The horizontal layout should be adequate to provide a disposal capacity sufficient for 2.5 million cubic yards (1.9 million cubic meters) bank/ unbulked impacted material (functional requirement). The OSDF should provide sufficient capacity for anticipated bulking of impacted material as a result of excavation, transport, and placement. The OSDF should also provide sufficient capacity to accommodate seasonal (winter) cover soil, if required. The OSDF should be designed with a "contingency" disposal capacity to be used in the event that the volume of impacted material requiring disposal increases as a result of remediation-phase confirmatory sampling and to provide additional capacity for potential partial closure activities. The contingency disposal capacity should be in the range of 10 to 15 percent of the specified required disposal capacity (design consideration).

- For cost effectiveness, the OSDF should be regularly shaped, to the extent possible, with as few changes in geometry as possible and with smooth transitions between changes in geometry (design consideration).

2.2.2.2 Final Height and Slope Limits

- The maximum height of the OSDF from the top of the final cover system to existing grade (measured at the crest of the facility) should not exceed 70 ft (22 m) (functional requirement) and the average maximum height along the crestline should not exceed about 65 ft (20 m) (design consideration).

- The final cover system shall be constructed at slopes between 5 and 25 percent (ARAR: OAC 3745-27-08(C)(15)(f)(ii)). The slopes should be flat enough to satisfy slope stability factor of safety criteria and erosion control

criteria. Within these constraints, slopes should be as steep as possible to achieve a cost effective design (design consideration).

- The transitions between topslope and sideslope areas of the final cover system should be gradual to prevent erosion caused by transitional flow of surface-water runoff (design consideration).

2.2.2.3 Foundation Grade and Slope Limits

- The bottom of the OSDF (i.e., bottom of the liner system) shall overlie at least 12 ft (3.6 m) of undisturbed gray till (equivalent standard of performance requirement for CERCLA ARAR waiver).

- The distance between the bottom of the compacted clay component of the OSDF liner system and the GMA shall not be less than 15 ft (4.5 m) (ARAR: OAC 3745-27-08(H)(2)(e)). For purposes of compliance with this requirement, the top of the GMA is considered to be the historical high water level in that aquifer.

- The OSDF liner system should be founded in native brown till to the extent feasible. Construction of the liner system on fill should be minimized (functional requirement).

- The OSDF should be laid out such that the top of the protective layer for the liner system is at or near existing grade (functional requirement). However, based on geometric considerations, founding of the liner system below existing grade in the northern portion of the OSDF is permitted (design consideration).

- The compacted clay component of the liner system shall be constructed with a slope of at least 2 percent (ARAR: OAC 3745-27-08(C)(1)(h)). Therefore, the foundation grades must be constructed with a slope of at least 2 percent (design consideration). It is interpreted that this slope requirement does not apply along the leachate collection corridor.

2.2.2.4 Perimeter Features

- The OSDF should be laid out having a perimeter surface-water management system (design consideration). Design criteria for this system are given in Section 2.8 of this DCP.

- The OSDF should be laid out having an access corridor to leachate management system manholes and cleanouts (design consideration). Design criteria for this access corridor are given in Section 2.9 of this DCP.

2.2.3 Calculations

Calculations required to establish the location and layout of the OSDF are as follows:

- OSDF required volume;

- OSDF capacity verification; and

- OSDF earthwork required volume.

2.2.4 References

FEMP property data and information required to locate and layout the OSDF should be obtained from the references cited in Section 1.5 of this DCP.

2.3 OSDF Performance

2.3.1 Design Life

The function of the OSDF is to isolate impacted material from the environment throughout the facility design life (i.e., for 1,000 years, to the extent reasonable, and

in any case for 200 years) (ARAR: 40 CFR §192.02(a)). The OSDF design should be developed to achieve this design life goal. Requirements to achieve the goal fall into five categories, defined as follows (design considerations):

- *internal hydrologic control* - provide a high level of leachate containment and collection capability to prevent OSDF-related impacts to ground water and surface water;

- *external hydrologic control* - provide resistance to hydrologic impacts, including infiltration through the cover system and damage by surface-water runon or runoff;

- *geotechnical stability* - provide adequate OSDF slope stability factors of safety for conditions throughout construction, filling, and closure, and then through the post-closure period, including impacts associated with potential long recurrence-interval earthquake events;

- *resistance to erosion* - provide resistance to erosion of the OSDF soil layers to achieve minimal erosional impacts throughout the design life; and

- *resistance to biointrusion* - prevent intrusion by plant roots and burrowing animals.

The requirements described above should be achieved in the OSDF design in the manner indicated in Table 2-1. Also, the requirements should be achieved by (design considerations):

- using natural (i.e., geologic), durable construction materials wherever possible (e.g., clay liners, gravel drainage layers, etc.);

- using those commercially-available geosynthetic construction materials that demonstrate the best long-term durability characteristics (e.g., high density polyethylene geomembranes);

000019

TABLE 2-1

FUNCTIONAL REQUIREMENT - DESIGN FEATURE MATRIX ON-SITE DISPOSAL FACILITY

	FUNCTIONAL REQUIREMENT				
	Internal Hydrologic Control	**External Hydrologic Control**	**Geotechnical Stability**	**Resistance to Erosion**	**Resistance to Biointrusion**
DESIGN FEATURE	· Liner and final cover systems completely encapsulate impacted material · Thick geomembrane liner (80 mil) and cap (60 mil) used to maximize service life · Geomembrane liner and cap present through at least the initial and intermediate periods · Compacted clay liner and cap remains functional through final period · Leachate collection system remains functional through at least the initial and intermediate periods · Geochemical attenuation provided by at least 3 ft of compacted clay liner, two geosynthetic clay liners, and at least 12 ft of in-situ native gray till	· Facility designed to prevent uplift under extreme perched water conditions · Site designed to prevent stormwater runon to the OSDF under 2,000-year storm event · Site designed to control and route stormwater runoff away from the OSDF under 2,000-year storm event · Facility sited or constructed out of 2,000-year floodplain · Low-permeability cover used to minimize infiltration into the OSDF	· OSDF located on stable glacial till foundation · OSDF slopes designed to be very stable · OSDF designed to be resistant to deformation under 2,400 year design seismic event · Impacted material placed and compacted in stable configuration · Construction materials selected to enhance stability (e.g., textured geomembrane)	· OSDF designed to be a stable geomorphic landform · Final cover system designed to have smooth transitions between cover top slopes and side slopes · Final cover system corners designed to be rounded · Final cover system slopes designed to be gentle to limit runoff velocity · Final cover system designed to resist erosion under design storm conditions · Biointrusion barrier beneath final cover system blocks potential depth of erosion or gullying	· Biointrusion barrier designed to impede plant root and animal intrusion · Primarily above-ground facility facilitates visual monitoring and maintenance · Continuing maintenance through the initial period and through as much of the intermediate period as necessary · Access to site limited and institutional controls can be implemented if necessary

- providing synergistic (e.g., adjacent geomembrane, GCL, and compacted clay liner and final cover system components) and redundant (e.g., dual leachate collection system drain pipes) design components; and

- designing a final facility geometry that replicates natural geomorphologic landforms (e.g., gently rolling topography).

The design of OSDF should be considered within a temporal framework. Over the OSDF design life (up to 1,000 years), the properties of some of the materials of construction, particularly the geosynthetics, may change. In addition, over time, and in the absence of external inputs, the impacted material will cease to generate leachate. To describe the behavior of the OSDF over time, three primary periods of behavior may be defined.

- *Initial Period.* The initial period is defined as the period from initial construction until the end of the 30-year post-closure monitoring period described in the *Final Record of Decision for Remedial Actions at Operable Unit 2* [DOE, 1995c]. It is assumed that during this period steady-state hydraulic conditions are established wherein leachate ceases to be generated by the facility, or continues to be generated, but at a very slow rate. Throughout this initial period, all components of the OSDF are maintained in a fully-functional condition.

- *Intermediate Period.* The intermediate period is assumed to begin 30 years after final closure of the OSDF and to last for at least 200 years, and up to 1,000 years to the extent reasonably achievable. During this period, the critical geosynthetic components of the liner and final cover systems are fully functional. The leachate collection and detection systems are still capable of being maintained, should there be a need (i.e., should there be significant leachate flow requiring maintenance and monitoring). The final cover system and leachate management system are capable of being fully maintained.

- *Final Period.* The final period is defined as the period during which the performance of the OSDF has stabilized to its permanent state. The final

000051

period does not occur for at least 200 years, and possibly up to 1,000 years after final closure of the OSDF. During this period, natural earth components of the liner and final cover systems continue to be functional. It is conservatively assumed that during the final period, the critical geosynthetic components of the liner and final cover systems are no longer fully functional, and the leachate collection and leak detection systems are no longer maintained.

The OSDF design should be configured to allow decision makers at the time of the final period to select an appropriate final management strategy for the facility (design consideration). These strategies are predicated on the assumption that the compacted clay cap component of the final cover system remains fully functional during the final period, and, thus, the rate of leachate generation during that period is very low. Potential management strategies include:

- allowing any leachate generated by the OSDF (due to infiltration through the OSDF final cover system) to migrate through the earthen components of the liner system into the brown and gray till that will underlie the OSDF; in this case, the leachate collection system and leak detection system drain pipes from each cell will be sealed by grouting or other appropriate measures; based on the studies performed for the OU2 FS [DOE, 1995b] this final period management approach will provide continuing protection of the underlying GMA; and/or

- maintaining the leachate collection system and leak detection system outlets from the OSDF cells; liquid that flows out of the cells can be collected and transported off-site for treatment, or discharged to a natural treatment system, such as a wetland area established at or near the site.

The design criteria presented in this DCP are intended to meet the design life goals of the OSDF under the assumptions of the "behavior periods" identified above. The design documentation that will be prepared for the OSDF should demonstrate how the design criteria satisfy these performance requirements for each behavior period.

Table 2-1 illustrates in a preliminary way how, for each of the project functional requirements, this DCP establishes design features to create a facility that will provide for the required performance.

2.3.2 Geotechnical Stability and Settlement

2.3.2.1 Static Slope Stability

A. Criteria

Static slope stability analyses should be performed for the following conditions at a minimum (design considerations):

- OSDF foundation
  - interim impacted-material configuration
  - final OSDF configuration
- OSDF liner system
  - short-term (i.e., end-of-construction) liner system on side slope
- OSDF impacted-material configurations
  - interim impacted-material configuration
  - final impacted-material configuration
- OSDF intercell berm
  - short-term condition
- OSDF final cover system
  - short-term condition on final side slope

- long-term condition on final side slope

- OSDF access corridor
  - short-term condition
  - long-term condition

- borrow area cut slopes
  - long-term condition

The degree of stability of a slope is reported in geotechnical engineering in terms of the slope stability factor of safety. The factor of safety of a slope is the factor by which the shear strength of the material along a potential slip surface through the slope must be divided to bring the slope to a state of barely stable equilibrium (i.e., incipient failure) [Duncan, 1992]. A factor of safety of at least 1.0 is required for a slope to be stable. The larger the factor of safety, the more stable the slope. Therefore, a slope with a factor of safety of 1.5 is more stable than a slope with a factor of safety of 1.2.

Minimum acceptable factors of safety for the above analysis conditions should be developed considering the criticality of the OSDF, the consequences of failure, and guidance provided by:

- UMTRA Technical Approach Document [DOE, 1989];
- NAVFAC Design Manual [U.S. Navy, 1971]; and
- Duncan [1992].

Minimum acceptable factors of safety for static slope stability conditions should be at least those from the UMTRA Technical Approach Document. Minimum acceptable factors of safety from that document are listed below.

Condition	Minimum Acceptable Factor for Safety
Stability during construction	1.3
End of construction stability	1.3
Long-term stability	1.5
Post-flood rapid drawdown condition	1.2

B. Calculations

For each condition defined in (A) of this section, the engineer should define the critical conditions for stability and perform an analysis to confirm that the calculated factors of safety for the critical conditions are larger than the minimum acceptable values. In performing the analyses, the engineer should follow guidance provided in Holtz and Kovacs [1981], Duncan et al. [1987], and Kulhawy and Mayne [1990], for example, in choosing between total-stress and effective-stress analysis approaches and in choosing between unconsolidated-undrained (UU), consolidated-undrained (CU), and consolidated-drained (CD) shear strength parameters. In establishing shear strength parameters for geosynthetic interfaces, the engineer should consider not only the above factors, but also the differences between peak and large-displacement shear strength values. Proven approaches should be used that are consistent with the requirements of DOE and USEPA standards and guidelines. Acceptable approaches are described below.

- *OSDF Foundation.* For the OSDF foundation stability condition, use two-dimensional limit equilibrium analysis methods; for example, use Bishop's simplified method [Bishop, 1955] for circular potential slip surfaces and Janbu's simplified method [Janbu, 1973], Spencer's method [Spencer, 1973], or the Morgenstern and Price [1965] method for noncircular potential slip surfaces. Use the computer program XSTABL [Sharma, 1991;1992], UTEXAS3 [Wright, 1991], or other widely-accepted and validated program.

000055

- *OSDF Liner System.* For the short-term liner system on side slope, use the two-dimensional limit equilibrium method of Giroud et al. [1995a], or other comparable method. If seepage forces are potentially significant, use the approach in Giroud et al. [1995b], or other suitable method.

- *OSDF Impacted-Material Configurations.* For interim and final impacted material configurations, use the techniques listed under OSDF foundations above.

- *Intercell Berm and Access Corridor.* For short-term and long-term analyses, use the methods listed above under OSDF foundation, or other suitable method.

- *OSDF Cover System.* For the final cover system, use the two-dimensional limit equilibrium methods of Giroud et al. [1995a,b] listed above under OSDF liner system, or other suitable method.

- *Borrow Area Cut Slopes.* For long-term analyses, use the methods listed above under OSDF foundation, or other suitable method.

2.3.2.2 Seismic Slope Stability

A. Criteria

A seismic hazard assessment and site response analysis should be performed to evaluate potential seismically-induced peak horizontal accelerations of the OSDF foundation, liner system, and final cover system. The seismic hazard assessment should be based on the conservative assumption that the OSDF will be a Performance Category 2 facility as defined in DOE Order 5480.28 [DOE, 1993]. The OSDF foundation, liner system, impacted materials, and final cover system should be designed to comply with the more stringent of the criteria and guidance given below (design consideration).

- DOE-STD-1020-94, "*Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*", [DOE, 1994]. This DOE standard requires that Performance Category 2 facilities be designed for a peak ground surface acceleration having an annual probability of occurrence of 1×10^{-3}.

- USEPA/600/R-95/051, "*RCRA Subtitle D (258) Design Seismic Design Guidance for Municipal Solid Waste Landfill Facilities*", [USEPA, 1995]. This USEPA guidance document requires that new municipal solid waste disposal facilities be designed to resist the peak bedrock acceleration of a seismic event having a probability of occurrence of no greater than 10 percent in 250 years. This seismic design criterion applies to "all containment structures, including liners, leachate collection systems, and surface-water control systems ..." (40 CFR §258).

The minimum peak ground surface acceleration at the FEMP satisfying the DOE-STD-1020-44 requirement is 0.13 g, where "g" is the gravitational acceleration at the surface of the earth (32.2 ft/s^2 (9.8 m/s^2)). This acceleration value is obtained from Table C-5a of the DOE-STD-1020-94. The peak bedrock acceleration at the FEMP site, according to USEPA/600/R-95/051, is 0.16 g.

The results of the site response analyses should be used in pseudo-static stability analyses to evaluate OSDF seismic stability, and, if necessary based on the criterion given below, seismic deformation analyses should be performed (design considerations). The maximum permanent seismic deformation for all analysis conditions should be no larger than 6 in. (0.15 m) based on the recommendations in Seed and Bonaparte [1992] and Anderson and Kavazanjian [1995].

B. Calculations

Seismic Hazard Assessment

A seismic hazard assessment should be performed for the OSDF. The purpose of the seismic hazard assessment is to associate an earthquake magnitude with the peak ground acceleration (PGA) values specified by [DOE, 1994] and [USEPA, 1995] and

000057

to select representative design accelerogram(s). The seismic hazard assessment should be performed in accordance with established earthquake engineering procedures.

Site Response Analysis

Site response analyses should be performed to evaluate peak horizontal accelerations of the OSDF foundation, liner system, and final cover system. Site response analyses should be performed using established one-dimensional or two-dimensional computer models such as SHAKE [Schnabel et al., 1972], as updated by Idriss and Sun [1992] for one-dimensional analyses, and QUAD4M [Hudson et al., 1994] for two-dimensional analyses. The selection of impacted-material parameters for seismic analyses should fully consider the existing site stratigraphy and subsurface conditions. The nature of the impacted materials that will be disposed in the OSDF (i.e., primarily soil, but also flyash, sludge, and building debris) should also be carefully considered in establishing these parameters.

The site response analyses will also require selection of representative earthquake magnitudes and strong motion acceleration-time histories. Guidelines that should be used to establish these inputs to the site response analyses include:

- *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* [DOE, 1994];
- *RCRA Subtitle D (258) Seismic Design Guidance for Municipal Waste Landfill Facilities* [USEPA, 1995];
- *Uranium Mill Tailings Remedial Action Project, Technical Approach Document, Revision II* [DOE, 1989]; and
- *Pre-Design Investigation and Site Selection Report for the On-Site Disposal Facility* [DOE, 1995g].

The site response analyses should be used to obtain the peak average acceleration of the OSDF for evaluating stability of the OSDF liner system and foundation. The

analyses should also be used to obtain the peak horizontal acceleration of the final cover system (at the level of the critical cover system interface for the evaluation of seismic performance of that component of the OSDF).

Pseudo-Static Stability Analysis

Pseudo-static stability analyses should then be performed using the acceleration values identified above. The evaluation should establish whether the pseudo-static factor of safety for the critical case for each stability condition is larger than 1.0. This minimum acceptable pseudo-static factor of safety is consistent with the *UMTRA Technical Approach Document* [DOE, 1989] and other engineering guidance. The stability conditions for which pseudo-static analyses should be performed are as follows:

- OSDF foundation
  - interim impacted-material configuration
  - final OSDF configuration
- OSDF impacted-material configurations
  - interim impacted-material configuration
  - final OSDF configuration
- OSDF final cover system
  - long-term condition on final side slope
- OSDF perimeter access corridor
  - long-term conditions

Deformation Analysis

If any of the above analyses result in a factor of safety less than 1.0, seismic deformation analyses shall be performed to establish whether calculated deformations

000059

are within acceptable limits. If the calculated deformations are acceptable, then the adequacy of the design with respect to the specific design criteria should be considered acceptable. Deformation analyses should be performed using a Newmark [1965] sliding block approach, as coded in the computer program YSLIP_C [Yan, 1991], or other suitable method. In performing these analyses, large-displacement shear strengths should be assumed for liner and cover system geosynthetic interfaces.

2.3.2.3 Foundation Settlement

A. Criteria

- The settlement of the foundation should not cause grade reversal of the leachate collection layer or ponding of leachate on the liner system (design considerations).

- Geomembrane and geosynthetic clay liner materials and their seams, as well as leachate collection and leak detection piping, should be able to withstand stresses and deformations resulting from settlement of adjacent materials without exceeding allowable tensile strains and elongations (design consideration).

- The post-settlement slopes of the leachate collection system should be sufficient to convey leachate from the OSDF to the leachate transmission system gravity line (design consideration). The post-settlement slopes of the leachate transmission gravity line should be sufficient to convey leachate by gravity to the permanent lift station (design consideration).

B. Calculations

Calculations should be performed to evaluate the settlement of the foundation beneath the OSDF. The calculations should be performed as described below.

- The geotechnical characteristics (i.e., consolidation properties, unit weights, moisture characteristics, etc.) of the foundation materials and impacted

materials should be evaluated using the site-specific data identified in Section 1.5 of this DCP. Correlations between soil index and compressibility properties can be obtained from Duncan and Chang [1970], Holtz and Kovacs [1981], Kulhawy and Mayne [1990], or other suitable references.

- The depth of influence should be estimated for the stress that will be applied to the foundation soils by the OSDF. The depth of influence may be estimated based on methods presented by Perloff et al. [1967], Poulos and Davis [1974], or others, and should consider the effects of varying heights of fill at different locations within the OSDF.

- The settlement of each layer of the foundation should be calculated based on the calculated stress increase and the properties of the foundation materials using standard settlement calculation methods, such as those presented by Lambe and Whitman [1969], Duncan [1992], Duncan, et al. [1987], Holtz and Kovacs [1981], or others, as appropriate.

- The impact of the calculated settlement should be evaluated. The calculation results should be evaluated in terms of total settlements, differential settlements, change in slope of the leachate collection system, change in slope of the leachate transmission system gravity line, and impacts (if any) to the liner system components.

2.3.2.4 Impacted Material Settlement

A. Criteria

- Final cover system slopes after settlement should be large enough to prevent ponding of water on the final cover system (design consideration).

- Differential settlement of the OSDF final cover system resulting from compression of impacted material placed in the OSDF should not cause grade reversal of the final cover system (design consideration).

000061

- The OSDF final cover system drainage layer should convey the design flow with a hydraulic head of not more than 1.0 ft (0.3 m) under the post-settlement grades of that system (design consideration).

- Tensile strains in geosynthetic and soil components of the final cover system due to differential settlement must not cause damage to the components (design consideration).

B. Calculations

Calculations should be performed to evaluate the settlement of the OSDF final cover system. The calculations should be performed as described below.

- The layout of impacted materials in the OSDF should be established using information in the OSDF *Impacted Materials Placement Plan*.

- The geotechnical characteristics (i.e., consolidation properties, unit weights, moisture characteristics, etc.) of the impacted materials should be evaluated using the site specific data described in Section 1.5 of this DCP, other available information on the characteristics of materials to be placed in the OSDF, and information in the OSDF *Impacted Materials Placement Plan*.

- The potential for localized differential settlement due to impacted material non-homogeneity (i.e., "compressible zones" and "hard spots") should be evaluated considering the placement of the specific categories of impacted material allowed by the OSDF *Impacted Materials Placement Plan*. The potential for localized differential settlement should be evaluated using techniques such as those presented by Attewell [1987], Sagaseta [1987], Jones and O'Rourke [1988], Whittaker and Reddish [1989], Drumm et al. [1990], and Othman et al. [1995], or other suitable methods.

- Calculations should be performed to evaluate the potential magnitude of total settlement of the impacted material placed in the OSDF. The settlement calculation should use the same techniques as for foundation settlement (cited above), taking into account the specific geotechnical characteristics of the

impacted material when placed in the OSDF in the manner required by the *Impacted Material Placement Plan*.

- Potential effects of the calculated settlement of both the foundation and impacted materials on the final cover system should be evaluated. The impact may be evaluated in terms of: total settlements, differential settlements, changes in slope to the final cover system drainage layer, hydraulic head in the final cover system drainage layer, and stresses and strains in final cover system components.

2.3.3 References

FEMP property data and information required for geotechnical slope stability and settlement analyses should be obtained from the references cited in Section 1.5 of this DCP. Additional information may be obtained from the general technical literature cited below.

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2.4 Liner System

2.4.1 General Design Criteria

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, these 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)).

Additional requirements of the OSDF liner system are as follows:

- The liner system shall be effective for up to 1,000 years, to the extent reasonably achievable, and in any case for at least 200 years (ARAR: 40 CFR §192.02(a)).

- The liner system should extend completely under all areas where impacted material will be placed in the OSDF (design consideration).

- The liner system should be constructed in a manner that, after placement of the final cover system, completely encapsulates the impacted material placed in the OSDF (design consideration).

- The number of penetrations through the liner system by leachate collection and leak detection piping should be minimized. In particular, there should be no more than one penetration each for the leachate collection pipe, redundant leachate collection pipe, and leak detection pipe for each cell of the OSDF (design consideration).

- The liner system should be designed to resist damage caused by the loads applied during construction, placement of impacted material, closure, and post-closure care (design consideration).

- The liner system components should be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction, filling, and closure (design consideration).

- The geosynthetic components of the liner system shall be physically and chemically resistant to attack by the material to be disposed in the OSDF, leachate, or other materials that they may contact. This shall be established using documented data or testing using USEPA Method 9090. Geosynthetic materials shall also have properties acceptable for installation and use in the OSDF (ARARs: OAC 3745-27-08(E)(1) and (2)).

2.4.2 Hydrostatic Uplift

A. Criteria

The liner system shall have a factor of safety of 1.4 against hydrostatic uplift (ARAR: OAC 3745-28-08(C)(1)(k)).

B. Calculations

To satisfy the above design criterion, an analysis should be performed of the impacts of potential hydrostatic forces on the liner system. The analysis should consider the potential range of perched-zone ground-water levels within the OSDF foundation. A contour map should be prepared to establish design-basis perched ground-water levels to use in the analysis. If the design-basis perched ground-water levels exceed the elevations of the bottom of the liner system, an analysis should be conducted to evaluate the potential for uplift of the liner system. The analysis should be performed for both end-of-construction and long-term conditions. Procedures for calculating uplift pressures due to high ground water are given in Lambe and Whitman [1969] and Holtz and Kovacs [1981], for example. If the minimum required factor of safety is not achieved in the calculations, then the project design should be modified as necessary. Potential modifications that may be considered include raising the bottom elevation of the OSDF, installing an underdrain system beneath the OSDF, placing ballast (e.g., gravel) in an OSDF cell to compensate for buoyant uplift, or using a temporary dewatering system until the OSDF is ballasted by impacted material disposed in the OSDF.

2.4.3 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. (200 mm) thick; 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. (75 mm), 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. (50 mm);
  - not more than 10 percent of the particles, by weight, having a dimension greater than 0.75 in. (20 mm);
  - not less than 50 percent of the particles, by weight, passing through the standard U.S. No. 200 standard sieve; and
  - not less than 25 percent of the particles, by weight, having a maximum dimension not greater than 0.002 mm (2 μm) (ARAR: OAC 3745-27-08(C)(1)(c)).

The requirements of the initial two items appear to be satisfied by all of the brown and gray till underlying the FEMP property (excluding localized sand and gravel lenses). In contrast, the requirements of the final two items are satisfied by most, but not all, of the brown and gray till underling the FEMP property. However, OAC 3745-27-08(C) states that alternatives to the prescriptive requirements for soil liner materials may be used: "*...if it is demonstrated to the satisfaction of the Director that the materials and techniques will result in each lift having a maximum permeability of 1 x 10^{-7} cm/s.*" The available test data demonstrate that the brown and gray tills are capable of achieving a hydraulic conductivity no larger than 1 x 10^{-7} cm/s. Therefore, for the brown and gray till to be used in the compacted clay liner, a demonstration will be required pursuant to OAC 3745-27-08(C) to obtain an acceptable alternate to the particle size requirements. The primary considerations in developing this demonstration are given below:

- The primary performance criterion for compacted soil liners in OAC 3645-27-08(C)(1)(a) requires that each lift of the liner have a maximum hydraulic conductivity of 1 x 10^{-7} cm/s. The hydraulic conductivity of a clayey soil is, in part, a function of the percentage of clay-size particles. However, other factors such as soil plasticity, compaction moisture content, and dry density also strongly influence hydraulic conductivity. Benson et al. [1994] performed detailed analyses of how each of these parameters correlate with

hydraulic conductivity. The results of their study, which was based on data from 67 landfills, indicate that an average (rather than a minimum) fraction of clay-sized particles exceeding 15 percent is an acceptable criterion for compacted soil liners. In addition, Benson et al. [1994] provide data on a large number of compacted soil liners which do not meet the clay-size particle criterion set forth in OAC 3745-27-08(C)(1)(c)(iv), yet, when constructed using appropriate procedures, have measured hydraulic conductivities less than 1 x 10^{-7} cm/s. It is also noted that widely-accepted guidelines for clay liner materials (e.g., Daniel [1993]) do not contain criteria for the minimum acceptable percentage, by weight, of clay-size particles. These same guidelines only require not less than 20 to 30 percent of the particles, by weight, to be finer than a U.S. No. 200 standard sieve.

- As part of the OSDF design, a test pad program will be conducted using soil obtained from the OSDF foundation excavation and the on-site soil borrow area. 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 will be 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 x 10^{-7} cm/s. The test pad program will meet the requirements for test pads set forth in OAC 3745-27-08(C)(1)(m).

- 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 construction quality assurance (CQA) program will 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 (12 tests per hectare per lift)) to verify that the compaction conditions are consistent with those established

000071

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 x 10^{-7} cm/s. the CQA program will also include confirmatory hydraulic conductivity testing as required by OAC 3745-27-08(D)(1).

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)).

The OU2 ARARs contain requirements for testing the compacted clay liner during construction. These requirements must be incorporated into the OSDF construction specifications. The ARARs (OAC 3745-27-08(D)(1)) indicate that the following 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 (1 per 1,140 m^3) of soil, except the hydraulic conductivity test, which shall be performed at a frequency not less than 1 per 10,000 yd^3 (1 per 7,600 m^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.

2.4.4 Geosynthetic Clay Liner

A. Criteria

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

- be negligibly permeable to fluid migration (C)(3)(a)) (interpreted herein to require that the GCL have a minimum hydraulic conductivity of 5×10^{-9} cm/s under applicable normal stresses) (C)(3)(a));

- be installed having a minimum overlap of 6 in. (150 mm), or, for end of panel seams, a minimum overlap of 12 in. (0.3 m) (overlap shall be increased

000073

in accordance with manufacturers specifications or to account for shrinkage due to weather conditions) (C)(3)(b));

- have a bentonite mass per unit area of at least one pound per square foot (5 kg/m^2) (C)(3)(c));

- 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 (C)(3)(d)); and

- for the secondary liner component of the liner system, be constructed above the compacted clay liner (C)(3)(e)).

In addition to the foregoing requirements, the geosynthetic clay liner should be of the "internally reinforced" type, or of the type with a "HDPE geomembrane backing" (with the HDPE geomembrane backing placed in contact with the underlying soil layer). Either of these types of geosynthetic clay liner will improve short-term liner system stability compared to the level of stability achieved with an "unreinforced" type geosynthetic clay liner (design consideration). The benefits of geosynthetic clay liner internal reinforcement or partial hydration should be discounted in evaluating the long-term stability of the liner system (i.e., the geosynthetic clay liner should be considered unreinforced and fully hydrated for long-term stability analyses).

B. Calculations

The design of OSDF liner system should include further evaluation of the most appropriate types of geosynthetic clay liners to use on this project (design consideration).

2.4.5 Geomembrane Liner

A. Criteria

The geomembrane component of the liner system shall:

- be placed on the compacted clay liner (ARAR: OAC 3745-27-08(C)(2)); this is interpreted herein to mean that the geomembrane components of the liner system should be placed on top of the geosynthetic clay liner components;

- be manufactured of at least 60-mil (1.5-mm) thick high density polyethylene (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)).

The ARARs cited above require that the geomembrane components of the liner system be at least 60 mil (1.5 mm) thick. As a design enhancement to increase the service life of the OSDF liner system, the use of a thicker geomembrane (e.g., an 80-mil (2.0-mm) thick) material should be considered (design consideration).

Consideration should also be given to using "textured" geomembrane, as opposed to smooth geomembrane, to improve OSDF slope stability (design consideration).

The OU2 ARARs also contain specific requirements for geomembrane seam testing. These requirements shall be incorporated into the OSDF construction specifications. The OU2 ARARs require that 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 should 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 (150 m) of seam length (ARAR: OAC 3745-27-08(C)(2)(g)(iii)).

As part of the design of the OSDF liner system, an evaluation should be performed to establish whether a textured geomembrane manufactured of HDPE and of 80 mil (2.0 mm) thickness is the most appropriate type of geomembrane (in terms of composition, thickness, surface texturing, etc.) for use on the project. The evaluation should consider physical and mechanical properties, durability, and chemical compatibility (design consideration).

B. Calculations

The evaluation described above should be performed as part of the OSDF liner system design.

2.4.6 Geotextile Cushion

A. Criteria

The geomembrane component of the liner system should be designed to resist puncture or damage from the stresses applied by overlying drainage layer material. This may require the use of a geotextile cushion layer (design consideration). The geotextile cushion layer should also be designed to be robust and have adequate construction survivability characteristics (design considerations).

B. Calculations

The calculation for evaluating geotextile cushion layer requirements should consider two loading conditions: (i) long-term case assuming the OSDF is full; and (ii) short-term case assuming that construction equipment is working above the drainage layer material. Procedures such as those by Koerner et al. [1995], or other suitable procedures, should be used to calculate the required characteristics of the geotextile cushion. If the procedure by Koerner et al. [1995] is used, the geotextile cushion layer should be designed to have a factor of safety of 3.0.

Design for adequate construction survivability should be performed using the procedure described in Koerner [1994], or other suitable procedures.

2.4.7 Geosynthetic Tension and Anchor Trench Capacity

A. Criteria

The geosynthetic components of the liner system should be designed to prevent slippage at their interfaces with adjacent materials and, thus, to preclude the development of tension in these materials (design consideration).

Notwithstanding the fact that the geosynthetics will be designed to preclude the development of tensile stresses, an anchor trench should be constructed at the top of the OSDF side slope to anchor the geosynthetic components of the liner system. The

000077

purpose of the anchor trench is to facilitate installation of the geosynthetics and to prevent disturbance of the geosynthetics by wind prior to placement of overlying soil layers. To achieve these functions, the anchor trench should be 2 ft (0.6 m) deep. Based on industry experience, this depth of anchor trench will satisfy the functional requirements.

B. Calculations

An evaluation should be performed to establish that slippage at geosynthetic component interfaces will not occur. The evaluation should involve a comparison of the interface shear strengths of geosynthetic components to the mobilized shear stresses along the interfaces. The factor of safety in every case should be larger than 1.0 to prevent the development of geosynthetic tension. The work of Long et al. [1994] should be considered in performing the evaluation.

2.4.8 Frost Protection

A. Criteria

As discussed in Section 2.4.3 of this DCP, the compacted clay component of the liner system shall be adequately protected from damage due to freeze/thaw cycles (ARAR: OAC 3745-27-08(C)(1)(l)). This is achieved by having an adequate thickness of insulating material (e.g., soil) on top of the clay during freezing weather. An evaluation of the required thickness of overlying material is required.

B. Calculations

An evaluation should be performed to identify the minimum thickness of soil that must be placed over the geomembrane component of the secondary liner to protect the underlying compacted clay component from freeze-thaw due to winter weather. The evaluation should be performed using the modified Berggren method [Aldrich and Paynter, 1953]. The evaluation should be performed using climatological data relevant to the OSDF locale.

2.4.9 Chemical Compatibility

Geosynthetic materials, including seams, joint sealing compounds, and other synthetic materials used to contact the OSDF liner system shall be physically and chemically resistant to attack by the leachate that will be generated by the facility (ARAR: OAC 3745-27-08(E)(1)). To satisfy this requirement, a liner compatibility study should be implemented to demonstrate the compatibility of the geomembrane component of the liner system with the anticipated OSDF leachate. The liner compatibility study should be performed in two parts with the first part consisting of a review of published data on: (i) the general chemical compatibility and durability characteristics of HDPE geomembranes; and (ii) the performance of HDPE geomembranes in similar applications. If the available published data are not adequate to draw conclusions for design, a physical/chemical testing program should be undertaken to generate additional data. The testing program should include:

- immersion of representative geomembrane specimens in simulated OSDF leachate; the immersion procedures should be in accordance with USEPA Method 9090;

- pre- and post-immersion physical, mechanical, and micro-structural testing of the geomembrane specimens; and

- evaluation of the test results for evidence of any adverse impacts of leachate immersion on the geomembranes.

The scope of the liner compatibility study should be described in a work plan that addresses both the literature review and the physical/chemical laboratory testing program. The work plan should provide a detailed description of the immersion testing procedures and the procedures that will be used to evaluate the test results, should testing prove necessary. The work plan should first be developed in draft form for DOE, USEPA, and OEPA review and approval. A final work plan should be issued after incorporation of comments on the draft. A final report should be submitted to DOE, USEPA, and OEPA upon completion of the study.

000079

The liner compatibility study should be complete prior to completion of the final design package.

A liner compatibility study cost estimate should be prepared based on the draft liner compatibility study work plan. The cost estimate must be in FDF (formerly FERMCO) format. This format is illustrated by the FDF (formerly FERMCO) baseline OSDF cost estimate presented in Appendix E of this document.

2.4.10 References

FEMP property data and information required for design of the liner system should be obtained from the references cited in Section 1.5 of this DCP. Additional information for design may be obtained from the general technical references listed below.

Aldrich, H.P. and Paynter, H.M., "Frost Investigations, Fiscal year 1953, First Interim Report", *Analytical Studies of Freezing and Thawing Soils*, Arctic Construction and Frost Effects Laboratory, New England Division, U.S. Army Corps of Engineers, Boston, MA, 1953.

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Holtz, R.D. and Kovacs, W.D., "*An Introduction to Geotechnical Engineering*", Prentice Hall, Englewood Cliffs, New Jersey, 1981, 733 p.

Koerner, R.M., "*Designing with Geosynthetics*", Third Edition, Prentice Hall, Englewood Cliffs, NJ, 1994, 783 pp.

Koerner, R.M., Wilson-Fahmy, R.F., and Narejo, D.B., "*Puncture Protection of Geomembranes, Part I: Theory, Part II: Experimental, and Part III: Examples*", Geosynthetic Research Institute, 1995.

Lambe, T.W. and Whitman, R.V., "*Soil Mechanics*", John Wiley and Sons (Pub.), 1969, pp. 359-365.

Long, J.H., Gilbert, R.B. and Daly, J.J., "Geosynthetic Loads in Landfill Slopes: Displacement Compatibility", *Journal of Geotechnical Engineering*, ASCE, Vol. 120, No. 11, November 1994, pp. 2009-2025.

2.5 Leachate Management

2.5.1 Leachate Collection System

A. Criteria

The functions of the leachate collection system 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 should also extend over all areas that will subsequently be used for impacted material disposal and function with minimal maintenance and monitoring (design

considerations). In addition to the foregoing requirements, the leachate collection system should comply with the design criteria given below:

- The leachate collection system for a given OSDF cell should be independent of the leachate collection systems for adjacent cells (design consideration).

- During impacted material placement, the leachate collection system for a cell, coupled with the configuration of perimeter and intercell side slopes of the cell, shall provide control (containment) of runoff from active portions of the disposal facility for the 25-year, 24-hour storm event (ARAR: 40 CFR §258.26). For the FEMP property, this event has a rainfall intensity of 4.7 in. (120 mm) [Parsons, 1995a]. Temporary ditches and perimeter and intercell berms should have freeboard of at least 0.5 ft (0.15 m) under the design storm event (design consideration).

- The leachate collection system shall be designed to limit the leachate head in the system, in areas other than the permanent lift station, to less than 12 in. (0.3 m) (ARARs: OAC 3745-27-08(C)(4) and 40 CFR §258.40). The evaluation of maximum head should consider initial and intermediate filling conditions in a cell, as well as conditions after closure (design consideration). The evaluation need not consider potential transient higher heads due to rainfall that might fall into an open cell during cell start-up activities (design consideration).

- The leachate collection system shall be designed to resist clogging and crushing (ARAR: OAC 3745-27-08(C)(4)).

- The leachate collection system shall consist of a drainage layer placed on top of the geomembrane component of the primary liner (ARAR: OAC 3745-27-08(C)(4)(a)).

- The leachate collection system drainage layer material shall have a hydraulic conductivity, k, of at least 1 x 10^{-3} cm/s, be at least 1 ft (0.3 m) thick, and have a negligible amount of fines (ARARs: OAC 3745-27-08(C)(4)(a)(i)

through (iii)). The fines content requirement is interpreted herein to mean not more than 2 percent of the particles passing a U.S. No. 200 standard sieve.

- The leachate collection system drainage layer material shall not contain carbonate material (ARAR: OAC 3745-27-08(C)(4)(a)(iv)), unless it is shown to the satisfaction of USEPA and OEPA that a material with carbonate meets the design requirement. Material is considered to meet the carbonate content requirement if it satisfies the requirements of the 18 August 1994 OEPA Department of Solid and Industrial Waste Management (DSIWM) Interpretation entitled "*Carbonate Content of Drainage Layer*".

- Earth materials (i.e., non-carbonate, durable, sound aggregate), not geosynthetic drainage layers, should be used in the leachate collection system to the extent possible to maximize the design life of the system (design consideration). An alternative material requirement may be used for the leachate collection system if it is demonstrated to the satisfaction of the USEPA and OEPA that the alternative satisfies all other design requirements.

- The leachate collection system shall contain a means to remove leachate from the bottom of the landfill (ARAR: OAC 3745-27-08(C)(4)(b)).

- Leachate collection system pipes shall (as required by OAC 3745-27-08(C)(4)(b)):

  - be imbedded in the drainage layer ((4)(b)(i));

  - be constructed with a minimum slope of 0.5 percent ((4)(b)(ii));

  - be provided with access for clean-out devices ((4)(b)(iii));

  - have lengths and a configuration that do not exceed the capabilities of clean-out devices ((4)(b)(iv));

  - have welded joints to prevent separation ((4)(b)(v)); and

- be physically and chemically resistant to attack by the solid waste, leachate, or other materials they may contact ((4)(b)(vi)).

- A leachate collection system without a pipe network may be used if it is demonstrated that the system is in compliance with the 27 January 1995 DSIWM guidance document entitled "*Leachate Collection System Design - Use of a Drainage Layer without a Pipe Network*" (design consideration). This document requires that:

  - the leachate collection system limits the leachate head in the system to less than 12 in. (0.3 m) (design consideration);

  - the drainage layer has adequate permeability to minimize clogging potential (design consideration);

  - the leachate collection system is constructable, provides easy access for maintenance and repair, is reliable and redundant, and is properly sized (design consideration); and

  - the leachate collection system is physically and chemically resistant to attack by solid waste and leachate (design consideration).

- It is noted that the clean-out device requirement given above (OAC 3745-27-08(C)(4)(b)(iii)) is interpreted to apply to any length of pipe required to maintain a leachate head of less than 12 in. (0.3 m) on the primary liner. Additional pipe installed for redundancy need not meet this requirement (design consideration). In addition, leachate collection system pipes should be designed to resist stresses due to overburden materials and construction equipment (design consideration).

- The collection pipe network of the leachate management system 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 (ARAR: OAC 3745-27-19(K)(3)). Consistent with the interpretation of the previous ARAR, the requirements of this ARAR are

interpreted to apply to any length of pipe required to maintain a leachate head of less than 12 in. (0.3 m) on the primary liner. Additional pipe installed for redundancy need not meet these requirements (design consideration).

- The leachate collection system shall be overlain by a filter layer to prevent (to the extent possible) clogging of the drainage layer (ARAR: OAC 3745-27-08(C)(4)(c)).

- Leachate collection system pipes should be at least 6 in. (15 cm) in nominal diameter to minimize clogging potential and to provide ample access for clean-out equipment (design consideration).

- Leachate collection system pipes should be manufactured from HDPE for durability and chemical compatibility (design consideration). These pipes should have a standard dimension ratio (SDR) of no more than 11 to provide both a high degree of structural stability and a wall thickness sufficient to minimize the potential for surface degradation (e.g., oxidation) and therefore maximize the design life of the system (design consideration).

- Portions of leachate collection system pipes inside a cell should be perforated to allow inflow of leachate. Perforations should be designed to prevent plugging or clogging by the adjacent drainage material (design consideration).

- The factors of safety for flow in the leachate collection system pipes under the various design flow conditions are as follows:

  - baseline design flow rate during OSDF operations (i.e., baseline leachate flow obtained from leachate generation analysis; this baseline excludes temporary flows from stormwater runoff that is contained in the cell and allowed to percolate directly into the cell leachate collection system); the minimum acceptable factor of safety for this condition is 3.0;

  - storm design-basis flow rate during OSDF operations (i.e., baseline leachate flow plus temporary flows from stormwater runoff that is contained in the cell and allowed to percolate directly into the cell

leachate collection system); the storm design-basis flow rate should be mechanically controlled during active OSDF operations to satisfy following competing criteria: (i) rapid drainage of cell stormwater runoff; (ii) permanent lift station operational requirements; and (iii) maximum acceptable discharge rate to the biosurge lagoon; the minimum acceptable factor of safety for temporary pressure flow in the leachate transmission system gravity line for this condition is 1.0 using as a basis the manufacturer pressure rating for the carrier pipe; and

- baseline design flow rate after OSDF closure (i.e., baseline flow obtained from leachate generation analysis); the minimum acceptable factor of safety for this condition is 10.0.

- The leachate collection system should be provided with a redundant drain pipe to serve as a back-up in the event of unforeseen problems with the main leachate collection system pipe (design consideration).

- A protective layer shall be placed above the leachate collection system to protect the underlying liner system from damage due to intrusion of objects (ARAR: OAC 3745-27-08(C)(4)(d)).

- The protective layer should consist of a minimum 1 ft (0.3 m) thickness of impacted or clean soil that contains no sharp objects, debris, or other material that could damage the liner system (design consideration).

In addition to the foregoing, the OU2 ARARs contain requirements for testing the granular material that will be used to construct both the leachate collection system and the leak detection system. These requirements must be incorporated into the OSDF construction specifications. The ARARs (OAC 3745-27-08(D)(2)) indicate 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 (1 per 2,290 m^3):

- hydraulic conductivity; and

- grain-size distribution using ASTM D 422 or ASTM C 136 for the sieve method.

B. Calculations

The quantity of leachate generated in an OSDF cell during filling and after closure should be evaluated as part of the design process. The quantity of leachate should be calculated using the USEPA Hydrologic Evaluation of Landfill (HELP) model, Version 3.03 [Schroeder et al., 1994a,b]. Leachate generation estimates should be made for each representative step in the filling of an OSDF cell (i.e., after placement of an initial thickness of impacted material (initial filling), intermediate filling, and post-closure) and for each representative phase of OSDF development. The results of the calculations should be used to design the leachate collection system, leak detection system, and leachate transmission system.

Impacted runoff from active portions of the OSDF for the 25-year, 24-hour storm event should be calculated and containment of this runoff within the OSDF should be demonstrated. Impacted runoff volumes may be calculated as described in Technical Release 55, published by the United States Department of Agriculture-Soil Conservation Service [USDA-SCS, 1986a]. Impacted runoff routing calculations should be performed using Technical Release 55, or alternatively Technical Release 20 [USDA-SCS, 1975] techniques.

The following leachate collection system evaluations should be performed:

- maximum head in the leachate collection system, as calculated using the USEPA HELP computer model and checked using procedures presented by Giroud and Houlihan [1995], or other suitable methods;

- geotextile filter design, using procedures presented by Giroud [1982] or Christopher and Holtz [1984], or other suitable methods;

- geotextile biological clogging potential, using procedures by Koerner and Koerner [1995], and Koerner et al. [1994];

000087

- flow capacity of leachate collection system pipes (using standard pipe capacity calculation methods) for the various design flow conditions;

- leachate collection system pipe perforation sizing (using an analysis based on the leachate collection system drainage material grain size distribution); and

- leachate collection system pipe structural stability (using standard methods for evaluating the strength and stability of buried flexible pipes).

2.5.2 Leak Detection System

A. Criteria

The following design criteria apply to the leak detection system:

- The leak detection system should allow monitoring of any leachate migration through the primary liner of each cell of the OSDF (functional requirement). The maximum leak detection time (i.e., the time between when leakage occurs and when it drains into the leak detection system manhole) should be less than 20 days (design consideration), calculated assuming steady-state flow conditions.

- The leak detection system for a given OSDF cell should be independent of leachate detection systems for adjacent cells (design consideration).

- The leak detection system should be independent of the leachate collection system (functional requirement).

- The leak detection system should provide for efficient and reliable containment and collection of any leachate migration through the primary liner (design consideration).

- The leak detection system should limit the liquid head on the secondary liner to not more than 1 ft (0.3 m) under normal and extreme operating conditions,

be constructed of durable material, and not be prone to clogging or other forms of deterioration (design consideration).

- The leak detection system should be designed to route liquid that enters the system to a collection and measurement location (e.g., manhole or sump) outside of the OSDF (functional requirement).

- The leak detection system drainage material should meet the same design criteria and testing requirements identified in Section 2.5.1 for leachate collection system drainage material (design consideration).

- The leak detection system pipes should meet the same design criteria identified in Section 2.5.1 for leachate collection system pipes (design consideration).

An action leakage rate (ALR) should be defined for the leak detection system that establishes a threshold for response actions in the event of excessive flow rates from the leak detection system drain pipe (functional requirement). The ALR should be established in accordance with procedures for RCRA Subtitle C facilities, as described in 40 CFR §264. The ALR, monitoring to evaluate conformance with the ALR, and response actions to be taken in the event the ALR is exceeded will be described in the Ground-Water Monitoring Plan that will be prepared for the OSDF.

B. Calculations

The following calculations should be performed as part of the design of the leak detection system:

- the potential for leachate migration through the liner and into the leak detection system, using the USEPA HELP model [Schroeder et al., 1994a,b], which uses the liner performance models of Giroud and Bonaparte [1989a,b] and Giroud et al. [1992] to calculate a rate of leakage through the primary liner;

000069

- hydraulic head in the leak detection system drainage layer due to the calculated leakage through the primary liner, using the procedure described in Bonaparte and Giroud [1995], or other suitable methods;

- time of travel in the leak detection system calculated using the procedure described in Bonaparte and Giroud [1995], or other suitable methods;

- leak detection system pipe flow capacity and factor of safety (using standard pipe capacity calculation procedures);

- leak detection system pipe perforation sizing (using an analysis based on the leak detection system drainage material grain size distribution);

- leak detection system pipe structural stability (using standard methods for evaluating the strength and stability of buried flexible pipes); and

- leak detection system ALR (using accepted procedures for RCRA Subtitle C facilities).

2.5.3 Leachate Transmission System

A. Criteria

The leachate transmission system must be designed to convey leachate (and liquids in the leak detection system) from the OSDF cells to a permanent lift station at the OSDF battery limit (functional requirement). From the permanent lift station, the leachate will be pumped through a double-wall forcemain pipe to the biosurge lagoon. This DCP addresses design of the leachate transmission system up to, and including, the permanent lift station physical structure and the controls on the leachate transmission gravity line outlet into the permanent lift station. The design of the forcemain from the permanent lift station to the biosurge lagoon, including permanent lift station pump requirements and valves, controls, and electrical/mechanical equipment downstream of the pumps, is being addressed in a separate design package.

ARARs relevant to the leachate transmission system are contained in OAC 3745-27-08(C)(5) which states that any 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 ((C)(5)(a));
- for storage tanks, be provided with secondary containment ((C)(5)(b));
- for leachate lines, be provided with double containment ((C)(5)(c)); 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 ((C)(5)(d)).

Additional ARARs for the leachate transmission system are as follows:

- At least one lift station back-up pump shall be kept at the disposal facility at all times (OAC 3745-27-19(K)(2)).
- If authorized, leachate may be temporarily stored within the limits of disposal until the leachate can be treated and disposed (OAC 3745-27-19(K)(4)).

The leachate transmission system design criteria presented below have been developed to satisfy these ARARs as well as the functional requirements contained in Appendix D of this DCP and the design considerations normally associated with this type of system:

- Liquid in the leak detection system of an OSDF cell should flow by gravity through a double-wall HDPE pipe (which penetrates the liner system) to a leak detection system manhole located on the west side of the OSDF (outside the limit of impacted material disposal).
- Each OSDF cell should have its own leak detection system manhole. The manhole should allow for direct discharge of flow from the leak detection

000091

system carrier pipe (i.e., the inner pipe component of the double-wall pipe) into a primary containment vessel located inside the manhole. The manhole should serve as a secondary containment structure for the primary containment vessel within the manhole. The leak detection manhole should allow for the monitoring of any liquid collected by the leak detection system and conveyed by the leak detection system carrier pipe into the primary containment vessel component of the manhole. The leak detection system containment pipe (i.e., the outer pipe component of the double-wall pipe) should have a monitoring port and fixed end seal within the leak detection system manhole.

- The design should isolate the leak detection system manhole from the leachate collection system manhole during the period of active facility maintenance (i.e., during the initial post-closure period and some or all of the intermediate period described in Section 2.3 of this DCP). The design should allow for accumulated liquids in the primary containment vessel to be pumped (during this period of isolation) from a suction line in the vessel into a gravity flow drain connected to the leachate transmission system gravity line. The design should further allow for the activation of a gravity flow drain from the primary containment vessel to the leachate transmission system gravity line should such a line be called for at some future time after final closure of the facility. Each leak detection manhole should have a cleanout (internal or external to the manhole) for maintaining the leak detection system carrier pipe and a high level alarm for the primary containment vessel of the manhole. The design should also provide access to install a sump pump in the vessel to allow pumping of construction water that drains from the leak detection system prior to the start of OSDF cell operation.

- Liquid in the leachate collection system of an OSDF cell should flow by gravity through a double-wall HDPE pipe (which penetrates the liner system) to a leachate collection system manhole located on the west side of the OSDF (outside the limit of impacted material disposal). In the manhole, the leachate should discharge directly into the leachate transmission system gravity line.

- Each OSDF cell should have its own leachate collection system manhole. Each manhole should have cleanouts (internal or external to the manhole) for maintaining the leachate transmission system gravity line, the leachate collection system carrier pipe, and the redundant leachate collection system carrier pipe. The leachate collection system carrier pipe in each manhole should have a sampling port for obtaining leachate samples for environmental analyses. This sampling port should also allow for the monitoring of leachate collection system flows from a cell after its closure. The leachate collection system carrier pipe should have temporary valves for regulating leachate flow into the gravity line during construction and periods of gravity line maintenance, extension, repair, etc. The design should require that the temporary valves be removed from each cell prior to final closure of the OSDF (so that, in the long term, there are no obstructions in the pipe). Each manhole should have an inlet for the redundant leachate collection system carrier pipe. The redundant carrier pipe should have a valve (secured in a closed position) and sampling port (for periodically confirming the absence of liquid in the pipe). The carrier pipe valve should be configured so that it can be opened to allow flow to the leachate transmission gravity line at a future date in the event of a failure of the primary leachate collection system pipe. Both the primary and redundant leachate collection system containment pipes should have monitoring ports and fixed end seals within the leachate collection system manholes.

- The leachate transmission system gravity line should consist of double-wall HDPE pipe having a minimum nominal diameter for the carrier pipe of 6 in. (150 mm). The maximum pipe SDR should be 11. The factors of safety for flow in the leachate transmission system gravity line under the various design flow conditions are as follows:

  - baseline design flow rate during OSDF operations (i.e., baseline leachate flow obtained from leachate generation analysis; this baseline excludes temporary flows from stormwater runoff that is contained in the cell and allowed to percolate directly into the cell leachate collection system): the minimum acceptable factor of safety for this condition is 3.0;

000093

- storm design-basis flow rate during OSDF operations (i.e., baseline leachate flow plus temporary flows from stormwater runoff that is contained in the cell and allowed to percolate directly into the cell leachate collection system); the storm design-basis flow rate should be mechanically controlled during active OSDF operations to satisfy following competing criteria: (i) rapid drainage of cell stormwater runoff; (ii) permanent lift station operational requirements; and (iii) maximum acceptable discharge rate to the biosurge lagoon; the minimum acceptable factor of safety for temporary pressure flow in the leachate transmission system gravity line for this condition is 1.0, using as a basis the manufacturer pressure rating for the carrier pipe; and

- baseline design flow after OSDF closure (i.e., baseline leachate flow obtained from leachate generation analysis); the minimum acceptable factor of safety for this condition is 10.0.

- The inner carrier pipe of the leachate transmission system gravity line should be continuous over its entire length (i.e., from its upgradient end to its discharge point). The outer containment pipe should be continuous between leachate collection system manholes, and open to the manholes. The leachate collection system manholes should be periodically inspected for the presence of liquid which could be indicative of a possible leak in the leachate transmission system carrier pipe or the leachate collection system pipe, valves, or fittings. The leachate collection system manholes should be equipped with liquid level alarms.

- The leachate transmission system gravity line should be located on the west side of the OSDF (outside of the limit of impacted material disposal). Once the OSDF is fully developed, the gravity line should run the length of the OSDF, from the first cell near the north end of the facility to the last cell near the south end. From the last cell, the gravity line should run to the permanent lift station. To promote gravity flow, the gravity line should be constructed with a minimum slope of 0.25 percent. The gravity line should be buried in a trench at a sufficient depth below ground to prevent freezing

of liquids in the line and damage due to traffic loads and other stresses. The gravity line should be adequately bedded in the trench.

- The leachate transmission system gravity line and leachate collection system and leak detection system manholes should 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 leachate transmission gravity line for one or several cells. At a given stage, the leachate transmission gravity line should run through all of the leachate collection system manholes previously installed and those installed for a given stage to the southernmost manhole installed in that stage. This southernmost manhole will serve as a connection point to a temporary gravity line. The leachate transmission gravity line should discharge directly into the temporary gravity line.

- Liquids discharged into the temporary gravity line should flow to the permanent lift station at a minimum slope of 0.25 percent. The temporary gravity liner should consist of double-wall HDPE pipe having a minimum nominal diameter for the carrier pipe of 6 in. (150 mm). The maximum pipe SDR should be 11. A flow meter should be installed in the temporary to monitor the rate and volume of liquid sent to the permanent lift station. The temporary gravity line should be equipped with cleanout devices spaced along the pipe such that it can be maintained along its entire length. The permanent lift station should be located in proximity to the southwest corner of the OSDF. The permanent lift station should be installed concurrent with construction of the first OSDF cell.

- The pumps for the permanent lift station should be sized to pump liquid through a double-wall forcemain to the biosurge lagoon. The temporary gravity line should be designed to carry flow at the storm design-basis flow rate, which will be established as previously discussed in this section of the DCP. (Note: The pumps for the permanent lift station and the forcemain that will convey leachate from the permanent lift station to the biosurge lagoon will be designed as part of a separate design package.)

- Unneeded portions of the temporary gravity line should be taken out of service as part of each subsequent stage of construction. At that time, the leachate transmission system gravity line should be extended to the next connection to the temporary gravity line or to the permanent lift station, as appropriate.

- The permanent lift stations shall be protected from adverse effects due to leachate and differential settlement. The lift station shall be equipped with an automatic high level alarm located no greater than 6 ft (2.0 m) above the invert of the gravity line lift station inlet. 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)(4)(e)). The lift station should also have a valve on the transmission line and a system for automatically closing the valve in the event of a power failure or if liquid levels in the lift station rise to an unacceptably high level (below the rim of the lift station or any level that would cause an electrical short or damage to equipment in the lift station). A valve should be installed to provide a manual means for preventing flow into the lift station. The permanent lift station should be provided with secondary containment. The secondary containment system should be designed so that it can be monitored for the presence of leakage and should be equipped with a liquid level alarm.

- All manholes and the permanent lift station should be designed to withstand (with a factor of safety of 1.4) hydrostatic uplift due to perched ground water. The design-basis perched ground-water contour map identified in Section 2.4.2 of this DCP should be used for the uplift evaluation. If the minimum factor of safety is not achieved in the calculations, the design-basis of the manholes should be modified as necessary. Potential modifications include extending the base of the manhole using secured gussets, and, if required, adding a concrete anchor ring around the base of the manhole.

- Manholes should be designed to have a factor of safety of 2.0 against failure resulting from axial and radial wall stresses. The manholes should be evaluated for their adequacy with respect to radial crushing, radial buckling, axial crushing, and axial buckling (design considerations). To satisfy these

design criteria, an analysis should be performed to evaluate the effects of lateral earth pressure and potential hydrostatic forces on the manholes. The analysis should consider the type of backfill material to be used around the manholes and the design-basis perched ground-water levels along the alignment of the leachate transmission system. If the minimum factor of safety is not achieved in the calculations, the design-basis of the manholes should be modified as necessary. Potential modifications include increasing the manhole wall thickness, adding internal or external gussets, and changing the type of backfill to be placed around the manholes.

- The temporary gravity line between the leachate transmission system gravity line and permanent lift station should be installed in a trench at a depth that does not interfere with the existing utilities. The pipe should be adequately bedded in the trench. Alternatively, the gravity line may be placed on or above existing ground and covered with a soil berm or insulation of sufficient thickness to protect the pipe from traffic loads, freeze-thaw, and other stresses. Layout of the gravity line to avoid interference with the utility corridor should be coordinated with FEMP site-wide planning activities. The temporary gravity line should have adequate strength to resist internal stresses caused by the pressure of the liquid flowing through the line.

- The permanent lift station shall be capable of storing the quantity of leachate generated during an one-week period using design assumptions simulating final closure of the OSDF (OAC 3745-27-08(C)(5)(d)). Potential storm surge flows from an OSDF cell into the leachate transmission gravity line due to heavy precipitation into a newly opened cell should be regulated using throttling valves installed in conjunction with the flow meter in the temporary gravity line manhole so that the storm design-basis flow rate upon which the permanent lift station pump design is based is not exceeded.

- The permanent lift station should have sufficient pump capacity to prevent the buildup of liquid in the manhole for the storm design-basis flow rate for the leachate transmission gravity line. The lift station should have redundant pump capacity and automatic controls (with manual overrides) for operating the pumps.

- The permanent lift station pumps should be designed to be conveniently removed from the lift station for periodic maintenance. Extra pumps for the permanent lift station should be maintained on the FEMP property for use during periods of pump servicing.

- The permanent lift station should contain pump controls, valves, and mechanical and electrical equipment to achieve the operational objectives described above.

- The Systems Plan for the OSDF should describe the operational and maintenance activities necessary to achieve the operational objectives described above.

B. Calculations

Calculations should be performed to ensure that the leachate transmission system can transmit the required quantity of liquid and store leachate as required by the design criteria. Calculations should include the following:

- The capacity of the leachate transmission system gravity line should be evaluated using standard pipe capacity calculation methods to ensure that the pipe has sufficient capacity to maintain flow conditions at the required factors of safety under the various design flow conditions.

- The structural stability of the leachate transmission system gravity line and temporary gravity line should be evaluated using standard methods for buried flexible pipes.

- The minimum thicknesses of soil cover that must be placed over the leachate transmission system gravity line and temporary gravity line for frost protection should be estimated based on the modified Berggren method [Aldrich and Paynter, 1953].

- The hydraulic pressures inside the leachate transmission system temporary gravity line should be calculated, and it should be demonstrated that the pipes have adequate strengths to handle these pressures.

- The pressure head, efficiency, and pumping rate requirements of the pumps that will be installed in the permanent lift station should be evaluated using standard pump design procedures. The pumps for the permanent lift station will be designed as part of the different design package addressing design of the forcemain from the permanent lift station to the biosurge lagoon.

- The permanent lift station should be designed with sufficient storage volume to safely contain the quantity of leachate generated over a one-week period at the start of the post-closure period. The calculations must demonstrate that the permanent lift station has adequate storage capacity for this flow scenario.

- The permanent lift station (and all manholes) should be designed to resist hydrostatic uplift with a minimum factor of safety of 1.4. Procedures for calculating the hydrostatic uplift pressures due to high ground water are given in Lamb and Whitman [1969] and Holtz and Kovacs [1981], for example. Procedures for calculating manhole uplift resistance should be obtained from manhole supplier technical literature.

- All manholes should be designed to have a factor of safety of 2.0 against failure resulting from axial and radial wall loads including radial crushing, constrained radial buckling, axial crushing, and axial buckling. Acceptable analysis procedures include, for example: (i) axial buckling as presented in Roark and Young [1982]; (ii) axial crushing as presented in Watkins, Szpak, and Allman [1974]; (iii) radial circumferential crushing as presented in Watkins, Szpak, and Allman [1974]; and (iv) constrained radial buckling as presented in Cagle and Glassock [1975].

2.5.4 Till Monitoring System

A. Criteria

FDF is preparing a *Project Specific Plan (PSP)* for a *Groundwater Detection Monitoring Program (GDMP)* for the OSDF. A component of the plan involves a till monitoring system consisting of horizontal monitoring wells installed beneath the OSDF liner system at the low point of each OSDF cell. The purpose of the till monitoring system is to provide a capability to detect leakage through the liner system occurring at the low point in the cell. This DCP addresses the physical design of the horizontal monitoring wells associated with the till monitoring system.

The horizontal monitoring wells of the till monitoring system should meet the design criteria given below (design considerations):

- The horizontal monitoring well for a given OSDF cell should be independent of the leachate collection system and leakage detection system for that cell.

- The horizontal monitoring well for a given cell should be located vertically below the low point of that cell.

- The horizontal monitoring well should consist of a perforated horizontal pipe in a gravel filled trench. The pipe should be manufactured from HDPE for durability and should have a maximum SDR of 11. The nominal diameter of the well should be at least 6 inch (150 mm) to provide adequate cleanout capability.

- The trench in which the horizontal monitoring well is placed should be designed to resist differential settlement due to different compressibilities of the trench fill and adjacent undisturbed till soil. Differential settlements between the trench backfill and undisturbed till should not induce tensile strains in the compacted clay liner exceeding 0.5 percent. This allowable tensile strain level has been conservatively established based on the available geotechnical literature and information.

- Liquid entering the horizontal monitoring well should flow by gravity to a monitoring point located at the western perimeter of the OSDF.

- Access should be provided at the western perimeter of the OSDF for purging and sampling the horizontal monitoring well. Cleanout access should also be provided.

- The pipe perforations for the horizontal monitoring well should be designed to retain the granular trench backfill that will be used in the perforated zone.

- The geotextile filter layer that will surround the granular trench backfill in the perforated zone should be designed to retain the adjacent native and compacted soils.

B. Calculations

The following calculations should be performed for the horizontal monitoring wells:

- tensile strain induced in the compacted clay liner due to differential compressibility of the granular trench backfill and undisturbed till, using classical geotechnical engineering procedures for calculating total and differential settlements (see for example the references cited in Section 2.3.3 of this DCP);

- horizontal monitoring well structural stability (using standard methods for evaluating the strength and stability of buried flexible pipes);

- required perforation sizing of the horizontal monitoring well (using an analysis based on the granular trench backfill grain size distribution);

- gravity flow capacity of the horizontal monitoring well (using standard pipe capacity calculation methods); and

000101

- geotextile filter design, using procedures presented by Giroud [1982] or Christopher and Holtz [1984], or other suitable methods.

2.5.5 References

FEMP property data and information required for design of the leachate management system should be obtained from the references cited in Section 1.5 of this DCP. Additional information for design may be obtained from the general technical references listed below.

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2.6 Final Cover System

2.6.1 General Design Criteria

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.

Closure of the OSDF, which includes installation of the final cover system, must be performed in a manner that minimizes the need for further maintenance and the potential for release of leachate to the environment to the extent needed to protect human health and the environment (ARAR: OAC 3745-27-11(O)). The final cover system requirements must also be designed to be effective for 1,000 years, to the extent reasonable, and in any case, for at least 200 years (ARAR: 40 CFR §192.02(a)). In addition, the final cover system should meet the following OU2 and OU5 ARARs (40 CFR §265.310(a)):

- minimize liquid infiltration into the closed OSDF;
- function with minimal maintenance;
- promote drainage and minimize erosion or abrasion of the cover;
- accommodate settling and subsidence so that the integrity of the cover is maintained; and
- have a permeability less than or equal to the permeability of the liner system or natural subsoils present.

2.6.2 Final Cover Vegetation

A. Design Criteria

As part of closure of the OSDF, vegetation will be planted on the topsoil component of the final cover system. Through time, this vegetation will climax according to a natural succession pattern. The vegetation to be planted should satisfy the design criteria given below.

- The vegetative cover should minimize erosion and off-site sedimentation so that sediment removal structures will not be necessary, (i.e. seed/fertilizer mix should preclude gully initiation) (design consideration).
- The maximum root depth of the vegetative cover should not grow below the vegetative soil layer (design consideration).
- The vegetative cover should not be an attraction to wildlife, to the greatest extent possible (design consideration).
- The vegetation in drainage channels of the OSDF should be able to withstand temporary inundation (design consideration).
- A low-maintenance, self-sustaining vegetation that is resistant to drought and conforms to the surrounding landscape is desirable.

B. Calculations

The vegetation evaluation will be performed as follows:

- conduct a survey of regional seed sources to identify species availability;
- develop a matrix for locally suitable and available plant species;
- rank suitable species with respect to site conditions, design criteria, and design parameters; and

- develop seed mix designs and associated cultural requirements for establishing seasonal and permanent vegetation for wet, moderate, and dry conditions.

Additional work to establish site-specific soil amendments will be required. Composite soil samples of potential topsoil materials will be analyzed. The results of the analysis will be used to establish lime, fertilizer, and organic material application rates.

2.6.3 Topsoil

A. Design Criteria

A vegetated topsoil layer will form the uppermost component of the OSDF final cover system. The topsoil layer should satisfy the design criteria given below.

- The topsoil layer should be at least 6 in. (0.15 m) thick (functional requirement).

- The topsoil layer shall have healthy grasses or other vegetation that form a complete and dense vegetative cover (ARAR: OAC 3745-27-08(C)(15)(e)).

- The topsoil layer should promote vegetation that is self-sustaining (design consideration).

- Temporary erosion control of the topsoil layer should be achieved using temporary erosion control matting, if needed, or other suitable methods (design consideration).

- Long-term erosion control of the topsoil layer should be achieved through combination of flat slopes, smooth slope transitions, and use of appropriate soil types and seed/fertilizer mixes that preclude gully initiation (design consideration).

- Topsoil shall have a maximum projected erosion rate of 5 tons/acre/year (11 tonnes/ha/yr) (ARAR: OAC 3745-27-08(C)15)(f)). In addition, the properties of the topsoil and underlying layers should be adequate to result in a cumulative projected volume of eroded material over the design life of the facility that results in sufficient remaining soil thickness to provide freeze-thaw protection of the compacted clay component of the final cover system (design consideration).

- Topsoil and vegetation should resist gully initiation under the tractive forces of surface-water runoff from the cover (design consideration).

B. Calculations

Long-term final cover system erosional resistance should be evaluated as follows:

- obtain the allowable tractive force on the topsoil using methods established by Temple et al. [1987], as described in the DOE Technical Approach Document [1989] and referenced documents;

- establish the actual tractive force on the cover system vegetation and the "effective" tractive force on the topsoil using methods established by Temple et al. [1987], as described in the DOE Technical Approach Document [1989] and referenced documents;

- using the final cover geometry of the OSDF, establish the maximum slope length achievable prior to gully formation using methods described in the U.S. Nuclear Regulatory Commission (NRC) Staff Technical Position: "*Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites*" [NRC, 1990] and referenced documents;

- demonstrate that the OSDF final cover slope length is less than the maximum allowable slope length calculated in the previous step;

- establish peak flow velocity on the final cover system for the design storm recurrence interval using methods established by Temple et al. [1987];

- establish the permissible velocity for the final cover using methods described in NRC Staff Technical Position: "*Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites*" [NRC, 1990] and referenced documents;

- demonstrate that the peak flow velocity does not exceed the permissible velocity; this calculation is performed as a check of the Temple/NRC tractive force method; and

- using the Modified Unified Soil Loss Equation [Nelson et al., 1986], confirm that erosion rate of the topsoil and underlying soil layers: (i) does not exceed 5 tons per acre per year (11 tonnes per hectare per year); and (ii) does not (over the (up to) 1,000-year design life of the OSDF) result in an insufficient soil thickness to provide freeze-thaw protection of the compacted clay layer; the required thickness for freeze-thaw protection should be performed using the modified Berggren method [Aldrich and Paynter, 1953].

The need for temporary erosion control matting should be evaluated using the gully formation analysis described above, assuming a 2-year, 24-hour storm event and bare topsoil.

2.6.4 Vegetative Soil Layer

A. Design Criteria

A vegetative soil layer will underlie the topsoil layer of the OSDF final cover system. Design criteria for the vegetative soil layer are given below.

- The vegetative soil layer should be a well-graded mixture of clayey, silty, and sandy material, at least 21 in. (0.54 m) thick (functional requirement).

- The vegetative soil layer should be designed for minimal erosion by wind and water and to preclude the development of gullies (design consideration).

- The vegetative soil layer together with other final cover system layers that overlie the composite cap shall have sufficient thickness to protect the composite cap components from damage due to root penetration (ARAR: OAC 3745-27-08(C)(15)(e)).

- The vegetative soil layer should meet the erosion rate criteria given in Section 2.6.3 of this DCP.

B. Calculations

The cover system erosional resistance and frost protection should be evaluated as part of the calculation described in Section 2.6.3 of this DCP.

2.6.5 Granular Filter Layer

A. Design Criteria

A granular filter layer will underlie the vegetative soil layer component of the OSDF final cover system. The filter should comply with the following design criteria.

- The filter layer should be at least 6 in. (0.15 m) thick (functional requirement).

- The filter layer should be designed using granular earth materials if possible. If a suitable filter cannot be designed using granular earth materials, then geosynthetic materials may be considered (design consideration).

- The granular filter layer should be designed to prevent migration of soil from the vegetative soil layer through the filter to the biointrusion barrier layer (design consideration).

- The granular filter layer should be continuous over the surface of the biointrusion barrier layer (design consideration).

B. Calculations

Industry standard procedures should be used to establish the particle size requirements of the granular filter layer. Procedures such as those presented in the UMTRA Technical Approach document [1989] or Cedegren [1977], or other appropriate procedures, should be used. If geotextile filters are needed, the procedures of Giroud [1982] or Christopher and Holtz [1984], or other appropriate references, should be applied.

2.6.6 Biointrusion Barrier

A. Design Criteria

A biointrusion barrier layer will 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 should comply with the following design criteria.

- The biointrusion barrier should consist of durable crushed rock or natural stone (possibly with gravel and boulder size fractions) (functional requirement).

- The biointrusion barrier should be at least 3 ft (0.9 m) thick (functional requirement).

- The biointrusion barrier should be designed to prevent plant root or animal intrusion into the OSDF (functional requirement).

- To prevent plant root or animal intrusion, the biointrusion barrier should extend at least 40 ft (12 m) laterally beyond the limit of impacted material disposal in the OSDF. Alternatively, the biointrusion barrier may be terminated in a trench around the perimeter of the OSDF. The bottom elevation of the trench should be no higher than the elevation of the bottom of the adjacent OSDF liner system (design considerations).

- The maximum dimension of the biointrusion barrier material should be no more than one-half of the barrier thickness (i.e., not more than 18 in. (0.45 m) for a 3 ft (0.9 m) thick barrier thickness) (design consideration).

- The biointrusion barrier material should be free draining (design consideration).

- The upper surface of the biointrusion barrier layer should be "choked off" with material that will provide a filter to the overlying granular filter layer (design consideration).

- The specifications for the choke layer and the biointrusion barrier materials should require a rock quality rating of 60 percent or higher for these materials based on the design procedure for rock selection presented in the UMTRA Technical Approach Document [DOE, 1989] (design consideration).

B. Calculations

The biointrusion barrier should be designed to have rock of sufficient size to deter burrowing animals, yet sufficient void space (excluding the choke layer) to allow rapid drainage of infiltration and to discourage root growth. The guidance in Hakonson [1986] should be used to establish biointrusion barrier attributes to achieve these objectives. Information presented in the UMTRA Technical Approach Document [DOE, 1989] should be used to evaluate the durability characteristics of the barrier material.

The filter criteria in the UMTRA Technical Approach Document [DOE, 1989], Cedegren [1977], or other suitable criteria, should be used to evaluate required particle size distribution requirements of the choke layer with respect to serving as a filter to the overlying granular filter layer and, in turn, being filtered by the underlying biointrusion barrier layer.

The erosion resistance of the biointrusion barrier should be evaluated using the Stepheson method [Apt et al., 1988], as described in NRC Staff Technical Position: "*Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites*"

[1990]. The erosion resistance should be checked using the method established by Hartung and Scheverlein [1970].

2.6.7 Cover Drainage Layer

A. Design Criteria

A cover drainage layer will underlie the biointrusion barrier component of the OSDF final cover system. In turn, this layer is required to overlie the geomembrane cap component of the OSDF final cover system (ARAR: OAC 3745-27-08(C)(15)(a)). (Note: A geotextile cushion layer may be placed between the cover drainage layer and geomembrane cap without violating this ARAR.) The cover drainage layer should satisfy the following design criteria.

- The drainage layer shall consist of a 12 in. (300 mm) 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)). Alternatively, the drainage layer may consist of a geonet that has equivalent performance capabilities to a granular material satisfying the requirements of OAC 3745-27-08(C)(4)(a) (ARAR: OAC 3745-27-08(C)(16)(b)(ii)). To maximize the service life of the OSDF final cover system, a granular drainage layer is to be preferred to a geonet drainage layer.

- The drainage layer should limit the buildup of hydraulic head on the geomembrane cap to not more than 1 ft (0.3 m), or to the thickness of the drainage layer, whichever is less (design consideration).

- The drainage layer should be designed to rapidly convey infiltrating liquid off of the OSDF final cover system (design consideration).

B. Calculations

Final cover system infiltration potential should be evaluated as part of an analysis of the final cover system water balance using the USEPA HELP model, Version 3,

000113

[Schroeder, 1994a,b] or other appropriate method. The calculation should be performed, assuming representative properties for the cover system components.

The hydraulic head buildup in the cover drainage layer should also be evaluated using the USEPA HELP model. The procedure presented in Giroud and Houlihan [1995] should be used to confirm the help model results. The calculations should evaluate both the maximum and average head buildup conditions under the design storm event. The maximum head should be compared to the thickness of the drainage layer to confirm that the layer thickness is greater than the maximum head and that the maximum head is less than 1 ft (0. 3 m). The average hydraulic head should be used in calculations to evaluate the slope stability factor of safety of the final cover system.

2.6.8 Geotextile Cushion Layer

A. Design Criteria

A geotextile cushion layer will be installed above the geomembrane cap component of the OSDF final cover system to protect the geomembrane from puncture by particles in the overlying cover drainage layer (design consideration). The geotextile should also be robust enough to resist the effects of construction (i.e., termed construction survivability) (design consideration).

B. Calculations

The design of the geotextile cushion layer to provide adequate puncture protection for the geomembrane cap should be performed using the procedure described by Koerner et al. [1995]. If this method is used, the minimum acceptable factor of safety against puncture is 3.0. The calculation for evaluating geotextile cushion requirements should consider two loading conditions: (i) short-term case assuming that construction equipment is working above the drainage layer material; and (ii) long-term case assuming the final cover system is installed. The design of the geotextile cushion layer to have adequate construction survivability should be performed using the procedure described in Koerner [1994].

2.6.9 Composite Cap

A. Design Criteria

The functional requirements (Appendix B) for the OSDF call for the OSDF final cover system to 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 (1.5-mm) thick geomembrane cap;
- geosynthetic clay cap; and
- 2-ft (0.6-m) thick compacted clay cap.

Taken together, these three layers are called the "composite cap". Design 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. (0.45 m) and a maximum hydraulic conductivity of 1 x 10^{-6} cm/s (ARAR: OAC 3745-27-08(C)(15)(ii)). The functional requirements in Appendix B of this DCP require that the compacted clay component of the composite cap be at least 24 in. (0.6 m) 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)).

000115

- The HDPE geomembrane component of the composite cap shall have a minimum thickness of 60 mils (1.5 mm), 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 (ARAR: OAC 3745-27-08(C)(15)(f)(ii)). A flatter maximum slope should be used if necessary to achieve required slope stability factors of safety (design consideration).

- 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)).

- The geosynthetic clay cap component of the composite cap should have a hydraulic conductivity of no greater than 3×10^{-9} cm/s under the applicable normal stress (design consideration).

- In addition to the foregoing, the geosynthetic clay cap should be of the "internally-reinforced" type, or the type with an "HDPE-geomembrane backing" (with the HDPE geomembrane backing placed in contact with the underlying soil layer). Either of these types of geosynthetic clay liner will improve short-term cover system stability compared to the level of stability achieved with an "unreinforced" type geosynthetic clay liner. The benefits of geosynthetic clay liner internal reinforcement or partial hydration should be discounted in evaluating the long-term stability of the final cover system (i.e., the geosynthetic clay liner should be considered unreinforced and fully hydrated for long-term stability analyses) (design considerations).

- The geosynthetic clay cap should be designed to prevent failure due to long-term creep down the cover system sideslopes (design consideration).

B. Calculations

As part of the design of the OSDF final cover system, an evaluation should be performed to establish whether a textured geomembrane, manufactured of HDPE, and of 60 mil (1.5 mm) thickness, is the most appropriate type of geomembrane (in terms of composition, thickness, surface texturing, etc.) for use on the project. The design of the OSDF final cover system should also include further evaluation of the most appropriate types of geosynthetic clay liners to use on this project.

2.6.10 References

FEMP property data and information required to design the OSDF final cover system should be obtained from the references cited in Section 1.5 of this DCP. References from the general technical literature that may be used in the design of the final cover system are given below.

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Temple, D.M., Robinson, K.M., Ahring, R.M., and Davis, A.G., *Stability Design of Grass-Lined Open Channels*, United States Department of Agriculture, Agriculture Handbook No. 667, Sept. 1987, 167 p.

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2.7 Test Pad Program

2.7.1 General Design Requirements

The function of the test pad program is to confirm the hydraulic conductivity characteristics of the soil that will be used to construct the compacted clay liner and cap components of the OSDF. Information obtained during the test pad program will be used to qualify the site-specific clay borrow source(s) and define construction procedures for the compacted clay liner and cap materials.

To demonstrate that the clay from each borrow source (presently anticipated to include both the OSDF foundation excavation and the on-site borrow area) can meet the criteria for clay liner and cap materials and construction methods, the test pad program should establish that (design considerations):

- the clay material can be compacted under the anticipated construction conditions to an in-place hydraulic conductivity not larger than 1 x 10^{-7} cm/s; and

- on-site sources exist for clay borrow materials that meet the other design criteria for clay liner and cap material (see Section 2.4.5 of this DCP).

Also, to meet the requirements of OAC 3745-27-08(C)(1)(m), the test pad program shall:

- be designed such that the proposed tests are appropriate and their results are valid ((1)(m)(i);

- be designed to establish construction procedures that result in a clay liner or cap with satisfactory hydraulic conductivity; the construction procedures include:
  - lift thickness;
  - compaction moisture content; and
  - type, weight, and number of passes of construction equipment ((1)(m)(ii); and

- be completed prior to construction of the disposal facility component which the test pad will model ((1)(m)(iii).

The test pad program should also be designed to establish on-site borrow material processing requirements. Lastly, construction procedures for the clay liner and cap test pad program should be in general accordance with industry established guidelines, such as those in USEPA [1989, 1993].

2.7.2 Clay Borrow Material Criteria

The clay material used in the test pad program should be obtained from the same sources as the clay material that will be used in the OSDF construction project. The

clay material shall satisfy the following material property requirements (ARAR: OAC 3745-27-08(C)(1)(c)):

- 100 percent of the particles must have a maximum dimension not greater than 2 in. (50 mm);
- not more than 10 percent of the particles, by weight, must have a dimension greater than 0.75 in. (1.9 cm);
- at least 50 percent of the particles, by weight, must pass through the U.S. No. 200 standard sieve; and
- at least 25 percent of the particles, by weight, must have a maximum dimension less than 0.002 mm (2 μm).

As described in Section 2.4.5 of this DCP, available borrow at the site may not, in all cases, meet the requirement to have 25 percent of the particles, by weight, smaller than 0.002 mm (2 μm). The available borrow also may not, in all cases, meet the requirement to have at least 50 percent of the particles, by weight, pass a U.S. No. 200 standard sieve. A demonstration will need to be submitted to USEPA and OEPA pursuant to OAC 3745-27-08(C)(1) to obtain acceptance of the on-site borrow materials. The test pad program will be an integral part of that demonstration.

2.7.3 Test Pad Layout and Construction Criteria

The test pads should be constructed at one or more locations within the battery limit that meet the following criteria:

- The test pad should be located in an area where the soil conditions are similar to the subgrade conditions that will be encountered in the OSDF construction area (design consideration).

000121

- The test pad should be located in an area acceptable to FERMCO based on existing conditions with respect to the presence of impacted surficial soil and any plan for removal of such soil (design consideration).

- The location for the test pad should be selected considering ease of access for construction vehicles, presence of perched ground water, surface-water management, etc. (design consideration).

The test pad construction program should adhere to the following basic procedures (design considerations):

- Prior to the start of construction, surface-water management and erosion and sediment controls should be established, and clearing and grubbing should be performed.

- Soils for test pad construction should be obtained from the identified on-site borrow source(s).

- The test pads should be constructed using 8 in. (200 mm) thick loose lifts, with a maximum clod size of 3 in. (75 mm) or half of the compacted lift thickness.

- The test pads should be constructed using varying numbers of passes of compaction equipment and specified ranges of moisture content so that a relationship can be established between compaction effort, moisture content, and hydraulic conductivity.

- The target compaction criteria should be established prior to the start of test pad construction. The criteria should be based on the results of pre-construction laboratory testing of samples of the soils to be used to construct the test pads. The target compaction dry density should be at least 95 percent of the maximum standard Proctor dry unit weight according to test method ASTM D 698; target moisture contents should be between the optimum moisture content and 4 to 5 percentage points wet of the optimum moisture content.

- Specific equipment requirements should be identified for moisture conditioning, clod breakdown, and compaction before the start of the test pad construction project.

- Once constructed, in-situ testing techniques should be used to establish the field hydraulic conductivity of each test pad.

- After testing is complete, the test pad should be decommissioned.

To meet the requirements of OAC 3745-27-08(C)(1), the test pad shall:

- be constructed whenever, during OSDF construction, there is a significant change in soil material properties ((1)(m)(iv);

- have a minimum width three times the width of the compaction equipment and a minimum length two times the length of compaction equipment, including any attachments ((1)(m)(v);

- be comprised of at least four lifts; for each lift a minimum of 3 tests for moisture content and density must be performed ((1)(m)(vi);

- be tested for field permeability, following the completion of test pad construction ((1)(m)(vii); and

- be reconstructed as many times as necessary to meet the permeability requirement ((1)(m)(viii).

To meet all of the foregoing requirements, it is anticipated that at least two test pads will need to be constructed to account for different potential borrow source characteristics. It is also anticipated that each test pad will contain several lanes, with soil moisture conditions and compaction criteria differing between lanes. For economy, the test pads should be constructed at one time. Testing of the pads may be performed sequentially or in parallel depending on the project schedule and availability of field test equipment.

000123

2.7.4 Field Test Pad Program Evaluation

The test pad program should involve both pre-construction and construction-phase testing of clay liner and cap materials.

Pre-Construction Testing Program

Pre-construction laboratory testing should be performed on the material that will be used for test pad construction to establish the soil compaction conditions that will be used in test pad construction (design consideration). The steps that should be included in the pre-construction testing program are given below (design considerations).

- Step 1. Perform soil index testing of materials from the borrow sources; at a minimum soil index testing should include natural moisture content (ASTM D 2216), grain size distribution (ASTM D 422), and Atterberg limits (ASTM D 4318).

- Step 2. Establish soil moisture-density relationships for several different compactive efforts.

- Step 3. Perform soil hydraulic conductivity testing to evaluate hydraulic conductivity as a function of compaction moisture content and dry density. Hydraulic conductivity testing should be performed in accordance with ASTM D 5084.

- Step 4. Based on the results of Steps 2 and 3, select field target compaction conditions (i.e., acceptable range of moisture contents and dry densities), to be used for each lane of the test pad. Procedures as described by Daniel and Benson [1990] may be used for guidance in establishing moisture-density criteria.

Construction-Phase Testing Program

Field and laboratory testing should be performed during and after test pad construction to verify the adequacy of the construction materials and methods (design consideration). Testing should include (design considerations):

- field moisture content and dry density of each lift of the test pad using a nuclear gauge (ASTM D 2922 and D 3017), periodically checked using a sand cone test (ASTM D 4914) and oven moisture content test;

- laboratory confirmatory standard Proctor compaction testing (ASTM D 698);

- laboratory hydraulic conductivity testing using a flexible wall permeameter (ASTM D 5084) and undisturbed specimens of compacted material obtained using a Shelby tube; and

- field sealed double-ring infiltrometer (SDRI) testing of each completed test pad (ASTM D 3385).

2.7.5 Work Plan

A work plan should be prepared to describe the proposed test pad program (functional requirement). The work plan should include drawings showing the test pad layout, typical sections, surface-water management plan, and specifications for construction of the test pad (design consideration). The work plan should also include the basis for test pad design, requirements for laboratory and field testing, and requirements for construction quality assurance (CQA) monitoring and documentation (design consideration). The test pad work plan should first be prepared at the prefinal (90%) level of completeness for submittal for review by DOE, USEPA, and OEPA. A final work plan should be issued after incorporation of review comments.

2.7.6 Cost Estimate

A test pad program cost estimate should be prepared based on the prefinal test pad program work plan (functional requirement). The cost estimate must be in FDF format (functional requirement). This format is illustrated by the FDF baseline OSDF cost estimate presented in Appendix E of this document.

2.7.7 Report

The results of the test pad program should be analyzed and a report prepared to present the program results (functional requirement). The report should contain: (i) recommendations regarding the suitability of the borrow sources for use as clay liner and cap material; (ii) requirements for borrow source processing; and (iii) recommended criteria for clay liner and cap construction (design consideration).

2.7.8 Schedule

The final test pad work plan must be completed prior to the completion of the OSDF intermediate design package (functional requirement). The test pad program final report must be completed prior to completion of the OSDF final design package (functional requirement).

2.7.9 References

FEMP property data and information required to develop the test pad program should be obtained from the references cited in Section 1.5 of this DCP. References from the general technical literature that may be used to develop the test pad program are given below.

Daniel, D.E. and Benson, C.H., "Water Content-Density Criteria for Compacted Soil Liners", *ASCE Journal of Geotechnical Engineering*, 1990, Vol. 116, No. 12, 1990, pp. 1811-1830.

U.S. Environmental Protection Agency (USEPA), "*Seminar Publication - Requirements for Hazardous Waste Landfill - Design, Construction, and Closure*, EPA/625/4-89/022, U.S. Environmental Protection Agency, 1989.

U.S. Environmental Protection Agency (USEPA), "*Technical Guidance Document - Quality Assurance and Quality Control for Waste Containment Facilities*", EPA/600/R-93/182, U.S. Environmental Protection Agency, 1993.

2.8 Surface-Water Management

2.8.1 Categories of Surface Water

Surface-water management for the OSDF must consider three categories of surface water:

- stormwater runon from outside the battery limit into the battery limit;
- stormwater runoff, which includes all runoff from disturbed areas within the battery limit, except for wastewater explicitly identified below; and
- wastewater, which includes all waters that must be contained, collected, and conveyed to the biosurge lagoon or the FEMP former production area storm drainage control system.

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

- leachate and runoff from impacted material within the OSDF; these wastewaters will be contained in the OSDF, allowed to percolate into the leachate collection system, and then conveyed by gravity through the leachate collection system pipe to the OSDF leachate transmission system (as discussed in Section 2.5 of this DCP);
- runoff from impacted-material staging areas; these are self-contained units; liquid generated in these units will be conveyed to the FEMP former

production area storm drainage control system, or other on-site wastewater collection/conveyance point acceptable to DOE and OEPA/USEPA;

- runoff from impacted-material haul roads; this water will be contained, collected, and conveyed to the FEMP former production area storm drainage control system, or other on-site wastewater collection/conveyance point acceptable to DOE and OEPA/USEPA; and

- perched ground water that seeps into excavations; this water will be contained, collected, and conveyed to the FEMP former production area storm drainage control system, or other on-site wastewater collection/conveyance point acceptable to DOE and OEPA/USEPA.

The remainder of this section of the DCP presents design criteria for management of stormwaters and wastewaters.

2.8.2 General Design Criteria

The functions of the surface-water management system are to: (i) route surface water to designated locations where it can be appropriately managed; (ii) protect the OSDF from damage caused by precipitation and stormwater runon and runoff; and (iii) 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, filling, 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 permanent surface-water management system should be designed to require minimal monitoring and maintenance. The system should be integrated, to the extent possible, with existing topography, features, and facilities (design considerations).

2.8.3 Stormwater Management During OSDF Construction/Filling/Closure

A. Design Criteria

- Temporary surface-water control structures for the OSDF shall be designed for the 25-year, 24-hour storm event (ARAR: EPA 40 CFR §258.26 and OAC 3745-27-08(C)(6)(a) and (b)). For the FEMP property, this event has a rainfall intensity of 4.7 in (120 mm) [Parsons, 1995a].

- Temporary surface-water control structures shall be designed to minimize silting and scouring (ARAR: OAC 3745-27-08(C)(6)(c)).

- Temporary runon control measures should meet the following criteria (design considerations).

  - Upgradient runon should be prevented from entering active working areas. Such runon should be diverted around work areas using berms, dikes, or channels as appropriate. This runon should not be allowed to mix with wastewater.

  - Runon to temporary excavations should be prevented using berms, ditches, or other surface-water control features.

  - Runon to impacted material stockpiles should be prevented using berms, ditches, or other surface-water control features.

  - Prior to placement of impacted material into an OSDF cell, permanent runon controls must be in place. The requirements for permanent runon control are described in more detail in Section 2.8.4 of this DCP.

- Runoff from disturbed areas should be routed to the appropriate temporary sediment basin or managed using other appropriate erosion control practices. There must be no mixing of stormwater runoff and wastewaters (functional requirements).

000139

- Temporary sediment basins shall meet the following criteria of OEPA (ARAR: OAC 3745-27-08(C)(6)(d)):

  - the minimum acceptable basin storage shall be established as the larger of the calculated runoff volume from a 10-year, 24-hour storm event, or, 0.125 acre-ft (0.015 ha-m) per year (for each acre (ha) of upgradient disturbed area) multiplied by the scheduled frequency of basin cleanout (in years) ((6)(d)(i)); for the FEMP property, the 10-year, 24-hour storm event has a rainfall intensity of 4.1 in. (103 mm) [Parsons, 1995a];

  - the principal spillway shall be capable of safely discharging the flow from a 10-year, 24-hour storm event; the inlet elevation of the emergency spillway shall be designed to provide flood storage, with no flow entering the emergency spillway during a 25-year, 24-hour storm event, with allowance provided for the flow passed by the principal spillway during the event ((6)(d)(ii)); as previously noted, for the FEMP property, the 25-year, 24-hour storm event has a rainfall intensity of 4.7 in. (120 mm) [Parsons, 1995a];

  - the combination of principal and emergency spillways should be capable of safely discharging the flow from a 100-year, 24-hour storm event; the basin embankment design should provide for no less than 1 ft (0.3 m) of net freeboard when flow is at the design depth, after allowance for embankment settlement ((6)(d)(iii)); for the FEMP property, the 100-year, 24-hour storm event has a rainfall intensity of 5.6 in. (142 mm) [Parsons, 1995]; and

  - the basin shall be constructed using a compacted soil liner, a geomembrane, or a combination thereof ((6)(d)(iv)).

- With respect to the last ARAR ((6)(d)(iv)), on 24 February 1992, the OEPA DSIWM issued the following guidance on the need for lining sediment basins:

  "The sole purpose of a liner in a sediment basins is water retention. Therefore, a design capable of ponding water, whether or not it

contains a liner, will be acceptable to the Director. In areas with predominantly in-situ low permeability clay, a liner may be unnecessary (it would be wise to scarify and recompact the clay surface). The landfill engineer is responsible for meeting the "ponding" standard. In areas with more permeable soils a recompacted clay liner is necessary, but the QA/QC standards can be minimal and certainly do not need to follow the landfill liner standards."

The foregoing requirement is interpreted as allowing the development of unlined sediment basins in the low-permeability tills underlying the FEMP. To assure compliance with the intent of this guidance, the construction specifications for sediment basins associated with the OSDF should require scarification and recompaction of the till exposed in the sediment basin excavation, and overexcavation of any observed granular soil zones, followed by backfilling with till and recompaction (design consideration).

- Stormwater runoff from watersheds in the OSDF to the receiving water course (e.g., Paddys Run) should be discharged at a rate no greater than the predevelopment runoff discharge rate [ODNR-DSWC, 1996] (design consideration).

- Temporary channels for stormwater runoff should be designed to meet the following criteria (design considerations).

  - Channel lining:
    - peak flow velocity in riprap-lined channels should be less than 12 ft per second (3.7 m/s), unless it is demonstrated that greater velocities will not cause erosion or malfunction of the surface-water management feature; and
    - peak flow velocities in grass-lined channels should be less than 5 ft per second (1.5 m/s).

  - Channel sideslopes should be no steeper than 3 horizontal to 1 vertical.

000131

- Channel bottom widths may be zero.

- The channel freeboard should be at least 0.5 ft (0.15 m) under the design storm event.

- Channels should be sloped at no less than 0.5 percent to prevent sediment buildup and clogging, unless it can be established by calculation that a lesser slope will not clog or build up sediment that will cause loss of flow capacity in the design storm event. Channel slopes should be no steeper than 5 percent unless it can be established by calculation that a steeper slope will not cause unacceptable erosion or other malfunction.

- Temporary culverts should be designed according to the following criteria (design considerations).

  - Culverts may be used in locations as needed and where cost-effective.

  - Channels should be protected from erosion using riprap or erosion mats for a distance of at least two culverts diameters upstream and four culvert diameters downstream of the culvert inlet or outlet, respectively.

- Riprap shall be designed according to the following criteria (design considerations).

  - Riprap should meet the following particle size criteria [ODNR-DSWC, 1996]:
    - $D_{max} = 1.5 \times D_{50}$
    - $D_{15} = 0.5$ to $0.75 \times D_{50}$

    where: D_{50} = theoretical spherical diameter of average stone size; D_{max} = theoretical spherical diameter of largest stone size; and D_{15} = theoretical spherical diameter of the stone size for which 15 percent of the material is smaller.

  - The minimum thickness of the riprap lining should be two times D_{50}, but not less than 6 in. (150 mm).

- 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 in permanent structures containing riprap, if required to prevent undermining of the riprap.

- Rock, grade control structures should be designed according to the following criteria (design considerations).

  - Rock, grade control structures may be used in temporary facilities. They should be designed in accordance with standard design procedures.

  - The minimum height of rock, grade control structures should be 1.5 ft (0.45 m) and the minimum top width should be 2 ft (0.6 m).

- Temporary erosion control measures should include the items listed below (design considerations).

  - Runoff from all disturbed areas should be routed to sediment basins, or managed using other appropriate sediment control practices, prior to discharge to natural watercourses, except for wastewaters which should be managed as described in Section 2.8.5 of this DCP.

  - The size of any excavated or disturbed area should be as small as possible to minimize the potential for erosion (design consideration). Disturbed areas should be revegetated at the earliest possible time.

  - Temporary erosion control may be achieved using geosynthetic materials, vegetation, straw bales, silt fences, or other appropriate structures.

  - The use of erosion control materials should be minimized in impacted soils requiring OSDF disposal. Preference should be given to runon

control, surface grading, and the selective use of erosion resistant impacted materials to control erosion of impacted areas.

- Maintenance and upkeep procedures for temporary erosion control features should be specified in the *Surface-Water Management and Erosion Control Plan*.

It is noted that stormwater routing and stormwater management system design for watercourses and structures beyond the battery limit will be addressed in other design packages being prepared as part of the integrated FEMP remediation.

B. Calculations

Calculations should be performed to size the sediment basins for each contributory drainage area for each representative phase of the OSDF development. The calculations should be performed as described below.

- The amount of surface-water runon and runoff should be calculated for each contributory drainage area.
- The size of the drainage control structures (e.g., channels) should be calculated for each contributory drainage area.
- The size of the sediment basin, including outlet structures, should be calculated for each contributory drainage area.

The above calculations should be performed using the design storm events previously identified. Runon/Runoff routing and sediment basin sizing may be evaluated using the procedures described in USDA-SCS Technical Releases 20 and/or 55 [USDA-SCS, 1975, 1986a]; an acceptable tool for performing these calculations is the computer program "*HydroCAD™ Stormwater Modeling System*" [Applied Microcomputer Systems, 1993]. The above evaluations should be based on the information and guidance contained in USDA-SCS manuals [1985, 1986b, and 1988] and ODNR-DSWC [1996].

Culverts should be sized in accordance with U.S. Federal Highway Administration guidelines [USDOT, 1985] and meet the structural design criteria contained in applicable design references such as the Concrete Pipe Design Manual [America Concrete Pipe Association, 1970].

In the event that a channel bottom grade is less than 0.5 percent, an analysis should be performed to establish that the channel does not clog or build up sediment that will cause loss of flow capacity in the design storm event.

2.8.4 Stormwater Management After OSDF Closure

A. Design Criteria

- Permanent runon 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). For the FEMP property, this event has a rainfall intensity of 13.0 in. (330 mm) [Parsons, 1995a]. Runon should be controlled and diverted away from and around the OSDF using channels or diversion berms (design consideration).

- Permanent 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).

- Permanent runoff control measures should be designed according to the following criteria (design considerations).

  - Runoff from the 2,000-year, 24-hour storm event should be allowed to sheet flow to the toe of the OSDF final cover.

  - Runoff from the toe of the OSDF final cover should either sheet flow away from the facility or to a drainage channel beyond the toe.

000135

- Any drainage channels beyond the OSDF final cover system toe should outlet to existing drainage features at the battery limit. The location of the outlets should progress from north to south concurrent with the progressive development of the OSDF. The final outlet location for runoff from the eastern portions of the OSDF should be immediately south of the southern limit of the OSDF.

- Permanent drainage channels shall be designed to meet the following criteria (design considerations).

  - The dimensions of the channel should accommodate both normal low flows and peak precipitation runoff flows.

  - The final grades of the channel should be no less than 0.5 percent to prevent sediment buildup and clogging, unless it can be established by calculation that a lesser slope will not clog or buildup sediment that will cause loss of flow capacity in the design storm event. Channel slopes should be no steeper than 5 percent unless it can be established by calculation that a steeper slope will not cause unacceptable erosion or other malfunction.

  - Peak flow velocity in the channel should not initiate channel gully erosion or scour.

  - Erosion potential should be minimized at channel transitions by utilizing smooth, rounded, and graded transitions wherever possible (preferred) and erosion control structures only when needed.

  - Flow velocity in the channel during high frequency (e.g., 2-year return frequency) and low-intensity (i.e., approximately 1 in. (125 mm) in 24 hours) storm events should be large enough to limit sedimentation in the channels, to the extent possible.

  - Channel sideslopes should be no steeper than 3 horizontal to 1 vertical.

- The freeboard in the drainage channel should be at least 0.5 ft (0.15 m) during the design storm event.

- Permanent drop inlets and culverts may be used downgradient of the OSDF if necessary and if failure of the drop inlet and culvert would not result in damage to, or interruption of, the OSDF. Permanent drop inlets and culverts should be designed to meet the following criteria (design considerations).

  - Culverts beneath roads or access corridors should be designed for American Association of State Highway and Transportation Officials (AASHTO) H-20 live loads and applicable dead loads.

  - Channels should be protected from erosion using riprap for at least two culvert diameters upstream and four culvert diameters downstream of the culvert inlet or outlet, respectively.

  - Permanent culverts should not be used upgradient of the OSDF.

- Riprap, if needed, should be designed as described in Section 2.8.3 of this DCP (design consideration).

- Riprap should consist of field stone or rough unhewn quarry stone of approximately rectangular shape. The stone should be hard and angular and of a good quality, consistent with the UMTRA Technical Approach Document [DOE, 1989] (design consideration).

- Granular soils should be used as filters and bedding for permanent riprap features where necessary to prevent undermining of the riprap (design consideration).

- Rock, grade control structures, if used, should be designed to meet the criteria listed in Section 2.8.3 of this DCP (design consideration).

- Stormwater runoff from watersheds in the OSDF to the receiving water course (e.g., Paddys Run) should be discharged at a rate no greater than the

000137

predevelopment runoff discharge rate [ODNR-DSWC, 1996] (design consideration).

It is noted that stormwater routing and stormwater management system design for watercourses and structures beyond the battery limit will be addressed in other design packages being prepared as part of the integrated FEMP remediation.

B. Calculations

Calculations should be performed to size the drainage channels for each contributory drainage area. For these areas where a permanent drainage channel is not needed, the amount of surface-water runoff should be calculated. The calculations that should be performed are described below.

- The amount of surface-water runon and runoff should be calculated for each contributory drainage area.
- The size of the permanent drainage channel should be calculated for each contributory drainage area.

The above calculations should be performed using the design storm events previously identified. Runon/runoff routing and sediment basin sizing may be evaluated using the procedures described in USDA-SCS Technical Releases 20 and 55 [USDA-SCS, 1975, 1986a]; an acceptable tool for performing these calculation is the computer program "*HydroCAD™ Stormwater Modeling System*" [Applied Microcomputer System, 1993]. The above evaluations should be based on information and guidance contained in USDA-SCS manuals [1985,1986b,1988].

In the event that a channel bottom grade is less than 0.5 percent, an analysis should be performed to establish that the channel does not clog or build up sediment that will cause loss of flow capacity in the design storm event.

The erosion resistance of the permanent drainage channel at the north and east toes of the OSDF should be evaluated as follows:

- obtain the allowable tractive force on the channel vegetation and topsoil using methods established by Temple et al. [1987], as described in the DOE Technical Approach Document [1989] and referenced documents;

- establish the actual tractive force on the channel vegetation and the "effective" tractive force on the channel topsoil using methods established by Temple et al. [1987], as described in the DOE Technical Approach Document [1989] and referenced documents;

- determine the potential for erosion of the drainage channel by comparing the allowable tractive force on the topsoil to the "effective" actual tractive force on the topsoil; and

- evaluate the potential for the riprap portion of the channel lining to erode using the Safety Factors Method as described in the DOE Technical Approach Document [1989] and referenced documents.

2.8.5 Wastewater Management

Wastewaters that will be encountered in development of the OSDF were identified in Section 2.8.1 of this DCP. These wastewaters should be managed as follows.

- *Leachate* - All precipitation or other water that falls or runs into an active OSDF cell will be considered leachate and allowed to percolate into the cell leachate collection system (functional requirement). Placement of impacted material in OSDF cells shall be performed such that runoff from active and open portions of a cell resulting from the 25-year, 24-hour storm event can be managed within the cell (ARAR: EPA 40 CFR §258.26 and OAC 3745-27-08(C)(6)(a)). Leachate should be managed as described in Section 2.5 of this DCP.

- *Impacted Runoff* - Impacted material staging areas for demolition debris and soils will be constructed within the former production area whenever possible. Runoff from these areas should drain to stormwater control structures within

the former production area storm drainage control system (design consideration). Runoff from any staging area located within the OSDF battery limit should also be directed to the FEMP former production area storm drainage control system if possible, or to other on-site wastewater collection/conveyance points (if necessary) acceptable to DOE and OEPA/USEPA (design consideration). Additional discussion of the impacted material staging area is presented in Section 2.11 of this DCP. Runoff from impacted material access roads should be contained within the haul road boundary and allowed to flow by gravity to the FEMP former production area storm drainage control system, or to other on-site wastewater collection/conveyance points (if necessary) acceptable to DOE and USEPA/OEPA (design consideration).

- *Perched Ground Water* - Perched ground water that enters the OSDF excavation should be collected in a toe drain, or other suitable sump, and pumped to the FEMP former production area storm drainage control system (including pumpage to the impacted-material haul road, where the water will be allowed to flow by gravity to the FEMP former production area storm drainage control system), or to other on-site wastewater collection/conveyance points (if necessary) acceptable to DOE and OEPA/USEPA (design consideration). The management of perched ground water that enters the borrow area excavation is not wastewater; management of this latter runoff is discussed in Section 2.10 of this DCP.

2.8.6 References

FEMP property data and information required to design the surface-water management system should be obtained from the references cited in Section 1.5 of this DCP. References from the general technical literature that may be used to design these systems are given below.

American Concrete Pipe Association, "*Concrete Pipe Design Manual*", American Concrete Pipe Association, Arlington, VA, February, 1970.

Applied Microcomputer Systems, "*HydroCAD™ Stormwater Modeling System*", Version 3.10, Chocorua, NH, 1993.

Chow, V.T., *"Open-Channel Hydraulics"*, McGraw-Hill, Inc., 1959.

Ohio Department of Natural Resources - Division of Soil and Water Conservation (ODNR-DSWC), "*Rainwater and Land Development*", 2nd Edition, 1996.

Parsons, *"2,000-Year Flood and Probable Maximum Flood Sitewide Flood Plain Determination"*, CERCLA/RCRA Unit 2, Project Order 148, Fernald Environmental Management Project, Rev. A, Fairfield, OH, August 1995a.

Richardson, E.V., et al., "*Highways in the River Environment - Hydraulic and Environmental Design Considerations*, U.S. Department of Transportation, Available from Publications Office, Engineering Research Center, Colorado State University, Fort Collins, CO, 1975.

Temple, D.M., Robinson, K.M., Ahring, R.M., and Davis, A.G., *Stability Design of Grass-Lined Open Channels*", U.S. Department of Agriculture, Agriculture Research Service, Agriculture Handbook Number 667, 1987.

U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS), "*Computer Program for Project Formulation, Hydrology*", Technical Release 20 (TR20), U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., 1975.

U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS), "*National Emergency Handbook, Section 4 - Hydrology*", U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., 1985.

U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS), "*Urban Hydrology for Small Watersheds*", Technical Release 55 (TR55), U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., 2nd Edition, 1986a.

U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS), *Engineering Field Manual for Conservation Practices*, U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., 1986b.

U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS), "*Water Management and Sediment Control for Urbanizing Areas*", U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., 1987.

U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS), *Ponds - Planning, Design Construction*, Agricultural Handbook Number 590, U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., November 1988.

U.S. Department of Transportation (USDOT), "*Hydraulic Design of Highway Culverts*", Hydraulic Design Series No. 5, Federal Highway Administration, McLean, VA, September 1985.

U.S. Department of Energy (DOE), "*Technical Approach Document, Revision II*", Uranium Mill Tailings Remedial Action Project, December 1989.

2.9 Support Facilities and Utilities

2.9.1 General Design Criteria

The function of support elements and utilities is to provide support for, and enhance the performance of, the OSDF during construction, filling, closure, and post-closure care. As identified in Section 1.3 of this DCP, the support elements will include survey benchmarks, construction support area, equipment decontamination facility, materials storage areas, access control features, construction haul roads and leachate transmission system access corridor. Utilities will include electricity, water, and wastewater systems. Design criteria are presented separately in this section for each of these elements.

The support elements must provide adequate and reliable support for the activities that will be performed for the OSDF. Utilities must provide reliable service to the support elements for each type of utility. The support elements and utilities should be developed 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.

2.9.2 Specific Criteria

2.9.2.1 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 (ARAR: OAC 3745-27-08(C)(7)). The benchmarks shall be constructed in accordance with the following requirements (ARAR: OAC 3745-27-08(C)(7)):

- 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 ((C)(7)(a)).

- Survey marks shall be at least as stable as a poured concrete monument 10 in. (0.25 m) in diameter installed to a depth of 42 in. (1.1 m) 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 ((C)(7)(b)).

- Survey control standards for the survey marks shall be in accordance with the following ((C)(7)(c)):

    - for the first facility survey mark established from the known control point, minimum horizontal distance accuracy shall be one foot horizontal to two thousand five hundred feet horizontal;

- for each facility survey mark established from the first facility survey mark, minimum horizontal accuracy shall be one foot horizontal distance to five thousand feet 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 five thousand feet horizontal.

2.9.2.2 Utilities

Design criteria for utilities for the OSDF are given below.

- The utility types and demand should be evaluated based on the requirements for both temporary construction facilities during each stage of construction, filling, and closure of the OSDF and requirements for the post-closure care period (design consideration).

- The design of the utilities must be performed using regulations and guidance from local and state governments, OEPA, Cincinnati Gas & Electric, other public utilities, ASTM, ASCE, ANSI, ACI, NEC, and other groups which promote safety and design standards for utilities supply. The design of utilities should also comply with FEMP site facility standards (functional requirement).

- The utility services design should be from the point of service to the battery limit. Design of the utilities from the battery limit to the utility sources will be performed as part of a separate design package being prepared under the integrated FEMP remediation (design consideration).

- The routing of utilities should be based on consideration of avoiding areas that are to be demolished or developed, on-site soil remediation areas, and borrow areas in which excavation is planned (design consideration).

- The utilities should be installed at a depth sufficient to prevent damage due to freeze-thaw effects (design consideration).

- The utility lines should be designed to accommodate vehicle and/or railroad loadings at locations where the utilities will cross beneath haul roads, access roads, or railroads (design consideration).

- A water supply should be provided for dust suppression and moisture control during placement of material in the OSDF. Water supply points should be provided convenient to equipment used in construction of the OSDF (design consideration).

2.9.2.3 Construction Administration Area

Design criteria for the construction administration area are given below.

- The activities related to construction administration should be conducted in temporary facilities or trailers (design consideration).

- Trailers should be located within a fenced-in area and on a paved or gravel surface within the battery limit (design consideration).

- Temporary facilities or trailers should be designed having an adequate amount of space for the activities that will occur in the trailer (design consideration).

- Temporary facilities or trailers should be provided with adequate parking and all-weather ingress and egress (design consideration).

- The temporary facilities or trailers, including construction standards, tiedowns, utility provisions, and access provisions, must satisfy local codes and regulations (design consideration).

2.9.2.4 Equipment Decontamination Facility

An equipment decontamination facility will be used for decontaminating equipment exposed to impacted material within the battery limit. A decontamination pad should be provided in order for equipment to pass from the active impacted material work area in an OSDF cell or other area designated for clean-up to the area of OSDF construction or other areas designated and confirmed to meet FEMP clean-up criteria (functional requirement). The equipment decontamination facility must be designed to (functional requirements):

- be capable of providing decontamination of the undercarriage and exterior of a vehicle to remove particulate matter, using high pressure spray from portable hand-held sprayers; the decontamination stations may be temporary and transportable; side panels should be used to control fugitive emissions from the decontamination stations;

- be large enough to contain runoff and spray water from decontamination of construction equipment and other equipment that will be decontaminated;

- contain wastewater and solids that are generated by the decontamination process;

- have a containment system beneath the equipment decontamination surfacing; if the decontamination facility is a stationary, constructed facility, it should include, at a minimum, an HDPE geomembrane liner overlain by a granular drainage layer; the containment system must convey any flow to a sump accessible for pump-out using a portable submersible pump; and

- have a sump, pump, and plumbing system to evacuate decontamination water from the facility and route it to the leachate transmission system or other acceptable wastewater collection/conveyance point.

In addition, large off-road earth moving equipment may be decontaminated inside an active cell with a portable high-pressure spray. Decontamination activities in an active cell will be confined to designated areas so as not to interfere with impacted

material placement operations. The runoff from decontamination activities will be allowed to percolate into the cell leachate collection system (design consideration).

2.9.2.5 Material Storage Areas

Material storage areas will be used by the OSDF construction subcontractor to store materials that will subsequently be used in constructing, filling, and closing the OSDF. In general, material storage areas should include a construction materials (e.g., geomembrane, pipe, etc.) storage area and a clean soil stockpile area. The material storage areas should be (design considerations):

- located within the battery limit;
- large enough to contain the materials that will be used during construction of each phase of the OSDF;
- located in an area that is convenient to the OSDF construction area;
- located within an area where runoff is routed to a sediment basin; and
- designed with runon diversion controls.

2.9.2.6 Access Control

Access control features should provide control over ingress to, and egress from, the OSDF (functional requirement). One of the primary features of the access control system is installation of a security fence around the active construction area, with storage, support, and administration areas also enclosed by security fencing. The fencing is intended to prevent unauthorized access to the OSDF. The access control features must be designed as described below (design considerations).

- Security fencing should be of chain link construction and satisfy Ohio Department of Transportation (ODOT) standard specifications.

- Signs warning unauthorized individuals to keep out should be placed on the fence at 50 ft (15 m) intervals.

- Authorized personnel and vehicle access should be through a lockable access control gate.

- Access gate(s) should be placed at location(s) that are convenient for controlling access to the facility, while not unnecessarily limiting access.

- The security fence should be designed so that it does not inhibit flow at locations where it crosses surface-water drainage features.

- Access control facilities should be designed to allow monitoring of equipment used to transport both impacted materials and construction materials.

2.9.2.7 Construction Haul Roads and LTS Access Corridor

Construction haul roads should be provided for the equipment that transports soils from the borrow area to the OSDF cell construction site (functional requirement). A leachate transmission system (LTS) access corridor should be provided for the equipment that maintains the LTS during OSDF filling, closure, and post-closure periods (functional requirement). The following criteria should be used in designing construction haul roads and the LTS access corridor within the battery limit.

- Unpaved roads should be designed using methods appropriate to that type of road (design consideration). Culvert crossings beneath roads should be designed for AASHTO H-20 live loads (functional requirement) plus applicable dead loads.

- The maximum design speed for haul roads and the access corridor should be 20 miles per hour (mph) (36 kilometers per hour, or kph) (design consideration).

- The design life for construction haul roads should be based on a maintenance interval of one to two weeks during the construction season (design consideration). The design life for the LTS access corridor should be based on maintenance intervals of 12 months (design consideration).

- The minimum acceptable section for the construction haul roads and the LTS access corridor is, from top to bottom (design consideration):

  - 12-in. (0.3-m) thick layer of a free-draining crushed gravel;

  - geotextile separator; and

  - prepared subgrade.

- Minimum construction haul road widths should be as follows (design consideration):

  - one-way, single-lane construction haul roads should be 16 ft (4.9 m) wide with shoulders of up to 5 ft (1.5 m) to accommodate vehicles having large widths; and

  - two-way, double-lane construction haul roads should be 32 ft (10 m) wide with shoulders of up to 5 ft (1.5 m).

- Minimum LTS access corridor width should be 12 ft (3.6 m), with minimum 3 ft (0.9 m) shoulder on downhill side of the access corridor (design consideration).

- Construction haul roads should be designed with a 3 percent cross slope or crown. These roads should also have edge ditches for runoff and runon control (design consideration).

- Wherever possible construction haul road grades should be 3 percent, or less. Where required to obtain cell access, road grades as steep as 10 percent may be allowed for short distances (design consideration).

- The LTS access corridor should be designed with a minimum 3 percent cross slope or crown and a maximum grade matching the grade of the LTS (design consideration).

- Road turning radii should be at least 50 ft (15 m) at the centerline of the road (design consideration).

Cut and fill slopes for construction haul roads should be designed to have a maximum side slope of 3H:1V. Where construction activities or other spatial constraints limit right of way, cut and fill having a maximum slope of 2H:1V may be used if shown to be stable (design consideration). Drainage ditches should be used to convey runoff from the haul roads (design consideration).

2.9.2.8 Calculations

The following calculations should be prepared in development of the design of the support facilities and utilities:

- electrical power demand: estimate the electrical power requirements for the construction administration area, materials storage areas, equipment decontamination facility, and permanent lift station;

- potable water demand: estimate the potable water requirements for the construction administration area (to include fire protection), for clay liner, cap, and general earthwork construction, and for dust control;

- sanitary wastewater discharge: estimate the sanitary sewer discharge for the construction administration area;

- decontamination facility water demand: estimate the water demand for the equipment decontamination facility;

- decontamination facility pump design: calculate the required pump capacity;

- construction administration area surfacing: calculate the required asphalt pavement and aggregate base course thicknesses;

- construction haul road design: calculate the required aggregate base and subbase coarse thicknesses; and

- LTS access corridor design: calculate the required aggregate base and subbase coarse thicknesses.

2.9.3 References

FEMP property data and information required to design the support facilities and utilities should be obtained from the references cited in Section 1.5 of this DCP. References from the general technical literature that may be used to design these activities are given below.

American Association of State Highway and Transportation Officials (AASHTO), "*AASHTO Guide for Design of Pavement Structures*," Washington, D.C., 1992.

Portland Cement Association (PCA), "*Thickness Design for Concrete Highway and Street Pavement*", 1984.

State of Ohio, Department of Transportation (ODOT), "*Location and Design Manual, Volume I, Roadway Design*", Revision, October 1992, Columbus, OH, 1992.

State of Ohio, Department of Transportation (ODOT), "*Construction Materials Specifications*," Columbus, OH, January 1993.

Yang, H.H., "*Pavement Analysis and Design*", Prentice-Hall, Inc., New York, NY, 1993.

Yoder, E. and Witczack, M., "*Principles of Pavement Design*", John Wiley and Sons, Inc., New York, NY, 1975.

2.10 Borrow Area

2.10.1 General Design Criteria

The function of the borrow area is to provide soil for construction of the liner and final cover systems, and for other earthwork, related to construction, filling, and closure of the OSDF. This consists of soil borrow for construction of the compacted clay liner and cap, vegetative soil layer, compacted fill, and other earthwork associated with the project. The topsoil layer in the borrow area will be removed and stockpiled in the borrow area for later use unless it is determined to be impacted material, in which case it should be disposed of in the OSDF in accordance with the Impacted Material Placement Plan (IMPP). The borrow area for OSDF construction is located in the "East Field" area of the FEMP property. This borrow area will be developed over a period of from 7 to 25 years (depending on the actual schedule for OSDF construction, filling, and closure), with a 10 year design life used for planning purposes. After the borrow area is restored, it should function with minimal maintenance.

The borrow area should be developed in a manner that results in efficient utilization of the available soils, results in efficient utilization of the natural topography of the borrow area to effectively control runon and runoff, provides soils with the engineering properties required for the OSDF earthwork components being constructed, and minimizes the costs associated with the development and restoration of the area (design considerations). In addition to these requirements, the design of the borrow area should consider the requirements described below (design considerations).

- The borrow area should be laid out in a manner that provides easy ingress and egress.

- The area should be developed in a manner that requires minimal additional earthwork after borrow activities are complete to achieve the required restoration grades.

- Restoration should be performed progressively as work is completed in spent portions of the borrow area.

- Erosion and sediment controls should be implemented in the borrow area prior to excavation, through borrow activities, and in conjunction with restoration activities.

2.10.2 Specific Criteria

2.10.2.1 Location of Borrow Area

A. Design Criteria

- The borrow area should be located in an area having material quantities and types sufficient for OSDF construction, filling, and closure (design consideration).

- The borrow area should be located within the FEMP property and should not encroach on the transmission line, oil pipeline, or other easements (design consideration).

- The borrow area should not extend vertically into the gray till. The reasons for this are: (i) the efficiency of the borrow area operation will be improved by limiting the depth of excavation; and (ii) by limiting the depth of excavation, the restored borrow grades will be flatter and restoration of the area will be more cost effective. The borrow area should be constructed with sufficient final slope (e.g., at least 1.0 percent) to promote drainage (design considerations).

- Within the above constraints, the borrow area should be as deep as possible to minimize the size of the area (design consideration).

B. Calculations

No formal calculation is required for the location of the borrow area. A review of past geotechnical investigations and the results of ongoing laboratory testing of borrow area soil samples collected in November 1995 should be conducted to assess the engineering properties of the material and to predict the suitability of the materials for use as compacted clay liner and cap materials, as well as other earthwork components of the OSDF, as listed in Section 2.10.1.

2.10.2.2 Layout of Borrow Area

A. Design Criteria

- The borrow area should be laid out to facilitate surface-water management throughout the life of the borrow area (design consideration).
- The borrow area should be graded to promote stormwater runoff and prevent ponding of surface water (design consideration).
- The borrow area should be laid out to avoid interferences with roads, utility corridors, easements, etc. (design consideration).
- A soil contingency volume (equal to at least 15 percent of the required soil bank/unbulked volume based on the design estimate) should be provided in the borrow area for possible use in (design consideration):
  - construction of an OSDF contingency cell if disposal volumes are larger than anticipated;
  - backfilling to subgrade elevations beneath the footprint of the OSDF in the event that additional excavation of impacted material is necessary;
  - constructing portions of the contouring layer of the cover system and the non-granular portion of the protective layer of the liner system with

"clean" soil in the event that suitable impacted soil is not available for this purpose; and

- providing material for "seasonal" closure between construction seasons in the event that suitable impacted soil is not available for this purpose.

- Intermediate borrow area slopes that will not be vegetated should be cut at a safe angle of repose for the material (design consideration).

- Permanent restored slopes within the borrow area should be no steeper than 5H:1V (design consideration).

B. Calculations

A review of previous geotechnical field and laboratory test data, including brown till in-situ densities and moisture contents, standard Proctor compaction test results, and permeability test results should be made. The results of currently on-going laboratory testing of borrow area soil should also be reviewed. The calculations described below should be undertaken in support of the design of the borrow area.

- The bank/unbulked volume of borrow soil required to build the earthwork components of the OSDF described in 2.10.1 should be calculated. The calculation should be conducted using the required compacted earthwork volume of on-site borrow material. This required compacted earthwork volume should be corrected to account for shrinkage/bulking of the borrow soil, the possible need for contingency volume, and the removal of the topsoil layer for stockpiling and later use as the topsoil layer in the OSDF final cover system.

- The bank/unbulked volume of available borrow soil, as calculated using computed-aided design (CAD) techniques, should be verified by hand calculation.

- The in-situ moisture content of the soil at the borrow area should be compared to the anticipated compaction moisture contents for the various

earthwork components of the OSDF liner and final cover systems to assess the construction water demand and/or amount of soil drying required to moisture condition the borrow soils.

2.10.2.3 Development of Borrow Area

A. Design Criteria

- The borrow area should 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 (design consideration).

- Requirements for processing of the borrow area soils should be identified during design. If possible, such processing should be performed in the borrow area or any temporary stockpile area. Such processing could include moisture conditioning, blending, screening, or admixture modification (design consideration).

- Prior to the start of construction in the borrow area, the following activities should be performed (design considerations):

  - establishment of temporary stormwater management and erosion and sediment controls for the borrow area, including sediment basins;

  - establishment of access controls for the borrow area (consistent with the requirements of Section 2.9.2.6 of the DCP);

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

- Prior to the start of borrow area development, topsoil in the area should be removed and stockpiled for later use in closure of the OSDF unless it is determined to be impacted material, in which case if should be disposed in the OSDF in accordance with the IMPP (design consideration).

B. Calculations

No formal calculations are required for the development of the borrow area.

2.10.2.4 Surface-Water Management for Borrow Area

A. Design Criteria

- Temporary and permanent surface-water control structures for the borrow area with the exception of sediment basins, should be designed for the 25-year, 24-hour storm event (design consideration). Depending on the size of the contributory area, sediment basins should be designed for either the 10-year, 24-hour storm event, or the 25-year, 24-hour storm event [ODNR-DSWC, 1996]. This criterion is discussed further later in this section of the DCP.

- Stormwater runoff from borrow area watersheds to the receiving water course (e.g., Paddys Run) should be discharged at a rate no greater than the predevelopment runoff discharge rate [ODNR-DSWC, 1996] (design consideration).

- Stormwater runoff should be managed so that, after restoration of the borrow area, the effects of erosion of the borrow area ground surface are minimal. Long-term erosion of the ground surface in the borrow area must not impact the OSDF (design considerations).

- Temporary runon control structures should be implemented to minimize runon from entering work areas. Such runon should be diverted around work areas using diversion dikes or channels as appropriate (design consideration).

- Temporary channels for stormwater runoff should be designed to meet the criteria presented in Section 2.8.3. of the DCP (design consideration).

000137

- Permanent channels should be designed to meet the criteria presented in Section 2.8.4 of the DCP (design consideration).

- Culverts should be designed to meet the criteria presented in Section 2.8.4 of the DCP (design consideration).

- Riprap should be designed to meet the criteria presented in Section 2.8.4 of the DCP (design consideration).

- Sediment basins should meet the following criteria [ODNR-DSWC, 1996] (design considerations).

  - The minimum capacity of the sediment basin to the elevation of the crest of the pipe spillway should be 1,800 cubic ft for each acre (155 cubic meter for each hectare) within the drainage area that will be disturbed by construction during the designed life of the sediment basin.

  - The capacity of the pipe spillway should be sufficient to pass the runoff from the 2-year, 24-hour storm event. For the FEMP property, this event has a rainfall intensity of 2.5 in. (63 mm) [Parsons, 1995a].

  - The combination of the principal and emergency spillways should be capable of safely discharging the flow from the 10-year, 24-hour storm event if the drainage area to the sediment basin is less than or equal to 20 acres (8 ha), or the 25-year, 24-hour storm event if the drainage area to the sediment basin is greater than 20 acres (8 ha).

  - Consideration should be given to using the permanent Fernald facility main entrance road as a containment dike for the stormwater runoff in lieu of an emergency spillway.

  - If an emergency spillway is implemented, a minimum freeboard of 1 ft (0.3 m) should be provided measured from the peak water elevation in the emergency spillway to the top of the embankment.

- Temporary erosion control measures should include those items described in Section 2.8.3 in the DCP (design consideration).

It is noted that stormwater routing and stormwater management system design for watercourses and structures beyond the battery limit will be addressed in other design packages being prepared as part of the integrated FEMP remediation.

B. Calculations

Calculations should be performed to route the design storm through the borrow area for existing conditions and for construction conditions (i.e., during borrow activities), and to size sediment basins. The calculations should be performed as described below.

- The amount of surface-water runon and runoff should be calculated for each contributory drainage area.

- The size of the sediment basin, including outlet structures, should be calculated for each contributory drainage area.

The above calculations should be performed using the design storm events previously identified. Runon/runoff routing and sediment basin sizing should be evaluated using the procedures described in USDA-SCS Technical Release 20 and/or 55 [USDA-SCS, 1975, 1986a]; an acceptable tool for performing these calculations is the computer program "*HydroCAD™ Stormwater Modeling System*" [Applied Microcomputer Systems, 1993]. The above evaluations should be based on the information and guidance contained in USDA-SCS manuals [1985,1986b,1987,1988].

In the event that a channel bottom grade is less than 0.5 percent, an analysis should be performed to establish that the channel does not clog or build up sediment that will cause loss of flow capacity in the design storm event.

000179

2.10.2.5 Restoration

A. Design Criteria

The borrow area should be restored in accordance with the FEMP site-wide restoration plan (which is currently being developed) to a condition that requires minimal maintenance (functional requirement). The borrow area should be restored to a condition that is consistent with the geomorphological character of the area surrounding the FEMP (design consideration). The following criteria should be followed in preparing the restoration plan for the borrow area.

- Final grades should be selected that minimize long-term erosion in the area. The final grades should not result in erosion that is greater than the calculated erosion rate for stabilized slopes in the vicinity of the FEMP that have similar grades and similar soil types (design consideration).

- Stormwater runoff from the restored borrow area should be routed as indicated in Section 2.10.2.3 (design consideration).

- The restored borrow area should be revegetated with plant species that minimize erosion, that can be successfully established on the design final grades and soil types, and that are self-propagating in the expected conditions of the restored borrow area (design consideration).

- The design of the restoration plan should provide for progressive restoration of the borrow area, with commencement of restoration in an area as soon as borrow activities have been completed. To the extent possible, activities should not be performed in portions of the borrow area that have been restored (design consideration).

B. Calculations

No formal calculations are required for restoration of the borrow area. Procedures and materials for establishing permanent vegetation in the borrow area should be

consistent with those procedures and materials selected for the OSDF final cover system (see Section 2.6 of this DCP).

2.10.3 References

FEMP property data and information required to design the borrow area should be obtained from the references cited in Section 1.5 of this DCP. References from the general technical literature that may be used to design the borrow area are given in Section 2.8.6 of the DCP.

2.11 Impacted Material Management

2.11.1 General Design Criteria

This section of the DCP addresses impacted material management activities within the OSDF battery limit. Other activities, primarily associated with remediation of the operable units, and use of temporary staging areas outside of the battery limit are addressed in other design packages being prepared as part of the integrated FEMP remediation.

Impacted material management activities must be conducted in a manner that is protective of the OSDF liner system, leachate management system, and final cover system, that prevents the uncontrolled release of impacted material to the environment, and that is safe and cost effective. In this section of the DCP, the criteria that should be followed for the design of impacted material management facilities associated with the OSDF are described. Impacted material should be placed in accordance with the "*Impacted Material Placement Plan*," which will be prepared as described in Section 3.2.6.2. Impacted material management activities will include: (i) transporting impacted materials from areas within the battery limit where the materials are excavated to either temporary staging or stockpiling areas and/or the OSDF; (ii) transporting impacted material from operable units to either temporary staging areas and/or the OSDF; (iii) placing the material within the OSDF; and (iv) managing the generation of fugitive emissions and wastewaters during impacted material placement operations.

000151

Facilities for impacted material management should (functional requirements):

- 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.

2.11.2 Specific Design Criteria

2.11.2.1 Impacted-Material Haul Roads

A. Design Criteria

Temporary haul roads should be provided for the equipment that transports impacted material (functional requirement). The following criteria should be used in designing impacted material haul roads within the battery limit.

- Unpaved roads should be designed using methods appropriate to that type of road (design consideration). Culvert crossings beneath roads should be designed for AASHTO H-20 live loads plus applicable dead loads (functional requirement).

- The maximum design speed for haul roads should be 20 miles per hour (mph) (36 kilometers per hour, or kph) (design consideration).

- The design life for impacted material haul roads should be based on a maintenance interval of one to two weeks during the construction season (design consideration).

- The minimum acceptable section for impacted material haul roads is (design consideration):

  - 12-in. (0.3-m) thick layer of a free-draining crushed gravel;

  - geotextile separator; and

  - prepared subgrade.

- Minimum impacted material road widths should be as follows (design consideration):

  - one-way, single-lane impacted material haul roads should be 16 ft (4.9 m) wide with shoulders of up to 5 ft (1.5 m) to accommodate vehicles having large widths; and

  - two-way, double-lane impacted material haul roads should be 32 ft (10 m) wide with shoulders of up to 5 ft (1.5 m).

- Impacted material haul roads should be designed with a 3 percent cross slope or crown. These roads should also have edge ditches and berms for runoff and runon control (design consideration).

- Wherever possible, impacted material haul road grades should be 3 percent, or less. Where required to obtain cell access, road grades as steep as 10 percent may be allowed for short distances (design consideration).

000163

- Road turning radii should be at least 50 ft (15 m) at the centerline of the road (design consideration).

Cut and fill slopes for impacted material haul roads should be designed to have a maximum side slope of 3H:1V. Where construction activities or other spatial constraints limit right of way, cut and fill having a maximum slope of 2H:1V may be used if shown to be stable (design consideration). Drainage ditches should be used to convey impacted runoff from the haul roads to impacted-runoff sumps (design consideration). Water collected in impacted-material haul road sumps should be treated as wastewater and managed as described in Section 2.8.3 of this DCP (design consideration).

B. Calculations

Impacted material haul roads should be designed for the anticipated type and volume of traffic that will pass over the road. Road layouts should be calculated using standard CADD-based procedures for horizontal and vertical control. If unpaved, the roads should be designed using standard techniques for design of unpaved roads (for example, as described by Giroud and Noiray [1981] or using the AASHTO method [AASHTO, 1993]. If paved, roads shall be designed using the most current AASHTO procedures. Roads should be designed to allow use of locally available aggregates and construction materials, such as those materials identified in the ODOT standard specifications.

2.11.2.2 Impacted Material Staging Areas

A. Design Criteria

The construction of impacted-material staging areas may be required during OSDF filling. To the extent feasible, impacted materials, other than impacted soils, should be staged on existing building slabs within the FEMP former production area (design consideration). If an impacted-material staging area is required within the battery limit for materials other than impacted soil, it should meet the requirements given below:

- Any impacted-material staging area within the battery limit should incorporate a gravel or concrete working pad (design consideration). Any concrete working pad should be designed in accordance with ACI 318-93 [ACI, 1993] (design consideration). The working pad, whether gravel or concrete, should include a containment system that includes as a minimum, from top to bottom (functional requirement):

  - working surface of suitable thickness and strength, capable of supporting both on-road and off-road impacted material haul vehicles in a manner that does not damage the underlying containment system;

  - 12-in. (0.3-mm) thick layer of a free-draining crushed gravel;

  - geotextile cushion layer;

  - 40-mil (1.0-mm) thick HDPE geomembrane; and

  - prepared subgrade.

Any impacted-material staging area within the battery limit for materials other than impacted soil should also:

- contain and control impacted runoff from the staging area and manage that runoff as wastewater using the criteria described in Section 2.8 of this DCP (design consideration);

- prevent stormwater runon to the area through use of a perimeter curb or berm (design consideration);

- enable access by equipment for placement and removal of material (design consideration); and

- have provisions for fugitive emissions control using either geosynthetics, water spray, crusting agents, surfactants, or other appropriate methods (design consideration).

To the extent the stockpiling of impacted soil is necessary (likely during construction of the first OSDF cell) it should be stockpiled within the FEMP former production area (design consideration). If necessary to temporarily stockpile impacted soil within the battery limit, the temporary stockpile should (design considerations):

- contain and control impacted runoff from the staging area and manage that runoff as wastewater using the criteria described in Section 2.8 of this DCP;
- prevent stormwater runon to the area through use of a perimeter curb or berm;
- enable access by equipment for placement and removal of material; and
- have provisions for fugitive emissions control using either geosynthetics, water spray, crusting agents, surfactants, or other appropriate methods.

B. Calculations

An evaluation should be performed of the required size and storage capacity of any impacted-material staging area required within the battery limit. The evaluation should verify that the maximum anticipated quantity of material requiring staging at any point in time can be accommodated. Standard engineering methods for calculation of volumes should be used. Calculations should also be performed to design any concrete working pad to resist the applied traffic loads.

2.11.2.3 Impacted Material Excavation, Removal, and Handling

- As Low As Reasonably Achievable (ALARA) goals should apply to all impacted-material excavation, removal, handling, and placement activities (DOE Order 5400.5, Chapter I(4) and II(2)).
- Procedures should be employed that minimize the need for the use of respirators by on-site workers (design consideration).

- Impacted soil encountered in the OSDF area should be managed as follows (design considerations).

  - The top layers of soil in areas indicated on the drawings as impacted should be removed. The depth of removal should be addressed as part of other design packages prepared as part of the integrated FEMP remediation. Such soils should either be stockpiled for later placement in the OSDF or, preferably, transported and placed directly in the OSDF, depending on the availability of a suitable location within the OSDF.

  - Temporary stockpiles for impacted soils within the battery limit should be constructed as described in Section 2.11.2.2 of this DCP.

  - Runon to excavation areas should be prevented to the extent possible, as described in Section 2.8 of this DCP. The size of the active excavation area should be limited to minimize the potential for stormwater runoff from the area.

  - Overexcavation of impacted material should be minimized.

  - The soil beneath the removed layer should be sampled and tested as addressed in other plans prepared as part of the integrated FEMP remediation. Additional excavation may be needed based on the results of confirmation sampling.

  - Excavated areas that will not immediately undergo further development should be promptly revegetated to minimize the potential for erosion.

000167

2.11.2.4 Impacted Material Transport

A. Design Criteria

The following criteria and requirements should be incorporated into the *Impacted Material Placement Plan*.

- The OSDF construction subcontractor should 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 (design consideration).

- Material transport procedures should be designed to cause minimal disturbance to the site and work area (design consideration).

- Material transport procedures should be designed in coordination with impacted material removal and impacted material placement activities (design consideration).

- 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 (design considerations).

- Impacted material transport equipment requirements should address the control of airborne particulate emissions (design consideration).

- Acceptable emission control methods include (design consideration):

  - transport in closed containers with metal or tarp lids;

  - keeping impacted material moist; and

  - spraying earthen material with a crusting agent.

- Crushing agents should be evaluated for compatibility with OSDF liner system components and only agents that contain constituents known to be compatible should be used (design consideration).

2.11.2.5 Impacted Material Placement

A. Design Criteria

The *Impacted Material Placement Plan* must only allow the placement of material satisfying the OSDF WAC (functional requirement). Impacted material placement activities should result in the disposal of impacted material in a manner that prevents unacceptable worker exposure to health and safety hazards, and in a manner that achieves the long-term performance goals of the OSDF (design considerations).

Impacted material placement procedures should take into account (design considerations):

- 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, and 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.

000169

In addition to the foregoing requirements, impacted material placement activities should be designed to achieve the following (design considerations).

- Impacted material should be placed in the OSDF so that it will achieve the design life goal of 1,000 years to the extent reasonable, and in any case at least 200 years.

- Impacted material should be placed in a manner that is protective of the liner system and final cover system.

- Impacted material should be placed so that it will remain stable under both static and earthquake loading conditions.

- 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 (see Figure 1-1 of this DCP). 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 be designed to 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 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.

- Municipal solid waste material requiring disposal should be spread out in relatively thin lifts and covered with at least 12 in. (0.3 m) of cover soil. The purpose of this procedure is to minimize the potential for anaerobic decomposition of the waste (and, thus, the generation of landfill gas) and also the potential for differential settlement of the disposal pile. Similarly, green waste from excavation activities requiring OSDF disposal should be spread out in thin lifts and completely covered with soil. Consideration should be given to chipping any tree limbs and branches requiring OSDF disposal to reduce the size of the green waste particles prior to disposal.

- At the end of each work day, the impacted material surface should be graded and maintained to control precipitation runoff and impacted material erosion.

In addition to the foregoing, placement of impacted material in an OSDF cell shall be performed such that the cell can always store runoff from active and open portions of the cell resulting from the 25-year, 24-hour storm event (ARAR: OAC 3745-027-08(C)(6)).

B. Calculations

Calculations should be conducted to estimate potential total and differential settlements of the disposal pile. These calculations should be conducted as described in Section 2.3.2.4 of this DCP. Calculations should also be performed to estimate the required cell storage to contain impacted materials from the 25-year, 24-hour storm event. These calculations should be performed as described in Section 2.5.1 of this DCP.

2.11.2.6 Seasonal (Winter) Shutdown

Temporary shutdown of impacted material placement activities will be required during periods of freezing conditions and at locations where impacted material will not

be placed for at least 30 days. In these cases, a "seasonal" cover should be provided for exposed surfaces. After the period of temporary shut-down is complete, the cover should be removed as appropriate. If the cover is "clean" soil, the upper zone of the material may be salvaged for future use. However, soil in contact with impacted material should itself be considered impacted. Seasonal cover should (design considerations):

- have the least volume technically practical in order to limit loss of cell volume (i.e., 6 to 12 in. (0.15 to 0.3 m));
- be cost effective to place;
- be of sufficient thickness to protect underlying geosynthetics from frost effects;
- control stormwater runoff and route runoff to a location where it can be properly managed;
- limit infiltration through previously placed impacted materials and minimize impacted material erosion;
- limit fugitive emissions to not more than acceptable levels; and
- remain stable and durable for the anticipated period of seasonal shut-down.

Potential "seasonal" cover materials that should be evaluated as part of the OSDF design include on-site clean soils, off-site clean soils, and on-site impacted materials with suitable surface protection (e.g., commercially-available surfactant products or crusting agents). Runoff from seasonally-covered impacted material slopes should be managed as leachate (design consideration).

2.11.3 Radon Emission and Gas Generation

A. Design Criteria

The following radon and gas generation design criteria apply to the OSDF and should be addressed.

- Release of radon-222 to the atmosphere shall not: (i) exceed an average release rate of 20 picoCuries per square meter per second (pCi/m^2/s); or (ii) increase the average annual concentration of radon-222 at or above any location outside the OSDF by more than 0.5 picoCuries per liter (pCi/l) (ARAR: 40 CFR §192.02(b)).

- The amount of labile (i.e., easily assimilatable) organic carbon placed in the OSDF should not be so great as to cause a sufficient volume of methane generation to: (i) create a health and safety concern to the OSDF construction subcontractor; or (ii) cause cracking or uplift of the OSDF final cover system (design consideration). If health and safety concerns, or final cover system design issues, are identified, mitigative measures should be specified. These measures potentially include: (i) reducing the volume of labile organic carbon (e.g., grubbing wastes, MSW, etc.) disposed in the OSDF; (ii) providing engineering controls (e.g., active ventilation and methane detectors) in manholes and lift stations with pipes open to the OSDF; and (iii) incorporating a gas venting layer into the OSDF final cover system.

- The *Impacted Material Placement Plan* should require impacted material placement procedures that result in the most uniform dispersion of organic material that is practical in order to minimize the concentration of labile organic carbon available to methanogenic bacteria at any one location (design consideration). Methanogenesis rates are directly proportional to the local concentration of labile organic carbon [Amaral and Knowles, 1994].

- To the extent allowed by other design considerations, the final cover system should be designed to provide a favorable environment for methanotrophic bacteria (design consideration). The ability of certain methanotrophic species

000173

of bacteria, which would typically be present in landfill cover soils, to consume methane produced in underlying soil or waste layers has been demonstrated [Knightly et al., 1995].

B. Calculations

The radon emission rate should be estimated using the computer code RAECOM [NRC, 1984]. Initially, conservative estimated input parameters, rather than measured site-specific input parameters, should be used. The estimated radon emission rate obtained using this approach should be compared to the ARAR for radon release. If the estimated rate is not more than 25 percent of the ARAR release rate, the calculation is complete. If the estimated rate is more than 25 percent of the ARAR release rate, a more detailed calculation, using site-specific data to establish input parameters, will be undertaken.

The potential for methane generation in the OSDF should be evaluated as follows.

- The maximum total methane generation potential of the OSDF should be estimated using a stoichiometric conversion of the labile organic carbon content of the material in the OSDF to methane; one such conversion procedure is that in Thorneloe et al. [1993].

- A range of potential methane generation rates within the OSDF should be estimated based on a qualitative evaluation of the likely impacts of OSDF environmental conditions (e.g., temperature, moisture content availability, etc.) on methanogenesis activity; descriptions of the impacts of environmental conditions on methanogenesis activity can be found in Amaral and Knowles [1995], Atlas [1984], and Sims et al. [1989]. The conservative assumption that emission rate equals generation rate should be used initially.

- The potential health and safety impacts of the calculated emission rate should be evaluated and appropriate mitigation measures should be instituted if indicated by the evaluation.

- The potential effects of the calculated emission rates on the OSDF final cover system should be evaluated and appropriate mitigation measures should be instituted if indicated by the evaluation.

2.11.4 References

FEMP property data and information required to design the impacted material management activities should be obtained from the references cited in Section 1.5 of this DCP. References from the general technical literature that may be used to design these activities are given below.

Amaral, J.A. and Knowles, R., "Methane Metabolism in a Temperate Swamp", *Applied and Environmental Microbiology*, Volume 60, 1995, pp. 3945-3951.

American Association of State Highway and Transportation Officials (AASHTO), "*AASHTO Guide for Design of Pavement Structures*," Washington, D.C., 1992.

American Concrete Institute (ACI), "*Building Code Requirements for Concrete (ACI 318-93)*", Detroit, MI, 1993.

Atlas, R.M., *Microbiology: Fundamentals and Applications.* Macmillan Publishing Company, New York, 1984.

Giroud, J.P., and Noiray, L., "Design of Geotextile Reinforced Unpaved Roads," *J. Geotechnical Engineering Division,* ASCE, Vol. 107, No. GT9, September 1981, pp. 1233-1254.

Knightly, D., Nedwell, D.B., and Cooper M., "Capacity for Methane Oxidation in Landfill Cover Soils Measured in Laboratory-Scale Soil Microcosms", *Applied and Environmental Microbiology*, Volume 61, 1995, pp. 592-601.

NRC, *"Radon Attenuation Handbook for Uranium Mill Tailings Cover System"*, NUREG/CR-3533, prepared by Rogers and Associates Engineering, Salt Lake City, Utah, for the U.S. Nuclear Regulatory Commission, Washington, D.C., 1984.

Sims, J.L., Sims, R.C., and Matthews, J.E., *Bioremediation of Contaminated Surface Soils*, EPA/600/9-89/073, Robert Kerr Environmental Research Laboratory, August, 1989.

State of Ohio, Department of Transportation (ODOT), "*Construction of Materials Specifications*," Columbus, OH, January 1993.

Thorneloe, S., Barlaz, M., Peer, R., Huff, L., Davis, L., and Mangino, J., "Waste Management", *Atmospheric Methane: Sources, Sinks, and Role in Global Change*, Report No. EPA/600/A-94/090, U.S. Environmental Protection Agency, Research Triangle Park, NC, 1993, pp. 362-398.

U.S. Environmental Protection Agency (USEPA), *"Air Emissions from Municipal Solid Waste Landfills — Background Information for Proposed Standards and Guidelines"*, Report No. EPA-450/3-90-011a, U.S. Environmental Protection Agency, Research Triangle Park, NC, March 1991.

SECTION 3

3. PROJECT DELIVERABLES

3.1 General Requirements

3.1.1 Introduction

The purpose of this section of the DCP is to identify administrative and substantive requirements for preparation and issuance of project deliverables for this design package. Section 3.1 addresses general administrative requirements. Substantive requirements are addressed in Section 3.2. Required deliverables for other design packages being developed as part of the integrated FEMP remediation are not addressed in this DCP. These other deliverables will be addressed in other appropriate DCPs. The requirements described in this section could change slightly based on the specifics of the OSDF detailed design.

3.1.2 Reports

Reports that will be prepared for this design package are identified in Section 1.6 of this DCP and described in more detail in Section 3.2. The reports must be prepared using the WordPerfect Version 5.1 word processing program and should be submitted both in bound (i.e., assembled and bound in three-ring binders) and unbound, reproducible (i.e., "camera-ready") format. Any spreadsheets that are included in the reports should be prepared in a format compatible with Lotus 123, Version 3.4 software. Reports for regulatory submittal should be prepared in sets of 20 bound copies, plus an unbound copy for reproduction.

3.1.3 Calculations

Calculations should be submitted with the preliminary, intermediate, prefinal, final, and CFC design packages. A list of calculations to be prepared for the OSDF project is presented in Table 1-1 of this DCP (see pages 1-14 through 1-16). Spreadsheets that are submitted with calculations should be prepared in a format compatible with Lotus

123, Version 3.4 software. Calculations for regulatory submittal should be prepared in twenty bound copies, plus an unbound copy for reproduction.

3.1.4 Drawings

Drawings should be compiled using computer-aided design (CAD) techniques using a system compatible with Microstation (Version 5.0) software. An anticipated list of OSDF CFC drawings is presented in Table 1-2 of this DCP (see pages 1-17 and 1-18). As noted in Section 1.6 of this DCP, drawings that primarily present construction details and contractor instructions need not be included in the submittals for regulatory review.

OSDF drawings should be prepared on 30 in. by 42 in. (76 cm by 110 cm) and half-size sheets. Full-size drawings intended for submittal to regulatory agencies should be printed on both mylar and bond media. Each drawing should be sequentially numbered with a fully-executed title block. Revision blocks should be prepared for each revision to reflect changes to the drawings. After the prefinal submittal, changes made to the drawings should be shown by "clouding" the area that is revised and making a keynote in the revision block; if this method of revision comprises the clarity of the drawings, then the drawing should be replaced and reissued. Drawings should be submitted with the preliminary, intermediate, prefinal, final, and CFC design packages. Drawings for regulatory submittal should be prepared in 20 bound copies, plus an unbound copy for reproduction.

3.1.5 Specifications

Specifications should be submitted with the preliminary, intermediate, prefinal, final, and CFC design packages. An anticipated list of OSDF CFC specifications is presented in Table 1-3 (see page 1-19). As noted in Section 1.6 of this DCP, specifications that primarily address construction details and contractor instructions need not be included in the submittals for regulatory review.

OSDF specifications should be prepared using the standard Construction Specifications Institute (CSI) format for each construction activity. Specifications should provide sufficient detail to control the quality of construction materials and activities, while encouraging competitive procurement of materials and services. Specifications should be prepared using WordPerfect 5.1 format. Specification for regulatory submittal should be prepared in 20 bound copies, plus an unbound copy for reproduction.

3.1.6 Cost Estimates

Cost estimates should be prepared for OSDF construction, filling, and closure, for implementation of the test pad program, and for implementation of the leachate/liner compatibility study. The cost estimates must be in FERMCO format. This format is illustrated by the FERMCO baseline OSDF cost estimate presented in Appendix E of this document. Cost estimate spreadsheets must be compatible with Lotus 123, Version 3.4 software. Cost estimates for regulatory submittal should be prepared in 20 bound copies, plus an unbound copy for reproduction.

3.1.7 Value Engineering

A value engineering session will be conducted after the preliminary design package is prepared to identify and evaluate potential cost-effective design alternatives. The results of the value engineering session should be evaluated by the OSDF design team for incorporation into the OSDF design. This process should be documented and the results incorporated into the design no later than the prefinal design package submittal.

3.2 Description of Design Deliverables

3.2.1 Design Criteria Package

This DCP should be submitted concurrently with the various design package submittals. This DCP contains criteria for use in the design of the OSDF and support

facilities identified in this document. The DCP should be updated throughout the project as new or additional design criteria or design methods are identified and adopted. Updating should be carried out as described in Section 1.7 of this DCP.

3.2.2 Calculations, Drawings, and Specifications

As discussed in Section 1.2.2 of this DCP, the design deliverables include preliminary, intermediate, prefinal, final, and CFC design packages. Each design package will contain calculations, drawings, and specifications.

Calculations

Calculations should be prepared for the purpose of establishing the design of the OSDF and confirming that the design criteria contained in this DCP are met. Calculations should be prepared as indicated in Section 3.1.3 of this DCP.

Drawings

Drawings should be prepared in a manner that fully and clearly presents the materials and work activities required of the OSDF construction subcontractor to construct, fill, and close the OSDF. Drawings should be prepared as indicated in Section 3.1.4 of this DCP.

Specifications

Specifications should be prepared for the purpose of defining the OSDF construction subcontractor's responsibilities and duties, acceptable materials of construction, and standards for acceptable work. The specifications should address construction, filling, and closure of the OSDF, and construction, operation, and maintenance of appropriate support facilities. The specifications are to be prepared in standard CSI format and should generally contain the sections listed below (note: all second level headings need not be used). Specifications should be prepared as indicated in Section 3.1.5.

PART 1 GENERAL	PART 2 PRODUCTS	PART 3 EXECUTION
Summary	Materials	Examination
References	Manufactured Units	Preparation
Definitions	Equipment	Erection Installation Application
System Description	Components	Field Quality Control
Submittals	Accessories	Adjusting
Quality Assurance	Mixes	Cleaning
Delivery, Storage, and Handling	Fabrication	Demonstration
Project/Site Conditions	Source Quality Control	Protection
Sequencing and Scheduling		Schedules
Warranty		
Maintenance		

3.2.3 Leachate/Liner Compatibility Study Work Plan Report

A *Leachate/Liner Compatibility Study Work Plan* should be developed to describe a proposed leachate/liner compatibility study to be performed in accordance with the requirements of Section 2.4.6 of this DCP. A draft of the work plan should first be submitted to DOE, USEPA, and OEPA for review, comment, and approval. A final work plan should then be prepared and issued. A *Leachate/Liner Compatibility Study Report* should be prepared that contains the results of the leachate/liner compatibility study. The report should describe the work performed to evaluate the durability and chemical compatibility characteristics of the geomembrane liner and final cover system

components of the OSDF. The report should also contain conclusions and recommendations for use in selecting and specifying the geomembrane components of the OSDF.

3.2.4 Soil Liner Test Pad Program Report

A *Soil Liner Test Pad Work Plan* should be prepared to implement the requirements of Section 2.7 of the DCP. The work plan should first be submitted in draft form for DOE, USEPA, and OEPA for review, comment, and approval. A final work plan should then be prepared and issued. The results of the soil liner test pad program should be analyzed and presented in a *Soil Liner Test Pad Program Report*. The report should describe the procedures used in the test pad evaluation, the procedures used to analyze the field and laboratory test data, and the conclusions of the program. The report should contain: (i) recommendations regarding the suitability of the borrow sources for use as clay liner and cap material; (ii) requirements for borrow source processing; and (iii) recommended criteria for clay liner and cap construction.

3.2.5 Soil-Geosynthetic Interface Testing Report

A *Soil-Geosynthetic Interface Testing Work Plan* should be prepared to establish the interface testing needed to establish the OSDF liner system and final cover system design. This work plan should be submitted in draft form for DOE review, comment, and approval. A final work plan should then be prepared and issued. A *Soil-Geosynthetic Interface Testing Report* should be prepared to present the results of the laboratory direct shear testing program to evaluate the shear strengths of soil-geosynthetic and geosynthetic-geosynthetic interfaces that will exist in the OSDF liner and final cover systems. The report should describe the materials tested, the test procedures followed, and the results obtained. The report should also contain conclusions and recommendations on interface shear strengths to use in the design of the OSDF liner and final cover systems.

000182

3.2.6 Project Support Plans

3.2.6.1 Construction Quality Assurance Plan

A *Construction Quality Assurance (CQA) Plan* should be prepared to describe the quality assurance monitoring, testing, documentation, and nonconformance resolution activities that will be undertaken during construction, filling, and closure of the OSDF. The *CQA Plan* should address both material and construction method conformance with the requirements of the specifications, appropriate regulatory requirements and guidance, and good construction practice. It is anticipated that these activities will be undertaken by OSDF A/E quality assurance personnel. The *CQA Plan* should be developed to conform to OEPA requirements (ARAR: OAC 3745-27-08(F)) and to relevant USEPA guidance. The plan should address, at a minimum:

- CQA project organization and personnel qualification requirements;
- documentation requirements;
- conformance surveying;
- soils CQA;
- geosynthetics CQA;
- manholes, pipes, fittings, and valves CQA;
- electrical/mechanical equipment CQA; and
- cast-in-place concrete CQA.

It is noted that OSDF subcontractor construction quality control (CQC) requirements are addressed in the OSDF specifications.

The *CQA Plan* should first be prepared in draft form for DOE, USEPA, and OEPA review, comment, and approval. The draft plan should be submitted with the

OSDF intermediate design package. A final CQA plan should then be prepared and issued with the OSDF prefinal design package.

3.2.6.2 Impacted Material Placement Plan

An *Impacted Materials Placement Plan* should be prepared to describe procedures to be followed by the OSDF construction subcontractor for handling impacted material within the battery limit and placing the material in the OSDF. The plan is intended for use by the OSDF construction subcontractor during construction, filling, and closure of the OSDF. The plan should augment the specifications for impacted material handling and placement. The plan should be developed to provide flexibility to the OSDF construction subcontractor in selecting efficient and cost-effective equipment and material placement procedures.

The *Impacted Materials Placement Plan* should define the following:

- expected types and allowable dimensions of impacted material;
- required preparation procedures and measures for impacted material (with particular attention to procedures required for placement of solid waste, lime sludge, and building debris);
- impacted material handling and transport procedures within the battery limit;
- protection of the liner system and other engineered components of the OSDF;
- impacted material placement procedures and methods;
- procedures for leachate and surface-water control in active cells;
- procedures to control fugitive emissions (primarily dust);
- procedures for seasonal (winter) closure and other short-term closure due to inclement weather;

000181

- quality assurance and quality control procedures for impacted material placement activities (including quality assurance checks that incoming waste meets the waste acceptance criteria (WAC)); and

- documentation and records of impacted material placement.

The *Impacted Materials Placement Plan* should first be prepared in draft form for DOE, USEPA, and OEPA review, comment, and approval. The draft plan should be submitted with the OSDF intermediate design package. A final plan should then be prepared and issued with the OSDF prefinal design package.

3.2.6.3 Impacted Material Quality Assurance Plan

An *Impacted Material Quality Assurance Plan* should be prepared as a stand alone document or as a component to the *Impacted Materials Placement Plan*. It is anticipated that the plan will be implemented by OSDF A/E quality assurance personnel. The plan should address the quality assurance of impacted material placement. The plan should include:

- monitoring and documentation activities to confirm that impacted materials disposed in the OSDF meet the OSDF WAC;

- monitoring and documentation activities to confirm that impacted materials disposed in the OSDF meet physical criteria for such disposal;

- manifesting requirements for impacted materials destined for the OSDF;

- waste acceptance quality assurance personnel qualification requirements; and

- recordkeeping requirements.

The *Impacted Materials Quality Assurance Plan* should first be prepared in draft form for DOE, USEPA, and OEPA review, comment, and approval. The draft plan

should be submitted with the OSDF intermediate design package. A final plan should then be prepared and issued with the OSDF prefinal design package.

3.2.6.4 Surface-Water Management and Erosion Control Plan

A *Surface-Water Management and Erosion Control Plan* should be prepared to describe the procedures to be followed within the battery limit to control stormwater runon and runoff, minimize erosion, and minimize off-site sedimentation. The plan should be prepared for use by the OSDF construction subcontractor during construction, filling, and closure of the OSDF. The plan should be prepared in a manner that allows reasonable flexibility to the OSDF construction subcontractor in managing stormwater at the site.

The *Surface-Water Management and Erosion Control Plan* should address at least the following:

- relevant stormwater management regulatory requirements and standards;
- OSDF design drawings and specifications relevant to stormwater management and erosion and sediment control;
- procedures to be used to manage and control runon from off-site;
- procedures to be used to manage runoff from within the battery limit;
- procedures for erosion and sediment control;
- maintenance practices for sediment basins;
- criteria for installing and removing stormwater control and erosion protection facilities; and
- discharge criteria for water to be released from the battery limit.

000188

The *Surface Water Management and Erosion Control Plan* should first be prepared in draft form for DOE, USEPA, and OEPA review, comment, and approval. The draft plan should be submitted with the OSDF intermediate design package. A final plan should then be prepared and issued with the OSDF prefinal design package.

3.2.6.5 Borrow Area Management and Restoration Plan

A *Borrow Area Management and Restoration Plan* should be prepared to describe the procedures to be followed in developing and restoring the on-site borrow area. The plan is intended for use by the OSDF construction subcontractor during development and restoration of the borrow area. The plan should be prepared to augment the drawings and specifications and should incorporate relevant criteria from this DCP. The plan should cross reference the *Surface Water Management and Erosion Control Plan* for borrow area stormwater management and erosion control requirements and procedures.

The *Borrow Area Management and Restoration Plan* should contain information on at least the following aspects of borrow area development and restoration:

- layout;
- phasing;
- borrow area clearing;
- excavation procedures;
- stormwater management;
- erosion and sediment control;
- removal and management of impacted material (if any);

- stockpiling of topsoil and unsuitable borrow material; and
- borrow area restoration.

The location, layout, and phasing of the on-site borrow area should be shown on the design drawings. Results of field and laboratory testing of materials in the borrow area should be provided and summarized in tabular or graphical form in the plan.

The *Borrow Area Management and Restoration Plan* should first be prepared in draft form for DOE, USEPA, and OEPA review comment, and approval. The draft plan should be submitted with the OSDF intermediate design package. A final plan should then be prepared and issued with the OSDF prefinal design package.

3.2.6.6 Systems Plan

A *Systems Plan* should be prepared to describe the operations, monitoring, and maintenance activities to be performed by the OSDF construction subcontractor during filling and closure of the OSDF, and by the appropriate responsible party after closure. The plan should be prepared to augment the drawings and specifications and should incorporate relevant criteria from this DCP.

The *Systems Plan* should contain operational, monitoring, and maintenance requirements for at least the following OSDF engineered systems:

- leachate collection system;
- leak detection system;
- leachate transmission system;
- electrical/mechanical equipment;
- final cover system; and

- ancillary facilities.

Operational, monitoring, and maintenance requirements for the stormwater management and erosion control systems will be covered in the *Surface Water Management and Erosion Control Plan*. The *System Plan* should cross reference these other requirements. The *Systems Plan* should also describe the response actions to be taken if flows from the leak detection system drain pipe for a cell exceed the action leakage rate (ALR).

The *Systems Plan* should first be prepared in draft form for DOE, USEPA, and OEPA review, comment, and approval. The draft plan should be submitted with the OSDF intermediate design package. A final plan should then be prepared and issued with the OSDF prefinal design package. During construction of the OSDF, the *Systems Plan* should be updated and expanded to contain equipment manuals and operating and maintenance procedures for the specific equipment and systems procured and installed by the OSDF construction subcontractor.

3.2.6.7 Construction Site Safety and Security Plan

A *Construction Site Safety and Security Plan* should be prepared to provide procedures for OSDF construction subcontractor personnel to operate the OSDF in a safe and secure manner. The plan should address requirements for:

- OSDF physical security structures, including fencing and gates;
- OSDF site security procedures, including access control, ID badges, prohibited items, and vehicle searches;
- safety rules and procedures for vehicle operation, electrical and mechanical equipment, tools, and fire prevention equipment;
- emergency procedures;

- contingency planning; and
- communications.

The *Construction Site Safety and Security Plan* should first be prepared in draft form for DOE, USEPA, and OEPA review, comment, and approval. The draft plan should be submitted with the OSDF intermediate design package. A final plan should then be prepared and issued with the OSDF prefinal design package.

3.2.6.8 Air Monitoring Plan

An *Air Monitoring Plan* should be prepared to establish the requirements, and describe the procedures, for monitoring air quality around the OSDF during construction, filling, and closure of the OSDF. The plan should address requirements for:

- air monitoring locations and frequencies;
- air monitoring equipment;
- data interpretation and recordkeeping;
- quality assurance requirements; and
- air monitoring personnel qualification requirements.

The *Air Monitoring Plan* should first be prepared in draft form for DOE, USEPA, and OEPA review, comment, and approval. The draft plan should be submitted with the OSDF intermediate design package. A final plan should then be prepared and issued with the OSDF prefinal design package.

3.2.7 Cost Estimates

A construction cost estimate must be prepared for the OSDF project. The cost estimate should include a detailed breakdown of material and construction quantities and a derivation of estimated unit costs for each element of construction. The unit costs should be presented in units similar to the proposed contract payment basis (e.g., time and material costs estimates should be prepared for items to be paid on a time and material basis). Construction cost estimates should be developed after preparation of the preliminary, prefinal, and final design packages. Cost estimates should also be prepared for implementation of the liner compatibility study and the soil liner test pad program, as described in Sections 2.4.9 and 2.7.7, respectively, of this DCP.

3.2.8 Value Engineering Documentation

The value engineering session results should be documented in a manner that describes which value engineering concepts were incorporated into the design and which were not. Value engineering documentation should be prepared after completion and submittal of the prefinal design package.

3.2.9 Design Documentation

Design documentation should be prepared to document the manner in which the OSDF final design package satisfies all of the design criteria enumerated in this DCP. Design documentation should have an organization consistent with the organization of this DCP. Design documentation should be prepared after completion and submittal of the final design package.

3.2.10 Response Documents

Written responses must be prepared for all formal comments on project deliverables received from DOE and the regulatory agencies (OEPA and USEPA). Response documents are anticipated for the following:

- Design Criteria Package;
- Test Pad Work Plan;
- Liner Compatibility Study Work Plan;
- Preliminary Design Package;
- Intermediate Design Package;
- Prefinal Design Package;
- Final Design Package; and
- Project Work Plans.

APPENDIX A

APPENDIX A

OPERABLE UNIT 2 RECORD OF DECISION (SECTIONS 9 AND 10)

9.0 SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives using the nine criteria, and public comment; DOE and EPA have determined that Alternative 6 is the most appropriate remedy for Operable Unit 2 at the FEMP.

Alternative 6 will be protective of the federal ownership scenario through excavation of all waste materials and soils with COCs above the cleanup levels (presented in Section 9.2), material processing for size reduction and moisture control if required, on-site disposal in an engineered disposal facility, off-site disposal of a small fraction of the excavated material that exceeds the waste acceptance criteria of the on-site disposal facility, and continued federal ownership of the FEMP. The key components of the selected remedy are summarized below.

9.1 KEY COMPONENTS

The selected remedy consists of the following key components:

- Construction of the engineered on-site disposal facility. The on-site disposal facility will be located within the limits of the potentially acceptable region shown on Figure 7-1 and will have at least a 300-foot buffer zone between the waste and the property boundary.

  The on-site disposal facility will be constructed with a composite liner of soil and geosynthetics. The excavated material will be placed on the liner system. The composite cap of soil and geosynthetics will be constructed above the waste and tied-in with the liner system. Construction will also include associated site work and installation of monitoring wells. The composite liner and cap will be as shown on Figure 7-2, or equivalent. The design of the disposal facility is subject to review and approval during remedial design based on additional investigations and the design process.

- Excavation at the Operable Unit 2 subunits to the required depth established by the RI and FS Reports to remove materials with COC concentrations above the cleanup levels (see Section 9.2). Excavation will be performed in such a way as to minimize possible dilution of waste and the concept of ALARA will be documented in the Remedial Action Work Plan and implemented during construction.

- Verification sampling and testing in the excavated area to confirm that material with COC concentrations above the cleanup levels has been removed. If the results of the verification sampling and testing indicate that contamination above cleanup levels remains, then additional excavation and verification sampling and testing will be performed until acceptable results are obtained.

- Segregation of debris (e.g., concrete, steel, pallets, etc.) from Operable Unit 2 subunits and processing for size reduction, if required, before disposal in the on-site disposal facility.

- Collection and treatment of the construction water from the Operable Unit 2 subunits and disposal facility construction areas.

- Establishment of maximum waste acceptance criteria for the on-site disposal of Operable Unit 2 materials. Operable Unit 2 material with concentrations at or below 346 pCi/g of uranium-238 or 1,030 ppm of total uranium will be accepted at the on-site disposal facility.

- Transportation and on-site disposal of excavated material with a concentration at or below 346 pCi/g of uranium-238, or 1,030 ppm of total uranium.

- Transportation and off-site disposal of approximately 3,100 cubic yards of material with a concentration of uranium-238 above 346 pCi/g, or of total uranium above 1,030 ppm.

- Excavation, treatment, and off-site disposal of approximately 300 cubic yards of lead-containing soil from the South Field Firing Range that will be handled as mixed waste.

- Restoration of Operable Unit 2 subunits after excavation and verification sampling and testing. Restoration of the Operable Unit 2 subunits will include grading of the subunits to blend with the surrounding topography, seeding, fencing, and the installation of monitoring wells.

- Institutional controls such as access restrictions (fencing) and groundwater monitoring at the Operable Unit 2 subunits and on-site disposal facility. Monitoring will continue for at least 30 years following closure of the on-site disposal facility. Continued federal ownership of the FEMP is also a key component of the selected remedy.

- Maintenance of the Operable Unit 2 subunits after restoration and maintenance of the on-site disposal facility, including the capping system and leachate collection system. Because this remedy will result in contaminants remaining on site in an engineered disposal facility, a review will be conducted no less often than every five years after the initiation of remedial action in accordance with CERCLA §121(c) to ensure that the remedy continues to provide adequate protection of human health and the environment. This review will continue until determined that it is no longer needed to maintain protectiveness of the disposal facility.

The net present worth cost for the selected remedy based on a construction duration of 51 months and 30 years for operations and maintenance (O&M) after remediation is $105.9 million. This net present worth cost includes $85.9 million for construction and $20.0 million for O&M after remediation. These cost estimates are based on conservative estimates of waste volume. The on-site disposal facility will be constructed in phases to accommodate only that waste which is generated.

Figure 7-1 depicts the proposed feasible location of the on-site disposal facility. Based on a series of soil borings made in the area, the geology of the disposal facility location identified in the figure in combination with the engineering controls will be protective of human health and the environment. However, the disposal facility location is subject to review and approval during the remedial design phase. DOE intends to construct only one disposal facility at the FEMP. Should on-site disposal be selected for other FEMP operable units, the disposal facility capacity and configuration would be adjusted accordingly during the remedial design process to accommodate other FEMP operable unit remediation wastes (that meet the established waste acceptance criteria). DOE will not dispose of any off-site waste in this on-site disposal facility.

9.2 CLEANUP LEVELS

The goals for protecting human health and the environment depend on the contaminated media and the exposure pathways. The exposure pathways are dependent on the future land use designated for the FEMP site. The two land-use scenarios considered in the FS are continuing federal ownership of the FEMP (with restricted access) and the site being used by a farmer with no use limitations. These scenarios represent two extremes of land use; future land use may be similar to either one of these scenarios or may fall between these two scenarios. Corresponding soil cleanup levels have been determined to meet the acceptable risk range (1×10^{-4} to 1×10^{-6} and a HI = 0.2). If found to be necessary, the Operable Unit 5 ROD will modify the Operable Unit 2 cleanup levels downward to ensure protectiveness of human health and the environment.

The cleanup levels for the selected alternative were developed to protect the expanded trespasser under a future land-use scenario of continued federal ownership. A multi-step process was followed to develop the Operable Unit 2 cleanup levels, which were called Preliminary Remediation Levels (PRLs) in the FS/PP. The first step of the process was to develop risk-based Preliminary Remediation Goals (PRGs), which are cleanup levels based on results of the Baseline Risk Assessment that are protective of human health. Risk-based PRGs were then modified based on a number of factors including access controls, such as fencing to keep intruders out, and proposed engineering controls.

The Operable Unit 2 cleanup levels have been divided into primary and secondary cleanup levels, which are presented in Table 9-1 and Table 9-2, respectively. The COCs for the primary cleanup levels contribute over 90 percent of the risk from Operable Unit 2 and over 99 percent of the volumes

TABLE 9-1

OPERABLE UNIT 2 PRIMARY SOIL CLEANUP LEVELS FOR THE SELECTED ALTERNATIVE

Contaminant of Concern (COC)	Units	Background[a]	Cleanup Level[b]	Basis for Cleanup Level
ALL SUBUNITS				
Radium-226	pCi/g	1.42	1.8	10^{-6} ILCR[c]
Radium-228	pCi/g	1.25	2.0	10^{-6} ILCR
Thorium-228	pCi/g	1.43	1.8	10^{-6} ILCR
Thorium-232	pCi/g	1.36	1.5	10^{-6} ILCR
SOLID WASTE LANDFILL				
Uranium-234[g]	pCi/g	1.04	62.9	10^{-6} ILCR
Uranium-235/236[g]	pCi/g	0.15	63.1	10^{-6} ILCR
Uranium-238	pCi/g	1.22	12.9[d]	ARAR[e,f]
Uranium-Total	mg/kg	3.4	38.6	ARAR[f]
LIME SLUDGE POND				
Uranium-234[g]	pCi/g	1.04	196	10^{-6} ILCR
Uranium-235/236[g]	pCi/g	0.15	195	10^{-6} ILCR
Uranium-238	pCi/g	1.22	45.3[d]	ARAR[f]
Uranium-Total	mg/kg	3.4	136	ARAR[f]
INACTIVE FLYASH PILE (WASTE/SOIL OVER THE GREAT MIAMI AQUIFER)				
Arsenic	mg/kg	8.2	16.9	10^{-6} ILCR
Uranium-234[g]	pCi/g	1.04	8.68	10^{-6} ILCR
Uranium-235/236[g]	pCi/g	0.15	7.79	10^{-6} ILCR
Uranium-238[g]	pCi/g	1.12	6.12	10^{-6} ILCR
Uranium-Total[g]	mg/kg	3.4	24.8	ARAR[f]
INACTIVE FLYASH PILE (WASTE/SOIL LOCATED OVER >16 FEET NATURAL SOIL)				
Arsenic	mg/kg	8.2	16.9	10^{-6} ILCR
Uranium-234[g]	pCi/g	1.04	4.24	10^{-6} ILCR
Uranium-235/236[g]	pCi/g	0.15	3.35	10^{-6} ILCR
Uranium-238[g]	pCi/g	1.12	3.22	10^{-6} ILCR
Uranium-Total[g]	mg/kg	3.4	24.8	ARAR[f]
SOUTH FIELD (WASTE/SOIL LOCATED OVER THE GREAT MIAMI AQUIFER)				
Lead[h]	mg/kg	26.4	400	ARAR[i]
Thorium-230[g]	pCi/g	1.97	6.97	ARAR[j]
Uranium-234[g]	pCi/g	1.04	8.68	10^{-6} ILCR
Uranium 235/236[g]	pCi/g	0.15	7.79	10^{-6} ILCR
Uranium-238[g]	pCi/g	1.12	6.12	10^{-6} ILCR
Uranium-Total[g]	mg/kg	3.4	24.8	ARAR[f]

See footnotes at end of table.

TABLE 9-1
(Continued)

Contaminant of Concern (COC)	Units	Background[a]	Cleanup Level[b]	Basis for Cleanup Level
SOUTH FIELD (WASTE/SOIL LOCATED OVER >16 FEET NATURAL SOIL)				
Thorium-230[g]	pCi/g	1.97	6.97	ARAR[j]
Uranium-234[g]	pCi/g	1.04	4.24	10^{-6} ILCR
Uranium 235/236[g]	pCi/g	0.15	3.35	10^{-6} ILCR
Uranium-238[g]	pCi/g	1.12	3.22	10^{-6} ILCR
Uranium-Total[g]	mg/kg	3.4	24.8	ARAR[f]
ACTIVE FLYASH PILE				
Arsenic	mg/kg	8.2	16.9	10^{-6} ILCR
Uranium-234[g]	pCi/g	1.04	8.64	10^{-6} ILCR
Uranium-235/236[g]	pCi/g	0.15	7.75	10^{-6} ILCR
Uranium-238[g]	pCi/g	1.12	6.12	10^{-6} ILCR
Uranium-Total[g]	mg/kg	3.4	28	ARAR[f]

[a]Background value from Operable Unit 2 RI Report, Table 4-1A, surface concentrations.
[b]The cleanup level is the lowest value of the 10^{-6} ILCR, 0.2 Hazard Index, or ARAR standard.
[c]ILCR = incremental lifetime cancer risk. In the case of radionuclides, the cleanup level is the concentration responsible for the incremental risk plus the background concentration.
[d]This value determined by calculating the uranium-238 concentration in uranium-total.
[e]ARAR = applicable or relevant and appropriate requirement
[f]Based on the proposed MCL for uranium (56 Federal Register 33050).
[g]Cleanup level due to off-property resident farmer receptor
[h]The lead cleanup level applies to the Firing Range only, not the entire South Field area.
[i]Based on the EPA "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities" (OSWER Directive 9355.4-12).
[j]Based on DOE Order 5400.5, Chapter IV (4)(a)(2).

Source: Table 2-23, Operable Unit 2 FS Report.

TABLE 9-2

OPERABLE UNIT 2 SECONDARY SOIL CLEANUP LEVELS FOR THE SELECTED ALTERNATIVE

Contaminant of Concern (COC)	Units	Background[a]	Cleanup Level[b]	Basis for Cleanup Level
SOUTH FIELD (WASTE/SOIL LOCATED OVER THE GREAT MIAMI AQUIFER)				
Aroclor-1260[c]	mg/kg	0	25	10^{-6} ILCR[d]
Benzo(a)anthracene	mg/kg	0	0.455	ARAR[e,f]
Benzo(a)pyrene	mg/kg	0	0.777	ARAR[f]
Benzo(b)fluoranthene[c]	mg/kg	0	0.513	ARAR[f]
Benzo(k)fluoranthene	mg/kg	0	0.603	ARAR[f]
Dibenzo(a,h)anthracene[c]	mg/kg	0	0.157	ARAR[f]
Dieldrin	mg/kg	0	0.00957	ARAR[f]
Indeno(1,2,3-cd)pyrene[c]	mg/kg	0	0.496	ARAR[f]
Phenanthrene	mg/kg	0	0.19	ARAR[f]
Technetium-99	pCi/g	0	71	10^{-6} ILCR
Thorium-230[c]	pCi/g	1.97	6.97	ARAR[g]
SOUTH FIELD (WASTE/SOIL LOCATED OVER >16 FEET NATURAL SOIL)				
Aroclor-1260[c]	mg/kg	0	25	10^{-6} ILCR
Benzo(a)anthracene	mg/kg	0	0.455	ARAR[f]
Benzo(a)pyrene	mg/kg	0	0.777	ARAR[f]
Benzo(b)fluoranthene[c]	mg/kg	0	0.513	ARAR[f]
Benzo(k)fluoranthene	mg/kg	0	0.603	ARAR[f]
Dibenzo(a,h)anthracene[c]	mg/kg	0	0.157	ARAR[f]
Dieldrin	mg/kg	0	0.00957	ARAR[f]
Indeno(1,2,3-cd)pyrene[c]	mg/kg	0	0.496	ARAR[f]
Phenanthrene	mg/kg	0	0.19	ARAR[f]
Technetium-99	pCi/g	0	71	10^{-6} ILCR
Thorium-230[c]	pCi/g	1.97	6.97	ARAR[g]
ACTIVE FLYASH PILE				
Neptunium-237	pCi/g	0	4.99	10^{-6} ILCR

[a]Background value from Operable Unit 2 RI Report, Table 4-1A, surface concentrations.
[b]The cleanup level is the lowest value of the 10^{-6} ILCR, 0.2 Hazard Index, or ARAR standard.
[c]Cleanup level due to off-property resident farmer receptor.
[d]ILCR = incremental lifetime cancer risk. In the case of radionuclides, the cleanup level is the concentration responsible for the incremental risk plus the background concentration.
[e]ARAR = applicable or relevant and appropriate requirement
[f]Based on the Ohio Water Quality Standards (OAC 3745-1-07)
[g]Based on DOE Order 5400.5, Chapter IV (4)(a)(2).

Source: Table 2-23, Operable Unit 2 FS Report.

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to be excavated under the selected alternative. The COCs for the secondary cleanup levels pose risks that are close to the 10^{-6} point of departure and contribute a small percentage to the overall risk from Operable Unit 2. Based on existing analytical results from the RI and the volume calculations from the FS, secondary cleanup levels will most likely be achieved by remediation to the primary levels, however, will be confirmed through post-remediation sampling.

10.0 STATUTORY DETERMINATIONS

In accordance with the statutory requirements of Section 121 of CERCLA, as amended, remedial actions taken pursuant to Sections 104 and 106 must satisfy the following:

- Be protective of human health and the environment.
- Comply with all ARARs established under federal and state environmental laws (or justify a waiver).
- Be cost effective.
- Utilize permanent solutions and alternative technologies or recovery technologies to the maximum extent practicable.
- Satisfy the statutory preference for remedies that utilize treatment and also significantly reduce the toxicity, mobility, and volume of the hazardous substances, pollutants, or contaminants.

In addition, CERCLA §121(c) requires five year reviews to determine if adequate protection of human health and the environment is being maintained where remedial actions result in hazardous substances remaining on-site above health-based levels. A discussion is provided below on how the selected response action for Operable Unit 2 satisfies these requirements.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy achieves the requirement of being protective of human health and the environment by removing the sources of contamination and disposing of the excavated material in an engineered on-site disposal facility and a fraction of material at an off-site disposal facility. The on-site disposal facility will utilize engineering design features to prevent human and ecological contact with the contaminated material. The facility will also be designed so that based on current EPA standards and modeling/risk assessment methodologies, it will not pose unacceptable impacts to the Great Miami Aquifer. Baseline cancer risks from current conditions exceed the 10^{-4} to 10^{-6} acceptable risk range established by EPA in the NCP. Under the future land use scenario of continued federal ownership, the residual cancer risk associated with Operable Unit 2 will be reduced to 2.5×10^{-6} which is within the acceptable target risk range. Non-carcinogenic hazards will be reduced to 2.0×10^{-2} which is less than the EPA standard of 1.0.

10.2 COMPLIANCE WITH ARARs

Compliance with the chemical-, action-, and location-specific ARARs is discussed below. Detailed discussion of the principal ARARs and TBCs is presented in Section 7.5. The complete list of applicable requirements, relevant and appropriate requirements, and TBCs is presented in Appendix A.

10.2.1 Chemical-Specific ARARs/TBCs

Alternative 6 will comply with the chemical-specific ARARs/TBCs discussed in Section 7.5.2 and identified in Table A-1 of Appendix A. ARARs associated with penetrating radiation and potential releases of contaminants to air, surface water, and groundwater will be met through the removal of all contaminated material above cleanup levels from Operable Unit 2. Most of this material will be disposed at an on-site disposal facility. Operable Unit 2 remediation waste that does not meet the on-site waste acceptance criteria will be sent to an approved off-site disposal facility.

The engineering controls and institutional actions described earlier for the on-site disposal facility were established for the protection of human health and will ensure that the groundwater MCLs and non-zero MCLGs will be met at the boundary of the disposal facility and at each Operable Unit 2 subunit. Ohio Water Quality Standards will be met at both Paddys Run and the Great Miami River. Air emission and radon protection standards will also be met above the on-site disposal facility and each subunit.

Although ARARs are not pertinent to the no action alternative, the FS compared the fate and transport modeling results for the No Action Alternative (Alternative 1) to the chemical-specific ARARs in order to establish a baseline against which the "action alternatives" could be compared to demonstrate compliance. The South Field was the only subunit that would exceed the surface water ARARs for the No Action Alternative. Under Alternative 6, the selected remedial alternative, the concentrations of dieldrin and polynuclear aromatic hydrocarbons (PAHs) at Paddys Run will be equal to the ARAR standards of 7.6×10^{-4} microgram/liter (μg/L) and 0.31 μg/L, respectively. The concentrations at the Great Miami River will be 9.8×10^{-7} μg/L for dieldrin (below the 7.6×10^{-4} μg/L standard) and 4.1×10^{-4} μg/L for PAHs (below the 0.31 μg/L standard). These concentrations are for the expanded trespasser scenario, which will have higher soil cleanup levels than the on-property resident farmer scenario. Therefore, since the expanded trespasser scenario will meet the ARAR standards, the on-property farmer scenario will meet them also.

Table 10-1 illustrates that on-site disposal also brings Operable Unit 2 into compliance with the proposed groundwater MCL for uranium, which would not be met under the No Action Alternative. The maximum groundwater concentration is presented in the table (underneath subunit); therefore, the points of compliance, which are at the boundaries of the subunit and the on-site disposal facility, will also comply with the proposed uranium MCL. Treated construction water will meet the Ohio Water Quality Standards found in Table A-1 of Appendix A.

TABLE 10-1

COMPLIANCE WITH OPERABLE UNIT 2 CHEMICAL-SPECIFIC ARARs

ALTERNATIVE 6

MAXIMUM CROSS-MEDIA GROUNDWATER CONCENTRATIONS[a]							
COC	ARAR Standard	Point of Compliance	Solid Waste Landfill	Lime Sludge Ponds	Inactive Flyash Pile/South Field	Active Flyash Pile	On-Site Disposal Facility
Total Uranium	20 μg/L[b]	Under Subunit	18 μg/L	3.2 μg/L	18.4 μg/L	10.7 μg/L	20 μg/L
		FEMP Fenceline	0.7 μg/L	0.1 μg/L	2.2 μg/L	1.5 μg/L	2.1 μg/L

[a] These concentrations are for the expanded trespasser scenario, which will have higher soil cleanup levels than the on-property resident farmer. Therefore, since the expanded trespasser scenario will meet the ARAR standards, the on-property resident farmer scenario will meet them also. The groundwater modeling procedures and results are presented in detail in the FS Report, Appendix D.
[b] Proposed MCL (56 Federal Register 33050)

10.2.2 Action-Specific ARARs/TBCs

Alternative 6 will meet the principal action-specific ARARs/TBCs discussed in Section 7.5.3 and listed in Tables A-2, A-3, and A-4 of Appendix A. Because Operable Unit 2 includes both low-level radioactive waste/residual radioactive material and solid waste, design and construction of the on-site disposal facility will meet the more stringent requirements for the disposal of low-level radioactive waste/residual radioactive material. EPA states in 40 CFR §192.02(a) that the disposal facility must be designed to be effective for up to 1,000 years, to the extent reasonably achievable, and in any case, for at least 200 years. DOE Order 5820.2A requires compliance with performance objectives for low-level radioactive waste disposal sites, including protection of public health and safety, protection of the public and the environment from releases of radioactivity, and protection of groundwater resources. DOE Order 5400.5 requires that the As Low As Reasonably Achievable (ALARA) policy to minimize radiation exposure be adopted during design and construction.

The on-site disposal facility will also meet the less stringent OEPA technical requirements for the disposal of solid waste. These requirements include specifications for the design and construction of a liner and cap system for the on-site disposal facility. Material with contaminant levels that are below the cleanup levels will be left in place.

Material from the South Field Firing Range is assumed to be mixed waste and will be treated and shipped to an off-site disposal facility that is approved to accept mixed waste. Firing Range material that is hazardous waste must comply with the storage, packaging, and transportation requirements of the Resource, Conservation, and Recovery Act (RCRA), including the manifest system, while it is being prepared and shipped from the FEMP. Packaging and transportation of the Firing Range wastes will also be required to meet DOE requirements for the transport of hazardous materials. Firing Range material that is not a hazardous waste, but contains COCs above the cleanup levels, will be disposed of on-site with the rest of the South Field low-level radioactive waste/residual radioactive material.

10.2.3 Location-Specific ARARs/TBCs

Alternative 6 will not meet all the location-specific ARARs/TBCs discussed in Section 7.5.4 or in Table A-5 of Appendix A. Because the on-site disposal facility will contain solid waste in addition to low-level radioactive waste/residual radioactive material, the following OEPA siting criteria from the Ohio Solid Waste Disposal Regulations are pertinent ARARs. OAC 3745-27-07 and -20 lists the following areas where a solid waste disposal facility may not be located:

- in 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 five years;
- above an aquifer declared by the Federal government under the Safe Drinking Water Act to be a sole source aquifer;
- 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;
- in a regulatory floodplain;
- within 1,000 feet of an existing water supply well or developed spring;
- within 300 feet of the facility's property line;

- within 1,000 feet of an existing residence whose owner has not consented in writing to the location of the facility;
- within 200 feet of a stream, lake, or wetland;
- the isolation distance between the uppermost aquifer system and the bottom of the recompacted soil liner of the disposal facility cannot be less than 15 feet of in situ or added geologic material.

The proposed feasible location of the on-site disposal facility is on the eastern side of the FEMP which is not in a floodplain; near a stream, lake, or wetland; within 1,000 feet of an existing water supply well or developed spring; near enough to an existing public water supply well so that contaminants may reach the well within a period of 5 years. The facility will not be placed within 300 feet of the FEMP property line or within 1,000 feet of an existing residential house. The isolation distance between the uppermost aquifer system and the bottom of the recompacted soil liner will be greater than 15 feet.

The remaining two siting criteria (bullets two and three) cannot be met because of the FEMP's location over a sole-source aquifer that is capable of sustaining a yield of 100 gallons per minute for a 24-hour period. OEPA has established two specific policies (GD202.101 and GD202.102) that identify conditions that would be acceptable to allow an exemption to the siting criteria. While these policies state that several factors will be considered in evaluating an exemption, the specific factors identified indicate that the protection of human health and the environment should be provided solely by the existing hydrogeologic conditions. This has been reaffirmed by OEPA in several meetings.

The primary hydrogeologic standards established by these policies are:

- Significant thickness of low permeable material between the disposal facility and the aquifer
- Lack of inter-connection between the sole-source aquifer and any significant zones of saturation
- Significant amount of sediment [soil] between the disposal facility and the high-yield aquifer to prevent leachate from migrating to the high-yield aquifer during the life of the landfill and the post-closure care period. The post-closure care period for a solid waste landfill is a minimum of 30 years [OAC 3745-17-14(A)].

It has been determined, based on existing hydrogeologic information, that the existing hydrogeologic conditions at the FEMP do not fully meet these conditions. This is based on the possibility that some granular soils are interbedded in the till and the need to protect the aquifer for significantly longer than 30 years (at least for 200 years; an ARAR under 40 CFR 192).

Because the aquifer underlies the entire site, a waiver was requested to locate an on-site disposal facility on the FEMP. The waiver request was based on the ability of the selected remedial action, through the use of another method or approach, to attain a standard of performance that is equivalent to that required by the ARARs. The criteria in determining a CERCLA ARAR waiver based on an equivalent standard of performance [40 CFR 300.430 (f)(1)(ii)(C)(4)] are: degree of protection, level of performance, reliability into the future, and time required for results. Additional information on the OEPA requirements is presented in Section 7.5.4.

The preamble to the NCP states that the purpose of this waiver is for the use of alternative but equivalent technologies and comparison based on risk is only permitted where the original standard is risk-based. The Ohio exemption guidance, with its focus on geological conditions, is for the most part analogous to a technology standard but also appears to be, with respect to level of performance, risk and technology based. Therefore the following analysis of the CERCLA waiver criteria uses a technology-based comparison, except for level of performance, which is a risk-based comparison. The circumstances of the selected alternative are considered equivalent to the OEPA requirements and thereby warrant the granting of a CERCLA ARAR waiver. The basis for equivalency is identified for each of the identified criteria:

Degree of protection:

- OEPA Standard

  The justification to allow a solid waste landfill over a high-yield sole-source aquifer is that the existing hydrogeology will provide adequate protection to the high yield sole source aquifer from the effects of a release of leachate and thereby protect the aquifer from contamination. The approach spelled out by the pertinent policies is to prevent leachate from reaching the aquifer during the active life of the landfill and the post closure period of 30 years. The active life of the disposal facility for Operable Unit 2 wastes is estimated to be 4.25 years. It should be noted that if future operable unit decisions direct disposal of other wastes in the on-site disposal facility, the maximum active life could be approximately 20 years.

- Equivalent Standard

  The combination of engineering controls and existing hydrogeology proposed in this alternative will provide the same degree of protection to the aquifer as the hydrogeologic conditions described in the OEPA policy alone. Modeling with the combined controls shows that the leachate will not reach the aquifer during the active life of the landfill and a post closure period of thirty years.

  It should be noted that the modeling performed in the Operable Unit 2 FS Report (Appendix D.1) was performed for 1000 years and assumed that the liner system and man-made materials (e.g., leachate collection, leak detection, and synthetic liners) of the disposal facility would fail. This modeling showed that with the enhanced cap to reduce infiltration and the existing hydrogeology, leachate that may eventually reach the aquifer would not cause the constituent concentrations in the aquifer to exceed the promulgated and proposed MCLs.

Level of performance (method based):

- OEPA Standard

  Significant thickness of low permeable material between the disposal facility and the aquifer

- Equivalent Standard

  Modeling has shown that the combination of 12 feet of gray clay with a minimum k_d of 3.1 and a maximum waste acceptance criteria of 346 pCi/g of uranium-238, or 1,030 ppm total uranium, will not exceed the proposed MCL for total uranium at the boundary of the disposal facility or a concentration level based on the 10^{-6} ILCR at the boundary of the FEMP. Only the layers in the engineered cap and the gray clay and unsaturated Great Miami Aquiferhydrogeologic layers were used in this modeling. The liner system and brown clay will increase the protection of the aquifer.

- OEPA Standard

  Lack of inter-connection between the sole source aquifer and any significant zones of saturation

- Equivalent Standard

  Any inter-connections will be minimized by:

  1) locating the disposal facility in an area with the greatest thickness of gray clay and the least occurrence of interbedded granular material; and

  2) providing an increase in the engineered controls to compensate for any reduction of protection due to interbedded granular material; and/or

3) providing engineering control of lateral movement of water in an area of interbedded granular material by removing the granular material affecting the geologic protection of the aquifer or by preventing the movement of water from these areas to the aquifer.

- OEPA Standard

  Significant amount of sediment [soil] must exist between the disposal facility and the high-yield aquifer to prevent leachate from migrating to the high yield aquifer during the life of the landfill and the post-closure care period. The post-closure care period for a solid waste landfill is a minimum of 30 years [OAC 3745-27-14(A)].

- Equivalent Standard

  At a minimum, a total of four additional layers will be added to the standard solid waste cap and liner [OAC 3745-27-08(C)]. These layers are a sand filter, biotic barrier and bentonite composite layers in the cap to reduce infiltration and to protect the integrity of the cap. A leak detection layer will be provided in the liner to monitor the integrity of the containment system and to provide early warning to allow corrective action prior to any adverse impact to the aquifer. These additional engineering controls together with the natural hydrogeology will prevent leachate from reaching the aquifer during the post-closure care period.

Level of performance (risk based):

- OEPA Standard

  ORC 3734.02(G) allows exemptions of OEPA regulations if an alternative is unlikely to adversely affect the public health or safety or the environment. The pertinent policies mirror this requirement using an approach which requires existing hydrogeologic conditions to provide this protection.

  OEPA does not propose a specific definition for the protection of human health and the environment. However, OAC 3745-27-10 (F)(7)(a)-(d), which specifies solid waste landfill operating requirements, sets forth concentration levels for constituents detected in the groundwater for which a corrective action is required. This standard provides an appropriate framework for risk analysis in this case because the waiver concerns the establishment of a solid waste disposal unit. These levels are concentrations that are at a statistically significant level to be:

  - protective of human health and the environment; and
  - the promulgated MCL; or
  - background concentrations for constituents that do not have a promulgated MCL; or
  - the alternative groundwater protection standard for a known or suspected carcinogen, concentration levels that represent a cumulative excess upper-bound lifetime cancer risk to an individual within the 1×10^{-4} to 1×10^{-6} range.

- Equivalent Standard

  This same definition has been used as a threshold criteria in evaluating alternatives in the CERCLA decision making process at the FEMP and specifically in the Operable Unit 2 FS with the addition that constituents in groundwater should not be higher than the proposed MCLs. This alternative meets this threshold criteria.

  Protection of human health has been determined through the risk assessment process based on contaminant transport modeling and the NCP acceptable ILCR range of $1x10^{-4}$ to $1x10^{-6}$ and in compliance with promulgated and proposed MCLs.

Reliability into the future:

The combination of hydrogeologic and engineering controls (including additional controls beyond the requirements for a solid waste disposal facility) provides increased reliability into the future because of the following:

- The biotic barrier in the cap will prevent burrowing animals or vegetative roots from compromising the integrity of the cap and thereby increasing the infiltration.
- Leak detection monitoring will provide an early warning of any problem in leachate containment and allow corrective measures to be undertaken prior to adverse impact to the aquifer.

Time required for results:

Construction of a disposal facility with additional engineering controls will not take significantly longer than the time required for a disposal facility which strictly meets the Ohio Solid Waste Disposal Regulations.

A CERCLA ARAR waiver of the OEPA prohibition of siting a disposal facility over a high-yield sole-source aquifer is justified based on an equivalent standard of performance [40 CFR 300.430 (f)(1)(ii)(C)(4)] to the OEPA policies allowing an exemption to the siting requirements. This waiver is applicable only to Operable Unit 2 on-site remediation wastes. If on-site disposal is chosen as the selected remedy for other FEMP operable units, separate waivers from this Ohio requirement would be necessary.

The disposal facility location and design will be subject to review and approval during the remedial design phase. DOE intends to construct only one disposal facility at the FEMP. Therefore, should

on-site disposal be selected for other Fernald operable units, the disposal facility capacity and location would be adjusted accordingly during the remedial design process.

There is a 0.2 acre area of wetlands located to the north of the Solid Waste Landfill that will be adversely impacted during the removal of contaminated material. Operable Unit 2 will comply with the substantive permitting requirements for impacts to wetlands under the Clean Water Act (33 CFR §§ 323-330). Compensatory mitigation for wetlands impacted by Operable Unit 2 activities will be determined using 404(b)(1) [33 United States Code (U.S.C.) §1344(b)(1)] guidelines of the Clean Water Act in consultation with the U.S. Army Corp of Engineers, EPA, and OEPA. The Inactive Flyash Pile and a portion of the South Field are located in the 100-year floodplain of Paddys Run. Under this alternative, no adverse impacts to the floodplain are expected.

10.3 COST EFFECTIVENESS

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its costs, the net present worth value being $105.9 million. The estimated cost of on-site disposal is $36.3 million more than consolidation and capping and will provide greater long-term effectiveness and permanence than consolidation and capping through the use of an engineered disposal facility with liners and leachate detection and collection devices. While the selected remedy effectively reduces the hazards posed by all the contaminants of concern in Operable Unit 2, its cost is about one half of the cost of excavation and off-site disposal of contaminated material.

10.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

EPA and the State of Ohio have determined that the selected remedy for Operable Unit 2 represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for Operable Unit 2. Of those alternatives that are protective of human health and the environment and comply with ARARs, this selected remedy provides the best balance of tradeoffs among the alternatives in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, short-term effectiveness, implementability, and cost, also considering State and community acceptance.

While the selected remedy does not offer as high a degree of long-term effectiveness and permanence as the off-site disposal alternative, it will significantly reduce the risks from the contaminated material

through excavation and placement in an engineered on-site disposal facility. By combining all the remediation waste into one disposal location, it can be managed more effectively over the long-term. The selected remedy also allows increased flexibility in land use options, a reduced size of buffer area, and centralized operations and maintenance.

The selected remedy does not provide a significant reduction of toxicity, mobility, or volume through treatment. Treatment of leachate and construction water will take place at the on-site AWWT facility and lead-contaminated mixed waste from the South Field Firing Range will be treated before being transported to an off-site disposal facility. Except for the no action alternative, each alternative includes the same amount of treatment.

The selected remedy provides adequate short-term effectiveness and is readily implementable. Because the majority of the waste material will remain on site during remediation, there is very little opportunity for public exposure to the contaminants. The exposure potential to remediation workers will be managed in accordance with a health and safety plan and is, therefore, considered acceptable. The on-site disposal alternative is considered to provide more short-term effectiveness and is more implementable than off-site disposal, but slightly less implementable than consolidation and containment. The selected remedy costs slightly more than consolidation and containment and is half the cost of off-site disposal.

The major tradeoffs that provide the basis for the selection of on-site disposal with off-site disposal of the fraction exceeding the waste acceptance criteria are long-term effectiveness and cost. The selected remedy provides the most reliable method of managing and monitoring the disposal of Operable Unit 2 contaminated material for the least cost. For this reason, Alternative 6 is determined to be the most appropriate remedy for the contaminated material from Operable Unit 2.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy does not satisfy the statutory preference for treatment as a principal element. The NCP states in 40 CFR §300.430(a)(iii)(A) and (B) that "EPA expects to use treatment to address the principal threats posed by a site" and "to use engineering controls, such as containment, for waste that poses a relatively low long-term threat." Operable Unit 2 wastes are considered to pose a low long-term threat in all subunits except a portion of the waste in the Inactive Flyash Pile and South Field. This waste is considered a principal threat due to the placement of the waste and the

vulnerable hydrogeology (sole-source Great Miami Aquifer) located underneath, not due to the concentrations or types of contamination. When this waste is excavated during the implementation of the selected remedy, it will no longer be a principal threat to the site, and, under the NCP, is not expected to undergo treatment.

10.6 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Natural resources at the FEMP site will be disturbed by construction and excavation activities. Many impacts will be temporary, pending completion of remedial activities. The implementation of the Operable Unit 2 remedy will disturb 75 acres of FEMP soils including areas of riparian, aquatic and managed grassland habitats. All areas impacted by excavation activities will be regraded to the surrounding grade and revegetated. However, implementation of the remedy will also result in permanent commitments.

Implementation of the selected remedy will result in the commitment of 49 acres introduced grassland/leased pasture habitat, 8.3 acres early/mid-successional and riparian woodland habitat, and 0.65 acres drainage-ditch wetland habitat. Long-term impacts will also occur from the implementation of an on-property borrow area. If this area is selected for borrow, approximately 17 acres of woodlands and associated species will be committed. In addition, 3.0 acres of swale/forested wetland and associated habitat could also be committed as a result of on-site borrow activity.

The introduced grassland/leased pasture areas are generally inhabited by small mammals and several species of birds. Early/mid-successional and riparian woodlands are dominated by white ash (*Fraxinus americana*) and American elm (*Ulmus americana*). Typical pioneer successional species such as Japanese honeysuckle (*Lonicera japonica*), blackberry (*Rubus sp.*), and multiflora rose (*Rosa multiflora*) are also present. Habitat exists in the riparian areas for the Federally-listed endangered Indiana bat (*Myotis sodalis*).

Several taxa are primarily found only in the riparian area. Two of the most common taxa include the belted kingfisher (*Megaceryle alcyon*) and blue jay (*Cyanocitta cristata*). Based on incidental observations, Facemire *et al.*, (1990) also reported typical woodland amphibians and reptiles such as the eastern box turtle (*Terrapene carolina*), spring peeper (*Hyla crucifer*), and American toad (*Bufo americanus*). Common bats in the riparian area including the big brown bat (*Eptesicus fuscus*), red bat (*Lasiurus borealis*), and the little brown bat (*Myotis lucifugus*).

Aquatic habitats to be disturbed include wetlands, Paddys Run, and the Storm Sewer Outfall Ditch. On-property drainage ditch/swales support shrub and/or emergent vegetation. Broad-leaf cattail (*Typha latifolia*) is the most common species. Numerous woody species in swales include black willow (*Salix nigra*), roughleaf dogwood, and American elm. Surveys found state-listed threatened Sloan's crayfish (*Orconectes sloanii*) residing in Paddys Run (St. John 1993 and 1994). Paddys Run also supports a diverse community of macroinvertebrates and fish. Habitat in the Storm Sewer Outfall Ditch is minimal, as the ditch is dry most of the year.

The 100- and 500-year floodplain of Paddys Run will be directly and indirectly impacted as a result of remedial activities. Limited excavation in the floodplain will occur during remedial activities at the flyash piles and South Field; however, changes in flood elevations are not be expected. Engineering controls will be implemented to minimize indirect impacts (i.e., runoff and sedimentation). Activities performed in the Storm Sewer Outfall Ditch will be in accordance with 404 guidelines of the Clean Water Act. A Floodplain/Wetland Assessment was completed and is provided in Appendix H to the Operable Unit 2 FS Report.

Additionally, consumptive use of geologic resources (e.g., quarried rock, sand, and gravel) and petroleum products (e.g., diesel fuel and gasoline) will be required for removal, construction, and disposal activities. Supplies of these materials will be provided by the construction contractor. Additional fuel use will result from limited off-site transport of the materials. Adequate supplies will be available without affecting local requirements for these products. The treatment processes for the remedial action alternative will require the consumptive use of materials and energy. The stabilization process will require additives such as flyash and lime sludge, which are readily available at the FEMP site.

Approximately 35 acres of the FEMP site, including a 300-foot buffer zone, will be restricted for future use under the Operable Unit 2 selected remedial alternative. The committed land will be actively monitored and maintained. Periodic monitoring of surface water and groundwater at the disposal facility will be performed, and periodic site inspections will identify any damage to the disposal facility. Maintenance activities will be performed, as necessary. The off-site facility (for remediation waste exceeding the on-site waste acceptance criteria) is expected to implement similar measures as required under its specific regulatory criteria.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The *Proposed Plan for Remedial Actions at Operable Unit 2* was released for public comment in October 1994. The Proposed Plan identified Alternative 6, Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding the Waste Acceptance Criteria, as the preferred alternative. All written and oral comments submitted during the public comment period were reviewed. Based on these comments, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

One significant change from the Proposed Plan to this ROD, is a change in the maximum waste acceptance criteria for the on-site disposal facility. The Proposed Plan provided a waste acceptance criteria of 360 pCi/g of uranium-238 and 1,080 ppm of total uranium. A waste acceptance criteria of 346 pCi/g of uranium-238 and 1,030 ppm of total uranium was proposed in the Operable Unit 5 Proposed Plan. This difference in waste acceptance criteria is due to using different, but comparable, computer models for the calculations. The Operable Unit 2 and Operable Unit 5 waste acceptance criteria are essentially the same, however for consistency, Operable Unit 2 has adopted the Operable Unit 5 waste acceptance criteria of 346 pCi/g uranium-238 and 1,030 ppm total uranium. This significant change has been reflected in this ROD.

It should be noted that EPA and OEPA approved the Operable Unit 2 FS Report with comments prior to the public comment period for Operable Unit 2. The Operable Unit 2 FS Report was revised to address the comments from EPA and OEPA. Those comments, and DOE's proposed responses and revisions, were made known to the public and made available for public review during the public comment period; the comments did not result in significant changes or changes that could not be reasonably anticipated by the public.

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APPENDIX B

APPENDIX B

DRAFT DETAILED FACILITY DESCRIPTION/FUNCTIONAL REQUIREMENTS

ON-SITE DISPOSAL FACILITY

DETAILED FACILITY DESCRIPTION/FUNCTIONAL REQUIREMENTS

PRELIMINARY
OCT 17, 1995

TABLE OF CONTENTS

Table of Contents i

List of Figures iii

List of Acronyms iv

1.0 Introduction and Background 1-1

2.0 Document Scope 2-1

3.0 General Functional Requirements 3-1

4.0 Regulatory Requirements 4-1

5.0 Nuclear Safety and Radiation Protection 5-1

6.0 Specific Functional Requirements 6-1

6.1 Primary Components 6-1
6.1.1 Liner System 6-1
6.1.1.1 Site Preparation 6-2
6.1.2 Leachate Collection/Management 6-2
6.1.3 Leak Detection 6-3
6.1.4 Liner Compatibility Study 6-3

6.2 Material Placement 6-3

6.3 Capping System 6-4
6.3.1 Interim and Partial Closure 6-4

6.4 Borrow Material for Liner/Cap Soil Barrier Layer and Vegetative Zone 6-5

6.5 Surface Water Management 6-5
6.5.1 Perimeter Drainage 6-5
6.5.2 Management of Stormwater during Construction 6-6
6.5.3 Stormwater Management within Facility during Placement Activities Prior to Closure 6-6
6.5.4 Stormwater Management After Closure (Partial or Final) 6-6

6.6 Support Elements 6-6
6.6.1 Staging Area 6-6
6.6.2 Perimeter Security Fencing/Temporary Fencing 6-7

6.7 Utilities 6-7
6.7.1 Utilities to Support Disposal Facility 6-7

6.7.2 Relocation of Existing Utilities 6-9

6.8 Support Facilities for the OSDF 6-9
6.8.1 Administrative Support 6-9
6.8.2 Personnel Contaminant Reductional During Placement Activities 6-10
6.8.3 Equipment Maintenance 6-10
6.8.4 Equipment Decontamination 6-10

6.9 Related Activities 6-10
6.9.1 Test Pad Program 6-10
6.9.2 Monitoring Well Closure 6-11
6.9.3 Monitoring Well Installation 6-11
6.9.4 Radiation Monitoring System Relocation 6-11
6.9.5 Air Monitoring System 6-11

6.10 Roadways 6-11
6.10.1 Haul Roads 6-11
6.10.2 North Entrance Road 6-12

6.11 Waste Liquid Conveyance System 6-12
6.11.1 Pipelines 6-12
6.11.2 Leak Detection System/High Level Alarm 6-13
6.11.3 Pump system 6-13
6.11.4 Flow Meter 6-14

7.0 Reference Materials 7-1

8.0 Project Milestones 8-1

LIST OF ACRONYMS AND ABBREVIATIONS

ACI	American Concrete Institute
ADT	Average Daily Traffic
A/E	Architect/Engineer
ALARA	As Low as Reasonably Achievable
ANSI	American National Standards Index
ARAR	Applicable or Relevant and Appropriate Requirement
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWWT	Advanced Wastewater Treatment
BA	Borrow Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFC	Certified For Construction
CFR	Code of Federal Regulations
cm/sec	centimeters per second
COCs	Contaminant Of Concern
COE	U.S. Army Corps of Engineers
CY	Calendar Year
DF	Disposal Facility
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Company
FRLs	Final Remediation Levels
NAD	North American Datum
NEC	National Electrical Code
OEPA	Ohio Environmental Protection Agency
OSDP	On-Site Disposal Facility
OU2	Operable Unit 2
RCRA	Resource Conservation and Recovery Act
ROD	Record Of Decision
SOW	Statement Of Work
WAC	Waste Acceptance Criteria

1.0 INTRODUCTION AND BACKGROUND

This document presents detailed information in support of the conceptual design for the On -Site Disposal Facility (OSDF) and presents the facility's functional requirements. This document presents that information necessary for inclusion in a Functional Requirements Document pursuant to FERMCO Engineering Procedure No. 12-4001, Revision D. Functional requirements are the fundamental technical criteria and design requirements necessary to develop facility design.

The Fernald Environmental Management Project (FEMP) is a 1,050 acre Department of Energy (DOE) facility located in southwestern Ohio approximately 18 miles northwest of downtown Cincinnati, Ohio. An aboveground, engineered disposal facility for low level radioactive and Resource Conservation and Recovery Act (RCRA) wastes is to be constructed within the boundaries of the FEMP.

The OSDF is a component of the selected remedy for Operable Unit 2, the preferred remedial alternative for Operable Unit 5, and the leading remedial alternative for Operable Unit 3.

2.0 DOCUMENT SCOPE

The functional requirements identified in this document cover the OSDF, relocated entrance road, haul road, leachate conveyance system, and utility support to the OSDF. This disposal facility will encapsulate impacted soil and debris with contamination levels below the waste acceptance criteria (WAC) from operable units at the FEMP.

3.0 GENERAL FUNCTIONAL REQUIREMENTS

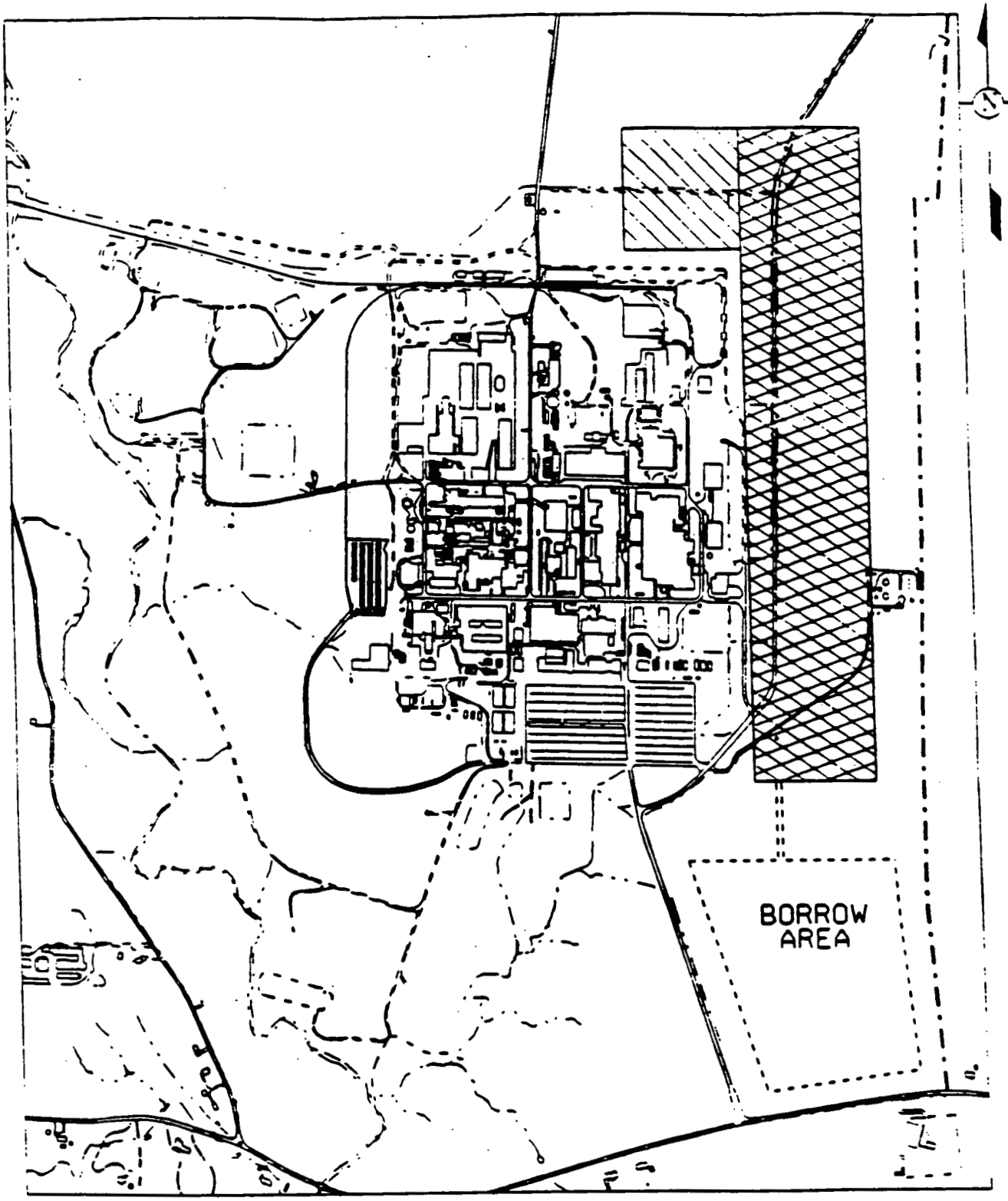
Approximately 2.5 million cubic yards (bank/unbulked) of material will be removed from Operable Units 2, 3, and 5 during remediation activities and will be placed in the OSDF for ultimate disposal. The majority of the material to be placed in the facility will be native soil and building materials impacted with radionuclides.

The design life for the OSDF will be at least 200 years with continued effectiveness for up to 1000 years to the extent practical and reasonably achievable. The design life of specific OSDF components will be determined using a graded approach based on the repairability/maintainability of the component, the consequences of failure to that component, and the ability to reasonably determine or extrapolate the design life of a specific component based on existing data, information and calculation methods. The facility will remain under perpetual Federal control with active maintenance; however, maintenance requirements are to be minimized in the engineering design of the facility.

For planning purposes, it is assumed that the remediation activities will be completed over a 10 year period. Depending on availability of funding, the implementation period could be reduced to seven years or expanded to 25 years or more.

The facility will be sited in an area within the FEMP property limits that has geology which is accepted as being protective of the underlying Great Miami Aquifer. A siting study has been conducted to delineate the most appropriate location. The siting is dependent on the most environmentally protective geology. The site selection and geometric configuration have been chosen to minimize impacts to the environment as well as minimizing settlement within the substrata. The Fate and Transport Model indicates that a minimum of 12 feet of native gray clay provides adequate protection of the Great Miami Aquifer from potential leachate from the facility. The preferred site is an area approximately 800 feet wide and 3700 feet in length located east of the former Production Area. This site is indicated on Figure 1.

The facility will be designed to provide long-term protection from migration of constituents of concern (COCs). A conceptual design for this facility is presented in Appendix E.3 of the Operable Unit 2 Feasibility Study (FS), and Sections 7 and 9 of the Final Record of Decision (ROD) for Remedial Actions At Operable Unit 2. The Waste acceptance criteria (WAC) for this facility have been determined so that the proposed engineered capping and liner system, coupled with the existing geology, will provide adequate protection to human health and the environment. The siting and design will ensure that the



LEGEND:

FEMP BOUNDARY
PREFERRED SITE
POTENTIAL EXPANSION AREA

SCALE

1000 500 0 1000 FEET

000226

FIGURE 1: PREFERRED SITE
OF DISPOSAL FACILITY

contents of the facility will pose no unacceptable risks to potential human and environmental receptors. The conceptual design for the capping and liner systems of the OSDF is shown in Figure 2. A conceptual cross-section is presented in Figure 3.

To accommodate construction of the OSDF, the FEMP north entrance road will be relocated. The north entrance road will be a permanent facility and soil above the final remediation levels will be removed from the vicinity of the road prior to its construction. The road will be a two lane, undivided road with shoulders on each side. Each lane will be 12 feet wide and each shoulder 5 feet wide. It will be an asphalt paved road with gravel shoulders having a 3 percent cross-slope. The design speed is 30 mph. The borrow material from south of the former production area will be used at the OSDF site, so hauling trucks will cross southern portions of the proposed north entrance road at two locations and also the south entrance road at one location. The use of lighted traffic signals will be investigated and, if applicable, included in the design.

A haul road will be constructed to bring OU2 waste materials and impacted soils and debris to the OSDF. The haul road will be located in the contaminated area to transport about 300,000 cu. yd. of waste material from within the operable units to the OSDF. The road will be a two lane, asphalt paved, undivided road with shoulders on each side. A typical section of the road consists of two 12-foot lanes and a 5 ft shoulder on each side.

Leachate and collected stormwater from the active and closed portions of the On-Site Disposal Facility OSDF will be collected at a sump at the southwest corner of the OSDF. The waste liquid will be pumped from the disposal facility collection sump to the treatment/disposal in a buried, double-contained pipeline. The design life of the waste liquid transfer system shall be 200 years. The system shall accommodate the maximum and minimum flow rates expected during and after capping of the OSDF.

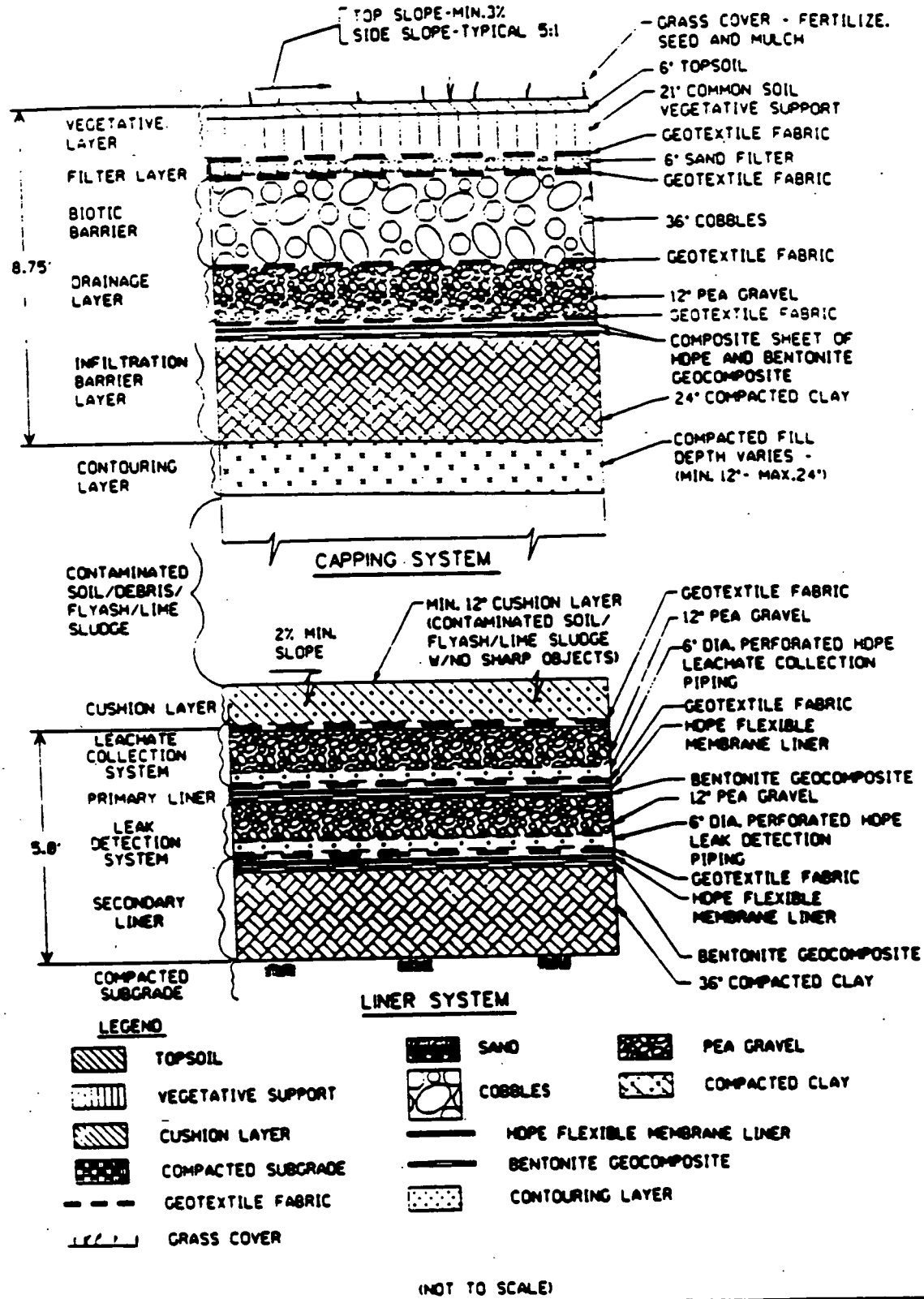
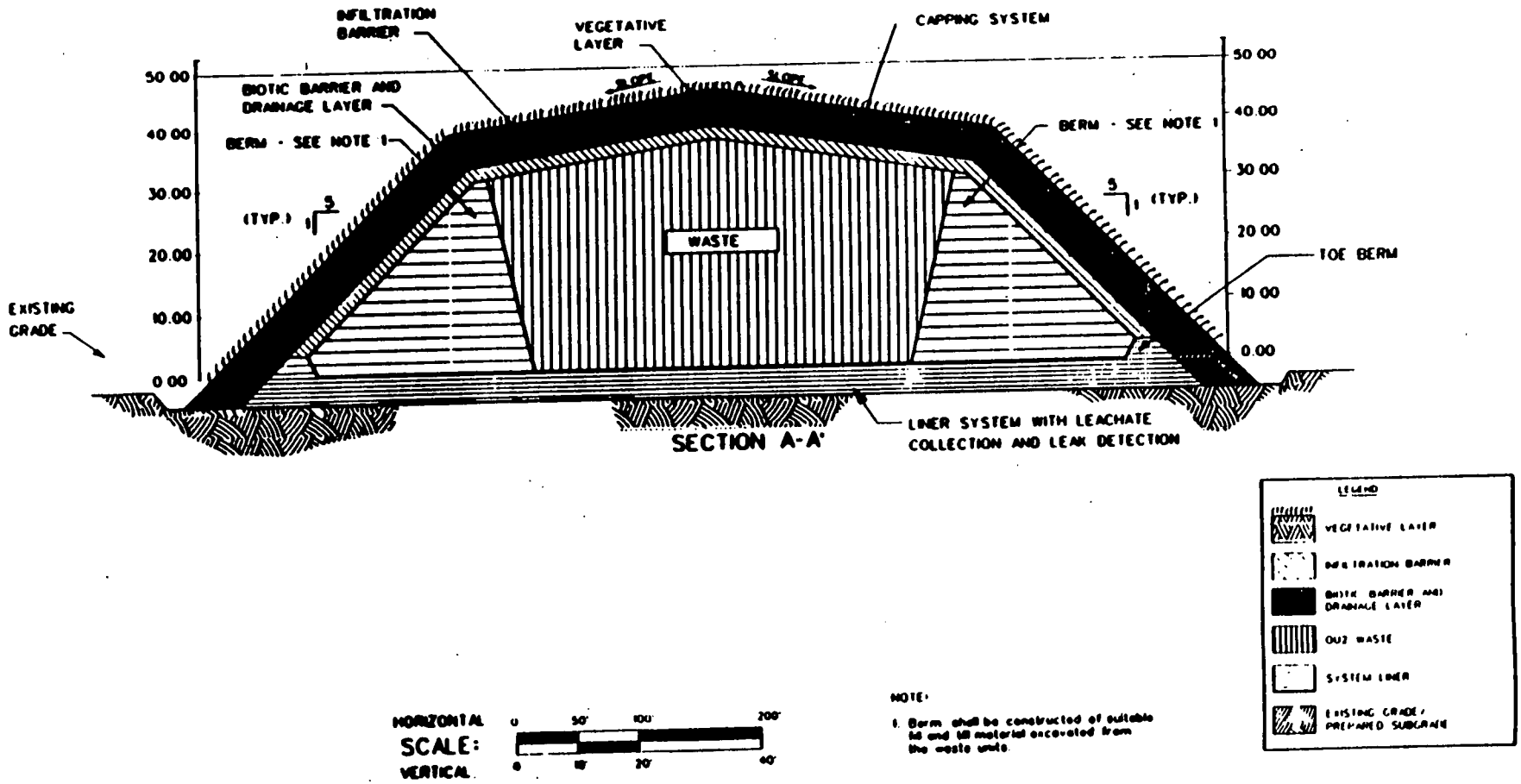


FIGURE 2: PRIMARY COMPONENTS OF DISPOSAL FACILITY



SECTION A-A'

FIGURE 3. CONCEPTUAL CROSS-SECTION

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/USR/HMAS/2101/DGN/BMP CHRIS.DGN

4.0 REGULATORY REQUIREMENTS

The OSDF detailed design will conform with CERCLA §121(d)(2) which requires that remedial actions protect human health and the environment and comply with applicable or relevant and appropriate requirements (ARARs). The complete list of Operable Unit 2 ARARs can be found in the *Operable Unit 2 (ROD)*.

EPA has identified three categories of ARARs:

- *Chemical-specific* ARARs are usually health- or risk-based numerical values or methodologies used to determine acceptable concentrations of chemicals that may be found in or discharged to the environment [e.g., maximum contaminant levels (MCLs) that establish safe levels in drinking water].
- *Action-specific* ARARs are usually technology- or activity-based requirements or limitations on actions or conditions involving special substances.
- *Location-specific* ARARs restrict actions or contaminant concentrations in certain environmentally sensitive areas. Examples of areas regulated under various federal laws include floodplains, wetlands, and locations where endangered species or historically significant cultural resources are present.

Sources of Operable Unit 2 ARARs are federal and state laws, regulations, and guidance and DOE Orders that address the site-specific circumstances in Operable Unit 2.

The chemical-specific requirements include ARARs associated with potential releases to air, surface water, groundwater, and penetrating radiation. Releases of dust and radiation to the air will meet applicable requirements; discharges to surface water will meet Ohio Water Quality Criteria; the groundwater will be protected to drinking water standards; and the public will be protected according to DOE Orders from potential releases of radiation.

Action-specific ARARs require that the OSDF be designed and constructed to comply with appropriate DOE Orders (including the As Low As Reasonably Achievable [ALARA] policy); 40 Code of Federal Regulations (CFR) 192 (uranium mill tailing disposal); RCRA requirements for the disposal of hazardous waste; and Ohio EPA solid waste disposal requirements.

The protection of endangered species, cultural resources, floodplains, and wetlands in the locations of remediation is covered under the location-specific requirements. These requirements also include the Ohio siting requirements for the OSDF. Pursuant to the Operable Unit 2 ROD, a waiver has been granted to allow the facility to be constructed over a high-yield, sole-source aquifer.

5.0 NUCLEAR SAFETY AND RADIATION PROTECTION

Radiation protection shall comply with ARARs identified for this project and ALARA principles. This project will not involve handling, storage, or treatment of special nuclear materials; therefore, safeguards for these materials are not required.

Since the maximum uranium radioactivity of waste materials allowed in the OSDF is less than 1,030 picoCuries/gram, no shielding or special handling requirements are needed.

6.0 SPECIFIC FUNCTIONAL REQUIREMENTS

The primary components of the OSDF are listed below and graphically presented in Figures 2 and 3.

- a liner system consisting of primary and secondary barrier layers with leachate collection, leak detection and a protective cushion layer
- placement and compaction of waste fill material
- management of leachate
- a multi-layered capping system consisting of an infiltration barrier layer overlain by a drainage layer, a biotic barrier, a filter layer and a vegetative layer
- management of surface water
- a relocated North entrance road for FEMP access
- a haul road for transport of impacted material from the South Field to the OSDF
- supply of and relocation of utilities impacted by the DF

6.1 LINER AND LEACHATE SYSTEMS

The basal features of the OSDF include the following:

- liner system
- leachate collection system, and
- leak detection system

These systems and their functional requirements are described in the following section.

6.1.1 Liner System

The liner system will consist of a combination of natural material (soil/rock) and synthetic components. The liner system's primary barrier layer will consist of a synthetic flexible membrane overlying a clay/synthetic geocomposite. The secondary barrier layer will also consist of a synthetic flexible membrane overlying a clay/synthetic geocomposite plus a minimum of three feet of compacted clay. The on-site native clays may be remolded to form this clay layer provided that performance requirements (permeability less than 10^{-7} cm/sec) are met. Otherwise, the clay will be hauled from an off-site borrow source. A passive, leak detection system will separate the barrier zones.

The liner system will, if feasible, be founded within the vertical limits of the brown clay formation which typically overlays the gray clay formation. The liner system must be sited so that at least 12 feet of gray clay exists below the liner. Further, it is desired that no part of the liner system be constructed on fill.

In order to minimize excavation, it is desired that the top of the protective cushion layer for the primary liner system be at or near existing grade. Due to the existing topography, some additional grading may be required at the northeast corner of the preferred site to provide proper drainage.

The liner system components will be keyed into a perimeter toe berm. The horizontal extent of the liner system to be installed in each phase will be delineated by this toe berm. The OSDF should be constructed in several discrete segments with separate leachate collection systems. Each of these is considered to be a phase. The toe berm will serve as a containment/diversion structure for runoff from the active area during placement of impacted material prior to installation of the cap. The liner system will be protected from damage caused by burrowing animals and plant roots.

6.1.1.1 Site Preparation

Prior to commencing excavation in preparation for installation of the liner system, the existing surficial (top 6 to 12 inches) soils identified as (COCs) will be removed as part of the remedial activities for the operable units. These materials will be temporarily stockpiled in a controlled area and protected from erosion, dust, and dermal contact by potential receptors. After completion of the liner system (by phase), the stockpiled surficial soils will be placed with other materials in the OSDF.

Water encountered during the excavation activities shall be considered as containing low level concentrations of COCs. All groundwater and/or surface water removed from the excavation will be transferred to a central sump system. The earthwork contractor will be responsible for submitting a plan with specific procedures for handling waters resulting from the construction activities. The criteria for discharges to the Advanced Waste Water Treatment (AWWT) from the remedial activities will be established by FERMCO. Refer to Section 6.5 for further requirements relative to stormwater management.

6.1.2 Leachate Collection/Management

The leachate collection system will be placed above the primary liner to collect potential water infiltrating the capping system (estimated to be 0.07 inches per year while the synthetic membrane maintains its integrity). This system will be designed based on requirements for leachate collection.

The leachate collection system will be protected by a combination of geotextiles and selected soil material (free of sharp, protruding objects) from the remediation activities. The placement of a cushion layer will not be part of the liner installation, but will be completed as part of the material placement activities. The leachate will be collected by a series of collector pipes. The collector pipe trench will be designed

to provide free draining of the leachate collection layer. Each collector pipe will pass through the toe berm and terminate into a sump. The individual sumps will discharge into an interceptor pipe running along one side of the facility. Cleanouts should be provided on the end of each collector pipe. A central sump (or sumps, as required) will be provided to transfer the collected leachate via a force main to treatment and/or disposal as needed.

6.1.3 Leak Detection

The leak detection system will be a passive system which only uses gravity drainage for flow to an observation sump. The system will be designed to be sensitive to low flows. Each collector (pipe) will pass through the perimeter toe berm to a respective sump. The sumps will not be interconnected nor will the leak detection system be interconnected with the leachate collection system.

6.1.4 Liner Compatibility Study

An evaluation of the compatibility and physical properties of proposed liner materials will be completed by the architect/engineering (A/E) firm. A review of published data on similar applications will be a key component of this evaluation. Physical/chemical testing will be executed where existing data is considered inadequate to verify the design of the liner. Interface testing to evaluate the engineering properties of the material contact will also be performed.

6.2 MATERIAL PLACEMENT

The nominal capacity of the facility has been set at 2.5 million cubic yards (bank/unbulked) based on the estimates of quantities of material to be placed in the facility resulting from the remediation activities at the operable units. These materials will be placed and compacted to form a mound over the liner system. The materials will be placed in a manner to minimize settlement and be compacted into a mass of relatively low permeability with minimal voids or channels through which water could flow unimpeded.

The side slopes of the mound shall be such that the potential erosion is controllable and the embankments are stable while making effective use of the available area. The conceptual design prepared by Operable Unit 2, as depicted in Figure 3, indicates a slope of five-foot horizontal to one vertical coupled with a height of 30 feet (vertical height at the top of the slope of material to be contained within the facility).

A material handling/placement plan will be prepared by the A/E utilizing data on stability from the Geotechnical Investigation and Predesign Siting Study. The A/E will provide performance specifications for handling/placement of material within the OSDF. Sizing of debris will be specified by FERMCO with input from the A/E. The performance specifications will include provisions for quality control

requirements during placement activities. The Placement Plan will also include specific requirements for OSDF worker health and safety. The design of the facility will provide for control of fugitive emissions during placement of impacted material. Real-time air monitoring will be conducted by FERMCO and the construction contractor. The air monitoring plan will prepared by FERMCO with input from the A/E.

The OSDF must accommodate a variety of placement and hauling equipment. Equipment may include track mounted dozers, wheel loaders, rubber-tired backhoes/front end loaders, and/or vibratory tamping compactors. Haul vehicles into the facility may be both off-highway and on-highway trucks.

6.3 CAPPING SYSTEM

The conceptual design of the capping system consists of a layered combination of natural material (soil/rock) and synthetic components. The surface of the compacted materials will be shaped/prepared for placement of the capping system. This "contouring" layer will be typically 12 inches, but not more than 24 inches thick. This contouring layer forms the subbase for the compound barrier zone consisting of a two-foot layer of compacted clay, a clay/synthetic geocomposite with an integral flexible membrane. A drainage layer will be placed above the barrier zone to collect and convey water infiltrating the capping system with direct discharge to the perimeter drainage system (Refer to Section 2.1). This layer may consist of natural (sand) soil material or a combination of natural and synthetic (geonet) materials. A biotic barrier is required above the drainage layer to provide long-term protection from burrowing animals and vegetative root intrusion. A filter layer will be 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. The vegetative zone will consist of a minimum of 6 inches of topsoil overlaying a minimum of 21 inches of soil suitable to support vegetative growth of sufficient thickness to maintain proper moisture control within the plant root zone. The surface cover/vegetation shall provide, to the extent feasible, protection against erosion (DOE Order 1023-92; 2000 year storm recurrence interval).

6.3.1 Interim and Partial Closure

Scheduling/financial constraints may dictate that the facility be closed down at intervals or for extended periods of time during such times all exposed impacted material will be covered, or other engineered controls will be used to control fugitive emissions. Daily/weekly cover may consist of tarps, geotextiles, or a watering system may be used to control fugitive emissions. 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. During material placement activities, erosion fabric/tarps or other temporary cover will be used, as necessary, to control erosion on the outer slope.

An extended shutdown of the facility (greater that one year) may necessitate partial closures. In anticipation of a shutdown (e.g. winter weather), the facility will be graded to promote proper drainage. Exposed surfaces will be covered with a layer of soil. In the event of an extended shutdown (greater than one year) 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 described above.

Portions of the liner system that may be subjected to freezing should be protected. It is anticipated that scheduled placement of materials will provide for this protection.

6.4 BORROW MATERIAL FOR LINER/CAP SOIL BARRIER LAYER AND VEGETATIVE ZONE

The requirements for borrow soils will be part of the OSDF design. The A/E will use data from a borrow area geotechnical study to develop borrow excavation and restoration plans. The actual excavation plan will reflect phasing to coincide with the construction activities at the OSDF.

6.5 SURFACE WATER MANAGEMENT

6.5.1 Perimeter Drainage

The facility will be isolated from adjacent land runon by a perimeter drainage system. This perimeter drainage system will divert runoff from abutting land north, east and west of the facility and rejoin the existing drainage channels/ditches south of the former Production Area. The perimeter drainage system will be installed in phases utilizing existing drainage channels wherever feasible. The installation of the first phase of the perimeter swale will precede the installation of the liner system. The design (profile) of the perimeter swale will provide for free discharge from the drainage layer, filter layer and biotic barrier layer which are part of the OSDF cap.

The design of the perimeter drainage system along the north and east sides of the facility will be coordinated with the drainage design for the relocated North Entrance Road.

6.5.2 Management of Stormwater during Construction

The disturbed area shall be kept to a minimum. Erosion and sediment controls will be provided to inhibit soil particles in stormwater runoff. Stormwater retention shall be provided so that the capacity of existing drainage system or treatment systems are not exceeded.

Runoff from undisturbed areas not containing impacted soils shall be isolated from the OSDF's Stormwater Drainage System and directed to the perimeter drainage system. Existing drainage channels are to be used wherever feasible.

Runoff from areas potentially containing COCs shall be collected and transferred to temporary holding/settling tanks. After allowing for settlement of fines, the water shall be decanted from the tanks and piped to treatment and/or disposal as needed.

6.5.3 Stormwater Management within Facility during Placement Activities Prior to Closure

Stormwater shall be contained within the active facility area by the perimeter toe berm and collected by infiltrating into the leachate collection system or by temporary sump(s). Measures to control erosion of particulate matter from the placed material will be provided. A nonwoven geotextile may be placed over the exposed cushion layer to filter the runoff to prevent the accumulation of fines in the leachate collection system. If sumps are used, filter traps are to be provided to screen out solids. The water collected shall be directed to a centralized sump system. This water will be pumped until the utility corridor near the sewage treatment plant is removed. After removal of these utilities, the water will gravity drain. A retention tank or basin may be required to temporarily hold the water depending on available treatment capacity or to relieve ponding over the liner system.

6.5.4 Stormwater Management After Closure (Partial or Final)

Stormwater from areas of the OSDF that have been closed shall be directed to the perimeter drainage system. This perimeter system is described in 6.5.1.

6.6 SUPPORT ELEMENTS

6.6.1 Staging Area

A staging area will be provided near or within the overall footprint of the facility to serve as a temporary holding area for demolition debris and impacted material. This area will be a concrete slab to facilitate rehandling of the debris/material without breaking up the ground surface. The size of the area is dependant on the rate the debris is generated and the availability of space within the facility to place the material for final disposition. The design will provide flexibility to accommodate varied demand by initially constructing a staging area one acre in size and designing expansions to provide an area of up to three acres.

Runoff from the staging area will be collected in a local sump where it will be pumped to treatment and/or disposal as needed. This discharge will be coordinated with other collected waters potentially containing COCs. Secondary containment in the form of a flexible membrane liner, drainage layer and subdrain system will be provided under the concrete slab.

6.6.2 Perimeter Security Fencing/Temporary Fencing

Perimeter security fencing will be installed to limit the work area for the OSDF. Temporary fencing will be installed, as required, to delineate work areas within the limits of work. Requirements for temporary fencing will be developed during the design activities.

6.7 UTILITIES

6.7.1 Utilities to Support OSDF

The construction, waste placement activities, closure, and post-closure of the OSDF and Borrow Area (BA) will require several site utilities to perform its function. These utilities are needed to support functions under varying service requirements. Utilities will be run to the point of service at the OSDF. These utility needs are described below for three phases of OSDF operation.

Construction:

- construction operations center including electrical power, potable water and communications.
- construction service water
- sewerage
- natural gas

Waste Placement and Closure Activities:

- administrative control center, including electrical power, potable water and communications
- waste placement activities service water
- sewage
- natural gas

Post-Closure Care Activities:

- administrative and maintenance control center, including electrical power, potable water and communications
- sewage
- natural gas

Functional Requirements are described below:

- The A/E firm shall determine the types of utilities and capacities of the services required. Interface with the OSDF A/E firm is required.
- The A/E firm will design the utility services from a source of the utility to the interface point with the OSDF. The interface point of these utilities will be determined by FERMCO. The location of the utility source shall be proposed by the A/E firm and approved by FERMCO.
- The design should take into consideration the requirements for safely connecting utility lines to existing live utility service lines ("hot tapping"). If hot tapping is not feasible, the subcontractor shall notify FERMCO as to the requirements for service outages during connection. FERMCO shall make the final determination of requirements for service outages.
- The design of the utilities shall be performed using regulations and guidance from local and state governments, OEPA, Cincinnati Gas & Electric, other public utilities, ASTM, ASCE, ANSI, ACI, NEC, or other groups which promote safety and design standards for utilities supply.
- The AE will evaluate the optimal routing to provide these utilities to the interface point, with consideration given to avoiding areas that are to be demolished, developed, on-site soil remediation areas and borrow areas in which excavation is planned.
- As possible, the utility routing shall be installed in existing utility corridors, as identified by FERMCO.
- The utilities shall be installed at a depth sufficient to resist frost damage/ frost heave, based on local conditions.
- The utility lines shall be designed to accommodate vehicle and/or railroad loadings at locations where the pipeline will cross beneath haul roads, access roads and railroads.
- A water supply will be provided for dust suppression and moisture control during placement of material in the facility. Multiple hose connections will be provided along the western side of the facility.

6.7.2 Relocation of Existing Utilities

It will be necessary to relocate existing utilities located within the proposed footprint of the OSDF. An A/E firm will verify the vertical and horizontal location of the existing utilities to be relocated in coordination with the design/construction of the relocated North Entrance Road and prepare a plan of the confirmed location.

These activities are required to abandon or remove, and relocate utility, service lines, and site facilities within the battery limits of the On-Site Disposal Facility north of the 480,725 north latitude (1982 North American Datum, NAD) line. This may include, but not be limited to: natural gas lines, underground and above ground power lines, buried and above ground telephone lines, sanitary and industrial waste sewers, water lines, and foundations, storm sewers, security fences, and air quality monitoring stations.

Utility relocation activities include the following:

- the determination of which utility lines, and air monitoring stations are to be replaced,
- the design of the replacement facilities,
- determination of the design capacity of each proposed utility line (based on existing and future requirements),
- determination of materials of construction and installation methods consistent with public utility requirements,
- routing of the replacement lines, and
- abandonment of the existing items (e.g., pipelines)

The design of replacement systems and abandonment/removal of existing systems shall be based on public utility, local and state government, OEPA, DOE, and FERMCO requirements.

6.8 SUPPORT FACILITIES FOR THE OSDF

Administrative, hygiene and maintenance facilities will be provided to support operations of the OSDF.

6.8.1 Administrative Support

Trailers will be provided for administrative functions required during placement of impacted material in the OSDF. Parking will be provided adjacent to the administrative trailer for the work crew, office staff and visitors. The parking area will have an all weather surface. An access road will be provided from existing roadways. The support area will be fenced with access controlled by a manually operated and locking gate. Lighting will be provided to illuminate the area for safety and security.

6.8.2 Personnel Contaminant Reduction During Placement Activities

A personnel decontamination trailer will be provided in order to pass from the administrative support area to the active work area of the disposal cell. This decontamination trailer will also contain lockers, complete showers, and sanitary facilities.

Personal vehicular access to the work area will not be permitted from the administrative area with the exception of emergency situations. A normally locked vehicle gate will be provided for emergency access/egress.

6.8.3 Equipment Maintenance

A site-wide fueling truck will service the OSDF equipment and vehicles; therefore, a local fueling station will not be required. All day to day equipment maintenance at the fueling station will be provided by FERMCO.

Major equipment repairs will be made in a central maintenance/decontamination facility provided by FERMCO. Equipment decontamination is discussed below.

6.8.4 Equipment Decontamination

The under carriage and exterior of all haul vehicles leaving the disposal facility work area will be cleaned to remove particulate matter. Each haul vehicle will pass through a decontamination station consisting of high pressure spray from the sides and bottom. These decontamination stations will be temporary facilities or transportable units since the egress points from the facility will vary considerably with time. Side panels will be used to control fugitive emissions from the decontamination stations. In the OSDF prior to shipment to the central maintenance/decontamination facility for complete decontamination and/or service.

6.9 RELATED ACTIVITIES

6.9.1 Test Pad Program

Soil test pads will be constructed within the limits of the OSDF in accordance with Ohio Administrative Code (OAC) 3745-27-08 paragraph (C)(1)(m). Separate test pads will be constructed for each source of soil.

6.9.2 Monitoring Well Closure

Existing monitoring wells located within the limits of the OSDF will be abandoned by overdrilling and grouting with expansive grout.

6.9.3 Monitoring Well Installation

New monitoring wells will be installed in conjunction with each phase of disposal cell construction.

6.9.4 Radiation Monitoring System Relocation

Existing radiation monitoring stations within the limits of the OSDF footprint will be relocated.

6.9.5 Air Monitoring Systems

Existing air monitoring devices located within the limits of the OSDF will be abandoned in conformance with site specifications and relocated as necessary to maintain the overall monitoring of the FEMP. New air monitoring devices for evaluating the performance of the on-site OSDF will be installed in conjunction with each phase of OSDF construction.

6.10 ROADWAYS

Both the haul road and the north entrance road is to be designed for H-20 loading.

6.10.1 Haul Road

The haul road will be located in the contaminated area and will be a two lane, undivided road with shoulders on each side. A typical section of the road consists of two 12-foot lanes and a 5 ft shoulder on each side. It will be an asphalt paved road with gravel shoulders having 3 percent cross-slope. The primary use of the haul road is to transport waste material from within the operable units to the on-site disposal area. It is anticipated that approximately 300,000 CY of material will be hauled from the Operable Unit 2 (OU2) South Field/Inactive Flyash Pile areas to the OSDF. The haul road is to be designed for an average daily traffic (ADT) of 400 and anticipated life of 5 years for the portion west of the proposed OU1 railroad system and 10 years for the eastern portion. The distribution factor for each lane is 50 percent. The eastern portion of the haul road crosses 5 railroad spurs, but these spurs will be non-operational at the time of the haul road construction. The design speed is 20 mph. Since the road is to be used by hauling trucks, the maximum grades will be less than 3%. The use of a lighted traffic signal at the road crossing and at an active railroad track crossing on the west side will be investigated and, if applicable, included in the design. Once the haul road is abandoned, any material not meeting the Final Remediation Levels (FRLs) will be removed and dispositioned in accordance with site policy.

6.10.2 North Entrance Road

The north entrance road will be a permanent facility and soil contaminated above the final remediation levels will be removed from the vicinity of the road prior to its construction. It will be a two lane, undivided road with shoulders on each side. A typical section of the road is shown on Figure A-3 which consists of two 12-foot lanes and 5-foot shoulders. It will be an asphalt paved road with gravel shoulders having a 3 percent cross-slope. The access road to the monitoring wells will be 12-foot wide gravel road with a turn around at the monitoring wells. This road will be used primarily by passenger cars and light trucks. The road is to be designed for an average daily traffic (ADT) of 6000, anticipated life of 20 years, and the distribution factor for each lane is 50 percent.

This road is to be constructed in two phases. The first phase will pass around the existing sewage treatment plant and electrical substation. The second phase will be constructed after the removal of the existing sewage treatment plant and the electrical substation when this road will be straightened. The design will incorporate both phases; however, the phases will be constructed in separate contracts. The design speed is 30 mph.

The borrow material from south of the plant will be used at the disposal site, so hauling trucks will cross southern portions of the proposed north entrance road at two locations and the south entrance road at one location. The use of lighted traffic signals will be investigated and, if applicable, included in the design.

6.11 WASTE LIQUID CONVEYANCE SYSTEM

Leachate and collected stormwater from the active and closed portions of the On-Site Disposal Facility (OSDF) will be collected at a sump at the southwest corner of the OSDF. The collected liquid will be pumped from the disposal facility collection sump to treatment/disposal in a buried, double-contained pipeline. The system includes pumping, piping, flow measurement and monitoring, leak detection, and maintenance fixtures and appurtenances required to safely transfer the collected liquid from the OSDF collection sump to the treatment/disposal collection location. The design life of the liquid transfer system shall be 200 years. The conveyance design shall include determining the flow requirements (depth of flow, velocity, head, etc.) at maximum flow rate as well as at the minimum flow rate expected after completion of the OSDF capping system. The conveyance system design flow rate is expected to vary over the waste placement and post-closure care period of the OSDF.

6.11.1 Pipeline

Functional requirements for the conveyance system pipe design include the following items:

- Pipeline will be designed with sufficient capacity to safely convey leachate and collected stormwater from the OSDF collection sump to the treatment/disposal collection location without back up of liquid into the OSDF leachate collection system. The capacity will be designed to handle the discharge generated during the construction, waste placement, and post-closure phases of the project.

- Pipeline will be double contained such that any leak occurring in the primary conveyance pipeline, would be collected in the secondary, outer pipe, and prevent discharges of water to the environment.

- Pipeline will be designed such that materials specified for the pipe are compatible with the contaminants expected to be present in the leachate, and be resistant to premature wear based on the condition of the liquids and/or surrounding soil. Additionally, the materials of construction will be compatible with the materials used by the OSDF design firm in their leachate collection system installed within the OSDF.

- The pipeline will include provisions for corrosion control, as required, to resist soil conditions encountered along the pipeline route.

- The pipeline will include provisions for inspection and cleanout of accumulated sediment, blockage, or other material that may cause flow constriction/reduction.

- The pipeline will be installed at a depth sufficient to resist frost damage/ frost heave, based on local conditions.

- The pipeline will be designed to accommodate vehicle and/or railroad loadings at locations where the pipeline will cross beneath haul roads, access roads and railroads.

- The pipeline will be designed to accommodate stream or culvert crossings (as applicable).

6.11.2 Leak Detection System/ High Level Alarm

The Functional Requirements of the alarm system for the liquid conveyance system include the following:

- A leak detection sensor will be provided to indicate to FEMP personnel that a leak has occurred in the primary pipe. The leak detection system shall indicate the approximate location of the leak.

- The leak detection system will be compatible with the system designed by the OSDF design firm for the OSDF leachate pipeline.

- A high level alarm system will be designed to alert AWWT operators of such conditions in the leachate collection sump.

6.11.3 Pump System

If a pressurized system is required, a pump system will be designed to deliver the anticipated flow rates (maximum and minimum) to the liquid treatment disposal facility. The pumps shall be installed in the collection sump. The Functional Requirements include the following:

- The pumps will be designed with sufficient flow and head capacity to convey the design flows from the OSDF discharge generated during the construction, waste placement, and post-closure phases of the project.

- The power supply requirements will be similar to those provided for the OSDF pumping system.

- The pump settings will be designed to include a method for removal, repair and replacement of pumps. Duplicate pumps or other arrangements shall be made to provide for uninterrupted delivery of waste liquid to the treatment/disposal facility during pump maintenance.

- The pump system will be designed to turn on and off automatically depending upon water levels in the leachate collection sump at the OSDF. A manual on/off override system will also be provided. The system will include an automatic and manual shutoff of the pumps when upstream conditions at the treatment/disposal facility require no flow, or when a leak is detected in the conveyance system.

- Capacity of the pump sump will be reviewed and modified as required to insure sufficient volume exists to prevent rapid on/off cycling of the pump system.

- Materials of construction of the pumps and seals will be compatible with and chemically resistant to the leachate contaminants.

- The pump system will be capable of handling sediments in the water resulting from runoff from the liner system without excessive wear which may result in premature pump replacement.

6.11.4 Flow Meter

A flow measurement device will be provided, and flow indication will be provided at the facility. The Functional Requirements for the flow meter include the following:

- Flow meter scale will be such that the design flows read at approximately 50% of full scale of the meter. The maximum design flow shall read at approximately 80% of full scale of the meter.

- Materials of construction shall be such that the flow transducer is resistant to corrosion and abrasion from the chemical and physical properties of the liquids being conveyed.

- Flow transducer shall be designed to provide a variable output signal to a flow meter located at the AWWT.

- The flow meter shall be provided with a flow totalizer to allow total flow over specific periods to be measured.

- The design of the flow meter installation shall allow for a method of repair, maintenance, cleaning, and removal of the flow meter transducer.

7.0 REFERENCE MATERIALS

This section identifies the primary documents used for reference during remedial design. This includes those documents prepared to date to support the Remedial Design and Remedial Actions. Specific codes, standards, and DOE Orders which apply to this project will be identified in the Design Criteria Package (DCP) of the OSDF.

The following are the primary reference documents which apply to this project:

- Remedial Investigation Report

  U.S. Department of Energy, 1995a. "Final Remedial Investigation Report for Operable Unit 2, FEMP, Fernald, OH, Remedial Investigation, Feasibility Study" U.S. DOE Fernald Office, Fernald Ohio.

- Feasibility Study

  U.S. Department of Energy, 1995a. "Final Feasibility Study Report for Operable Unit 2, FEMP, Fernald, OH, Remedial Investigation, Feasibility Study" U.S. DOE Fernald Office, Fernald Ohio.

- Record Of Decision

  U.S. Department of Energy, 1995a. "Final Record of Decision for Remedial Actions at Operable Unit 2, FEMP, Fernald, OH," U.S. DOE Fernald Office, Fernald Ohio.

- Remedial Design Work Plan

  U.S. Department of Energy, 1995. "Draft Remedial Design Work Plan for Remedial Actions at Operable Unit 2" FEMP, Fernald, OH," U.S. DOE Fernald Office, Fernald Ohio.

APPENDIX C

APPENDIX C

ARARs FOR OPERABLE UNIT 2

TABLE A-1
CHEMICAL-SPECIFIC REQUIREMENTS

Citation	Chemical	Requirement	Determination	Remarks
		GROUNDWATER PROTECTION STANDARDS		
EPA National Primary Drinking Water Regulations 40 CFR §141.15 and §141.16	MCLs for Radiological Contaminants	The following are maximum contaminant levels for radiological contaminants: Combined radium-226 and -228 . . . . . 5 pCi/L Gross alpha particle activity . . . . . 15 pCi/L (including radium-226 but excluding radon and uranium) Beta and photon radioactivity . . . . . 4 mrem/year from man-made radionuclides	Relevant and Appropriate	OEPA MCLs from OAC 3745-81-15 and -16 are the same as the Federal MCLs.
56 Federal Register 33050 (July 18, 1991)	Proposed MCLs for Radiological Contaminants	The following are the proposed maximum contaminant levels for radiological contaminants: Radium-226 . . . . . 20 pCi/L Radium-228 . . . . . 20 pCi/L Radon-222 . . . . . 300 pCi/L Uranium . . . . . 20 μg/L (30 pCi/L) Beta and photon emitters . . . . . 4 mrem ede/year (excluding radium-228) Adjusted gross alpha emitters . . . . . 15 pCi/L (excluding radium-226, uranium, and radon-222)	TBC	
EPA National Primary Drinking Water Regulations 40 CFR §141.61	MCLs for Organic Contaminants	The following are the maximum contaminant levels for organic contaminants: Benzo(a)pyrene . . . . . 0.0002 mg/L Polychlorinated biphenyls (PCBs) . . . . . 0.0005 mg/L	Relevant and Appropriate	Final MCLs are not presented for contaminants for which the non-zero MCLG is less than or equal to the MCL.
EPA National Primary Drinking Water Regulations 40 CFR §141.51	MCLGs for Inorganic Contaminants	The following are the non-zero maximum contaminant level goals for inorganic contaminants: Antimony . . . . . 0.006 mg/L Beryllium . . . . . 0.004 mg/L	Relevant and Appropriate	

000249

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
		GROUNDWATER PROTECTION STANDARDS (continued)		
50 Federal Register 46936 (November 13, 1985)	Proposed MCLGs for Inorganic Contaminants	The following are proposed, non-zero, maximum contaminant level goals for inorganic contaminants: Arsenic . . . . . 0.05 mg/L	TBC	
Ohio Drinking Water Regulations OAC 3745-81-11	MCLs for Inorganic Contaminants	The following are the maximum contaminant levels for inorganic contaminants: Arsenic . . . . . 0.05 mg/L	Relevant and Appropriate	Final MCLs are not presented for contaminants for which the non-zero MCLG is less than or equal to the MCL. This MCL is a stricter state standard.
EPA Groundwater Standards for Remedial Actions at Inactive Uranium Processing Sites 40 CFR §192.02(c)(3)(B)	Groundwater Protection Standards	The concentrations of the following constituents in groundwater must not exceed: Arsenic . . . . . 0.05 mg/L Combined radium-226 and radium-228 . . . . . 5 pCi/L Combined uranium-234 and uranium-238 . . . . . 30 pCi/L Gross alpha particle activity . . . . . 15 pCi/L (excluding radon and uranium)	Relevant and Appropriate	

000250

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
OHIO WATER QUALITY STANDARDS				
Ohio Water Quality Standards OAC 3745-1-21	Use Designation	Paddys Run and the Great Miami River are designated as: • warmwater aquatic life habitat • agricultural and industrial water supply • primary contact recreational use	Applicable	In addition to these overall designations: • Ross Rd. (River Mile (RM) 95.7) to Taylorsville Dam (RM 92.6) is a state resource water • RM 130 and RM 118 are public water supplies The FEMP effluent discharge pipe is located at RM 24.73, downstream of the state resource waters and public water supplies.
Ohio Water Quality Standards OAC 3745-1-07	Warmwater Habitat Water Quality Criteria	Parameter (µg/L) — outside mixing zone Max. / Avg. — inside mixing zone Max. Antimony (total) 650 190 1,300 Arsenic 360 190 720 Beryllium (total) 520 23 1,000 Dieldrin - 0.005 - Polychlorinated Biphenyls (PCBs) - 0.001 -	Applicable	Beryllium is based on a water hardness of 100 mg/L calcium carbonate ($CaCO_3$).
Ohio Water Quality Standards OAC 3745-1-07	Human Health and Agricultural Water Supply Criteria	Parameter (µg/L) — Human Health (outside mixing zone) — Agri-cultural Antimony (total) 780 - Arsenic - 100 Beryllium (total) 1.17 100 Dieldrin 0.00076 - Polychlorinated Biphenyls (PCBs) 0.00079 - Polynuclear Aromatic Hyrdrocarbons (PAHs) 0.31 -	Applicable	

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
		RADIATION DOSE LIMITS		
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(a)(2)	Protection of the General Population from Releases of Radioactivity	Concentrations of radioactive material which may be released to the general environment in surface water, ground water, soil, plants or animals must not result in an effective dose equivalent that exceeds 25 mrem per year to any member of the public. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable.	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (1)(a)	Public Dose Limits	The exposure of members of the public to radiation sources as a consequence of all routine DOE activities shall not cause, in a year, an effective dose equivalent greater than 100 mrem. Dose evaluations should reflect realistic exposure conditions. Specific authorization may be received for a temporary increase of the dose limit up to 500 mrem in a year.	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (1)	Public Dose Limits	The public dose limits include consideration of all exposure modes from all DOE activities (including remedial activities). Effective dose equivalent is the sum of the effective dose equivalent (weighted summation of doses to various organs of the body) from exposures to radiation sources external to the body during the year plus the committed effective dose equivalent from radionuclides taken into the body during the year. Medical sources, consumer products, residual fallout from past nuclear accidents and weapons tests and naturally occurring radiation sources are not included in this summation.	TBC	
National Emission Standards for Hazardous Air Pollutants 40 CFR §61.92, 61.93 Subpart H [Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (1)(b)]	National Emissions Standards for Emissions of Radionuclides Other than Radon from DOE Facilities	Emissions of radionuclides (except radon-220 and radon-222) to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.	Applicable	

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
RADIATION DOSE LIMITS (continued)				
National Emission Standards for Hazardous Air Pollutants 40 CFR §61.92, 61.93 Subpart H [Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (1)(b)] (continued)	National Emissions Standards for Emissions of Radionuclides Other than Radon from DOE Facilities	To determine compliance with the standard, radionuclide emissions shall be determined and effective dose equivalent values to members of the public calculated using EPA approved sampling procedures, computer models CAP-88 or AIRDOS-PC, or other procedures for which EPA has granted prior approval.	Applicable	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (3)(a)(5)	Interim Dose Limit for Native Aquatic Animal Organisms	The absorbed dose to native aquatic animal organisms shall not exceed 1 rad per day from exposure to the radioactive material in liquid wastes discharged to natural waterways.	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (4)(c)	External Gamma Radiation	External gamma radiation levels on open lands shall comply with the basic public dose limit of 100 mrem effective dose equivalent in a year and the ALARA process, considering appropriate-use scenarios for the area.	TBC	
EFFLUENT AND AIR EMISSION STANDARDS				
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (1)(d)	Drinking Water System Standards	It is DOE policy to provide a level of protection for persons consuming water from a public drinking water supply operated by the DOE, either directly or through a DOE contractor, that is equivalent to that provided to the public by the public community drinking water standards of 40 CFR Part 141 (listed above). These systems shall not cause persons consuming the water to receive an effective dose equivalent greater than 4 mrem in a year. Combined Ra-226 and Ra-228 shall not exceed 5×10^{-9} μCi/mL and gross alpha activity (excluding radon and uranium) shall not exceed 1.5×10^{-8} μCi/mL.	TBC	

000253

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
		EFFLUENT AND AIR EMISSION STANDARDS (continued)		
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (1)(d) (continued)	Drinking Water System Standards	The liquid effluents from DOE activities shall not cause private or public drinking water systems downstream of the facility discharge to exceed the drinking water radiological limits in 40 CFR Part 141 (listed above).	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter III	Derived Concentration Guides for Air and Water	The derived concentration guides (DCGs) are provided as reference values for conducting radiological environmental protection programs at operational DOE facilities and sites. DCG values are presented in Figures III-1 and III-3 of DOE Order 5400.5 for the following exposure modes: • ingestion of water • inhalation of air • immersion in a gaseous cloud The DCG values for internal exposure are based on a committed effective dose equivalent of 100 mrem for the radionuclide taken into the body by ingestion or inhalation during one year. The DCG values account for only three exposure pathways (ingested water <u>or</u> inhaled air <u>or</u> air immersion) and do not include other potentially significant pathways. When more complex environmental pathways are involved, a more complete pathway analysis is required for calculating public radiation doses resulting from the operation of DOE facilities.	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (3)(a)	Discharges of Liquid Waste to Surface Waters	The best available technology is the prescribed level of treatment for liquid radioactive discharges to surface waters that would otherwise contain radioactive concentrations greater than the DCG values. Implementation of the best available technology process is not required for waste streams that contain radionuclide concentrations of not more than the DCG values at the point of discharge to a surface waterway.	TBC	

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
		EFFLUENT AND AIR EMISSION STANDARDS (continued)		
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (3)(a) (continued)	Discharges of Liquid Waste to Surface Waters	The DCG for waste streams containing more than one type of radionuclide shall be the sum of the fractional DCG values.	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (3)(a)(4)	Prevention of Radionuclide Buildup in Sediments	Liquid process waste streams containing radioactive material in the solid present in the waste stream must not exceed 5 pCi/g above background level of settleable solids for alpha-emitting radionuclides or 50 pCi/g above background of settleable solids for beta-gamma-emitting radionuclides.	TBC	
National Emission Standards for Hazardous Air Pollutants 40 CFR §61.192 Subpart Q	National Emission Standards for Radon Emissions from Department of Energy Facilities	No source at a Department of Energy facility shall emit more than 20 pCi/m^{2}s as an average for the entire source, into the air.	Applicable	
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §192.02 (b) Subpart A 40 CFR §192.32 (b)(1)(ii) Subpart D Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (6)(d)	Control of Radon Emissions	The following standards apply to the: • control of residual radioactive materials from inactive uranium processing sites. • management of uranium byproduct materials after closure of a disposal area. • long-term management of uranium, thorium, and their decay products. Controls shall be designed to provide reasonable assurance that releases of radon-222 from the above materials to the atmosphere will not: • exceed an average annual release rate of 20 pCi/m^{2}s	Relevant and Appropriate	

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
		EFFLUENT AND AIR EMISSION STANDARDS (continued)		
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §192.02 (b) Subpart A 40 CFR §192.32 (b)(1)(ii) Subpart D Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (6)(d) (continued)	Control of Radon Emissions	• increase the annual average concentration of radon-222 in air or above any location outside the disposal site by more than 0.5 pCi/L.	Relevant and Appropriate	
National Primary and Secondary Ambient Air Quality Standards 40 CFR §50	National Ambient Air Quality Standards	The following are the primary National Ambient Air Quality Standards (NAAQS): Criteria Pollutant / Primary Standard / Averaging Time Carbon Monoxide: 9 ppm, 8-hour; 35 ppm, 1-hour Lead: 1.5 $\mu g/m^3$, Quarterly average Nitrogen Dioxide: 0.053 ppm, Annual Particulate Matter: 50 $\mu g/m^3$, Annual; 150 $\mu g/m^3$, 24-hour Ozone: 0.12 ppm, 1-hour Sulfur oxides: 0.03 ppm, Annual; 0.14 ppm, 24-hour	Relevant and Appropriate	

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
EFFLUENT AND AIR EMISSION STANDARDS (continued)				
Review of New Sources of Air Toxic Emissions OEPA Proposed Policy January 1994	De Minimis Emission Levels for Carcinogens	The following are the Ohio de minimis emission levels for classes A, B1, and B2 carcinogens: Carcinogen / EPA Class / Emission Level Chromium VI / A / 0.1 ton/year All Others / A, B1, B2 / 1.0 ton/year	TBC	
RADIONUCLIDE CONCENTRATIONS IN SOILS				
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §192.12(a) Subpart B 40 CFR §192.20 Subpart C	Cleanup of Soils Contaminated with Residual Radioactive Materials	Remedial actions shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials, the concentration of radium-226 in land averaged over any area of 100 m^2 shall not exceed the background level by more than: • 5 pCi/g, averaged over the first 15 cm of soil below the surface • 15 pCi/g, averaged over 15 cm thick layers of soil more than 15 cm below the surface Compliance with this requirement should be shown through measurements performed within the accuracy of currently available types of field and laboratory instruments in conjunction with reasonable survey and sampling procedures.	Relevant and Appropriate	
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §192.21 (f) and §192.22 (b) Subpart C	Supplemental Standards	Where radionuclides other than radium-226 and its decay product are present in sufficient quantity and concentration to constitute a significant radiation hazard from residual radioactive materials, remedial actions shall, in addition to satisfying the standards of 40 CFR §§ 192.02, Subpart A and 192.12, Subpart B (both listed above), reduce other residual radioactivity to levels that are as low as is reasonably achievable.	Relevant and Appropriate	

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
		RADIONUCLIDE CONCENTRATIONS IN SOILS (continued)		
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §192.32 (b)(2) Subpart D	Management of Uranium Byproduct Material	The requirements for the management of uranium byproduct materials after closure of a disposal area (40 CFR §192.32 (b)(1)) shall not apply to any portion of a disposal site which contains a concentration of radium-226 in land, averaged over areas of $100m^2$, which, as a result of uranium byproduct material, does not exceed the background level by more than the limits specified in 40 CFR §192.12 (a).	Relevant and Appropriate	
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §§ 192.40-192.42 Subpart E	Management of Thorium Byproduct Material	The following are requirements for the management of thorium byproduct materials: • the provisions for the management of uranium byproduct material (40 CFR §192.32) shall apply to thorium byproduct material and: - provisions applicable to the element uranium shall also apply to the element thorium - provisions applicable to radon-222 shall also apply to radon-220 - provisions applicable to radium-226 shall also apply to radium-228 With the concurrence of EPA, alternative provisions may be substituted for any of the above requirements provided the alternative provisions will provide at least an equivalent level of protection for human health and environment.	Relevant and Appropriate	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (4)(a)	Guidelines for Residual Radioactive Material	Guidelines for residual concentrations of radionuclides other than thorium and radium shall be derived from the basic dose limits by means of an environmental pathway analysis using specific property data where available. Procedures for these derivations are given in DOE/CH-8901. Residual concentrations of radioactive material in soil are defined as those in excess of background concentrations averaged over an area of $100\ m^2$.	TBC	

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
		RADIONUCLIDE CONCENTRATIONS IN SOILS (continued)		
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (4)(a)(2),(3)	Generic Guidelines for Residual Concentrations	The generic guidelines for residual concentrations (in excess of background) of radium-226, radium-228, thorium-230, and thorium-232 are: • 5 pCi/g, averaged over the first 15 cm of soil below the surface; and • 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface.	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (4)(a)(2),(3) (continued)	Generic Guidelines for Residual Concentrations	These guidelines take into account ingrowth of radium-226 from thorium-230 and of radium-228 from thorium-232, and assume secular equilibrium. If both thorium-230 and radium-226, or both thorium-232 and radium-228, are present and not in secular equilibrium, the appropriate guideline is applied as a limit for the radionuclide with the higher concentration. If other mixtures of radionuclides occur, the concentrations of individual radionuclides shall be reduced so that either the dose for the mixture will not exceed the basic dose limit or the sum of the ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide will not exceed 1. Explicit formulas for calculating residual concentrations guidelines for mixtures are given in DOE/CH-8901.	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (4)(a)(1)	Hot Spots	If the average concentration in any surface or below surface area less than or equal to 25 m^2, exceeds the limit or guideline by a factor of $(100/A)^{0.5}$ [where A is the area (in square meters) of the region in which the concentrations are elevated], limits for "hot spots" shall also be developed and applied. Procedures for calculating these hot spots limits, which depend on the extent of the elevated local concentrations, are given in DOE/CH-8901. In addition, reasonable efforts shall be made to remove any source of radionuclide that exceeds 30 times the appropriate limit in the soil, irrespective of the average concentration in the soil.	TBC	

TABLE A-1
(Continued)

Citation	Chemical	Requirement	Determination	Remarks
RADIONUCLIDE CONCENTRATIONS IN SOILS (continued)				
EPA Guidance Methods for Evaluating the Attainment of Cleanup Standards, Vol. 1	Attainment of Soil Cleanup Standards	This document describes methods for testing whether soil chemical concentrations at a site are statistically below a cleanup standard or ARAR. If it can be reasonably concluded that the remaining soil or treated soil at a site has concentrations that are statistically less than relevant cleanup standards then the site can be judged protective of human health and the environment.	TBC	
LEAD STANDARDS				
Resource Conservation and Recovery Act 40 CFR §268.41	Requirements for Lead Disposal	The maximum concentration of lead in the extract of any sample of treated soil is 5 mg/L.	Relevant and Appropriate	
Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (OSWER Directive 9355.4-12)	Screening Level for Lead in Soil	EPA recommends using 400 ppm soil lead as a screening level for lead in soil for residential scenarios at CERCLA sites and at RCRA Corrective Action sites. Residential areas with soil lead below 400 ppm generally require no further action.	TBC	

TABLE A-2
SOLID WASTE ACTION-SPECIFIC REQUIREMENTS

Citation	Action	Requirement	Determination	Remarks
		DEFINITIONS		
Resource, Conservation, and Recovery Act 42 U.S.C. §6903 (27)	Definition	Solid waste means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities, but does not include source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-01 (B)(40)	Definition	Solid wastes means such unwanted residual solid or semisolid material as results from industrial, commercial, agricultural, and community operations, excluding earth or material from construction, mining, or demolition operations, or other waste materials of the type that would normally be included in demolition debris, nontoxic flyash, spent nontoxic foundry sand, and slag and other substances that are not harmful or inimical to public health, and includes, but is not limited to, garbage, tires, combustible and noncombustible material, street dirt, and debris. Solid waste does not include any material that is an infectious waste or a hazardous waste. For the purpose of this definition, "semisolid material" does not contain liquids which can be readily released under normal climatic conditions, as determined by method 9095 (paint filter liquids test) in SW-846: "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods".	Applicable	
Resource, Conservation, and Recovery Act 40 CFR §261.3(a)	Definition	A solid waste is a hazardous waste, if: • it is not excluded from regulation as a hazardous waste under 40 CFR §261.4(b). • it exhibits any of the characteristics of hazardous waste. • it is listed in 40 CFR §§ 261.30 - 261.35. • it is a mixture of solid and hazardous wastes.	Applicable	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		DEFINITIONS (continued)		
Ohio Infectious Waste Regulations OAC 3745-27-01 (B)(15) OAC 3745-27-30 (A),(E),(H) ORC 3734.021 (A)(1)(c),(d)	Definition	Infectious waste is defined by 9 categories of waste including human blood specimens and blood products, sharp wastes used in the treatment or inoculation of human beings, and any other waste materials generated in the diagnosis, treatment, or immunization of human beings. A generator who places all sharp infectious wastes and all unused hypodermic needles, syringes, and scalpel blades into a "SHARPS" container before they are transported and who generates less than 50 lbs. of infectious wastes each month and does not hold a certificate of registration as a generator of infectious wastes may transport and dispose of infectious wastes in the same manner as solid wastes. Treated infectious wastes can be transported and disposed in the same manner as noninfectious waste. Infectious waste that is also radioactive shall be managed in accordance with applicable Ohio Department of Health and U.S. Nuclear Regulatory Commission regulations.	Applicable	
Resource, Conservation, and Recovery Act 40 CFR §261.4(b)(4)	Definition	Flyash waste, bottom ash waste, slag waste, and fly gas emission control waste, generated primarily from the combustion of coal or other fossil fuels, are excluded from the definition of hazardous waste.	Applicable	
Ohio Petroleum Contaminated Soil Policy OEPA Policy PP 01 03 200	Definition	The basis of the "contained in" policy is that environmental media, such as soil or groundwater, are not considered to be waste material. Because they are not a solid waste, the mixture rule, as set forth in OAC 3745-51-03, does not apply when they become contaminated with a listed hazardous waste but only contains the waste. The result of this policy is that if the waste constituents can be removed, the soil is no longer considered to contain a hazardous waste. Therefore, since soil is not a waste material it does not have to be de-listed in order for it to be used for its intended purpose. However, as long as the soil contains the waste material, it must be managed as a hazardous waste.	TBC	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		DEFINITIONS (continued)		
Ohio Petroleum Contaminated Soil Policy OEPA Policy PP 01 03 200 (continued)	Definition	If we apply this concept to petroleum-contaminated soil, the soils containing a petroleum hydrocarbon would not need to be managed as a solid waste if the contaminants were removed.	TBC	
CERCLA Compliance with Other Laws Manual Section 2.7	Definition	Placement/disposal of waste does not occur under the following circumstances: • waste is consolidated within a unit (including an area of contamination that can be viewed as a single unit); • waste is capped in place, including grading prior to capping; • waste is treated in situ; and • waste is processed within the unit in order to improve its structural stability for closure or for movement of equipment over the area.	TBC	
Resource, Conservation, and Recovery Act 40 CFR §260.10	Definition	Remediation waste means all solid and hazardous waste, and all media (including groundwater, surface water, soils, and sediments) and debris, which contain listed hazardous wastes or which themselves exhibit a hazardous waste characteristic, that are managed for the purpose of implementing corrective action requirements under 40 CFR §264.101 and RCRA section 3008(h). For a given facility, remediation wastes may originate only from within the facility boundary, but may include waste managed in implementing RCRA sections 3004(v) or 3008 (h) for releases beyond the facility boundary.	Relevant and Appropriate	

000263

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		DEFINITIONS (continued)		
Resource, Conservation, and Recovery Act 40 CFR §264.552 (a),(c)	Definition	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.	Relevant and Appropriate	Under all of the remedial alternatives, any hazardous waste from the firing range is being sent off-site for disposal. This CAMU rule would only be used if Operable Unit 5 plans to dispose hazardous waste in a centralized disposal cell; the cell would then have to be designed to meet RCRA standards and it would not be cost-effective to send the firing range material off-site for disposal. Because this is dependent on Operable Unit 5, the RCRA disposal requirements will be addressed in Operable Unit 5 ARARs.

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		DEFINITIONS (continued)		
Resource, Conservation, and Recovery Act 40 CFR §264.552 (a),(c) (continued)	Definition	• 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.	Relevant and Appropriate	
Resource, Conservation, and Recovery Act 40 CFR §264.553 (a),(b)	Definition	For temporary tanks and container storage areas used for treatment or storage of remediation wastes during remedial activities, the Regional Administrator may determine that a design, operating, or closure standard applicable to such units may be replaced by alternative requirements which are protective of human health and the environment. Any temporary unit to which alternative requirements are applied shall be: • located within the facility boundary; and • used solely for treatment or storage of remediation wastes.	Relevant and Appropriate	
		SOLID WASTE DISPOSAL		
Ohio Solid Waste Disposal Regulations OAC 3745-27-05 (A)	Solid Waste Disposal Methods	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).	Applicable	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
US EPA Solid Waste Disposal Regulations 40 CFR §257.3-7	Open Burning Prohibited	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.	Applicable	
US EPA Solid Waste Disposal Regulations 40 CFR §257.3-3	Surface Water	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.	Applicable	
US EPA Solid Waste Disposal Regulations 40 CFR §257.3-4	Groundwater Protection	A solid waste disposal facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9)	Landfill Construction	The following layers must be installed in the construction of a sanitary landfill (from bottom to top):	Applicable	This applies to new disposal of solid waste.
		Recompacted Soil Liner		
		The recompacted soil liner shall be: • constructed using loose lifts 8 inches thick with a maximum permeability of 1×10^{-7} cm/s. • constructed of a soil with a maximum clod size of 3 inches or half the lift thickness, whichever is less.		

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Landfill Construction	• 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. - not less than 25% of the particles, by weight, having a maximum dimension not greater than 0.002 millimeters. • 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. 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. 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). • 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: - compaction equipment limitations;	Applicable	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Landfill Construction	- slope stability; - maximum friction angle between any soil-geosynthetic interface and between any geosynthetic-geosynthetic interface; and - resistance of geosynthetics and geosynthetic seams to tensile forces. • constructed on a prepared surface that shall: - be free of debris, foreign material, and deleterious material; - 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 - not have any abrupt changes in grade that may result in damage to geosynthetics. • 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. • 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. • have a factor of safety for hydrostatic uplift not less than 1.4. • be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction and operation.	Applicable	

743

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Landfill Construction		Applicable	
		Flexible Membrane Liner		
		The flexible membrane liner shall be: • placed on the recompacted soil liner. • sixty mil high density polyethylene (HDPE). • be protected from the drainage layer by a cushion layer, as required by the Director Other materials or thicknesses may be used if, at a minimum, the flexible membrane liner meets all the following: • negligibly permeable to fluid migration. • physically and chemically resistant to chemical attack by the solid waste, leachate, or other materials which may come in contact with the flexible membrane liner. • seamed to allow no more than negligible amounts of leakage with seaming material that is physically and chemically resistant to chemical attack by the solid waste, leachate, or other materials which may come in contact with the seams. • have properties for its installation and use which are acceptable to the Director. • protected from the drainage layer by a cushion layer, as required by the Director. • have a minimum thickness of 40 mils.		
		Geosynthetic Clay Liner		
		The geosynthetic clay liner used in lieu of part of the recompacted soil liner shall be:		

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Landfill Construction	• 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. • be constructed above the recompacted soil liner.	Applicable	
		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. • include a drainage layer placed on top of the flexible membrane liner composed of granular material that must: - have a minimum permeability of 1×10^{3} cm/s; - have a minimum thickness of 1 foot; - have a negligible amount of fines; and - not contain carbonate material. 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.		

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Landfill Construction	• include leachate collection pipes to remove leachate from the bottom of the landfill. The pipes must: - be imbedded in the drainage layer; - have a minimum slope of 0.5%; - have lengths and configuration which shall not exceed the capabilities of clean-out devices; - be provided with access for clean-out devices which shall be protected from differential settling; - have joints sealed to prevent separation; and - 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. 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. • include a filter layer to prevent clogging of the leachate collection system. • 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.	Applicable	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Landfill Construction	• 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.	Applicable	
		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. • Storage tanks must be provided with spill containment • Leachate lines must be double-cased • Storage structures must have a minimum of 1 week of storage capacity using design assumptions simulating final closure. • 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.		

000272

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Landfill Construction	**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. • Surface water control structures shall be designed to minimize silting and scouring. • If sedimentation ponds are used, they shall be designed and constructed according to OAC 3745-27-08 (C)(6)(b).	Applicable	
		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).		
		Groundwater Control • 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.		

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
EPA Criteria for Municipal Solid Waste Landfills 40 CFR §258.40	Landfill Design Criteria	The liner and leachate system shall be designed and constructed to maintain less than a 30-cm depth of leachate over the liner. The geomembrane must be at least 30-mil thick.	Relevant and Appropriate	
EPA Criteria for Municipal Solid Waste Landfills 40 CFR §258.26	Run-On/Run-Off Control Systems	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.	Relevant and Appropriate	
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (D) and (E)	Landfill Construction	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.	Applicable	
		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.		

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (D) and (E) (continued)	Landfill Construction	**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 • chemical compatibility testing may be required by the Director. **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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g)	Landfill Construction	The following activities must be performed to ensure that the components of the sanitary landfill facility meet the specifications of this rule.	Applicable	

000275

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g) (continued)	Landfill Construction	**Test Pads** The recompacted soil liner and the recompacted soil barrier layer in the cap system shall be modeled by the construction of test pads. The test pads shall: • be designed such that the proposed tests are appropriate and their results are valid. • 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. • be constructed whenever there is a significant change in soil material properties. • 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. • be comprised of at least four lifts.	Applicable	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g) (continued)	Landfill Construction	• 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. • be reconstructed as many times as necessary to meet the permeability requirement. Any amended construction details shall be noted. An alternative to test pads may be used if it is demonstrated to the satisfaction of the Director that the alternative meets the requirements.	Applicable	
		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.		
		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.		

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (G)	Landfill Construction	All tests failing to meet the specifications outlined above must be investigated and the areas reconstructed to meet specifications.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (F)	Landfill Construction	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.	Applicable	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-19 (E)(19)	Sanitary Landfill Operation	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-19 (E)(26)	Sanitary Landfill Operation	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-19 (J)(1), (4)	Sanitary Landfill Operations	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-19 (K)(1)	Sanitary Landfill Operations	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-19 (K)(2)	Sanitary Landfill Operations	At least one lift station back-up pump shall be kept at the sanitary waste landfill facility at all times.	Applicable	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-19 (K)(3)	Sanitary Landfill Operations	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-19 (K)(4)	Sanitary Landfill Operations	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-10	Groundwater Monitoring Program	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.	Applicable	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-11 (H)	Final Closure of Landfill Facilities	At final closure of a landfill facility: • all land surfaces shall be graded to prevent ponding of water where solid waste has been placed. Drainage facilities shall be provided to direct surface water from the landfill facility. • a groundwater monitoring system shall be designed and installed in accordance with OAC 3745-27-10, if a system is not already in place.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-11 (O)	Final Closure of Landfill Facilities	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(15)	Construction of a Landfill Cap System	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. • The cap system shall have a maximum projected erosion rate of 5 tons/acre/year. • Any penetrations into the cap system shall be sealed so that the integrity of the soil barrier layer is maintained. The cap system shall, at a minimum, consist of the following (from bottom to top):	Applicable	
		Recompacted Soil Barrier Layer		
		The recompacted soil barrier layer of the cap shall be:		

000281

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(15) (continued)	Construction of a Landfill Cap System	• a minimum of 18 inches thick and constructed in accordance with the specifications outlined above for construction of the recompacted soil liner for a landfill facility ((C)(1)(a) to (C)(1)(g) and (C)(1)(m) to (C)(1)(o) of OAC 3745-27-08) with the exception that the maximum permeability of the recompacted soil barrier shall be $1x10^{-6}$ cm/sec; OR • 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: • 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. • 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.	Applicable	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(15) (continued)	Construction of a Landfill Cap System	• 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.	Applicable	
		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)].		
		Drainage Layer		
		The drainage layer shall be: • a minimum of 1 foot of granular material; <u>OR</u> • a drainage net that has equivalent performance capabilities as the granular material. • 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).		
		Frost Protection Layer		
		The frost protection layer shall be: • placed on top of the drainage layer. • a minimum of 30 inches thick.		

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-08 (C)(15) (continued)	Construction of a Landfill Cap System	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.	Applicable	
		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. 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.		
Ohio Solid Waste Disposal Regulations OAC 3745-27-11 (H)(5) (b)	Final Closure of Landfill Facilities	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.	Applicable	

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		SOLID WASTE DISPOSAL (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-14 (A)(1), (2)	Sanitary Landfill Post-Closure Care	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 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 • 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	Applicable	
EPA Criteria for Municipal Solid Waste Landfills 40 CFR §258.61	Post-Closure Care	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.	Relevant and Appropriate	
		POLYCHLORINATED BIPHENYL (PCB) DISPOSAL		
PCB Manufacturing, Processing, Distribution, and Use Prohibitions 40 CFR §761.3	Excluded PCB Materials	PCB materials which appear at concentrations less than 50 ppm are excluded from the PCB disposal requirements in this regulation.	Relevant and Appropriate	Operable Unit 2 does not contain PCB materials which have a concentration greater than 50 ppm.

TABLE A-2
(Continued)

Citation	Action	Requirement	Determination	Remarks
		ASBESTOS MANAGEMENT AND DISPOSAL		
National Emission Standard for Asbestos 40 CFR §61.151 (a) Ohio Asbestos Handling Regulations OAC 3745-20-07 (A),(C)	Inactive Asbestos Waste Disposal Sites	Each owner or operator of an inactive asbestos waste disposal site shall do one of the following: • discharge no visible emissions from an inactive waste disposal site; • cover the asbestos-containing waste material with at least 6 inches of compacted nonasbestos-containing material and grow and maintain a cover of vegetation on the area adequate to prevent exposure of the asbestos-containing waste material; or • cover the asbestos-containing waste material with at least 2 feet of compacted nonasbestos-containing material, and maintain the cover to prevent exposure of the asbestos-containing waste material. The owner or operator may use an alternative control method that has received prior approval of the Administrator.	Federal Relevant and Appropriate, Ohio Applicable	The Federal requirement is relevant and appropriate because it specifically applies to a type of facility that is not found in Operable Unit 2. The Ohio requirement is generally applicable to any inactive asbestos waste disposal site.

TABLE A-3
RADIOLOGICAL ACTION-SPECIFIC REQUIREMENTS

Citation	Action	Requirement	Determination	Remarks
		DEFINITIONS		
Atomic Energy Act 42 U.S.C. §2014 (e)(2), (ee) Nuclear Waste Policy Act 42 U.S.C. §10101 (12), (16),(23)	Definition	The term low-level waste means radioactive material that is not: • high-level radioactive waste, the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations. • spent nuclear fuel, fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing. • transuranic waste, material contaminated with elements that have an atomic number greater than 92, including neptunium, plutonium, americium, and curium, and that are in concentrations greater than 10 nanocuries per gram. • byproduct material, the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content.	Applicable	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV	Definition	Residual radioactive material is defined as: • residual concentrations of radionuclides in soil (soil is defined as unconsolidated earth material, including rubble and debris that might be present in the earth material); • concentrations of airborne radon decay products; • external gamma radiation; • surface contamination; and • radionuclide concentrations in air or water resulting from, or associated with, any of the above.	TBC	

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743

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
		DEFINITIONS (continued)		
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(i)(6) Attachment 2 (1)	Definition	Radioactive material that is below regulatory concern is a definable amount of low-level waste that can be deregulated with minimal risk to the public. Waste containing amounts of radionuclides below regulatory concern, as defined by Federal regulations, may be disposed without regard to radioactivity content.	TBC	
		DOE ALARA POLICY		
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter I (4) and Chapter II (2)	As Low As Reasonably Achievable (ALARA) Process	The order adopts the ALARA process in planning and carrying out all DOE activities. ALARA requires judgement with respect to what is reasonably achievable. Factors that relate to societal, technological, economic, and other public policy considerations shall be evaluated to the extent practicable. Factors to be considered, at a minimum, shall include: • maximum dose to members of the public; • collective dose to the population; • alternative processes, such as alternative treatment of discharge streams, operating methods, or controls; • doses for each process alternative; • cost for each of the technological alternatives; • examination of the changes in cost among alternatives; and • changes in societal impact associated with process alternatives (e.g., differential doses from various pathways).	TBC	

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
DOE ALARA POLICY (continued)				
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter I (4) and Chapter II (2) (continued)	As Low As Reasonably Achievable (ALARA) Process	Except for meeting requirements of NEPA, qualitative analyses are acceptable, in most instances, for ALARA judgements, especially when the potential doses are well below the dose limit. The bases for these judgements should be documented. More detailed analyses should be considered if the decision might result in doses that approach the limit.	TBC	
GENERAL RADIOACTIVE MATERIALS DISPOSAL REQUIREMENTS				
Radiation Protection of the Public and the Environment DOE Order 5400. 5 Chapter II (3)(b)	Discharges of Liquid Waste to Aquifers and Phaseout of Soil Columns	New or increased discharges of radionuclides in liquid waste to active soil columns and virgin soil columns is prohibited.	TBC	
MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE				
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(a)	Performance Objectives of Low-Level Radioactive Waste Management	DOE low-level radioactive waste shall be managed to accomplish the following performance objectives: • protection of public health and safety; • protection of the public and the environment from releases of radioactivity (see chemical-specific requirements for radioactive dose limitations); and • protection of groundwater resources, consistent with Federal, State, and local requirements.	TBC	
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(c)	Low-Level Radioactive Waste Generation	Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. Waste reduction efforts shall include consideration of process modification, process optimization, materials substitution, and decontamination.	TBC	

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE (continued)				
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(c) (continued)	Low-Level Radioactive Waste Generation	All DOE low-level waste generators shall establish auditable programs to assure that the amount of low-level waste generated and/or shipped for disposal is minimized. Each DOE low-level waste generator shall separate uncontaminated waste from low-level waste to facilitate cost effective treatment and disposal. Each DOE low-level waste generator preparing a design for a new process or process change shall incorporate principles into the design that will minimize the generation of low-level waste.	TBC	
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(d)	Waste Characterization	Low-level waste shall be characterized with sufficient accuracy to permit proper segregation, treatment, storage, and disposal. This characterization shall ensure that, upon generation after processing, the actual physical and chemical characteristics and major radionuclide content are recorded and known during all stages of the waste management process. Waste characterization data shall be recorded on a waste manifest and shall include: • the physical and chemical characteristics of the waste; • volume of the waste (total of waste and any solidification or absorbent media); • weight of the waste (total of waste and any solidification or absorbent media); • major radionuclides and their concentrations; and • packaging date, package weight, and external volume.	TBC	These requirements will apply when low-level radioactive waste is transported off-site for disposal.

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TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE (continued)				
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(f)	Waste Treatment	Waste shall be treated by appropriate methods so that the disposal site can meet the performance objectives stated above. Waste treatment techniques such as incineration, shredding, and compaction to reduce volume and provide more stable waste forms shall be implemented as necessary to meet performance requirements. Use of waste treatment techniques to increase the life of the disposal facility and improve long-term facility performance, by improved site stability and reduction of infiltrating water, is required to the extent it is cost effective. The development of large scale waste treatment facilities shall be supported by the appropriate National Environmental Policy Act documentation. Operation of waste treatment facilities shall be supported by adequate documentation.	TBC	
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(g)	Waste Shipment	The volume of waste and number of shipments of low-level wastes shall be minimized and the shipments will be conducted based on plans developed by field organizations. Generators shall provide an annual forecast in the third quarter of the fiscal year to the field organizations managing the off-site disposal facility to which the waste is to be shipped. Generators must receive advance approval from the receiving facility and shall certify prior to shipment that waste meets the receiving facility waste acceptance criteria. The certification program shall be auditable and able to withstand independent review.	TBC	
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(i)(1)-(6)	Waste Disposal	Low-level waste shall be disposed of by methods appropriate to achieve the performance objectives stated in paragraph 3a (listed above), consistent with the radiation dose limits in paragraph 3b (see chemical-specific requirements).	TBC	

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE (continued)				
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(i)(1)-(6) (continued)	Waste Disposal	Engineered modifications (stabilization, packaging, burial depth, barriers) for specific waste types and for specific waste compositions for each disposal site shall be developed to achieve the performance objectives. Site specific waste classification limits may be developed if operationally useful in determining how specific wastes should be stabilized and packaged for disposal. Disposition of waste designated as greater than class C, as defined in 10 CFR §61.55, must be handled as a special case. Disposal systems for such waste must be justified by a specific performance assessment through the NEPA process and with the concurrence of DOE headquarters. The following are additional disposal requirements intended either to improve stability of the disposal site or to facilitate handling and provide protection of the health and safety of personnel at the disposal site: • Waste must not be packaged for disposal in cardboard or fiberboard boxes, unless such boxes meet DOT requirements and contain stabilized waste with a minimum of void space. For all types of containers, void spaces within the waste and between the waste and its packaging shall be reduced as much as practical. • Liquid wastes, or wastes containing free liquid, must be converted into a form that contains as little freestanding and noncorrosive liquid as is reasonable achievable, but, in no case, shall the liquid exceed 1 percent of the volume of the waste when the waste is in a disposal container, or 0.5 percent of the volume of the waste processed to a stable form. • Waste must not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.	TBC	

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE (continued)				
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(i)(1)-(6) (continued)	Waste Disposal	• Waste must not contain, or be capable of generating quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste. This does not apply to radioactive gaseous waste packaged as identified in the next requirement. • Waste in a gaseous form must be packaged at a pressure that does not exceed 1.5 atmospheres at 20°C. • Waste must not be pyrophoric. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable.	TBC	
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(i)(8)	Disposal Facility and Disposal Site Design	Design criteria shall be established prior to selection of new disposal facilities, new disposal sites, or both. These design criteria shall be based on analyses of physiographic, environmental, and hydrogeological data to assure that the policy and requirements of this Order can be met. The criteria shall be also based on assessments of projected waste volumes, waste characteristics, and facility and disposal site performance. Disposal units will be designed consistent with disposal site hydrology, geology, and waste characteristics and in accordance with NEPA.	TBC	
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(i)(9)	Disposal Facility Operations	Operating procedures for low-level waste disposal facilities shall be developed so that they: • protect the environment, health and safety of the public, and facility personnel; • ensure the security of the facility; • minimize the need for long-term control; and • meet the requirements of the closure/post-closure plan. Permanent identification markers for disposal excavations and monitoring wells shall be emplaced.	TBC	

000293

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE (continued)				
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(i)(9) (continued)	Disposal Facility Operations	Operating procedures shall include training for disposal facility operating personnel, emergency response plans, and a system of reporting unusual occurrences to DOE. Waste placement into disposal units should minimize voids between containers. Operations are to be conducted so that active waste disposal operations will not have an adverse effect on filled disposal units.	TBC	
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(j)	Disposal Site Closure/Post Closure	Site-specific comprehensive closure plans shall be developed for new and existing operating low-level waste disposal sites. The plan shall address closure of disposal sites within a 5-year period after each is filled and shall conform to the requirements of the NEPA process. Performance objectives for existing disposal sites shall be developed on a case-by-case basis as part of the NEPA process. During closure and post closure, residual radioactivity levels for surface soils shall comply with existing DOE decommissioning guidelines. Corrective measures shall be applied to new disposal sites or individual disposal units if conditions occur or are forecasted that could jeopardize attainment of the performance objectives of this Order. Inactive disposal facilities, disposal sites, and disposal units shall be managed in conformance with RCRA, CERCLA, and the Superfund Amendments and Reauthorization Act (SARA). Closure plans for new and existing operating low-level waste disposal facilities shall be reviewed and approved by the appropriate field organization.	TBC	

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE (continued)				
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(j) (continued)	Disposal Site Closure/Post Closure	Termination of monitoring and maintenance activity at closed facilities or sites shall be based on an analysis of site performance at the end of the institutional control period.	TBC	
Radioactive Waste Management DOE Order 5820.2A Chapter III (3)(k)	Environmental Monitoring	Each low-level waste treatment, storage, and disposal facility shall be monitored by an environmental monitoring program that, at a minimum, meets the following requirements: • The program shall be designed to measure: - operational effluent releases; - migration of radionuclides; - disposal unit subsidence; and - change in disposal facility and disposal site parameters which may affect long-term site performance. • Based on the characteristics of the facility being monitored, the program may include, but not necessarily be limited to, monitoring surface soil, air, surface water, and, in the subsurface, soil and water, both in the saturated and the unsaturated zones. • The monitoring program shall be capable of detecting changing trends in performance sufficiently in advance to allow application of any necessary corrective action prior to exceeding performance objectives. The monitoring program shall be able to ascertain whether or not effluents from each treatment, storage, or disposal facility or disposal site meet the requirements of applicable EH Orders.	TBC	

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
		LOW-LEVEL RADIOACTIVE WASTE CONFINEMENT		
General Design Criteria DOE Order 6430.1A 1324-5.3	Low-Level Solid Waste Confinement	Low-level solid waste that is disposed to the ground shall be confined by a site-specific system of barriers that may include, but not necessarily be limited to, waste form, waste packaging, and the geologic setting. When site permeability characteristics do not provide the required confinement capabilities, the confinement system shall be augmented by the following: • constructing low permeability walls around the low-level waste; • lining the walls and bottom of the excavated area with low permeability material; and • other suitable methods for reducing permeability. Means shall be provided to minimize contact of emplaced low-level waste with water. Active water control measures shall not be required following permanent closure. Typical requirements for water control are as follows: • placing a layer of highly permeable material beneath the low-level waste to channel any percolating water to a sump; • mounding the soil surface to facilitate surface water runoff; • use of a suitable low-permeability cover material (e.g., clay) over the disposal area to prevent contact of the waste by infiltrating rainwater. This cover material shall be protected by a layer of overburden (e.g., sand, gravel, top soil). • a site diversion system for surface water runoff during operation of the facility; • temporary protective covers (e.g., tarpaulin) before the completion of the natural in-place soil barrier over the low-level waste;	TBC	

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
LOW-LEVEL RADIOACTIVE WASTE CONFINEMENT (continued)				
General Design Criteria DOE Order 6430.1A 1324-5.3 (continued)	Low-Level Solid Waste Confinement	• revegetation of the overburden layer; and • other suitable and reliable means for minimizing water contact with low-level waste.	TBC	
General Design Criteria DOE Order 6430.1A 1324-6	Radioactive Solid Waste Confinement Systems	The following requirements outline the confinement system for radioactive solid waste: • Primary confinement consists of process systems equipment and its associated ventilation and off-gas system, storage containers, or other waste and site-specific engineered barriers. • Secondary confinement consists of process cell barriers and the ventilation systems associated with the cells or building, or a large storage building or structure. In some cases, a drum, cask, or other waste and site-specific engineered barrier shall provide secondary confinement. • The natural geologic setting composes the tertiary confinement system. In addition, the tertiary confinement system shall meet the following performance objectives: • Following permanent closure, on-going site maintenance shall not be needed. • In the absence of unplanned natural processes or human contact with a low-level waste disposal facility, calculated contaminant levels in groundwater at the site boundary shall not exceed the maximum contaminant levels (MCLs) established pursuant to the Safe Drinking Water Act (see chemical-specific requirements).	TBC	

000297

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
LOW-LEVEL RADIOACTIVE WASTE CONFINEMENT (continued)				
General Design Criteria DOE Order 6430.1A 1324-6 (continued)	Radioactive Solid Waste Confinement Systems	• In the event of human-induced activities following permanent closure, or reasonably foreseeable but unplanned natural processes, the guidelines of DOE Order 6430.1A, Section 1300-1.4.2, Accidental Releases, shall not be violated. Institutional controls may be relied on for a limited time following closure. For the purposes of calculation, these controls shall not be relied on for more than 100 years following permanent closure.	TBC	
CONTROL OF URANIUM AND THORIUM BYPRODUCT MATERIAL				
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §192.02 (a) Subpart A	Control of Residual Radioactive Materials	Controls of residual radioactive materials from inactive uranium processing sites shall be designed to be effective for up to 1,000 years, to the extent reasonably achievable, and in any case, for at least 200 years.	Relevant and Appropriate	
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §192.20 Subpart C	Implementation	Reasonable assurance to show compliance with 40 CFR §192.02 (Subpart A) standards should be done through the use of analytical models and site-specific analyses.	Relevant and Appropriate	
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §192.32 (b)(1)(i) Subpart D	Management of Uranium Byproduct Material	Disposal areas for the management of uranium byproduct materials after closure shall each comply with the closure performance standard in 40 CFR §264.111 with respect to nonradiological hazards and shall be designed to provide reasonable assurance of control of radiological hazards to be effective for 1,000 years, to the extent reasonable, and, in any case, for at least 200 years	Relevant and Appropriate	

TABLE A-3
(Continued)

Citation	Action	Requirement	Determination	Remarks
CONTROL OF URANIUM AND THORIUM BYPRODUCT MATERIAL (continued)				
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §§ 192.40-192.42 Subpart E	Management of Thorium Byproduct Material	The provisions for the management of uranium byproduct material (40 CFR §192.32) shall apply to thorium byproduct material and provisions applicable to the element uranium shall also apply to the element thorium	Relevant and Appropriate	
MANAGEMENT OF RESIDUAL RADIOACTIVE MATERIAL				
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (5)	Release of Property	Real property (land and structures), personal property, materials, and equipment shall be released if the concentration of radioactivity is within the limits of residual radioactive contamination.	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (6)	Control of Residual Radioactive Material Above the Guidelines	Residual radioactive material with concentrations above the generic guidelines (see chemical-specific requirements) shall be managed in accordance with Chapter II, Requirements for Radiation Protection of the Public and the Environment, and operational and control requirements.	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (6)(d)	Long-Term Management of Residual Radioactive Material	To properly manage uranium, thorium, and their decay products, access to a property and use of on-site materials contaminated by residual radioactive material should be controlled through appropriate administrative and physical controls such as those described in 40 CFR 192. These controls should be designed to be effective to the extent reasonable for at least 200 years.	TBC	
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (7)	Supplemental Limits and Exceptions for Residual Radioactive Material	If special specific property circumstances indicate that the concentration guidelines or authorized limits are not appropriate, supplemental limits or an exception may be requested to those guidelines or limits.	TBC	

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TABLE A-4
OTHER ACTION-SPECIFIC REQUIREMENTS

Citation	Action	Requirement	Determination	Remarks
		AIR POLLUTION CONTROL		
Ohio General Provisions on Air Pollution Control OAC 3745-15-07 ORC 3704.01-.05	Prevention of Air Pollution Nuisance	Measures shall be taken to adopt and maintain a program for the prevention, control, and abatement of air pollution in order to protect and enhance the quality of the state's air resource so as to promote the public health, welfare, and economic vitality of the people of the state. The emission or escape into open air from any source whatsoever of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, odors, and combinations of the above in such a manner or in such amounts as to endanger the health, safety, or welfare of the public or to cause unreasonable injury or damage to property shall be declared to be a public nuisance. It is unlawful for any person to cause, permit, or maintain any such public nuisance.	Applicable	
Ohio Permit to Install New Sources of Pollution OAC 3745-31-05 (A)(3)	Best Available Technology (BAT)	The installation or modification and operation of an air contaminant source must employ the best available technology.	Relevant and Appropriate	
Ohio Ambient Air Quality Standards OAC 3745-17-02 OAC 3745-17-05	Particulate Ambient Air Quality Standards	The level of the primary and secondary 24-hour ambient air quality standards for total suspended particulates is 150 $\mu g/m^3$, 24-hour average concentration. The level of the primary and secondary annual standards for total suspended particulates in 50 $\mu g/m^3$, annual arithmetic mean. The significant and avoidable deterioration of air quality in any part of the area where presently existing air quality is equal to or better than the particulate ambient air quality standards shall be prohibited.	Applicable	
Ohio Particulate Matter Standards OAC 3745-17-07	Control of Visible Particulate Emissions from Stationary Sources	Visible particulate emissions from any stack shall not exceed 20 percent opacity, as a six-minute average. Transient exceedance limits are included in this regulation.	Applicable	

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TABLE A-4
OTHER ACTION-SPECIFIC REQUIREMENTS

Citation	Action	Requirement	Determination	Remarks
AIR POLLUTION CONTROL (continued)				
Ohio Emissions of Particulate Matter OAC 3745-17-07(B)(4),(5),(6)	Control of Visible Particulate Emissions	There shall be no visible particulate emissions from any paved roadway or parking area except for a period of time not to exceed six minutes during any sixty-minute observation period. There shall be no visible particulate emissions from any unpaved roadway, parking area, or material storage piles except for a period of time not to exceed thirteen minutes during any sixty-minute observation period.	Applicable	
Ohio Emissions of Particulate Matter OAC 3745-17-08	Restriction of Emission of Fugitive Dust	No person shall cause or permit any fugitive dust source to be operated; or any materials to be handled, transported or stored; or a building or its appurtenances or a road to be used constructed, altered, repaired or demolished without taking or installing reasonably available control measures to prevent fugitive dust from becoming airborne. Such reasonably available control measure shall include, but not be limited to, one or more of the following which are appropriate to minimize or eliminate visible particulate emissions of fugitive dust: • the use of water or other suitable dust suppression chemicals for the control of fugitive dust from the demolition of existing buildings or structures, construction operations, the grading or roads or the clearing of land; or • the periodic application of asphalt, oil, water, or other suitable dust suppression chemicals on dirt or gravel roads and parking lots, and any other surfaces which cause emissions of fugitive dust.	Relevant and Appropriate	This requirement is applicable only to certain cities in Butler and Hamilton Counties.
Ohio Particulate Matter Standards OAC 3745-17-11	Restrictions on Particulate Emissions	The following are restrictions for particulates from any operation, process, or activity which releases or may release particulate emissions into the ambient air. These limits are based on the weight of material being processed.	Applicable	

TABLE A-4
(Continued)

Citation	Action	Requirement	Determination	Remarks
AIR POLLUTION CONTROL (continued)				
Ohio Particulate Matter Standards OAC 3745-17-11 (continued)	Restrictions on Particulate Emissions	Process Weight at Maximum Capacity lb/hr. / Allowable Rate of Particulate Emission lb/hr. 100 / 0.551 200 / 0.877 400 / 1.40 600 / 1.83 800 / 2.22 1000 / 2.58	Applicable	
Standard of Performance for Nonmetallic Mineral Processing Plants 40 CFR §60.672 (a),(d),(e)	Restrictions on Particulate Emissions From Crushers	No owner or operator shall cause to be discharged into the atmosphere from a crusher any emissions which: • contain particulate matter in excess of 0.05 grams per dry cubic meter at standard conditions (g/dscm); and • exhibit greater than 7 percent opacity Truck dumping of nonmetallic minerals into any crusher is exempt from these requirements.	Relevant and Appropriate	
WATER POLLUTION CONTROL				
National Pollutant Discharge Elimination System 40 CFR §122.26 (a)(1)(ii) 40 CFR §122.26 (b)(14)(v),(x)	Storm Water Discharge Associated with Industrial Activity	A discharge composed entirely of storm water associated with industrial activity is required to obtain a NPDES permit. These categories of facilities are considered to be engaging in "industrial activity": • landfills, land application sites, and open dumps that receive or have received any industrial wastes (waste that is received from any of the facilities described under this subsection) including those that are subject to regulation under subtitle D of RCRA; and	Applicable	Engineering controls will be implemented to monitor and control stormwater runoff during removal, treatment, and disposal of Operable Unit 2 material.

TABLE A-4
(Continued)

Citation	Action	Requirement	Determination	Remarks
		WATER POLLUTION CONTROL (continued)		
National Pollutant Discharge Elimination System 40 CFR §122.26 (a)(1)(ii) 40 CFR §122.26 (b)(14)(v),(x) (continued)	Storm Water Discharge Associated with Industrial Activity	• construction activity including clearing, grading, and excavation activities that disturbs 5 acres or more of total land area.	Applicable	
Clean Water Act §404 (33 U.S.C. §1344) Guidelines for Specifications of Disposal Sites for Dredged or Fill Material 40 CFR §230.10	Discharge of Dredged or Fill Material	No discharge of dredged or fill material shall be permitted: • if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as, the alternative does not have other significant adverse environmental consequences. • unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem. No discharge of dredged or fill material shall be permitted if it: • causes or contributes, after consideration of disposal site dilution and dispersion, to violations of any applicable state water quality standard. • violates any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act. • jeopardizes the continued existence of species listed as endangered or threatened under the Endangered Species Act of 1973, as amended, or results in likelihood of the destruction or adverse modification or a habitat which is determined to be a critical habitat under the Endangered Species Act of 1973, as amended.	Applicable	

TABLE A-4
(Continued)

Citation	Action	Requirement	Determination	Remarks
		WATER POLLUTION CONTROL (continued)		
Clean Water Act Nationwide Permit Program 33 U.S.C. §1341(a)(1),(d) 33 CFR §330.1 (c)	Nationwide Permits - Terms and Conditions	An activity is authorized under an NWP only if that activity and the permittee satisfy all of the following NWPs terms and conditions. Potentially applicable NWPs include: • Nationwide Permit #26 - Headwaters and Isolated Waters Discharges - The discharge does not cause the loss of more than 10 acres of waters of the United States. - The permittee notifies the district engineer if the discharge would cause the loss of waters of the United States greater than one acre. - For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands. - The discharge, including all attendant features, both temporary and permanent, is part of a single and complete project. • Nationwide Permit #38 - Cleanup of Hazardous and Toxic Waste - This permit authorizes specific activities required to effect the containments, stabilization or removal of hazardous or toxic waste materials that are performed ordered, or sponsored by a government agency with established legal or regulatory authority provided the permittee notifies the district engineer. - For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands.	Applicable	In a January 17, 1992 letter to the U.S. Army Corps of Engineers, OEPA conditionally certified that projects authorized by these Nationwide Permits will comply with the applicable provisions of the Federal Water Pollution Control Act.

TABLE A-4
(Continued)

Citation	Action	Requirement	Determination	Remarks
		WATER POLLUTION CONTROL (continued)		
Clean Water Act Nationwide Permit Program 33 U.S.C. §1341(a)(1),(d) 33 CFR §330.1 (c) (continued)	Nationwide Permits - Terms and Conditions	- This nationwide permit does not authorize the establishment of new disposal sites or the expansion of existing sites used for the disposal of hazardous or toxic waste.	Applicable	
Clean Water Act Nationwide Permit Program 33 CFR §330.4 (c)(1) Ohio Section 401 Water Quality Certifications OAC 3745-32	Nationwide Permits - Terms and Conditions	State 401 water quality certification pursuant to section 401 of the Clean Water Act, or waiver thereof, is required prior to the issuance or reissuance of individual or nationwide permits authorizing activities which may result in a discharge into waters of the United States	Applicable	
Clean Water Act General Regulatory Policies 33 CFR §323.3	Permits for Discharges of Dredged or Fill Material	Permits will be required for the discharge of dredged or fill material into waters of the United States including wetlands. Certain discharges specified in 33 CFR Part 330 are permitted by that regulation (nationwide permits). If a discharge of dredged or fill material is not permitted by 33 CFR Part 330 (Nationwide Permits), an individual section 404 permit will be required for the discharge of dredged or fill material into waters of the United States. Discharges of dredged or fill material into waters of the United States done by or on behalf of any Federal agency, other than the Corps of Engineers, are subject to the authorization procedures of these regulations.	Applicable	
Ohio Water Pollution Control Regulations ORC 6111.04	Acts of Pollution Prohibited	No person shall cause pollution or place or cause to be placed any sewage, industrial waste, or other wastes in a location where they cause pollution of any waters of the state.	Applicable	

TABLE A-4
(Continued)

Citation	Action	Requirement	Determination	Remarks
WATER POLLUTION CONTROL (continued)				
Ohio Water Pollution Control Regulations ORC 6111.04 (continued)	Acts of Pollution Prohibited	No person to whom a permit has been issued shall place or discharge, or cause to be placed or discharged, in any waters of the state any sewage, industrial waste, or other wastes in excess of the permissive discharges specified under such existing permit without first receiving a permit from the Director to do so.	Applicable	
NOISE POLLUTION CONTROL				
Noise Control Act 42 U.S.C. §4901, *et seq.* Noise Pollution and Abatement Act 42 U.S.C. §7641	Noise Pollution Control	The public must be protected from noises that jeopardize health and welfare.	Applicable	

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TABLE A-5
LOCATION-SPECIFIC REQUIREMENTS

Citation	Location	Requirement	Determination	Remarks
THREATENED AND ENDANGERED SPECIES PROTECTION				
Procedures for Implementing the National Environmental Policy Act 40 CFR §6.302(h) Endangered and Threatened Wildlife and Plants 50 CFR §17.21,§17.94 Interagency Cooperation-Endangered Species Act 50 CFR §402.01	Endangered Species and Critical Habitat	All Federal agencies must insure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of the constituent elements essential to the conservation of a listed species within a defined critical habitat.	Applicable	In 1994, surveys were conducted for potential threatened or endangered plant species; no individuals were found. In 1993 and 1994, surveys have verified the presence of the state-threatened Sloan's crayfish [*Orconectes sloanii*] in Paddys Run. Suitable habitat for the Indiana bat [*Myotis sodalis*], a federally-listed endangered species, also exists on the Fernald property.
Interagency Cooperation-Endangered Species Act 50 CFR §402.12 (a),(b)	Biological Assessment	A biological assessment shall evaluate the potential effects of the action on listed and proposed critical habitat and determine whether any such species or habitat are likely to be adversely affected by the action and is used in determining whether formal consultation or a conference is necessary. These procedures are required for Federal actions that are "major construction activities".	Applicable	No critical habitat is present on the Fernald property.
Ohio Endangered Species Regulations ORC 1531.25	Endangered Animal Species	No person shall take or possess any native species of wild animal, or any eggs or offspring thereof, that is threatened with state-wide extinction.	Applicable	See first remark.
Ohio Endangered Species Regulations ORC 1518.02 OAC 1501:18-1	Endangered Plant Species	No person shall root up, injure, destroy, remove, or carry away on or from public highways, public property, or waters of the state, or on or from the property of another, without the written permission of the owner, lessee, or other person entitled to possession, any endangered or threatened plant listed in OAC 1501:18-1.	Applicable	See first remark.

000309

TABLE A-5
(Continued)

Citation	Location	Requirement	Determination	Remarks
THREATENED AND ENDANGERED SPECIES PROTECTION (continued)				
Classification of Solid Waste Disposal Facilities and Practices 40 CFR §257.3-2	Any	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.	Applicable	See first remark.
HISTORIC AND CULTURAL RESOURCE PROTECTION				
Antiquities Act of 1906 16 U.S.C. §431	Antiquity Preservation	No person may appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity situated or controlled by the Government of the United States.	Applicable	An assessment of the Operable Unit 2 waste units was performed in March 1993 and it was determined that the areas had already been sufficiently disturbed so that there would be no requirement to consult the State Historic Preservation Officer (SHPO). Archaeological investigations will be conducted for the disposal facility study area. Any other proposed areas of disturbance for Operable Unit 2 remedial actions will be surveyed and the SHPO consulted as necessary.
Archaeological Resources Protection Act 16 U.S.C. §47099 Procedures for Implementing the National Environmental Policy Act 40 CFR §6.301(c) Protection of Archaeological Resources 43 CFR §7.4(a)	Archaeological Resource Recovery and Preservation	Whenever any Federal agency finds, or is notified, in writing, by an appropriate historical or archaeological authority, that its activities in connection with any Federal construction project or federally licensed project, activity, or program may cause irreparable loss or destruction of significant scientific prehistorical, historical, or archaeological data, such agency shall notify the Secretary of the Interior, in writing, and shall provide the Secretary with appropriate information concerning the project, program, or activity.	Applicable	See above remark.

TABLE A-5
(Continued)

Citation	Location	Requirement	Determination	Remarks
HISTORIC AND CULTURAL RESOURCE PROTECTION (continued)				
Archaeological Resources Protection Act 16 U.S.C. §47099 Procedures for Implementing the National Environmental Policy Act 40 CFR §6.301(c) Protection of Archaeological Resources 43 CFR §7.4(a) (continued)	Archaeological Resource Recovery and Preservation	No person may excavate, remove, damage, or otherwise alter or deface or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public lands unless such activity is pursuant to a permit. If an EPA activity may cause irreparable loss or destruction of significant scientific, prehistoric, historic, or archaeological data, the responsible official or the secretary of the Interior is authorized to undertake data recovery and preservation activities.	Applicable	See above remark.
National Historic Preservation Act 16 U.S.C. §470 36 CFR 800 Procedures for Implementing the National Environmental Policy Act 40 CFR §6.301 (a),(b)	Historic Preservation	A Federal agency must take into account how each of its undertakings could affect historic properties. The purpose of this Act is not only to protect those properties listed in or eligible for the National Register of Historic Places, but also those properties that have not been listed or formally determined eligible for the listings. The heads of all Federal agencies shall assume responsibility for the preservation of historic properties which are owned or controlled by such agency. Prior to any Federal undertaking which may directly and adversely affect any National Historic Landmark, the head of the responsible agency shall, to the extent possible, minimize the harm to such landmark.	Applicable	See above remark.
Native American Graves Protection and Repatriation Act 25 U.S.C. §3001	Protection of American Indian Grave Sites	Provides for the return of human remains and cultural objects from Native American graves to affiliated tribes.	Applicable	

000311

TABLE A-5
(Continued)

Citation	Location	Requirement	Determination	Remarks
HISTORIC AND CULTURAL RESOURCE PROTECTION (continued)				
American Indian Religious Freedom Act 42 U.S.C. §1996	Protection of American Indian Religious Freedom	Provides for tribal access by native peoples to grave sites and sites of cultural, symbolic, or religious significance.	Applicable	
FLOODPLAINS/WETLANDS PROTECTION				
Procedure for Implementing the National Environmental Policy Act 40 CFR §6.302(a) [Executive Order 11990]	Protection of Wetlands	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.	Applicable	An updated site-wide delineation of Fernald wetlands, performed in accordance with the U.S. Army Corps of Engineers Wetland Delineation Manual, was completed in March 1993. Although there are wetlands located near the Lime Sludge Ponds, the Solid Waste Landfill is the only subunit with wetlands located inside the battery limits. These wetlands may be affected during the Operable Unit 2 remedial action. Wetlands in other areas of the site may also be impacted by construction and operation of the on-site disposal facility. A Wetland/Floodplain Assessment was conducted.
Procedures for Implementing the National Environmental Policy Act 40 CFR §6.302(b) [Executive Order 11988]	Floodplain Management	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.	Applicable	An updated floodplain determination was performed for Paddys Run in October 1993 using the Army Corps of Engineers' standard HEC2 water surface profile analysis program. The 100-year flood elevations reach the western slope of the Inactive Flyash Pile and the toe of the South Field slope. Indirect, short-term floodplain impacts will occur during remediation. A Wetland/Floodplain Assessment was conducted.

TABLE A-5
(Continued)

Citation	Location	Requirement	Determination	Remarks
		FLOODPLAINS/WETLANDS PROTECTION (continued)		
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 10 CFR §1022.3(a), (b)(1),(2),(3),(5),(6),(c), (d),(e)	Floodplain/Wetlands	DOE shall exercise leadership and take action to: • avoid to the extent possible the long- and short-term adverse impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands, and avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative. • incorporate floodplain management goals and wetlands protection considerations into its planning, regulatory, and decision-making processes and shall to the extent practicable: - reduce the hazard and risk of flood loss. - minimize the impact of floods on human safety, health, and welfare. - restore and preserve natural and beneficial values served by the floodplains. - minimize the destruction, loss, or degradation of wetlands. - preserve and enhance the natural and beneficial values of wetlands • undertake a careful evaluation of the potential effects of any DOE action taken in a floodplain and any new construction undertaken by DOE in wetlands not located in a floodplain • identify, evaluate, and as appropriate, implement alternative actions which may avoid or mitigate adverse floodplain/wetlands impacts • provide opportunity for early public review of any plans or proposals for actions in floodplains and new construction in wetlands	Applicable	

TABLE A-5
(Continued)

Citation	Location	Requirement	Determination	Remarks
		FLOODPLAINS/WETLANDS PROTECTION (continued)		
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 10 CFR §1022.5(b),(h)	Floodplain/Wetlands	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.	Applicable	
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 10 CFR §1022.11(a),(b),(c)	Floodplain/Wetlands	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.	Applicable	
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 10 CFR §1022.12(a)	Floodplain/Wetlands	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).	Applicable	

000314

TABLE A-5
(Continued)

Citation	Location	Requirement	Determination	Remarks
FLOODPLAINS/WETLANDS (continued)				
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 10 CFR §1022.15(a)	Floodplain/Wetlands	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-20 (C)(2)	Floodplain	The limits of solid waste placement and the leachate management system cannot be located in a regulatory floodplain, unless deemed acceptable by the Director.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(4)(d)	Stream, Lake, or Wetland	The limits of waste placement cannot be located within 200 feet of a stream, lake, or wetland, unless deemed acceptable by the Director.	Applicable	
GROUNDWATER PROTECTION				
Safe Drinking Water Act 42 U.S.C. §1424(e)	Sole Source Aquifer	All Federal financially assisted projects constructed in the area of a sole source aquifer and its principal recharge zone will be subject to EPA's review to insure that these projects are designed and constructed so that they do not create a significant hazard to public health.	Applicable	A notice in 53 FR 15876 (May 4, 1988) designated the Buried Valley Aquifer System of the Great Miami/ Little Miami River Basins of southwestern Ohio as a sole or principal source of drinking water. The Fernald site is located above this aquifer.
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(3)(a)	Any	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(2)(c)	Any	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.	Applicable	

000315

TABLE A-5
(Continued)

Citation	Location	Requirement	Determination	Remarks
		GROUNDWATER PROTECTION (continued)		
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(2)(d)	Any	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(3)(c)	Water Supply Well or Developed Spring	The limits of sold 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	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(2)(e)	Any	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.	Applicable	
OEPA Guidance on Solid Waste Siting Criteria: Material Acceptable to the Director GD202.104	Any	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	TBC	

TABLE A-5
(Continued)

Citation	Location	Requirement	Determination	Remarks
		GROUNDWATER PROTECTION (continued)		
OEPA Guidance on Solid Waste Siting Criteria: Material Acceptable to the Director GD202.104 (continued)	Any	• the geologic material must be able to impede both physically and chemically, the flow of leachate constituents through it In order to meet both criteria listed above, the added geologic material should: • be classified as CL, SC, GC, CL-ML, or CH under the Unified Soil Classification System (USCS) • be composed of particles of which at least 25% by dry weight will pass through a No. 200 (75 μm) sieve • be composed of no more than 25% by dry weight particles which will not pass through a No. 4 sieve • no particle should be greater than 8 inches in diameter • have a final permeability of no more than 1×10^{-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	TBC	
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(4)(b)	Any	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.	Applicable	
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(4)(c)	Any	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.	Applicable	

000317

TABLE A-5
(Continued)

Citation	Location	Requirement	Determination	Remarks
GROUNDWATER PROTECTION (continued)				
Ohio Solid and Hazardous Waste Rules ORC 3734.02(A)	Protection of Human Health and the Environment	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.	Applicable	
RADIOLOGICAL SITING CRITERIA				
Radioactive Waste Management DOE Order 5820.2A Chapter III (7)	Disposal Site Selection	Disposal site selection criteria (based on planned waste confinement technology) shall be developed for establishing new low-level waste disposal sites. Disposal site selection shall be based on an evaluation of the prospective site in conjunction with planned waste confinement technology, and in accordance with the National Environmental Policy Act process. Site selection shall also be based on the following criteria: • The disposal site shall have hydrogeologic characteristics which, in conjunction with the planned waste confinement technology, will protect the groundwater resource. • The potential for natural hazards such as floods, erosion, tornadoes, earthquakes, and volcanoes shall be considered in site selection. • Site selection criteria shall address the impact on current and projected populations, land use resources development plans and nearby public facilities, accessibility to transportation routes and utilities, and the location of waste generation.	TBC	

TABLE A-5
(Continued)

Citation	Location	Requirement	Determination	Remarks
		RADIOLOGICAL SITING CRITERIA (continued)		
Joint NRC-EPA Guidance on Siting of Mixed Low-Level Radioactive and Hazardous Waste Units (March 13, 1987)	Any	Areas with highly vulnerable hydrogeology deserve special attention in the siting of a mixed low-level waste disposal facility. Hydrogeology is considered vulnerable when groundwater travel time along any 100-foot flow path from the edge of the engineered containment structure in less than approximately 100 years. Disposal sites located in areas of vulnerable hydrogeology may require extensive, site-specific investigations which could lead to and provide bases for restrictions or modifications to design or operating practices. However, a finding that a site is located in an area of vulnerable hydrogeology alone, based on the EPA criteria, is not considered sufficient to prohibit siting under RCRA.	TBC	

APPENDIX D

APPENDIX D

ARARs FOR OPERABLE UNIT 5

APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED REQUIREMENTS FOR OPERABLE UNIT 5

TABLE OF CONTENTS

List of Acronyms		B-ii
Foreword		B-iv
Table B.1	Chemical-Specific Requirements for the Operable Unit 5 Selected Remedy	B.1-1
Table B.2	Location-Specific Requirements for the Operable Unit 5 Selected Remedy	B.2-1
Table B.3	Action-Specific Requirements for the Operable Unit 5 Selected Remedy	B.3-1
Table B.4.A	Method of Compliance with Chemical-Specific ARARs for the Operable Unit 5 Selected Remedy	B.4.A-1
Table B.4.B	Method of Compliance with Location-Specific ARARs for the Operable Unit 5 Selected Remedy	B.4.B-1
Table B.4.C	Method of Compliance with Action-Specific ARARs for the Operable Unit 5 Selected Remedy	B.4.C-1

LIST OF ACRONYMS

AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
AWWT	advanced wastewater treatment [facility]
BAT	best available technology
BUSTR	Bureau of Underground Storage Tank Regulations
CAA	Clean Air Act
CAMU	corrective action management unit
CEDE	committed effective dose equivalent
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
CWA	Clean Water Act
DCG	derived concentration guide
DFO	director's findings and orders
DOE	U. S. Department of Energy
DOT	U. S. Department of Transportation
EPA	U. S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FHBM	flood hazard boundary maps
FIRM	flood insurance rate maps
GMA	Great Miami Aquifer
HWMU	hazardous waste management unit
LDR	land disposal restriction
MCL	maximum contaminant level [under SDWA]
MCL	maximum concentration limit [under RCRA]
MCLG	maximum contaminant level goal [under SDWA]
MTR	minimum technology requirements
NAAQS	National Ambient Air Quality Standards
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NWP	Nationwide Permit [Program]

LIST OF ACRONYMS (Continued)

OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ORC	Ohio Revised Code
OU5	Operable Unit 5
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi	picocurie
ppb	parts per billion
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Survey
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Office
SOWC	Southwestern Ohio Water Company
SSOD	storm sewer outfall ditch
STP	site treatment plan
SWMU	solid waste management unit
TBC	to be considered
TSCA	Toxic Substances Control Act
TU	temporary unit
UMTRCA	Uranium Mill Tailings Radiation Control Act
UST	underground storage tank
VOC	volatile organic compound
WAC	waste acceptance criteria

FOREWORD

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED REQUIREMENTS FOR OPERABLE UNIT 5

The tables in this appendix identify the chemical-, location-, and action-specific applicable or relevant and appropriate requirements (ARARs) for Operable Unit 5; two types of tables are provided for each.

The first type (Tables B.1, B.2 and B.3) identifies the regulations that are ARARs or to be considered (TBC) criteria for the anticipated Operable Unit 5 remedial activities at the FEMP, and includes: 1) an explanation of what the requirement is about, 2) identification as an ARAR or TBC, and 3) why it is an ARAR or TBC. Note that the requirements column in these tables provides only a summary; the regulation, statute, or Federal Register citation listed in the tables should be consulted for a full description of the requirement.

The second type (Tables B.4.A through B.4.C) summarizes the methods of compliance with the requirements for the Operable Unit 5 selected remedy. TBCs (proposed requirements) are not included in these tables because they are not ARARs. Therefore, they are not used to determine if the selected remedy will be in compliance with environmental regulations.

TABLE B.1

DOE CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
DRINKING WATER			
	MCLs for Radiological Contaminants		
EPA National Primary Drinking Water Regulations 40 CFR §141.15and §141.16 Ohio Drinking Water Regulations OAC 3745-81-15 OAC 3745-81-16	The following are maximum contaminant levels for radiological contaminants: Combined radium-226 and -228 ..... 5 pCi/L Gross alpha particle activity ..... 15 pCi/L (including radium-226 but excluding radon and uranium) Beta and photon radioactivity ..... 4 mrem/year from man-made radionuclides Strontium-90 ..... 8 pCi/L	Relevant and Appropriate	This requirement is not applicable to OU5 activities because there are no public drinking water systems involved with this remediation. The MCLs are considered relevant and appropriate to the GMA as it is a sole-source aquifer currently used to supply drinking water to the regional area.
	Proposed MCLs for Radiological Contaminants		
56 Federal Register 33050 (July 18, 1991)	The following are the proposed maximum contaminant levels for radiological contaminants: Radium-226 ..... 20 pCi/L Radium-228 ..... 20 pCi/L Radon-222 ..... 300 pCi/L Uranium ..... 20 µg/L Beta and photon emitters ..... 4 mrem cede/year (excluding radium-228) Adjusted gross alpha emitters ..... 15 pCi/L (excluding radium-226, uranium, and radon-222)	TBC	These proposed MCLs are not ARARs because they are not promulgated. The proposed MCLs have been adopted as TBCs because they represent health-based guidance for application to the GMA to ensure protectiveness of human health.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
Groundwater Standards (Uranium Mill Tailings Radiation Control Act)			
Groundwater Standards for Remedial Actions at Inactive Uranium Processing Sites 40 CFR §192.02(a)(3)	The following are drinking water standards for processed and unprocessed uranium mill tailings: Uranium (234+238) ..... 30 pCi/L Molybdenum ..... 0.1 mg/L	Relevant and Appropriate	These standards are relevant and appropriate because uranium mill tailings were processed at the FEMP. Compliance with standards set for other constituents under this requirement will be met through the Safe Drinking Water Act as prescribed by the NCP.
MCLs and MCLGs for Volatile Organic Contaminants (Safe Drinking Water Act)			
EPA National Primary Drinking Water Standards for MCLGs 40 CFR §141.12and §141.50 EPA National Primary Drinking Water Standards for MCLs 40 CFR §141.61 Ohio Drinking Water Regulations for MCLs OAC 3745-81-12	The following are the nonzero federal maximum contaminant level goals (MCLG) and State of Ohio and federal maximum contaminant levels (MCL) for volatile organic contaminants in mg/L: Benzene: Federal MCLG (mg/L) – ; Federal or Ohio MCL (mg/L) 0.005 Carbon tetrachloride: - ; 0.005 Chloroform: - ; 0.1/0.08 Dibromochloropropane (DBCP): - ; 0.0002 Dichloroethane (1,2-): - ; 0.005 Dichloroethylene (1,1-): 0.007 ; 0.007 Dichloromethane: - ; 0.005 Dichloropropane (1,2-): - ; 0.005 Ethylbenzene: 0.7 ; 0.7 Monochlorobenzene: 0.1 ; 0.1 Styrene: 0.1 ; 0.1 Toluene: 1 ; 1 Trichloroethane (1,1,1-): 0.2 ; 0.2 Trichloroethane (1,1,2-): 0.003 ; 0.005 Trichloroethylene: - ; 0.005 Vinyl chloride: - ; 0.002 Xylenes: 10 ; 10	Relevant and Appropriate	This requirement is not applicable to OU5 activities because there are no public drinking water systems involved with this remediation. The MCLs and nonzero MCLGs are considered relevant and appropriate to the GMA as it is a sole-source aquifer currently used to supply drinking water to the regional area. Where the State of Ohio standard is more stringent than the federal standard, the Ohio standard is presented. - = Represents a MCLG of zero. Only nonzero MCLGs are pertinent per CERCLA.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
MCLs and MCLGs for Semivolatile Organic Contaminants (Safe Drinking Water Act)			
EPA National Primary Drinking Water Regulations for MCLGs and MCLs 40 CFR 141.11 40 CFR 141.51 40 CFR 141.62 Ohio Drinking Water Regulations OAC 3745-81-11 OAC 3745-81-23	The following are the federal maximum contaminant level goals (MCLG) and State of Ohio and federal maximum contaminant levels (MCL) for semivolatile organic contaminants in mg/L. Benzo(a)pyrene (PAH): Federal MCLG (mg/L) - ; Federal or Ohio MCL (mg/L) 0.0002 Dichlorobenzene o-: 0.6 ; 0.6 Dichlorobenzene m-: 0.6 ; 0.6 Dichlorobenzene p-: 0.075 ; 0.075 Hexachlorobenzene: - ; 0.001 Hexachlorocyclopentadiene: 0.05 ; 0.05 Pentachlorophenol: - ; 0.001 2,3,7,8-TCDD(Dioxin): - ; 3E-08 Trichlorobenzene (1,2,4): 0.07 ; 0.07	Relevant and Appropriate	This requirement is not applicable to OU5 activities because there are no public drinking systems involved with this remediation. The MCLs and MCLGs are considered relevant and appropriate to the GMA as it is a sole-source aquifer currently used to supply drinking water to the regional area. - = Represents a MCLG of zero. Only nonzero MCLGs are pertinent per CERCLA.
Proposed MCLs and MCLGs for Semivolatile Organic Contaminants (Safe Drinking Water Act)			
55 Federal Register 30370 (July 25, 1990)	The following are proposed nonzero federal maximum contaminant level goals (MCLG) and maximum contaminant levels for semivolatile organic contaminants in mg/L: Benzo(a)anthracene (PAH): Federal MCLG (mg/L) - ; Federal or Ohio MCL (mg/L) 0.0001 Benzo(b)fluoranthene (PAH): - ; 0.0002 Benzo(k)fluoranthene (PAH): - ; 0.0002 Bromodichloromethane: - ; 0.1/0.08 Butyl benzyl phthalate (PAE): - ; 0.1 Chloroform: - ; 0.1/0.08 Chrysene (PAH): - ; 0.0002 Dibenz(a,h)anthracene (PAH): - ; 0.0003 Hexachlorobutadiene: 0.001 ; NA Indenol(1,2,3,-c,d)pyrene (PAH): - ; 0.0004	TBC	These proposed MCLs are not ARARs because they are not promulgated. The proposed MCLs have been adopted as TBCs because they represent health-based guidance for application to the GMA to ensure protectiveness of human health. - = Represents a MCLG of zero. Only nonzero MCLGs are pertinent per CERCLA. NA = Not Available

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
MCLs and MCLGs for Pesticides/PCB Contaminants (Safe Drinking Water Act, continued...)			
EPA National Primary Drinking Water Regulations for MCLGs and MCLs 40 CFR 141.11 40 CFR 141.51 40 CFR 141.62 Ohio Drinking Water Regulations OAC 3745-81-11 OAC 3745-81-23	The following are the nonzero federal maximum contaminant level goals (MCLG) and State of Ohio and federal maximum contaminant levels (MCL) for pesticides/PCB contaminants in mg/L. Adipate (diethylhexyl): Federal MCLG 0.4 (mg/L); Federal or Ohio MCL 0.4 (mg/L) Aroclor: Federal MCLG - ; Federal or Ohio MCL 0.002 Atrazine: Federal MCLG 0.003; Federal or Ohio MCL 0.003 Chlordane: Federal MCLG - ; Federal or Ohio MCL 0.002 Endrin: Federal MCLG - ; Federal or Ohio MCL 0.0002[tt] Heptachlor: Federal MCLG - ; Federal or Ohio MCL 0.0004 Heptachlor epoxide: Federal MCLG - ; Federal or Ohio MCL 0.0002 Lindane: Federal MCLG 0.0002; Federal or Ohio MCL 0.0002 Methoxychlor: Federal MCLG 0.04; Federal or Ohio MCL 0.04 Polychlorinated biphenyls (PCBs): Federal MCLG - ; Federal or Ohio MCL 0.0005 Toxaphene: Federal MCLG - ; Federal or Ohio MCL 0.003	Relevant and Appropriate	This requirement is not applicable to OU5 activities because there are no public drinking systems involved with this remediation. The MCLs and MCLGs are considered relevant and appropriate to the GMA as it is a sole-source aquifer currently used to supply drinking water to the regional area. [tt] = Ohio Drinking Water MCL - = Represents a MCLG of zero. Only nonzero MCLGs are pertinent per CERCLA. NA = Not Available
MCLs and MCLGs for Herbicide Contaminants (Safe Drinking Water Act)			
EPA National Primary Drinking Water Regulations for MCLGs and MCLs 40 CFR 141.11 40 CFR 141.51 40 CFR 141.62 Ohio Drinking Water Regulations OAC 3745-81-11 OAC 3745-81-23	The following are the nonzero federal maximum contaminant level goals (MCLG) and State of Ohio and federal maximum contaminant levels (MCL) for herbicide contaminants in mg/L. 2,4-D: Federal MCLG 0.07 (mg/L); Federal or Ohio MCL 0.07 (mg/L) Dinoseb: Federal MCLG 0.007; Federal or Ohio MCL 0.007 2,4,5-TP: Federal MCLG 0.05; Federal or Ohio MCL 0.01[tt]	Relevant and Appropriate	This requirement is not applicable to OU5 activities because there are no public drinking systems involved with this remediation. The MCLs and MCLGs are considered relevant and appropriate to the GMA as it is a sole-source aquifer currently used to supply drinking water to the regional area. [tt] = Ohio Drinking Water MCL

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
MCLs and MCLGs for Inorganic Contaminants (Safe Drinking Water Act, continued...)			
EPA National Primary Drinking Water Regulations for MCLGs and MCLs 40 CFR 141.11 40 CFR 141.51 40 CFR 141.62 Ohio Drinking Water Regulations OAC 3745-81-11 OAC 3745-81-23	The following are the federal nonzero maximum contaminant level goals (MCLG) and State of Ohio and federal maximum contaminant levels (MCL) for inorganic contaminants in mg/L. Antimony: Federal MCLG 0.006; Federal or Ohio MCL 0.006 Barium: 2; 2 Beryllium: 0.004; 0.004 Cadmium: 0.005; 0.005 Chromium (total): 0.1; 0.05[tt] Copper: 1.3; TT Lead: - ; TT Mercury: 0.002; 0.002 Nickel: 0.1; 0.1 Selenium: 0.05; 0.01 Thallium: 0.0005; 0.002	Relevant and Appropriate	This requirement is not applicable to OU5 activities because there are no public drinking systems involved with this remediation. The MCLs and MCLGs are considered relevant and appropriate to the GMA as it is a sole-source aquifer currently used to supply drinking water to the regional area. [tt] = Ohio Drinking Water MCL TT = Copper - action level 1.3 mg/L; Lead - action level 0.015 mg/L. - = Represents a MCLG of zero. Only nonzero MCLGs are pertinent per CERCLA.
Proposed MCLs and MCLGs for Inorganic Contaminants (Safe Drinking Water Act)			
EPA National Primary Drinking Water Regulations for MCLGs and MCLs 40 CFR 141.11 40 CFR 141.51 40 CFR 141.62 Ohio Drinking Water Regulations OAC 3745-81-11 OAC 3745-81-23	The following are the proposed federal nonzero maximum contaminant level goals (MCLG) and State of Ohio and federal maximum contaminant levels (MCL) for inorganic contaminants in mg/L. Arsenic: Federal MCLG NA; Federal or Ohio MCL 0.05 Cyanide: 0.2; 0.2 Silver: 0.05; 0.05	Relevant and Appropriate	This requirement is not applicable to OU5 activities because there are no public drinking systems involved with this remediation. The MCLs and MCLGs are considered relevant and appropriate to the GMA as it is a sole-source aquifer currently used to supply drinking water to the regional area. NA = Not Available

000331

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
	MCLs for Resource Conservation and Recovery Act, Subtitle C and D		
Chemicals in Drinking Water (Solid Waste Disposal Facility) 40 CFR 257.4 Ohio Solid Waste Regulations OAC 3745-27-10(D) Chemicals in Drinking Water (Hazardous Waste Disposal Facility) 40 CFR 264.94 Ohio Hazardous Waste Regulations OAC 3745-54-94	A solid waste disposal facility shall not contaminate an underground drinking water source beyond the solid waste boundary (outermost perimeter of the waste). The concentration of chemicals shall not exceed background levels or listed MCLs, whichever is higher. A hazardous waste disposal facility must comply with the requirements specified in the facility permit for the uppermost aquifer underlying the waste management area beyond the point of compliance, which is a vertical surface located at the hydraulically downgradient limit of waste management that extends down into the uppermost aquifer underlying the regulated area. The concentration of chemicals in groundwater shall not exceed background levels or the listed maximum concentration level (MCL) of the constituent for groundwater protection, whichever is higher. **Inorganic Chemicals** — Solid Waste RCRA MCL (mg/L) / Hazardous Waste RCRA MCL (mg/L) Arsenic: 0.05 / 0.05 Barium: 1.00 / 1.00 Cadmium: 0.01 / 0.01 Chromium: 0.05 / 0.05 Lead: 0.05 / 0.05 Mercury: 0.002 / 0.002 Selenium: 0.01 / 0.01 Silver: 0.05 / 0.05 **Organic Chemicals** Benzene: .005 / NA Carbon tetrachloride: .005 / NA 1,2-Dichloroethane: .005 / NA 1,1-Dichloroethene: .007 / NA Trichloroethylene: .005 / NA **Radionuclides** Combined Ra-226 & Ra-228: 5 pCi/L Gross alpha particle activity (excluding radon & uranium): 15 pCi/L	Relevant and Appropriate	40 CFR 257.4 and 40 CFR 264.94 and their Ohio equivalents are relevant and appropriate because OU5 contains several of the chemicals listed in the regulation. Compliance with the MCLGs and MCLs under the Safe Drinking Water Act (SDWA) will assure compliance with these RCRA MCLs as discussed in the NCP. The RCRA MCLs reflect earlier versions of the SDWA but the intent is to follow the updated standards of the SDWA (Compliance With Other Laws Manual). ~~These regulations are pertinent to remedial alternatives that involve the use of capping systems or engineered cells. On property disposal of remediation waste might cause migration into the underlying aquifer and potentially contaminate drinking water systems as a consequence of remedial actions.~~ NA = Not Available

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
SURFACE WATER			
	Discharges of Liquid Waste to Surface Waters		
Ohio Water Quality Standards OAC 3745-1-04	"Five Freedoms" for Surface Water are provided by the State of Ohio: All surface waters of the State shall be free from: • Objectionable suspended solids • Floating debris, oil and scum • Materials that create a nuisance • Toxic, harmful or lethal substances • Nutrients that create nuisance growth	Relevant and Appropriate	OAC 3745-1-04 pertains to both discharges to surface waters of the State as a result of remediation and any on-site surface waters affected by site conditions. ~~All action alternatives involve effluent discharges to the Great Miami River. The no action alternative assumes surface water discharges to Paddys Run.~~
	Use Designation of Surface Water		
Ohio Water Quality Standards OAC 3745-1-21	Paddys Run and the Great Miami River are designated as: • Warm water aquatic life habitat • Agricultural and industrial water supply • Primary contact recreation	Applicable	The Great Miami River between Ross Road [River Mile (RM)95.7] to Taylorsville Dam (RM 92.6) is a state resource water and RM 130 and 118 are public water supplies. Discharges to the Great Miami River and Paddys Run must not cause a violation of applicable numeric or narrative water quality standards for these designations.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
	Warm Water Habitat Water Quality Criteria		
Ohio Water Quality Standards OAC 3745-1-07	Surface waters in the State of Ohio must comply with the maximum concentrations of each contaminant listed below for inside and outside the mixing zones of the receiving water to protect warm water aquatic habitats. "Outside Mixing Zone" shall be met after the effluent and the receiving water have been determined to be reasonably well mixed based upon information readily available to the Director. The criteria listed as "Inside Mixing Zone Maximum" shall be applicable as end-of-pipe maximum effluent limits or as criteria to be met within a short distance of the effluent pipe if it can be demonstrated that discharge-induced mixing occurs as per the definition of "area of initial mixing" in rule OAC 3745-1-02.	Applicable	OAC 3745-1-07 is applicable because the site is bordered by the Great Miami River and Paddys Run. ~~All remedial alternatives involving remedial action involve discharges to the Great Miami River. The No Action alternative assumes surface water discharges to Paddys Run.~~

Parameter (µg/L or as marked)	Outside Mixing Zone Max.	Outside Mixing Zone 30-Day Avg.	Inside Mixing Zone Max.	Rationale
Antimony (total)	650	190	1,300	NA = Not Available
Arsenic	360	190	720	
Benzene	1,100	560	2,100	
Beryllium (total)	520	23	1,000	Beryllium is based on a presumed water hardness of 100 mg/L calcium carbonate $CaCO_3$
Bis(2-ethylhexyl) phthalate	1,100	8.4	2,200	
Cadmium	5.6	1.4	11	
Carbon tetrachloride	1,800	280	3,500	
Chlordane	NA	0.01	NA	
Chlorobenzene	590	26	1,200	
Chromium	1,800	210	3,600	
Chloroform	1,800	79	3,600	
2-Chlorophenol	200	8.8	400	
Copper (total)	18	12	35	Copper is based on a presumed water hardness of 100 mg/L $CaCO_3$
Cyanide (free)	46	12	92	
1,2-Dichloroethane	12,000	3,500	24,000	
Dieldrin	NA	0.005	NA	

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement				ARAR/TBC	Rationale
	Parameter (µg/L or as marked)	Outside Mixing Zone Max.	Outside Mixing Zone 30-Day Avg.	Inside Mixing Zone Max.		
	Lead (total)	130	6.9	260		Lead is based on a presumed water hardness of 100 mg/L $CaCO_3$
	Mercury (total)	1.1	0.2	2.2		
	Methylene chloride	9,700	430	19,000		
	Nickel (total)	1,600	170	3,100		Nickel is based on a presumed water hardness of 100 mg/L $CaCO_3$
	Pentachlorophenol	5.3	3.2	11		
	PCBs	NA	0.001	NA		
	Selenium (total)	20	5.0	40		
	Silver (total)	1.6	1.3	3.2		Silver is based on a presumed water hardness of 100 mg/L $CaCO_3$
	Tetrachloroethylene	540	73	1,100		
	Trichloroethylene	1,700	75	3,400		
	Thallium (total)	71	16	140		
	Zinc (total)	120	110	230		Zinc is based on a presumed water hardness of 100 mg/L $CaCO_3$

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
	Human Health and Agricultural Water Supply Criteria		
Ohio Water Quality Standards OAC 3745-1-07	See previous requirement for explanation of inside/outside mixing zones. The maximum (outside mixing zone) concentrations for contaminants listed below are based on the designated use of the surface water body as Human Health or Agricultural. Outside Mixing Zone 30-Day Average Parameter (µg/L or as marked) / Human Health / Agricultural Antimony (total) / 4,300 / NA Arsenic / NA / 100 Benzene / 710 / NA Beryllium (total) / 1.17 / 100 beta-BHC / 0.55 / NA Bis(2-ethylhexyl) phthalate / 59 / NA Cadmium / NA / 50 Carbon tetrachloride / 44 / NA Chromium (total) / 3,433,000 / 100 Copper (total) / NA / 500 1,2-Dichloroethane / 990 / NA Dieldrin / 0.00076 / NA Fluoride (mg/L) / NA / 2.0 Lead (total) / NA / 100 Mercury (total) / 0.012 / 10 Nickel (total) / 4,600 / 200 N-Nitrosodi-n-propylamine / 12.4 / NA PCBs / 0.00079 / NA PAHs / 0.31 / NA Selenium (total) / NA / 50 Thallium (total) / 48 / NA Vinyl chloride / 5,250 / NA Zinc Total / NA / 25,000	Applicable	OAC 3745-1-07 is applicable because the site is bordered by the Great Miami River and Paddys Run. ~~All remedial alternatives involving remedial action involve discharges to the Great Miami River. The No Action alternative assumes surface water discharges to Paddys Run.~~ NA = Not Available

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
	Human Health and Agricultural Water Supply Criteria (Continued...)		
Management and Control of Radioactive Materials in Liquid Discharges DOE Order 5400.5 Chapter II, (3) Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (3)(a) 10 CFR 834 (PROPOSED)	In addition to the requirements to limit dose to members of the public (on site and off site) in accordance with the standards established in paragraphs II (1)(a) and II (1)(d), further controls are imposed on liquid releases to protect resources such as surface water. Derived concentration guides (DCGs) are not release limits, but rather are screening values for considering best available technology (BAT) for these discharges and for making dose estimates. These requirements apply at the point of discharge from the conduit to the environment (see DCGs in DOE Order 5400.5 Chapter III (3)). The BAT is the prescribed level of treatment for liquid radioactive discharges to surface water that would otherwise contain radioactive concentrations greater than the DCG values. Implementation of the BAT process is not required for waste streams that contain radionuclide concentrations of not more than the DCG values at the point of discharge to a surface waterway. Residual concentrations of radionuclides in water that may be ingested are listed in tabular form in DOE Order 5400.5 Chapter III. The DCGs for the COCs are based on a committed effective dose equivalent (CEDE) of 100 mrem/yr, assuming ingestion of 2 liters/day. Note that these DCGs apply <u>only if</u> ingestion is the single pathway of exposure.	TBC	DOE orders are not ARARs because they are not promulgated. This DOE order is a TBC because of the potential to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule.
DOE Order 5400.5 Chapter II (3)(a)(5) 10 CFR 834 (PROPOSED)	The absorbed dose to native aquatic animal organisms shall not exceed 1 rad per day from exposure to the radioactive material in liquid wastes discharged to natural waterways.	TBC	DOE orders are not ARARs because they are not promulgated. This DOE order is a TBC because of the potential to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
RADIATION LIMITS			
Dose Limits for Individual Members of the Public			
Ohio General Radiation Protection Standards OAC 3701-38-15(A)(1),(B) DOE Order 5400.5 Chapter II (1)(a) 10 CFR 834 (PROPOSED)	Operations causing air emissions shall be conducted such that: • The total effective dose equivalent to individual members of the public from the operation does not exceed 0.1 rem (100 mrem) in a year • The dose in any unrestricted area from external sources does not exceed 0.002 rem (2mrem) in any one hour	Relevant and Appropriate	This OAC standard is not applicable because it applies to radiation sources which are not regulated by the U.S. Atomic Energy Act authority. However, this standard is relevant and appropriate because of the potential to result in the exposure to members of the public. NESHAP 40 CFR 61.91 will assure compliance with the first bullet. The second bullet is not found in NESHAP or in DOE Orders. 10 CFR 834 is included as a TBC because it is presently a proposed rule.
Radiation Dose Limit Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (1) DOE Order 5400.5, Chapter II (1)(a) DOE Order 5400.5, Chapter II (1)(a)(3) 10 CFR 834 (PROPOSED)	The public dose limits include consideration of all exposure modes from all DOE activities (including remedial activities). The radiation dose limit is the sum of the effective dose equivalent (weighted summation of doses to various organs of the body) from exposures to radiation sources external to the body during the year plus the committed effective dose equivalent from radionuclides taken into the body during the year. Medical sources, consumer products, residual fallout from past nuclear accidents and weapons tests and naturally occurring radiation sources are not included in this summation. The exposure of members of the public to radiation sources as a consequence of all routine DOE activities shall not cause, in a year, an effective dose equivalent of more than 100 mrem for all exposure pathways. If unusual circumstances affect a DOE activity in such a manner that the potential public dose could exceed an effective dose equivalent of 0.1 rem (100 mrem) in a year, DOE may authorize a temporary increase of the dose limit up to 0.5 rem (500 mrem).	TBC	DOE orders are not ARARs because they are not promulgated. This DOE order is a TBC because of the potential to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
	Dose Limits for Individual Members of the Public, Continued...		
As Low As Reasonably Achievable (ALARA) DOE Order 5400.5 Chapter II, 2. 10 CFR 834 (PROPOSED)	Field elements shall develop a program and shall require contractors to implement an ALARA process for DOE activities and facilities that have the potential to cause radiation exposure to the public.	TBC	DOE orders are not ARARs because they are not promulgated. This DOE order is a TBC because of the potential to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule.
	STORAGE OF RADIOACTIVE MATERIAL		
Control of Residual Radioactive Material DOE Order 5400.5 Chapter IV (6)(b) 10 CFR 834 (PROPOSED)	Interim storage must provide: 1) Control and stabilization features shall be designed to provide, to the extent reasonably achievable, an effective life of 50 years with a minimum life of at least 25 years. 2) Controls shall be designed such that radon-222 concentrations in the atmosphere above facility surfaces or openings in addition to background levels, will not exceed: (a) 100 pCi/L at any given point; (b) An annual average concentration of 30 pCi/L over the facility site; and (c) An annual average concentration of 3 pCi/L at or above any location outside the facility site. (d) Flux rates from the storage of radon producing wastes shall not exceed 20 pCi/m ^{2}/sec, as required by 40 CFR Part 61. 3) Controls shall be designed such that concentrations of radionuclides in the groundwater and quantities of residual radioactive material will not exceed applicable federal or state standards. 4) Access to a property and use of on-site material contaminated by residual radioactive material should be controlled through appropriate administrative and physical controls such as those described in 40 CFR Part 192. These control features should be designed to provide, to the extent reasonable, an effective life of at least 25 years.	TBC	~~All OU5 alternatives except the no-action alternative~~ The selected remedy will provide for the interim storage of contaminated materials. 10 CFR 834 is included as a TBC because it is presently a proposed rule.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
	STORAGE OF RADIOACTIVE MATERIAL (Continued)		
Control of Residual Radioactive Material DOE Order 5400.5 Chapter IV (6)(d) 10 CFR 834 (PROPOSED)	1) Long-term management of uranium, thorium, and their decay products must provide: (a) Control and stabilization features designed to provide, to the extent reasonably achievable, an effective life of 1000 years with a minimum life of at least 200 years. (b) Control and stabilization features designed to limit radon-222 emanation to the atmosphere from the wastes to less than an annual average release rate of 20 pCi/m ^{2}/sec and prevent increases in the annual average radon-222 concentration at or above any location outside the boundary of the contaminated area by more than 0.5 pCi/L. Field verification of emanation rates shall be in accordance with the requirements of 40 CFR Part 61. (c) A long-term management facility for any potentially biodegradable contaminated wastes properly conditioned so that the generation and escape of biogenic gases will not cause the requirement in paragraph IV.6d(1)(b) to be exceeded and that biodegradation within the facility will not result in premature structural failure in violation of the requirements in paragraph IV.6d(a). (d) Groundwater protection in accordance with legally applicable federal and state standards. (e) Access to a property and use of on-site material contaminated by residual radioactive material controlled through appropriate administrative and physical controls such as those described in 40 CFR Part 192 for uranium mill tailings designed to be effective to the extent reasonable for at least 200 years. 2) In addition, long-term management of other radionuclides shall be in accordance with Chapters II, III, and IV of DOE 5820.2A, as applicable.	TBC	~~All remedial actions will provide for the long term storage of contaminated materials. Remedial alternatives under land use 2, 3, and 4 involve t~~ The long term management of radioactive materials will be necessary under the selected remedy. DOE orders are not ARARs because they are not promulgated. This DOE order is a TBC because ~~all alternatives have~~ the selected remedy has the potential to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
AIR			
National Emissions Standards for Emissions of Radionuclides Other than Radon From DOE Facilities			
National Emission Standards for Hazardous Air Pollutants 40 CFR §61.190,61.192 Subpart Q	No source at a DOE facility shall emit more than 20 pCi/m ^{2}/sec of radon-222 as an average for the entire source into the air.	Applicable	This requirement is applicable because the FEMP presently and/or will continue to be a storage and disposal facility for radium-bearing material. This requirement explicitly includes the FEMP in its designation of facilities.
National Emission Standards for Hazardous Air Pollutants 40 CFR §61.90,61.91 and 61.92- .97 Subpart H	These requirements are applicable to DOE-owned and operated facilities that emit any radionuclides other than radon-222 and radon-220 into the air. Emissions of radionuclides (except radon-220 and radon-222) to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr. To determine compliance with the standard, radionuclide emissions shall be determined and effective dose equivalent values to members of the public calculated using EPA-approved sampling procedures, computer models CAP-88 or AIRDOS-PC, or other procedures for which EPA has granted prior approval.	Applicable	~~All remedial alternatives have~~ The selected remedy has the potential to release radionuclides to the atmosphere through fugitive dust and/or point source emissions.
Control of Radon Emissions			
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR §192.06(b) Subpart A 40 CFR §192.32(b)(1)(ii) Subpart D National Emission Standards for Hazardous Air Pollutants, Radon-222 Emissions 40 CFR 61, Subpart Q	The following standards apply to the: • Control of residual radioactive materials from inactive uranium processing sites. • Management of uranium byproduct materials after closure of a disposal area. • Long-term management of uranium, thorium, and their decay products. Controls shall be designed to provide reasonable assurance that releases of radon-222 from the above materials to the atmosphere will not: • Exceed an average release rate of 20 pCi/m ^{2}/sec (averaged over the entire surface of the disposal site and over at least a one-year period). • Increase the annual average concentration of radon-222 in air or above any location outside the disposal site by more than 0.5 pCi/L.	Relevant and Appropriate	Radioactive materials in this operable unit are a result of releases from uranium processing. Contaminated soil and sediment are similar in characteristic to materials addressed by these regulations. Requirements for design of controls for on-property disposal should be consistent with design for control of other residual radioactive materials such as mill tailings.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
AIR EMISSION STANDARDS			
Lead in Air EPA Regulations on National Primary and Secondary Ambient Air Quality Standards 40 CFR 50.12 Ohio Ambient Air Quality OAC 3745-17-08	Lead and its compounds measured as elemental lead should not exceed 1.5 micrograms per cubic meter, maximum arithmetic mean averaged over a calendar quarter.	Relevant and Appropriate	The federal regulation at 40 CFR 50.12 is relevant and appropriate because it sets a standard for lead in air and lead has been identified as a contaminant of concern at OU5. ~~All alternatives contemplating action have~~ The selected remedy has a potential to release quantities of lead-bearing soil as fugitives during excavation and disposal operations. Additionally, lead could be a contaminant in particulate emissions from point source discharges from sludge dewatering and soil treatment/stabilization.
Definition of Derived Concentration Guides for Radionuclides DOE Order 5400.5 Chapter III 10 CFR 834 (PROPOSED)	The derived concentration guides (DCGs) are provided as reference values for conducting radiological environmental protection programs at operational DOE facilities and sites. • Ingestion of water • Inhalation of air • Immersion in a gaseous cloud The DCG values for internal exposure are based on a committed effective dose equivalent of 100 mrem for the radionuclide taken into the body by ingestion or inhalation during one year. The DCG values account for only three exposure pathways (ingested water or inhaled air or air immersion) and do not include other potentially significant pathways. When more complex environmental pathways are involved, a more complete pathway analysis is required for calculating public radiation doses resulting from the operation of DOE facilities.	TBC	DOE orders are not ARARs because they are not promulgated. This DOE order is a TBC because ~~all alternatives have~~ of the potential of remedial actions to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
AIR EMISSION STANDARDS (Continued)			
Derived Concentration Guides for Radionuclides DOE Order 5400.5 Chapter III,3. 10 CFR 834 (PROPOSED)	The DCGs are given for different lung retention classes (noted as D,W, or Y, where D equals a removal half-time of 0.5 days, W equals a removal half-time of 50 days, and Y equals a removal half-time of 500 days). Derived Concentration Guide ISOTOPE µCi/mL D W Y Uranium-235 5×10^{12} 2×10^{12} 1×10^{13} Uranium-236 5×10^{12} 2×10^{12} 1×10^{13} Uranium-238 5×10^{12} 2×10^{12} 1×10^{13} Exposure conditions assume an inhalation rate of 8400 m^3 of air per year (based on an exposure over 24 hours per day, 365 days per year).	TBC	DOE orders are not ARARs because they are not promulgated. This DOE order is a TBC because ~~all alternatives have~~ of the potential for remedial actions to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule.
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter III 10 CFR 834 (PROPOSED)	Residual concentrations of radionuclides in air in an uncontrolled area are limited to the following (for known mixtures of radionuclides, the sum of the ratios of the observed concentration of each radionuclide to its corresponding limit must not exceed 1.0). Derived Concentration Guide ISOTOPE µCi/mL D W Y Actinium-227 2×10^{15} 7×10^{15} 1×10^{14} Lead 9×10^{13} --- --- Polonium-210 1×10^{12} 1×10^{12} --- Protactinium-231 --- 9×10^{15} 1×10^{14} Radium-224 --- 4×10^{12} --- Radium-226 --- 1×10^{12} --- Radium-228 --- 3×10^{12} --- Technetium-99 1×10^{8} 2×10^{9} --- Strontium-90 5×10^{11} --- --- Thorium-228 --- 5×10^{14} 4×10^{14} Thorium-230 --- 4×10^{14} 5×10^{14} Thorium-232 --- 7×10^{15} 1×10^{14} Uranium-234 4×10^{12} 2×10^{12} ---	TBC	DOE orders are not ARARs because they are not promulgated. This DOE order is a TBC because ~~all alternatives have~~ of the potential for remedial actions to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
SOIL AND CONTAMINATED MATERIALS			
	Cleanup of Soil Contaminated with Residual Radioactive Materials		
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR 192.02 Subpart A 40 CFR 192.12(a) Subpart B 40 CFR 192.20 Subpart C	Remedial actions shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials, the concentration of radium-226 in land averaged over any area of 100 m^2 shall not exceed the background level by more than: • 5 pCi/g averaged over the first 15 cm of soil below the surface, and • 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface. Compliance with this requirement should be shown through measurements performed within the accuracy of currently available types of field and laboratory instruments in conjunction with reasonable survey and sampling procedures.	Relevant and Appropriate	The contaminated materials associated with OU5 are similar in characteristics to uranium mill tailings. This regulation is not applicable as the FEMP is not a designated uranium mill tailings facility. ~~This standard is relevant and appropriate to all remedial alternatives.~~
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR 192.21(f) and 192.22(b) Subpart C	Where radionuclides other than radium-226 and its decay product are present in sufficient quantity and concentration to constitute a significant radiation hazard from residual radioactive materials, remedial actions shall, in addition to satisfying the standards of 40 CFR 192.02,Subpart A and 192.12,Subpart B (both listed above), reduce other residual radioactivity to levels that are as low as is reasonably achievable.	Relevant and Appropriate	Contaminated material associated with OU5 are similar in characteristics to uranium mill tailings. ~~This standard is relevant and appropriate to all remedial alternatives.~~
Post Closure Standards for Uranium and Thorium Mill Tailings 40 CFR 192.32(b)(2) Subpart D	The requirements for the management of uranium byproduct materials after closure of a disposal area (40 CFR 192.32(b)(1)) shall not apply to any portion of a disposal site which contains a concentration of radium-226 in land, averaged over areas of 100m^2, which, as a result of uranium byproduct material, does not exceed the background level by more than: • 5 pCi/g averaged over the first 15 cm of soil below the surface, and • 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface.	Relevant and Appropriate	Contaminated materials associated with OU5 are similar in characteristics to uranium mill tailings. ~~This standard is relevant and appropriate to all remedial alternatives.~~
Management of Thorium Mill Tailings 40 CFR 192.40-192.42 Subpart E	The following are requirements for the management of thorium byproduct materials: • The provisions for the management of uranium byproduct material (40 CFR §192.32) shall apply to thorium byproduct material and: - Provisions applicable to the element uranium shall also apply to the element thorium - Provisions applicable to radon-222 shall also apply to radon-220 - Provisions applicable to radium-226 shall also apply to radium-228 With the concurrence of EPA, alternative provisions may be substituted for any of the above requirements provided the alternative provisions will provide at least an equivalent level of protection for human health and environment.	Relevant and Appropriate	Contaminated material associated with OU5 are similar in characteristics to uranium mill tailings. ~~This standard is relevant and appropriate to all remedial alternatives.~~

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
	Hot Spots		
Radiation Protection of the Public and the Environment - Soil Contamination DOE Order 5400.5 Chapter IV (4)(a)(1) 10 CFR 834 (PROPOSED)	If the average residual concentration of radionuclides in any surface soil or below surface area less than or equal to 25 m^2 exceeds the limit or guideline by a factor of $(100/A)^{0.5}$ [where A is the area (in square meters) of the region in which the concentrations are elevated], limits for "hot spots" shall also be developed and applied. Procedures for calculating these hot spots limits, which depend on the extent of the elevated local concentrations, are given in DOE/CH-8901. In addition, reasonable efforts shall be made to remove any source of radionuclide that exceeds 30 times the appropriate limit in the soil, irrespective of the average concentration in the soil.	TBC	~~All OU5 alternatives involve~~ The selected remedy involves the excavation of contaminated soil and sediment. DOE Orders provide guidance on addressing contaminated soil and sediment at DOE facilities. DOE orders are TBCs, rather than ARARs because they are not promulgated. 10 CFR 834 is included as a TBC because it is presently a proposed rule.
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (4)(a)(2)(3) 10 CFR 834 (PROPOSED)	The generic guidelines for residual concentrations of radium-226, radium-228, thorium-230, and thorium-232 are: • 5 pCi/g, averaged over the first 15 cm of soil below the surface; and • 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface. These guidelines take into account ingrowth of radium-226 from thorium-230 and of radium-228 from thorium-232, and assume secular equilibrium. If both thorium-230 and radium-226, or both thorium-232 and radium-228, are present and not in secular equilibrium, the appropriate guideline is applied as a limit for the radionuclide with the higher concentration. If other mixtures of radionuclides occur, the concentrations of individual radionuclides shall be reduced so that either the dose for the mixture will not exceed the basic dose limit or the sum of the ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide will not exceed 1. Explicit formulas for calculating residual concentrations guidelines for mixtures are given in DOE/CH-8901.	TBC	Radionuclides are COCs for soil within the scope of OU5. ~~All OU5 actions except the no-action alternative involve excavation of soil contaminated with these Constituents of Concern.~~ DOE orders are TBC rather than ARARs because they are not promulgated. This citation is included as a TBC as it is more restrictive than the federal standard in 40 § CFR 192, .02, .12(a), .20, .21(f), .22(b), .32(b)(2), .40-.42. 10 CFR 834 is included as a TBC because it is presently a proposed rule.
Guidelines for Residual Radioactive Material--Surface contamination DOE Order 5400.5, Chapter IV (4)(d) 10 CFR 834 (PROPOSED)	These generic surface contamination guidelines are applicable to existing structures and equipment. These guidelines are generally consistent with standards of the NRC (1982) and functionally equivalent to Section 4, "Decontamination for Release for Unrestricted Use," of Regulatory Guide 1.86, but apply to nonreactor facilities. These limits apply to both interior equipment and building components that are potentially salvageable or recoverable scrap. If a building is demolished, the guidelines in paragraph IV (6)(a) are applicable to the resulting contamination in the ground.	TBC	These criteria will be used for any process facility building built and/or used for the remedial action, including the AWWT, soil washing, soil staging, etc., structures and buildings. DOE orders are not ARARs because they are not promulgated. This DOE order is a TBC because ~~all alternatives have~~ of the potential of remedial actions to result in structures and equipment containing residual radioactivity. 10 CFR 834 is included as a TBC because it is presently a proposed rule.

TABLE B.1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
	Lead Soil Cleanup Standards		
Resource Conservation and Recovery Act 40 CFR 268.41	The maximum concentration of lead (5.0 mg/L) may not be exceeded whether it is the extract of a waste or waste treatment residual.	Applicable	Lead is a COC in soil and sediment in OU5. ~~This requirement is applicable to all remedial alternatives.~~
Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities OSWER Directive # 9355.4-12	This lead soil guidance states the following: • Screening level of 400 ppm for lead in soil is proposed for residential land use; • Site-specific preliminary remediation goals (PRGs) at CERCLA sites and media cleanup standards (MCLs) at RCRA corrective action facilities for residential land use are described; and • A plan for soil lead cleanup at CERCLA sites and RCRA Corrective Action facilities that have multiple sources of lead is described.	TBC	This policy is not ARAR because it is not a promulgated regulation. This interim directive is a TBC because it establishes an approach for determining protective levels for lead in soil at CERCLA sites and RCRA facilities that are subject to corrective action under RCRA Section 3004(v) or 3008(h).
	PCB Soil Cleanup Standards		
PCB Spill Cleanup Policy 40 CFR 761.125 40 CFR 761.125(c)	PCBs at concentration of greater than 50 ppm are subject to TSCA decontamination requirements in 40 CFR 761.120(b). Soil in nonrestricted access areas contaminated by a PCB spill will be decontaminated to 10 ppm PCBs by weight, provided that the soil is excavated to a minimum depth of 10 inches. The excavated soil will be replaced with clean soil, i.e., containing less than 1 ppm PCBs, and the spill site will be restored (e.g., replacement of turf) [761.125(c)(4)(v)]. For soil in restricted access areas, decontamination will be to 25 ppm PCBs by weight [761.125(c)(3)(v)].	TBC	PCBs are a COC in soil for OU5. Concentrations of PCBs at OU5 are expected to be less than 50 ppm. Although published in the Code of Federal Regulations, this is a policy, not a promulgated rule, and hence a TBC. This TBC is pertinent to all ~~remedial alternatives and will be considered relative to~~ Operable Unit 5 ~~PRLs~~ final remediation levels for soil containing PCBs as CERCLA wastes, per the NCP.

TABLE B.2

DOE LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
THREATENED & ENDANGERED SPECIES			
HABITAT PROTECTION			
Procedures for Implementing the National Environmental Policy Act 40 CFR §6.302(h) 10 CFR 1021 Endangered Species Act 16 U.S.C. §1531, et seq. Endangered and Threatened Wildlife and Plants 50 CFR §17.21, §17.31, §17.61, §17.71, and §17.94 Interagency Cooperation-Endangered Species Act 50 CFR §402.01	All federal agencies must ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of the constituent elements essential to the conservation of a listed species within a defined critical habitat. Additional requirements apply if it is determined that a proposed activity could adversely affect these species or their habitat.	Applicable	In 1993 and 1994 updated surveys at the FEMP determined the presence of the state-listed Sloan's crayfish (*Orconectes sloanii*) in Paddys Run. Additionally, it was determined that good habitat exists for the federally listed endangered Indiana bat (*Myotis sodalis*) along Paddys Run and the storm sewer outfall ditch. Moderate and marginal habitat exist in a very limited area for the state-listed endangered cave salamander (*Eurycea lucifuga*). Surveys did not locate habitat or populations for the federally listed endangered running buffalo clover (*Trifolium stoloniferum*) or the state-listed endangered mountain bindweed (*Polygonum cilinode*) and slender fingergrass (*Digitaria filiformis*). In addition, neither habitat nor populations of the state-listed threatened spring coralroot (*Corallorhiza wisteriana*) were found on FEMP property.
Interagency Cooperation-Endangered Species Act 50 CFR §402.12 (a),(b)	A biological assessment shall evaluate the potential effects of the action on listed and proposed critical habitat and determine whether any such species or habitat are likely to be adversely affected by the action and is used in determining whether formal consultation or a conference is necessary.	Applicable	These procedures are required for federal actions that are "major construction activities."

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
SPECIES PROTECTION			
Ohio Endangered Species Regulations ORC 1531.25	No person shall take or possess any native species of wild animal, or any eggs or offspring thereof, that is endangered with state-wide extinction.	Applicable	Updated surveys in 1993-94 found state-listed threatened Sloan's crayfish (*Orconectes sloanii*) populations in sections of Paddys Run. Moderate habitat for the state-listed endangered cave salamander (*Eurycea lucifuga*) was also determined during a 1993 survey of the FEMP.
Ohio Endangered Species Regulations ORC 1518.02 OAC 1501:18-1	No person shall root-up, injure, destroy, remove, or carry away on or from public highways, public property, or waters of the state, or on or from the property of another, without the written permission of the owner, lessee, or other person entitled to possession, any endangered plant listed in OAC 1501:18-1.	Applicable	Surveys in 1994 did not locate the federally listed endangered running buffalo clover (*Trifolium stoloniferum*), the state-listed endangered mountain bindweed (*Polygonum cilinode*) or slender finger grass (*Digitaria filiformis*), or state-listed threatened spring coralroot (*Corallorhiza wisterlana*).
Classification of Solid Waste Disposal Facilities and Practices 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.	Applicable	This regulation is applicable to ~~alternatives involving~~ the use of ~~capping systems or~~ engineered cells.

HISTORIC AND CULTURAL RESOURCE PROTECTION

ANTIQUITY AND HISTORIC SITE PRESERVATION			
Antiquities Act of 1906 16 U.S.C. §431-433 and Historic Sites Preservation Act 16 U.S.C. §461-467	No person may appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity situated or controlled by the Government of the United States without an applicable permit. Identification and preservation of cultural resources on federal lands is required, including natural landmarks.	Applicable	Proposed areas of disturbance associated with Operable Unit 5 remedial actions will be surveyed and the Advisory Council on Historic Preservation and the State Historic Preservation Office (SHPO) will be consulted as agreed upon in a programmatic agreement with DOE, SHPO, and the Advisory Council. This regulation is applicable to ~~all alternatives contemplating~~ soil excavation. ~~, which include all except No Action.~~

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
ARCHAEOLOGICAL RESOURCE RECOVERY AND PRESERVATION			
Procedures for Implementing the National Environmental Policy Act 40 CFR §6.301 (c) Archaeological Resources Protection Act (16 USC § 47099-47011) Protection of Archaeological Resources 43 CFR §7.4(a)	No person may excavate, remove, damage, or otherwise alter or deface or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public lands unless such activity is pursuant to a permit.	Applicable	Compliance will be coordinated through Section 106 of the National Historic Preservation Act.
HISTORIC PRESERVATION			
National Historic Preservation Act 16 USC § 470C Consideration of Historic Properties 36 CFR Part 800	DOE must take into account the effect of an undertaking on historic properties and accord the Advisory Council on Historic Preservation a reasonable opportunity to comment. Historic properties are defined as any prehistoric or historic district, building, site, structure, or object included in or eligible for inclusion in the National Register of Historic Places. This term includes artifacts, records, and persons released to and located within such properties. Historic properties that are to be substantially altered or demolished must be recorded for future use and reference.	Applicable	~~Proposed a~~Areas of disturbance associated with Operable Unit 5 remedial activities will be surveyed to determine applicable requirements and the Advisory Council will be consulted as agreed upon in a programmatic agreement with DOE, SHPO, and the Advisory Council. ~~This requirement is applicable to all remedial alternatives except the no-action alternative.~~
Archaeological and Historic Preservation Act 16 U.S.C. §469, §470	Upon discovery that a project may cause the irreparable loss, destruction, significant scientific finding, prehistorical finding, or loss of historical or archeological data, DOE must notify the Dept. of the Interior in writing and provide appropriate information concerning the project. DOE must, with possible assistance from SHPO, undertake recovery, protection, and preservation of the data.	Applicable	See previous comment.

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
HISTORIC PRESERVATION (Continued)			
American Indian Religious Freedom Act 42 U.S.C. §1996	Provides for tribal access by native peoples to grave sites and sites of cultural, symbolic, or religious significance.	Applicable	See previous comment.
Executive Order 11593, Protection and Enhancement of Cultural Environment 3 CFR 54	An inventory of a site with potential historic places is required for eligibility in the National Register of Historic Places.	Applicable	See previous comment.
Native American Graves Protection and Repatriation Act 25 U.S.C. §3001	Identification and preservation of cultural resources on federal lands is required, including natural landmarks. DOE must consult with appropriate Indian tribes prior to the intentional excavation or removal after an inadvertent discovery of Native American cultural items including human remains and objects of cultural significance.	Applicable	See previous comment.

SENSITIVE ENVIRONMENTAL LOCATIONS

FLOODPLAIN/WETLANDS			
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 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 predominately 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.	Applicable	Review will be conducted concurrently with NEPA determinations for proposed actions. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
FLOODPLAIN/WETLANDS (Continued)			
DOE Compliance with Floodplain/Wetlands Assessments 10 CFR §1022.12(a)	Prior to any proposed remedial action, DOE shall prepare a floodplain/wetlands assessment.	Applicable	Floodplain/wetland assessments will be prepared as required. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 10 CFR §1022.15(a)	If DOE finds that no practicable alternative to locating in the floodplain/wetland 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 or wetland.	Applicable	Floodplain/wetland impacts will be avoided and minimized to the maximum extent practicable. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
FLOODPLAIN/WETLANDS (Continued)			
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 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 wetland 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 floodplain. - Minimize the destruction, loss, or degradation of wetlands. - Preserve and enhance the natural and beneficial values of wetlands. • Undertake a careful evaluation of the potential effects of any DOE action taken in a floodplain and any new construction undertaken by DOE in wetlands not located in a floodplain. • Identify, evaluate, and as appropriate, implement alternative actions which may avoid or mitigate adverse floodplain/wetlands impacts. • Provide opportunity for early public review of any plans or proposals for actions in floodplains and new construction in wetlands.	Applicable	Short and long term impacts associated with Operable Unit 5 remedial activities will be avoided and minimized to the maximum extent practicable. ~~This requirement is applicable to all remedial alternatives except the no-action alternative.~~
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 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.	Applicable	Short and long term impacts associated with Operable Unit 5 remedial activities will be avoided and minimized to the maximum extent practicable. ~~This requirement is applicable to all remedial alternatives except the no-action alternative.~~

743

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
WETLANDS			
Procedure for Implementing the National Environmental Policy Act 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.	Applicable	Approximately 35.9 acres of jurisdictional wetlands and 8.9 acres of waters of the United States were identified onsite as a result of the 1993 FEMP Wetland Delineation. The U.S. Army Corps of Engineers officially approved the delineation on August 19, 1993. Wetland impacts associated with Operable Unit 5 remedial activities will be minimized and avoided to the maximum extent practicable. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~
Executive Order 11990, Protection of Wetlands	This order requires that federal agencies take action to avoid adversely impacting wetlands wherever possible, to minimize wetland destruction and to preserve the values of wetlands.	Applicable	Wetland impacts associated with Operable Unit 5 remedial activities will be avoided and minimized to the maximum extent practicable. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~
Nationwide Permit (NWP) Program 33 CFR §330	The U.S. Army Corps of Engineers has authorized certain categories of activities involving the discharge of dredged and fill material into wetlands and waters of the United States under the NWP program. Impacts involving the discharge of dredged and fill material will be conducted in accordance with the substantive requirements of applicable NWPs as required. Discharges not authorized by NWP will be conducted in accordance with the substantive requirements of 33 CFR 323 and 40 CFR 230.	Applicable	Approximately 35.9 acres of jurisdictional wetlands and 8.9 acres of waters of the United States have been identified on site. Impacts to these areas will be avoided and minimized to the maximum extent practicable. Discharges of dredged and fill material authorized by NWPs will be conducted in accordance with the substantive requirements of the respective permits. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~
Permits for the Discharge of Dredged and Fill Material into waters of the United States 33 CFR §323	Remedial actions involving the discharge of dredge and fill material into these areas shall meet the substantive requirements of this section and 40 CFR §230.	Applicable	Discharges of dredged and fill material not authorized by NWP will be conducted in accordance with the substantive requirements of these regulations. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
WETLANDS (Continued)			
Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged and Fill Material 40 CFR §230	40 CFR 230 sets guidelines for evaluation of discharges of dredged and fill material into wetlands and waters of the United States. The requirements specify that no discharge of dredged or fill material shall take place unless the permit authorizing agency makes a determination of the short-term effects of the discharge on the environment of the site, and if: 1. There is no practicable alternative to the action; 2. A state water quality standard will not be violated; and 3. It does not contribute to or causes the significant degradation of waters of the United States.	Applicable	Discharges of dredged and fill material associated with Operable Unit 5 remedial actions will be evaluated and conducted against the substantive requirements of these regulations. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~
Section 401 State Water Quality Certifications OAC 3745-32	Section 401 State Water Quality Certification is required to conduct dredge and fill activities within wetlands or waters of the United States. State Water Quality Certification is granted provided: 1. The discharge does not prevent or interfere with the attainment or maintenance of applicable water quality standards; and 2. The discharge does not result in a violation of any applicable provisions of the CWA.	Applicable	Discharges of dredged and fill material associated with Operable Unit 5 remedial actions will meet the substantive requirements of these regulations. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~
Protection of Wetlands 40 CFR §258.12	New municipal solid waste landfill units must not be located in wetlands unless Ohio approves otherwise.	Applicable	Wetland impacts associated with Operable Unit 5 remedial actions will be avoided and minimized to the maximum extent practicable. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (G)(15)	A solid waste disposal facility may not be located in a floodway.	Applicable	Floodway impacts associated with Operable Unit 5 remedial activities will be avoided and minimized to the maximum extent practicable. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(4)(d)	The limits of waste placement cannot be located within 200 feet of a stream, lake, or natural wetland, unless deemed acceptable by the Director of the OEPA.	Applicable	Wetland impacts associated with Operable Unit 5 remedial actions will be avoided and minimized to the maximum extent practicable. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~

743

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
FLOODPLAINS			
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (G)(15)	The limits of solid waste placement and the leachate management system cannot be located in a regulatory floodplain, unless deemed acceptable by the Director of the OEPA.	Applicable	~~Several remedial alternatives involve~~ This requirement is applicable to the siting of a solid waste disposal facility. ~~This requirement is applicable to all alternatives contemplating use of capping systems or engineered cells.~~
Ohio Solid Waste Disposal Regulations OAC 3745-29-07 (G)(15)	The limits of solid waste placement and the leachate management system cannot be located in a regulatory floodplain, unless deemed acceptable by the Director of the OEPA.	Applicable	~~Several remedial alternatives involve~~ This requirement is applicable to the siting of a solid waste disposal facility. ~~This requirement is applicable to all alternatives contemplating the use of capping systems or engineered cells.~~
Procedures for Implementing the National Environmental Policy Act 40 CFR §6.302(b)	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.	Applicable	Floodplain impacts associated with Operable Unit 5 remedial activities will be avoided and minimized to the maximum extent practicable. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~
Floodplain Management Executive Order 11988	This order requires federal agencies undertaking actions within a floodplain to evaluate the potential for adverse impact on the floodplain. If it is determined that adverse impacts could occur, the effects of the action must be minimized to the extent practical.	Applicable	Floodplain impacts associated with Operable Unit 5 remedial activities will be avoided and minimized to the maximum extent practicable. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~

SOLID WASTE SITING CRITERIA

SOLE-SOURCE AQUIFERS			
Siting Over a Sole-Source Aquifer Safe Drinking Water Act 42 U.S.C. §1424(e)	All federal financially assisted projects constructed in the area of a sole-source aquifer and its principal recharge zone will be subject to EPA's review to ensure that these projects are designed and constructed so that they do not create a significant hazard to public health.	Applicable	A notice in 53 FR 15876 (May 4, 1988) designated the Buried Valley Aquifer System of the Great Miami/ Little Miami River Basins of southwestern Ohio as a sole or principal source of drinking water. The FEMP site is located above this aquifer. ~~This requirement is applicable to all remedial alternatives except the no action alternative.~~

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
SOLE-SOURCE AQUIFERS (Continued)			
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(2)(c)	A solid waste 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.	Applicable	~~Several remedial alternatives involve~~ This requirement is applicable to the on-property disposal of solid waste. ~~This requirement is applicable to all alternatives contemplating the use of capping systems or engineered cells.~~
OEPA Guidance on Solid Waste Siting Criteria: GD202.101	The Director may grant an exemption to the prohibition of siting a solid waste landfill facility over a sole-source aquifer (OAC 3745-27-07(H)(2)(c)) under ORC 3743.02(G). In order to grant an exemption, the Director needs to determine that no adverse impact to human health or safety or the environment will occur due to granting the exemption. The decision to grant an exemption from this rule is made on a site-by-site basis. Among the items that should be considered when determining if a waiver will be granted are whether a significant thickness of low permeable material exists between the landfill facility liner and the sole-source aquifer and whether there is an interconnection between the sole-source aquifer and any significant saturated zones which exist above the sole-source aquifer.	TBC	~~Several remedial alternatives involve~~ This requirement is applicable to the on-property disposal of solid waste. ~~This requirement pertains to all alternatives contemplating the use of capping systems or engineered cells.~~
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(2)(d)	A solid waste 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 a water supply well located within 1000 feet of the limits of solid waste placement, unless deemed acceptable by the Director of the OEPA.	Applicable	~~Several remedial alternatives involve~~ This requirement is applicable to the on-property disposal of solid waste. ~~This requirement is applicable to all alternatives contemplating the use of capping systems or engineered cells.~~

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
SOLE-SOURCE AQUIFERS (Continued)			
OEPA Guidance on Solid Waste Siting Criteria: 100 Gallon Per Minute Aquifer GD202.102	An exemption to the prohibition of siting a solid waste landfill facility over an unconsolidated aquifer capable of sustaining a yield of 100 gallons per minute for a 24-hour period (OAC 3745-27-07(H)(2)(d)) may be obtained by demonstrating that the thickness and lack of permeability of the sediment that exists between the bottom of the proposed landfill facility liner and the top of the unconsolidated high-yield aquifer provide adequate protection to the unconsolidated high-yield aquifer from the effects of a release of leachate from the solid waste landfill facility. The sediment should prevent leachate from migrating from the bottom of the facility liner to the high-yield aquifer in a time period equal to the active life of the facility, including the postclosure care period.	TBC	This guidance is a TBC rather than a ARAR because it is not promulgated. This guidance is a TBC for ~~all alternatives contemplating~~ the use of ~~capping systems or engineered cells~~ the on-property disposal facility.
OTHER SOLID WASTE SITING LIMITATIONS			
Distance from a Public Water Supply, Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(3)(a)	A solid waste 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 five (5) years.	Applicable	~~Several remedial alternatives involve~~ This requirement is applicable to the on-property disposal of solid waste. ~~This requirement is applicable to all alternatives contemplating the use of capping systems or engineered cells.~~
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (G)(16)	The limits of solid waste placement and a leachate management system may not be located within 200 feet of a fault that has displacement in Holocene time.	Applicable	~~Several remedial alternatives involve~~ This requirement is applicable to the on-property disposal of solid waste. ~~This requirement is applicable to all alternatives contemplating the use of capping systems or engineered cells.~~

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
OTHER SOLID WASTE SITING LIMITATIONS (Continued)			
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(3)(c)	The limits of solid waste placement cannot be located within 1000 feet of a water supply well or developed spring unless it is deemed acceptable by the Director of the OEPA 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 upgradient 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.	Applicable	~~Several remedial alternatives involve~~ This requirement is applicable to the on-property disposal of solid waste. ~~This requirement is applicable to all alternatives contemplating the use of capping systems or engineered cells.~~
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(4)(b)	The limits of waste placement cannot be located within 300 feet of the solid waste landfill facility's property line, unless deemed acceptable by the Director of the OEPA.	Applicable	~~Several remedial alternatives involve~~ This requirement is applicable to the on-property disposal of solid waste. ~~This requirement is applicable to all alternatives contemplating the use of capping systems or engineered cells.~~
Ohio Solid Waste Disposal Regulations OAC 3745-27-07 (H)(4)(c)	The limits of solid waste placement cannot be located within 1000 feet of a domicile whose owner has not consented in writing to the location of the landfill facility.	Applicable	~~Several remedial alternatives involve~~ This requirement is applicable to the on-property disposal of solid waste. ~~This requirement is applicable to all alternatives contemplating the use of capping systems or engineered cells.~~
Ohio Solid Waste Disposal Regulations 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 solid waste landfill system cannot be less than 15 feet of in situ or added geologic material deemed acceptable by the Director of the OEPA.	Applicable	~~Several remedial alternatives involve~~ This requirement is applicable to the on-property disposal of solid waste. ~~This requirement is applicable to all alternatives contemplating the use of capping systems or engineered cells.~~

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
OTHER SOLID WASTE SITING LIMITATIONS (Continued)			
OEPA Guidance on Solid Waste Siting Criteria: Minimum Distance From a Public Water Supply Well GD202.105	The minimum distance to a public water supply well (OAC 3745-27-07 (H)(3)(c)) will be considered by the application of this criteria: - The five-year time of travel shall be calculated between the boundary of the solid waste landfill facility and the closest public water supply. A period of no less than five years will be required before groundwater flowing in a downgradient direction from the facility can intersect with a public water supply well screen. To be considered for an exemption from this rule, the following will need to be demonstrated: - That there is at least 50 feet of separation between the bottom of the solid waste landfill facility liner and the aquifer system in which the public water supply well is screened. - That any release of leachate will be detected before reaching the aquifer system in which the public water supply well is screened. - That once leachate is released below the liner, the leachate will not reach the aquifer system in which the public water supply well is screened within a time span of 100 years plus the anticipated life of the solid waste landfill facility, which shall include the 30-year postclosure care period.	TBC	~~Several remedial alternatives involve the on-property disposal of solid waste.~~ This guidance is a TBC rather than a ARAR because it is not promulgated. This guidance is a TBC for the on-property disposal of solid waste. ~~all alternatives contemplating the use of capping systems or engineered cells.~~ A public water supply exists outside of the five-year time of travel from the FEMP property boundary. ~~In addition, this public water supply system will be removed in the near future.~~
OEPA Guidance on Solid Waste Siting Criteria: Minimum Isolation Distances to Wells and Developed Springs GD0202.103	This guidance clarifies when exceptions to the required 1000-foot isolation distance from water supply wells and developed springs (OAC 3745-27-07 (H)(3)(c)) apply and when a situation contrary to the rule can be deemed acceptable to the Director of the OEPA.	TBC	This guidance is a TBC rather than a ARAR because it is not promulgated. ~~This guidance is a TBC for all alternatives contemplating the use of capping systems or engineered cells.~~

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
OTHER SOLID WASTE SITING LIMITATIONS (Continued)			
OEPA Guidance on Solid Waste Siting Criteria: Material Acceptable to the Director GD202.104	For geologic material to be deemed acceptable to the Director of the OEPA as added fill under OAC Rule 3745-27-07 (H)(2)(e), 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 • Be composed of particles of which at least 25% by dry weight will pass through a No. 200 (75 μm) sieve • Be composed of particles of which no more than 25% by dry weight 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 1×10^{-5} 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.	TBC	This guidance is a TBC rather than a ARAR because it is not promulgated. ~~This guidance is a TBC for all alternatives contemplating the use of capping systems or engineered cells.~~

743

TABLE B.2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale
HAZARDOUS WASTE			
LOCATION OF HAZARDOUS WASTE FACILITIES			
Hazardous Waste Facility Environmental Impact OAC 3745.05(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	Applicable	This requirement is applicable for ~~several alternatives which consider~~ treatment, storage, or disposal of hazardous wastes if HWMUs are to be constructed during remediation. This requirement may serve as a siting criteria.
Hazardous Waste Facility Minimum Risk OAC 3745.05(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: 1) contamination of groundwater and surface water; 2) fires or explosions from treatment, storage, or disposal methods; 3) accidents during transportation; 4) impact to public health and safety; 5) air pollution; and 6) soil contamination.	Applicable	Use of any existing or potential HWMUs for remediation where hazardous wastes may be stored, treated, or disposed of must meet these substantive requirements. This requirement may serve as a siting criteria.

TABLE B.3

DOE

ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
HAZARDOUS WASTES			
HAZARDOUS WASTE STORAGE			
Empty Containers OAC 3745-51-07 (A) and (B) RCRA 40 CFR 261.7 Subpart A	Any hazardous waste remaining in either an empty container or an inner liner removed from an empty container is not subject to regulation under 40 CFR Parts 261 through 265 (RCRA requirements). A container is empty if: 1) All wastes have been removed that can be removed using the practices commonly employed to remove materials from that type of container (e.g., pouring, pumping, and aspirating); and 2) No more than 2.5 cm (1 inch) of residue remains on bottom of the container or inner liner; or 3) No more than 3% by weight of the total capacity of the container remains in the container or inner liner if the container is less than or equal to 110 gal. in size, or no more than 0.3% by weight of the total capacity of the container remains in the container or inner liner if the container is greater than 110 gal. in size.	Relevant and Appropriate	This requirement is relevant and appropriate when containerizing soil contaminated by RCRA waste. This requirement would also be relevant and appropriate for containerizing any treatment residues exhibiting RCRA characteristics including advanced wastewater treatment (AWWT) sludges and soil decontamination residues. OEPA has the overriding authority for on-site management of RCRA wastes.
Condition of Containers OAC 3745-66-71 through 74, 76 and 77 RCRA 40 CFR 265.171 through .174, .176 and .177 Subpart I	If a container holding hazardous waste is not in good condition (e.g., severe rusting, apparent structural defects) or begins to leak, the owner or operator must transfer the hazardous waste from this container to a container that is in good condition or manage the waste in some other way that complies with this requirement.	Relevant and Appropriate	This requirement is relevant and appropriate to handling containers holding environmental media contaminated with RCRA waste. OEPA has the overriding authority for on-site management of RCRA wastes.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
	HAZARDOUS WASTE STORAGE (Continued)		
Waste Storage Piles OAC 3745-56-51, (A) through (F), 54 (A) and (B), 56 (A) and (B), 57 (A)(B) and (C), 58 (A)(B) and (C) 40 CFR 264.251 through .259	A waste pile used to store or treat hazardous waste must have: 1) A liner that is designed, constructed, and installed to prevent any migration of waste out of the pile into the adjacent subsurface soil or groundwater or surface water at any time during the active life (including the closure period) of the waste pile, and 2) A leachate collection and removal system immediately above the liner that is designed, constructed, maintained, and operated to collect and remove leachate from the pile. The owner/operator must design, construct, operate, and maintain a run-on control system capable of preventing flow onto the active portion of the pile during peak discharge from at least a 25-yr storm and manage a runoff management system to collect and control at least the water volume resulting from a 24-hr, 25-yr storm. Collection and holding facilities associated with run-on and runoff control system must be inspected weekly and be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system. If the pile contains any particulate matter which may be subject to wind dispersal, the owner or operator must cover or otherwise manage the pile to control wind dispersal. Ignitable, reactive, or incompatible waste must not be added to a waste pile, unless specified in OAC 3745-56-56 (A) and (B) or 57 (A)(B) and (C). During construction or installation, liners and cover systems must be inspected for uniformity, damage, and imperfections. At closure, the owner/operator must remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoil, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste unless OAC 3745-51-03(D) applies. If, after removing or decontaminating all residues and making all reasonable effort to effect removal or decontamination of contaminated components, subsoil, structures and equipment, the owner/operator finds that not all contaminated subsoil can be practically removed or decontaminated, he must close the facility and perform postclosure care in accordance with OAC 3745-57-10.	Relevant and Appropriate	This requirement is relevant and appropriate for on-site hazardous waste piles used for longer than 90 days unless the CAMU Rule is applied.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
	HAZARDOUS WASTE STORAGE (Continued)		
Containment OAC 3745-55-75 RCRA 40 CFR 265.175(a) through (c) Subpart I	A containment system for RCRA containment storage areas must be designed and operated to provide: 1) A sufficiently impervious base, which is sloped to collect any leaking liquids. 2) Sufficient capacity to contain liquids. 3) Prevention of run-on into the containment system. 4) A sump to prevent overflow of the collection system. Storage areas for containers holding only wastes that do not contain free liquids need not have a containment system, provided that: 1) The storage area is sloped or is otherwise designed and operated to drain and remove liquid resulting from precipitation, or 2) The containers are elevated or are otherwise protected from contact with accumulated liquid.	Relevant and Appropriate	This requirement is relevant and appropriate to handling soil contaminated with listed or characteristic RCRA waste. A Part B Permit Application for RCRA storage has been submitted to the OEPA.
Containment Building RCRA 40 CFR 264.1100 through .1102 Subpart DD 57 FR 37194 8/18/92	The owner or operator is not subject to the definition of land disposal in RCRA Section 3004(k) provided that the unit: 1) Is a completely enclosed, self-supporting structure that is designed and constructed of synthetic materials of sufficient strength and thickness to support themselves, the waste contents, and any personnel and heavy equipment that operate within the unit, and to prevent failure due to pressure gradients, settlement, compression, or uplift, physical contact with the hazardous wastes to which they are exposed, climatic conditions, and the stresses of daily operation, including the movement of heavy equipment within the unit and contact of such equipment with containment walls; 2 Has a primary barrier for management of solids, in addition to a liquid collection system and secondary containment for management of liquids. 3) Has controls sufficient to prevent fugitive dust emissions to meet the no visible emission standard in Sec. 264.1101(c)(1)(iv); and 4) Is designed and operated to ensure containment and prevent the tracking of materials from the unit by personnel or equipment. At closure, the owner or operator must remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoil, and structures and equipment contaminated with waste and leachate, and handle them as a hazardous waste.	Relevant and Appropriate	This requirement is not applicable because the facility is currently in interim status; 40 CFR 264 requirements only apply to facilities with a Part B Permit. Excavated RCRA soil and sediment may require temporary storage during the remedial action.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
HAZARDOUS WASTE MANAGEMENT AND DISPOSAL			
Preparing and Transporting Hazardous Waste Off-site RCRA 40 CFR 262.20 through .23, .30 and .33 Subparts B and C OAC 3745-53-20 through 31 OAC 3745-52-30 and 33	General requirements for transporting hazardous waste for off-site disposal require a Manifest. Pretransporting requirements include appropriate packaging, labeling, marking, and placarding.	Applicable	Any residues determined to be RCRA hazardous waste destined for off-site disposal are subject to manifest requirements. Remedial actions involving off-site disposal of RCRA wastes will be subject to this requirement.
Landfill Design RCRA 40 CFR 265.301(a) OAC 3745-68-011	Construction of a landfill must include two (2) or more liners and a leachate collection and removal system above and between such liners.	Applicable	~~If on-site disposal is selected for Operable Unit 5 low level mixed wastes then t~~ This requirement will be applicable to on-property disposal.
Land Disposal Restrictions RCRA 40 CFR 268.40 through .44 Subpart D OAC 3745-59	A restricted hazardous waste may be land disposed only if: 1) An extract of the waste or of the treatment residue of the waste does not exceed the value shown in 40 CFR 268.41. 2) It is treated using a technology specified in 40 CFR 268.42(a) or an equivalent treatment method. 3) The constituent concentrations in the waste or treatment residue of the waste do not exceed the value shown in 40 CFR 268.43.	Applicable	This requirement is applicable to those RCRA-listed hazardous wastes that will be disposed of off-site. Land disposal restrictions will not apply to on-property disposal within a CAMU under the CAMU Rule.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
HAZARDOUS WASTE MANAGEMENT AND DISPOSAL (Continued)			
Contaminated Debris RCRA 40 CFR 268.2 Subpart A 40 CFR 268.45 Subpart D 40 CFR 261.3 Subpart A	Debris means solid material exceeding a 60-mm particle size that is intended for disposal and that is a manufactured object, plant or animal matter, or natural geologic material. Hazardous debris means debris that contains a listed hazardous waste, or that exhibits a characteristic of hazardous waste. Hazardous debris must be treated prior to land disposal unless the EPA determines that the debris is no longer contaminated with hazardous waste or the debris is treated to the waste-specific treatment standard for the waste contaminating the debris. Provided the debris does not exhibit a RCRA characteristic it is not subject to regulation under 40 CFR parts 260, 261 to 266, 268, or 270 if: 1) The hazardous debris has been treated using one of the required extraction or destruction technologies specified in 40 CFR 268.45; or 2) The debris, considering the extent of contamination, is determined to no longer be contaminated with hazardous waste.	Applicable	This requirement is applicable to hazardous debris that will be disposed of off site. Land disposal restrictions will not apply to on-property disposal within a CAMU.
GENERAL FACILITY STANDARDS			
Hazardous Waste Determination RCRA 40 CFR 262.11 Subpart A OAC 3745-52-11 (A) through (F)	A person who generates a solid waste must determine if that waste is a hazardous waste using the following method: 1) First determine if the waste is not a solid waste (40 CFR 261.4). 2) Then determine if the waste is listed as a hazardous waste in Subpart D of 40 CFR Part 261. 3) For purposes of compliance with 40 CFR Part 268 or if the waste is not listed in Subpart D of 40 CFR part 261, the generator must then determine whether the waste is identified in Subpart C [characteristic] of 40 CFR part 261.	Relevant and Appropriate	This requirement is relevant and appropriate for soil contaminated with a RCRA listed waste or a RCRA characteristic waste, and for residues from treatment of soil contaminated with RCRA listed waste, if the waste is to be managed or stored on-property within a CAMU. This requirement would further apply to waste sludges generated by the AWWT or the soil decontamination process where RCRA constituents may be present. A hazardous waste determination will be applicable for any RCRA regulated waste destined for off-site disposal.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
GENERAL FACILITY STANDARDS (Continued)			
Treatment, Storage, and Disposal General Facility Standards RCRA 40 CFR 265.13 through .16 Subpart B OAC 3745-65-13 through 16	General facility standards require that operators of a facility must obtain chemical and physical analyses of a representative sample of each hazardous waste to be treated, stored, or disposed of at the facility prior to treatment, storage, or disposal. The analysis may include existing published or documented data on the hazardous waste or on hazardous waste generated from similar processes. The facility operator must also provide controlled access for the facility. In addition, the operator must maintain and inspect all monitoring equipment, safety and emergency equipment, security devices and operating and structural equipment that are important to preventing human health hazards. Operators must train personnel for procedures relevant to their emergency response training.	Relevant and Appropriate	These standards are relevant and appropriate where RCRA wastes are managed on site. ~~All alternatives must meet compliance if they require action that involves storage and treatment of soil containing listed waste.~~
Treatment, Storage, and Disposal Facility Preparedness and Prevention RCRA 40 CFR 265.31 through .35, .37 Subpart C OAC 3745-65-31 through 35, 37	TSD facility operators must design, construct, maintain and operate facilities to minimize the possibility of fire, explosion or any unplanned sudden or nonsudden release of hazardous waste to air, soil, or surface water which might threaten human health or the environment.	Relevant and Appropriate	This requirement is relevant and appropriate for ~~all alternatives involving~~ the storage and treatment of RCRA listed waste. RCRA listed waste or characteristic waste may be disposed of in an on-property disposal facility.
Treatment, Storage, and Disposal Facility Contingency Plan and Emergency Procedures RCRA 40 CFR 265.51, .52, and .55 through .56, Subpart D OAC 3745-65-51, 52, and 55 through 56	Each facility operator must have a contingency plan designed to minimize hazards to human health and the environment due to fires, explosions, or any unplanned releases of hazardous waste constituents to air, soil or surface/groundwater.	Relevant and Appropriate	This requirement is relevant and appropriate for ~~all alternatives involving~~ the storage and treatment of RCRA listed waste. RCRA listed waste or characteristic waste may be disposed of in an on-property disposal facility.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
GENERAL FACILITY STANDARDS (Continued)			
Treatment, Storage, and Disposal of Hazardous Waste in Miscellaneous Units OAC 3745-57-91 through 93 40 CFR 264.601 through .603	Prevention of any release that may have adverse effects on human health or the environment includes, but is not limited to: A. Migration of waste constituents in the groundwater or subsurface environment. B. Migration of waste constituents in surface water, or wetlands or on the soil surface. C. Migration of waste constituents in the air. Monitoring, tests, analytical data, inspections, response, and reporting procedures and frequencies must ensure compliance with pertinent portions of the OAC. A miscellaneous unit that is a disposal unit must be maintained in a manner that complies with OAC 3745-57-91 during the postclosure care period. If a treatment or storage unit has contaminated soil or groundwater that cannot be completely removed or decontaminated during closure, the unit must also meet the requirements of OAC 3745-57-91 during the postclosure care period. The postclosure plan under OAC 3745-55-18 must specify the procedures that will be used to satisfy this requirement.	Relevant and Appropriate	These requirements are relevant and appropriate to on-site facilities that treat, store, or dispose of hazardous waste in miscellaneous units unless the CAMU Rule is applied.
GROUNDWATER MONITORING			
Groundwater Monitoring Program RCRA 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 ground water in the uppermost aquifer underlying the facility.	Applicable	This requirement is applicable to all interim-status RCRA land-based units and to ~~select remedial alternatives that involve~~ the disposal of soil containing listed hazardous waste. The Ohio EPA Director's Final Findings and Orders (DFOs) signed September 10, 1993, provides an alternate groundwater monitoring program from 40 CFR 265.92, Subpart F, to integrate the RCRA program with the CERCLA response actions.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
GROUNDWATER MONITORING (Continued)			
Groundwater Protection Standard RCRA 40 CFR 264.92 through .100 Subpart F OAC 3745-54-92 through 100	The owner or operator must ensure that hazardous constituents detected in the groundwater from a regulated unit do not exceed the concentration limits for MCLs in the uppermost aquifer underlying the waste management area beyond the point of compliance during the compliance period. The groundwater monitoring requirements include procedures for detection, compliance, and corrective action monitoring programs.	Relevant and Appropriate	This requirement is relevant and appropriate to land-based units, which would include any remedial action ~~alternatives~~ using the on-site disposal facility. ~~and/or a consolidation area.~~ However, the FEMP is currently an interim status facility with a Part B Permit application pending.
CLOSURE UNDER RCRA			
Closure Performance Standard for HWMUs RCRA 40 CFR 265.111 Subpart G OAC 3745-66-11	The owner or operator must close a facility in a manner that: 1) Minimizes the need for further maintenance; and 2) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, postclosure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and 3) Complies with these closure requirements.	Applicable	This requirement is applicable to HWMU closures occurring during the remedial action. This requirement is relevant and appropriate~~, not applicable,~~ to ~~alternatives involving~~ disposal in an on-property disposal facility ~~and/or consolidation area~~.
Closure Performance Standard RCRA 40 CFR 265.114 Subpart G OAC 3745-66-14	During the partial and final closure periods, all contaminated equipment, structures, and soil must be clean closed, have risk-based closure, or be closed in place. If the owner or operator demonstrates that not all contaminated soil can be practically removed or decontaminated from a structure or land-based area, then the owner or operator must close the structure or area and perform postclosure care in accordance with the closure and postclosure care requirements that apply (40 CFR 264.310).	Applicable	This requirement is applicable to actions involving removal, treatment or storage of soil contaminated by RCRA constituents from HWMUs.
Storage Area Closure RCRA 40 CFR 264.178 Subpart I OAC 3745-55-78	At closure, all hazardous waste and hazardous waste residues must be removed from the containment system. Remaining containers, liners, bases, and soil containing, or contaminated with hazardous waste, or hazardous waste residues must be decontaminated or removed. If the owner or operator demonstrates that not all contaminated soil can be practically removed or decontaminated from a structure or land-based area, then the owner or operator must close the structure or area and perform postclosure care in accordance with the closure and postclosure care requirements that apply (40 CFR 264.310).	Relevant and Appropriate	This requirement is relevant and appropriate to Operable Unit 5 for handling hazardous waste or environmental media. This requirement is not applicable because the FEMP is currently in interim status; 40 CFR 264 requirements only apply to facilities with a Part B Permit.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
CLOSURE UNDER RCRA (Continued)			
Closure of Tank Systems RCRA 40 CFR 265.197 Subpart J OAC 3745-66-97	At closure of a tank system, the owner or operator must remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated soil, and structures and equipment contaminated with waste, and manage them as hazardous waste. If the owner or operator demonstrates that not all contaminated soil can be practicably removed or decontaminated then the owner or operator must close the tank system and perform postclosure care in accordance with the closure and postclosure care requirements that apply to landfills (40 CFR 264.310).	Relevant and Appropriate	This requirement is relevant and appropriate to RCRA wastes contained in tanks that will be used by Operable Unit 5 during remedial actions.
Contained-In Policy RCRA 58 FR 48092 9/14/93 Proposed rule. 58 FR 59976 11/12/93 Notice to extend comment. 59 FR 10778 3/8/93 Clarification, partial withdrawal.	Hazardous soil means soil that contains RCRA hazardous waste(s) listed in 40 CFR part 261, Subpart D, or that exhibits one or more of the characteristics of a hazardous waste as defined in 40 CFR part 261, Subpart C. This proposed rule recommends contained-in determinations for hazardous debris, hazardous soil and other environmental media. Any person may petition the Regional Administrator to exclude, under 261.(f)(2) or 261.3(g) of this chapter, hazardous debris and hazardous soil or other environmental media, including but not limited to groundwater, surface water, and sediment, from regulation as hazardous waste. The petition for a contained-in determination must include information sufficient to demonstrate that specific constituent concentrations in the hazardous debris, hazardous soil, or other environmental media to be excluded do not pose a hazard to human health and the environment at that site. (Such a petition is not necessary for remedial actions conducted pursuant to RCRA or CERCLA authorities provided that a similar determination is made by the Regional Administrator based on information substantially equivalent to the information listed below including public notice and comment requirements).	TBC	Policies are not promulgated and therefore cannot be ARARs. This policy will be considered for managing treated soil that is contaminated with RCRA waste.
Risk-Based Remediation Standards Ohio EPA Closure Plan Review Guidance for RCRA Facilities. Interim Final. 9/1/93	Federal regulations of May 2, 1986 (50 FR 16422) and March 19, 1987 (52 FR 8704) modified the closure performance standard such that risk assessment, or what constitutes "decontamination" of a site, may be considered by the EPA as a closure option. The OEPA adopted the equivalent of the EPA's March 19, 1987, regulations on December 8, 1988 (see OAC 3745-67-28), clarifying that risk assessment may be an option. It is OEPA and Dept. of Hazardous Waste Management practice to consider risk assessment as a possible third option for closure for all types of units.	TBC	The use of risk-based closures is to be considered for closing HWMUs with media contamination as integrated with the CERCLA remedial action.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
LANDFILL CLOSURE AND CORRECTIVE ACTION			
Corrective Action Management Unit RCRA 40 CFR 264.552 Subpart S 58 FR 865829 2/16/93	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 Sec. 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. For the purpose of implementing remedies under Sec. 264.101 or RCRA Section 3008(h), the Regional Administrator may designate an area at the facility as a corrective action management unit, as defined above. One or more CAMUs may be designated at a facility under the following conditions: 1) Emplacement of remediation wastes into or within a CAMU does not constitute land disposal of hazardous wastes. 2) Consolidation or emplacement of remediation wastes into or within a CAMU does not constitute creation of a unit subject to minimum technology requirements. The owner/operator shall provide sufficient information to enable the Regional Administrator to designate a CAMU in accordance with the criteria in Sec. 264.552. Note: RCRA regulated units (HWMUs) within a CAMU are fully subject to RCRA closure regulations.	Applicable	~~All action alternatives involve the excavation and handling of soil containing hazardous waste, therefore t~~ The CAMU concept is applicable to the remedial action for RCRA wastes. "Placement" as defined in HSWA does not occur in a CAMU. Therefore, land disposal restrictions (LDRs) and minimum technology requirements (MTRs) are not "triggered" as ARARs during and after the remedial activity within the boundaries of the CAMU.
Postclosure Care RCRA 40 CFR 265.117 Subpart G OAC 3745-66-17	Postclosure care for each hazardous waste management unit must begin after completion of closure of the unit and continue for 30 years after that date and must consist of at least the following: 1) Monitoring and reporting in accordance with the requirements of Subparts F,K,L,M,N, and X of this part; and 2) Maintenance and monitoring of waste containment systems in accordance with the requirements of Subparts F,K,L,M,N, and X of this part. Postclosure use of property on or in which hazardous wastes remain after partial or final closure must never be allowed to disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the facility's monitoring systems. If clean closure is performed then postclosure care is not required.	Applicable	This requirement is applicable to ~~all alternatives, except the no action alternative, involving~~ the closure of existing HWMUs.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
LANDFILL CLOSURE AND CORRECTIVE ACTION (Continued)			
Minimum RCRA Landfill Design Requirements for Closure RCRA 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: 1) Provide long-term minimization of migration of liquids through the closed landfill; 2) Function with minimum maintenance; 3) Promote drainage and minimize erosion or abrasion of the cover; 4) Accommodate settling and subsidence so that the cover's integrity is maintained; and 5) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoil present. After final closure, the owner of operator must comply with all postclosure requirements, including maintenance and monitoring throughout the postclosure care period. The owner or operator must: 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 system until leachate is no longer detected; 3) Maintain and monitor the leak detection system; 4) Maintain and monitor the groundwater monitoring system; 5) Prevent run-on and runoff from eroding or otherwise damaging the final cover; and 6) Protect and maintain surveyed benchmarks.	Relevant and Appropriate	This requirement is relevant and appropriate for on-property ~~consolidation, capping, and/or~~ disposal of material that may contain RCRA waste. This requirement is not applicable because the FEMP is currently in interim status; 40 CFR 264 requirements only apply to facilities with a Part B Permit.

RADIOACTIVE WASTES

MANAGEMENT AND DISPOSAL OF URANIUM MILL TAILINGS			
Landfill Requirements AEA/UMTRCA 40 CFR 192.02(a) Subpart A	Control of residual radioactive material shall be designed to be effective for up to 1000 years, to the extent reasonably achievable, and in any case, for at least 200 years, and provide protection of groundwater.	Relevant and Appropriate	The requirement is relevant and appropriate for residual radioactive materials because they are sufficiently similar to contaminated soil and sediment being addressed by Operable Unit 5. This requirement will be met as a general performance standard for all ~~alternatives requiring~~ on-property or off-site disposal.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
MANAGEMENT AND DISPOSAL OF URANIUM MILL TAILINGS (Continued)			
Implementation of Standards in 40 CFR 192, Subparts A and B AEA/UMTRCA 40 CFR 192.20 Subpart C	Implementing agencies shall establish methods and procedures to provide reasonable assurance that the provisions of Subparts A (above) and B (Table B.1) are satisfied. This should be done through use of analytical models and site-specific analyses for Subpart A, and through measurements performed within the accuracy of currently available types of field and laboratory instruments along with reasonable survey and sampling procedures. This includes measuring the flow rate of uranium and groundwater.	Relevant and appropriate	This requirement is relevant and appropriate for ensuring compliance with 40 CFR 192 Subparts A and B. Note that Subpart B is listed as an ARAR in the chemical-specific ARAR table, B.1.
Management of Uranium By-Product Materials AEA/UMTRCA 40 CFR 192.30 through .34 Subpart D	This subpart applies to the management of uranium by-product materials under Section 84 of the Atomic Energy Act of 1954, as amended, during and following processing of uranium ores, and to restoration of disposal sites following any use of such sites under Section 83(b)(1)(B) of the Act. Uranium by-product materials shall be managed to conform with groundwater protection, which includes detection monitoring. Subpart D(iv) allows for alternate concentration limits of uranium to be established, as described in 264.95 and 264.94(b)	Relevant and Appropriate	This requirement is for disposal areas at active uranium mill tailing sites, and is a relevant and appropriate requirement for the engineered disposal facility. ~~cell and capping systems.~~
LOW-LEVEL RADIOACTIVE WASTE DISPOSAL			
Performance Objectives DOE Order 5820.2A, Chapter III (3)(a)	Performance objectives must: 1) Protect public health and safety in accordance with standards specified in applicable EH Orders and other DOE Orders. 2) Assure that external exposure to the waste and concentrations of radioactive material which may be released into surface water, groundwater, soil, plants and animals results in an effective dose equivalent that does not exceed 25 mrem/yr to any member of the public. Releases to the atmosphere shall meet the requirements of 40 CFR 61. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment ALARA. 3) Assure that the committed effective dose equivalents received by individuals who inadvertently may intrude into the facility after the loss of active institutional control (100 years) will not exceed 100 mrem/yr for continuous exposure or 500 mrem for a single acute exposure. 4) Protect groundwater resources consistent with federal, state, and local requirements.	TBC	~~Soil contain radioactive materials consistent with low level wastes. All alternatives contemplate leaving r~~ Residual radioactivity at the site above background ~~and~~ could result in exposures to members of the public.
Disposal Methods DOE Order 5820.2A, Chapter III, (3)(i)(1)-(6)	Low-level radioactive waste shall be disposed of by methods appropriate to achieve the performance standard objectives in (3)(a) above, consistent with the radiation dose limits in paragraph (3)(b)	TBC	~~Alternatives involving on-site disposal facilities will handle materials consistent with low level waste.~~ This requirement is a TBC because it is not promulgated. It will be considered for on-site disposal.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
LOW-LEVEL RADIOACTIVE WASTE DISPOSAL (Continued)			
Disposal Facility and Disposal Site Design DOE Order 5820.2A, Chapter III (3)(i)(8)	Design criteria shall be established prior to selection of new disposal facilities, new disposal sites, or both. These design criteria shall be based on analyses of physiographic, environmental, and hydrogeologic data to assure that the policy and requirements of this Order can be met. The criteria shall also be based on assessments of projected waste volumes, waste characterizations, and facility and disposal site performance.	TBC	~~Alternatives involving on-site disposal facilities will handle materials consistent with low level waste.~~ This requirement is a TBC because it is not promulgated. It will be considered for on-site disposal.
Disposal Facility Operations DOE Order 5820.2A, Chapter III (3)(i)(9)	Operating procedures shall provide security, minimum long-term control, closure/postclosure, markers for excavations, and training.	TBC	~~Alternatives involving on-site disposal facilities will handle materials consistent with low level waste.~~ This requirement is a TBC because it is not promulgated. It will be considered for on-site disposal.
MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE			
Prohibits commingling of Low-Level Radioactive Wastes with Solid Waste ORC 3734.02.7 (A)(B)	Commingling of low-level radioactive waste with solid waste at a nonlicensed facility under the Atomic Energy Act of 1954 is prohibited, even if the radioactive waste is below regulatory concern.	Applicable	Low-level radioactive waste to be shipped for off-site disposal will only be sent to facilities licensed under the Atomic Energy Act of 1954.
Low-level Radioactive Waste Generation DOE Order 5828.2A, Chapter III (3)(c)	Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. Waste reduction efforts shall include consideration of process modification, process optimization, materials substitution, and decontamination. All DOE low-level waste generators shall establish auditable programs to assure that the amount of low-level waste generated and/or shipped for disposal is minimized. Each DOE low-level waste generator shall separate uncontaminated waste from low-level waste to facilitate cost-effective treatment and disposal. Each DOE low-level waste generator preparing a design for a new process or process change shall incorporate principles into the design that will minimize the generation of low-level waste.	TBC	~~Alternatives involving on-site disposal facilities will handle materials consistent with low level waste.~~ This requirement is a TBC because it is not promulgated. It will be considered for on-site disposal.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE (Continued)			
Waste Treatment DOE Order 5820.2A, Chapter III (3)(f)	Waste shall be treated by appropriate methods so that the disposal site can meet the performance objectives stated in DOE Order 5820.2A Chapter III (3)(a). Waste treatment techniques such as incineration, shredding, and compaction to reduce volume and provide more stable waste forms shall be implemented as necessary to meet performance requirements. Use of waste treatment techniques to increase the life of the disposal facility and improve the long-term facility performance, by improved site stability and reduction of infiltrating water, is required to the extent it is cost effective. The development of large scale waste treatment facilities shall be supported by the appropriate National Environmental Policy Act documentation. Operation of waste treatment facilities shall be supported by adequate documentation.	TBC	~~Alternatives using on-site disposal of low-level waste will meet these performance objectives.~~ This requirement is a TBC because it is not promulgated. It will be considered for on-site disposal.
Low-Level Radioactive Waste Shipment DOE Order 5820.2A, Chapter III (3)(g)	The volume of waste and number of shipments of low-level waste shall be minimized and the shipments conducted based on plans developed by field organizations. Generators must receive advance approval from the receiving facility and shall certify before shipment that waste meets the receiving facility waste acceptance criteria (WAC). The certification program shall be auditable and able to withstand independent review.	TBC	~~All alternatives requiring remedial action contemplate the off-site shipment of some contaminated soil, sludges, or treatment residues.~~ This requirement is not an ARAR because it is not promulgated.
Long-Term Storage DOE Order 5820.2A, Chapter III (3)(h)	Requires achieving performance objectives of DOE 5820.2A III (3)(a); requires records and documentation be maintained for low-level waste in storage; permits storage of waste until disposal by approved methods.	TBC	~~All alternatives requiring remedial action involve the staging of contaminated soil prior to treatment and/or disposal.~~ This requirement is not an ARAR because it is not promulgated.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
	MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE (Continued)		
Disposal Site Closure/Postclosure DOE Order 5820.2A, Chapter III (3)(j)	Site-specific comprehensive closure plans shall be developed for new and existing operating low-level waste disposal sites. The plan shall address closure of disposal sites within a 5-year period after each is filled and shall conform to the requirements of the NEPA process. Performance objectives for existing disposal sites shall be developed on a case-by-case basis as part of the NEPA process. During closure and postclosure, residual radioactivity levels for surface soil shall comply with existing DOE decommissioning guidelines. Corrective measures shall be applied to new disposal sites or individual disposal units if conditions occur or are forecasted that could jeopardize attainment of the performance objectives of this Order. Inactive disposal facilities, disposal sites, and disposal units shall be managed in conformance with RCRA, CERCLA, and the Superfund Amendments and Reauthorization Act (SARA). Closure plans for new and existing operating low-level waste disposal facilities shall be reviewed and approved by the appropriate field organization. Termination of monitoring and maintenance activity at closed facilities or sites shall be based on an analysis of site performance at the end of the institutional control period.	TBC	~~Alternatives using on-site disposal of low-level waste will meet these performance objectives.~~ This requirement is not an ARAR because it is not promulgated.
Environmental Monitoring DOE Order 5820.2A, Chapter III (3)(k)	Each operational or nonoperational low-level waste disposal facility shall be monitored by an environmental monitoring program that conforms with DOE 5484.1 and, at a minimum, meets the requirements listed below: 1) The environmental program shall be designed to measure: a) Operational effluent releases; b) Migration of radionuclides; c) Disposal units subsidence; d) Changes in disposal facility and disposal site parameters which may affect long-term site performance. 2) Based on the character of the facility monitored, the environmental monitoring program may include, but not necessarily be limited to, monitoring surface soil, air, surface water, and subsurface soil and water, both in the saturated and unsaturated zones. 3) The monitoring program shall be capable of detecting changing trends in performance far enough in advance to allow application of any necessary corrective action before exceeding performance objectives. The monitoring program shall be able to ascertain whether or not effluents from each treatment, storage, or disposal facility or disposal site meets the requirements of applicable DOE Orders.	TBC	~~Alternatives involving on-site disposal facilities will handle materials consistent with low-level waste.~~ This requirement is not an ARAR because it is not promulgated.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
UNDERGROUND STORAGE TANKS (USTs)			
UST CLOSURE			
General Requirements RCRA 40 CFR 280.61 through .66 Subpart F OAC 1301:7-7-36	Owners and operators of petroleum or hazardous substance UST systems must, in response to a confirmed release from the UST system, comply with abatement measures, site characterization, product removal, investigations for soil and groundwater cleanup, and corrective action plans, except for USTs excluded under 280.10(b) and UST systems subject to RCRA Subtitle C corrective action requirements under Section 3004(u) of the RCRA, as amended.	Applicable	Petroleum USTs will be closed as part of site-wide remedial actions.
Ohio Petroleum Contaminated Soil Policy OPEA Policy PP 01 03 200 PP.01-03-200	The basis of the "contained in" policy is that environmental media, such as soil or groundwater, are not considered to be waste material. Because they are not a solid waste, the mixture rule, as set forth in OAC 3745-51-03, does not apply when they become contaminated with a listed hazardous waste but only contains the waste. The result of this policy is that if the waste constituents can be removed, the soil is no longer considered to contain a hazardous waste. Therefore, since soil is not a waste material it does not have to be delisted in order for it to be used for its intended purpose. However, as long as the soil contains the waste material, it must be managed as a hazardous waste. If this concept is applied to petroleum-contaminated soil, the soil containing a petroleum hydrocarbon would not need to be managed as a solid waste if the contaminants was removed.	TBC	This policy allows for treated/cleaned soil to be backfilled at the excavation site. Operable Unit 5 will consider this policy for all soil treated below ~~PRGs or PRLs~~ final remediation levels to be backfilled as clean soil.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
BEST MANAGEMENT PRACTICES PROGRAM			
Best Management Practices (BMP) Programs Clean Water Act 40 CFR 125.104 Subpart K	BMP programs shall be developed in accordance with good engineering practices and: 1) Be documented in narrative form and include any necessary plot plans, drawings or maps; 2) Establish specific objectives for the control of toxic and hazardous pollutants: (a) Each facility component or system shall be examined for its potential for causing a release of significant amounts of toxic or hazardous pollutants to waters of the United States due to equipment failure, improper operation, natural phenomena such as rain or snowfall, etc. (b) Where experience indicates a reasonable potential for equipment failure (e.g., a tank overflow or leakage), natural condition (e.g., precipitation), or other circumstances to result in significant amounts of toxic or hazardous pollutants reaching surface waters, the program should include a prediction of the direction, rate of flow and total quantity of toxic or hazardous pollutants which could be discharged from the facility as a result of each condition or circumstance; 3) Establish specific BMPs to meet the objectives identified in (2) above, addressing each component or system capable of causing a release of significant amounts of toxic or hazardous pollutants to the waters of the United States.	Applicable	Substantive requirements of this regulation are applicable to any ~~to all alternatives requiring action. All action alternatives could~~ release of contaminants to waters of the United States if BMPs are not implemented.

AIR

AIR EMISSION STANDARDS FROM A STATIONARY SOURCE			
Air Emissions from Hazardous Waste Facilities ORC 3734.02 (I)	Emissions from a hazardous waste facility will not cause, or allow, any particulate matter, dust fumes, gas, mist, smoke, vapor, or odorous substance to interfere with the comfortable enjoyment of life for those individuals living near, or working in the vicinity of the facility, or that is injurious to public health.	Applicable	This requirement is applicable for ~~any remedial action that involves~~ the use of a hazardous waste facility which produces air emissions.
Air Emission Standards for Process Vents RCRA 40 CFR 264.1030, .1032 through .1034 Subpart AA	This subpart applies to process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations that manage hazardous wastes with organic concentrations of at least 10 ppm.	Applicable	This requirement is applicable for treating soil contaminated with RCRA waste.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
AIR EMISSION STANDARDS FROM A STATIONARY SOURCE (Continued)			
Malfunction and Maintenance of Air Pollution Control Equipment OAC 3745-15-06 (A)(1) and (A)(2)	Scheduled maintenance must be established for pollution control equipment, as well as time periods when the pollution source must be shut down during maintenance.	Applicable	This requirement is applicable for any remedial action that will use air pollution control equipment on site.
Stack Height Requirements OAC 3745-15-12 (B) and (C)	Stack height for air contaminant sources must be based on good engineering practices.	Applicable	~~All alternatives that include~~ The use of low-temperature thermal desorption must meet this requirement.
STATIONARY SOURCE AIR EMISSIONS			
General Provisions on Air Pollution Control OAC 3745-15-07 ORC 3704.01-.05	Measures shall be taken to adopt and maintain a program for the prevention, control, and abatement of air pollution in order to protect and enhance the quality of the state's air resource so as to promote the public health, welfare, and economic vitality of the people of the state. The emission or escape into open air from any source whatsoever of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, odors and combinations of the above in such a manner or in such amounts as to endanger the health, safety, and welfare of the public, or to cause unreasonable injury or damage to property shall be declared to be a public nuisance. It is unlawful for any person to cause, permit, or maintain any such public nuisance.	Applicable	During the remedial action, the potential exists for emissions of radionuclides and toxic chemicals to air, which might endanger individuals or damage property.
Installation and Modification of Air Contaminant Sources OAC 3745-31-05(A)(3)	New or modified air contaminant sources are required to employ best available technology to control emissions	Applicable	This requirement is applicable to ~~alternatives that involve~~ the construction or modification of air contaminant sources.
Control of Emissions of Organic Materials from Stationary Sources OAC 3745-21-07(G)(2)	Discharges containing organic material must not exceed 40 pounds in any one day, nor eight pounds in any one hour, unless the discharge has been reduced by at least 85%.	Applicable	This requirement is applicable to ~~alternatives that involve~~ the discharge of organic emissions.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
	FUGITIVE AIR EMISSION STANDARDS		
Visible Particulates in Air EPA Regulations on National Primary and Secondary Ambient Air Quality Standards 40 CFR 50.6(a),(b),(c) Ohio Ambient Air Quality OAC 3745-17-07 (A)	The level of the national primary and secondary 24-hour ambient air quality standards for particulate matter is a 150 $\mu g/m^3$, 24-hour average concentration. Visible particulate emissions from any stack may exceed 20% opacity, as a six-minute average, for not more than six consecutive minutes in any 60 minutes, but shall not exceed 60% opacity, as a six-minute average, at any time. The standards for national primary and secondary standards must be ≤ 50 $\mu g/m^3$, annual arithmetic average. Particulate matter shall be measured in the gradient air as PM_{10} (particles with an aerodynamic diameter less than or equal to a nominal 10 μm).	Applicable	The federal standard at 40 CFR 50.6 for particulate matter in air is applicable to remedial actions at Operable Unit 5 because remedial activities may contribute, at least temporarily, to particulate matter in the air. Particulate emissions may be generated through fugitive emissions from excavations and disposal activities and point source discharges from wastewater sludge dewatering or soil treatment/stabilization. The Ohio standard for particulates in air is not an ARAR because it is not more stringent than the federal standard at 40 CFR 50.6
Particulate Ambient Air Quality Standards OAC 3745-17-02 (C)(D)	The level of ambient air quality standards for total suspended particles is a 150 $\mu g/m^3$, 24-hour average concentration. The level of the primary and secondary annual standards for total suspended particulates is 50 $\mu g/m^3$.	Applicable	This requirement is applicable for ~~all alternatives that omit or allow~~ the escape of particulates. This includes ~~all remedial activities that require~~ excavation, demolition, cleaning and scrubbing.
Particulate Non-Degradation Policy OAC 3745-17-05	Degradation of air quality in any area where the air quality is better than required in 3745-27-02 (described above) is prohibited.	Applicable	See comment above.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
FUGITIVE AIR EMISSION STANDARDS (Continued)			
Control of Visible Particulate Emissions for Fugitive Dust OAC 3745-17-07 (B)(4),(5),(6)	There shall be no visible particulate emissions from any paved roadway or parking area except for a period of time not to exceed six minutes during any 60-minute observation period. There shall be no visible particulate emissions from any unpaved roadway or parking area except for a period of time not to exceed 13 minutes during any 60-minute observation period. There shall be no visible particulate emissions from any material storage piles except for a period of time not to exceed 13 minutes during any 60-minute observation period.	Relevant and Appropriate	Paved and unpaved roadways, parking areas, and material storage piles will be in use during the remedial action. This requirement is not applicable as the FEMP is not located within a city or township subject to the rule; however, the requirement is relevant and appropriate for site activities during the remedial action. Grading, loading, and construction operations will occur during soil excavation, soil backfilling and. during construction and capping of the disposal facility.
Ambient Air Quality Standards for Non-methane Hydrocarbons OAC 3745-21-02(C) and OAC 3745-21-03(D)	The ambient air quality guidelines for nonmethane hydrocarbons is a maximum three hour arithmetic mean concentration of 160 $\mu g/m^3$, not to be exceeded between the hours of six and nine a.m. Hourly and three-hour concentrations must be determined in accordance with prescribed methods.	Applicable	These requirements are applicable to ~~alternatives that involve~~ hydrocarbon emissions.
Restriction of Emission of Fugitive Dust OAC 3745-17-08 (B)	No person shall cause or permit any fugitive dust source to be operated; or any materials to be handled, transported, or stored; or a building (or its appurtenances) or a road to be used, constructed, altered, repaired, or demolished without taking or installing reasonably available control measures to prevent fugitive dust from becoming airborne. Such reasonably available control measures shall include, but are not limited to, one or more of the following which are appropriate to minimize or eliminate visible particulate emissions of fugitive dust. - The use of water or other suitable dust suppression chemicals for the control of fugitive dust from the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land; or - The periodic application of asphalt, oil, water, or other suitable dust suppression chemicals on dirt or gravel roads and parking lots, and any other surfaces that may cause emissions of fugitive dust.	Relevant and Appropriate	This requirement is not applicable as the FEMP is not located within a city or township subject to the rule; however, the requirement is relevant and appropriate for site activities during the remedial action. Grading, loading, and construction operations will occur during soil excavation, soil backfilling and ~~during capping and~~ construction of the disposal facility.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
SOLID WASTES			
SOLID WASTE DISPOSAL			
Facility Design Criteria OAC 3745-27-08 (C)(1) through (9); (D) through (H) 40 CFR 258.40 Subpart D	Prescriptive engineering design specifications must be followed for the solid waste landfill facility, including requirements for liner specifications, leachate management systems, leachate storage, surface water control, benchmark location, access road grading, groundwater control, explosive gas monitoring systems and structures, composite and alternate cap systems, and the final cover.	Applicable	These requirements are applicable to the on-site disposal facility. The prescriptive requirements needed for construction of a solid waste landfill will be performed. The OAC requirements are more stringent than the federal requirements, and therefore become the pertinent ARAR. Certification is not required as specified in OAC 3745-27-08 (A) and (B) because the FEMP is a CERCLA site. However, the substantive requirements will be met.
Open dumping or burning ORC 3734.03 OAC 3745-27-05 40 CFR Part 257.3-7	Open dumping or burning of solid waste or infectious wastes is prohibited.	Applicable	This requirement is applicable to site remediation.
SOLID WASTE DISPOSAL FACILITY OPERATIONS			
Facility Operations OAC 3745-27-09 (C), (D) through (F); (K) through (Q)	Solid waste landfill facility operations requirements.	Applicable	These requirements are applicable to the on-site disposal facility.
Daily Facility Operations OAC 3745-27-09 (C) through (E), (F)(2); (J) through (R) OAC 3745-27-19	This requirement specifies procedures for daily landfill operations and maintenance and the types of waste that are acceptable.	Applicable	These requirements are applicable to the on-site disposal facility.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
SOLID WASTE DISPOSAL FACILITY OPERATIONS (Continued)			
Required Technical Information OAC 3745-7-06 (A)(B) and (C)	The minimum technical information required for a solid waste permit to install. Included are a hydrogeologic investigation report, leachate production and migration information, surface water discharge information, design calculations, and plan drawings.	Applicable	This paragraph presents the substantive requirements of a solid waste permit to install. This requirement is applicable for ~~all alternatives where siting~~ a new solid waste landfill facility~~is considered. This requirement is also applicable to existing areas of contamination are capped per solid waste rules.~~ This rule establishes the minimum information required during the remedial design stage.
Ohio Solid Waste Disposal Regulations OAC 3745-27-19(N)	Section 3745-27-19(N) states the permittee shall submit to the Director of the OEPA, upon every 10th anniversary of the effective date of a permit to install that approved the initial construction of the facility, an analysis demonstrating that the design, construction and final closure plan of the solid waste landfill facility continue to constitute the best available technology. If the director of the OEPA determines that the design is no longer consistent with best available technology as being applied to the solid waste landfill industry in the state of Ohio, the permittee may be required to submit a permit to install application for necessary modifications to the landfill facilities. If a permit to install is required, the director of the OEPA shall not apply the siting criteria outlined in paragraph (H) of OAC 3745-27-07 when considering the permit to install application.	Relevant and Appropriate	~~Several remedial alternatives involve the on-property disposal of solid waste.~~ A permit-to-install is not required for the siting of an on-property landfill at the FEMP because it is a CERCLA site. However, the substantive requirements will be met through the CERCLA 5-year review process.
SOLID WASTE DISPOSAL FACILITY CLOSURE			
Final Closure of Solid Waste Landfill Facilities OAC 3745-27-11 (A),(B); (G)(1) through (3), (7)	It is the responsibility of the permittee to complete final closure of the solid waste landfill facility in a manner that minimizes the need for further maintenance and minimizes postclosure formation and release of leachate and explosive gases to air, soil, groundwater, or surface water to the extent necessary to protect human health and the environment. The adequacy of closure methods must be approved by OEPA for cap design, soil barrier layer, granular drainage layer and vegetative cover.	Applicable	These requirements are applicable to ~~alternatives that include~~ the on-site disposal facility.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
SOLID WASTE DISPOSAL FACILITY CLOSURE (Continued)			
Postclosure Care of Solid Waste Landfill Facilities OAC 3745-27-14 (A)(1),(2) RCRA Subtitle D	Following completion of final closure activities in accordance with Rule 3745-27-11 of the Administrative Code, the owner or operator shall conduct postclosure care activities at the solid waste landfill facility for a minimum of 30 years. Postclosure care activities for all solid waste landfill facilities shall include, but are not limited to: (1) 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; and (2) Maintaining the integrity and effectiveness of the cap system, including making repairs as necessary to correct the effects of settling, dead vegetation, subsidence, erosion, or other events, and preventing run-on and runoff from eroding or otherwise damaging the cap system.	Applicable	These requirements are applicable to the on-site disposal facility.
Postclosure Care EPA Criteria for Municipal Solid Waste Landfills 40 CFR §258.61	This requirement allows the State Director to direct 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.	Applicable	These requirements are applicable to the on-site disposal facility

WATER

SURFACE WATER			
Pollution to Waters of the State ORC 6111.04	Pollution to waters of the state is prohibited.	Applicable	This requirement is applicable to any discharge to waters of the state.
Compliance with Water Pollution Control Requirements ORC 6111.07 (A)(C)	Failure to comply with water pollution control requirements is prohibited.	Applicable	See comment above.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
SURFACE WATER (Continued)			
Ohio NPDES Permits CWA OAC 3745-33-05 ORC 6111.042 40 CFR 122.41 Subpart C	The point source must be equipped with instrumentation to monitor and record data and other information about the operation of the point source. The permittee shall maintain in good working order and operate at optimum levels in accordance with good engineering practices any wastewater treatment facilities or control systems regardless of the quality of the effluent. The permittee shall provide adequately trained and qualified personnel to operate the wastewater treatment facility.	Applicable	The Ohio NPDES permit is applicable because these requirements are more stringent than the federal regulations under the Clean Water Act. These requirements are applicable ~~as all alternatives involve~~ for point source discharges to the Great Miami River.
Storm Water Discharges Associated with Industrial Activity 40 CFR 122.26(a)(l)(ii) 40 CFR 122.26(b)(4) and OAC 3745-38	A discharge composed entirely of storm water associated with industrial activity must obtain a NPDES permit. These categories of facilities are considered to be engaging in "industrial activity": • Landfills, land application sites, and open dumps that receive or have received any industrial wastes (waste that is received from any of the facilities described under this subsection), including those that are subject to regulation under Subtitle D of RCRA; and • Construction activities including clearing, grading, and excavation that disturbs five acres or more of total land area.	Applicable	The Ohio NPDES permit is applicable because these requirements are more stringent than the federal regulations under the Clean Water Act. These requirements are applicable ~~as all alternatives involve~~ for point source discharges to the Great Miami River.
Antidegradation Policy OAC 3745-1-05 CWA 40 CFR 131.12	Existing instream water uses as defined in Rule 3745-1-07 of the Administrative Code and designated in Rules 3745-1-08 to 3745-1-32 of the Administrative Code, shall be maintained and protected. No further water quality degradation which would interfere with or become injurious to existing designated uses is allowable.	Applicable	This requirement is applicable for wastewater discharges to the Great Miami River. Under CERCLA, the State of Ohio has the overriding authority for the antidegradation of surface waters.
Analytical and Collection Procedures OAC 3745-01-03	Analytical methods and collection procedures for surface water discharge sampling are specified.	Applicable	This requirement is applicable to both discharges to surface waters as a result of remediation and any on-site surface waters affected by site conditions.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
SURFACE WATER (Continued)			
National Pollutant Discharge Elimination System; Wastewater Discharges Resulting From Clean-up of Response Action Sites Contaminated with Volatile Organic Compounds OEPA Policy #DSW-DERR 0100.027	Establishes response action guidelines for treatment technologies and discharge criteria for VOCs to be discharged to surface water.	TBC	This OEPA policy ~~will~~ provides guidance for ~~alternatives involving~~ wastewater discharges which contain VOCs.
GROUNDWATER MONITORING			
Monitoring Well System OAC 3745-27-10 (A) and (B)	Groundwater monitoring program requirements of new landfill facilities include background monitoring, detection monitoring and postclosure monitoring. The groundwater monitoring system will 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.	Applicable	These requirements are applicable to ~~alternatives that include~~ the on-site disposal facility.
Groundwater Monitoring Program OAC 3745-27-10 (C) and (D)	Sampling and analyses procedures must be designed to provide accurate representation of groundwater quality at the background and downgradient wells. Sampling and analysis procedures must be documented in a written plan. If the landfill facility owner deviates from the monitoring parameters listed in OAC 3745-27-10 (D)(3) to (D)(6), then an alternate list may be proposed to the Director. In addition, a written quality assessment program must be prepared.	Applicable	These requirements are applicable to ~~alternatives that include~~ the on-site disposal cell. An alternate list of monitoring parameters will be required from those specified in OAC 3745-27-10(D)(3) to (D)(6).
Groundwater Quality Assessment Program OAC 3745-27-10 (E) and (P)	If a statistically significant change from background levels is identified for each parameter or constituent being monitored, then the landfill owner must submit a quality assessment program within 15 days. The plan must determine: (1) If leachate or leachate-derived constituents have entered the groundwater (2) The rate and extent of migration of leachate or leachate-derived waste in the groundwater (3) The concentrations of leachate or leachate-derived waste in groundwater.	Applicable	These requirements are applicable to ~~alternatives that include~~ the on-site disposal facility.
Corrective Measures Study 3745-24-19(F)	After 180 days of determining that contaminants have leached from the landfill, a corrective measures study must be submitted to OEPA. Remediation must include meeting MCLs in groundwater for a risk-level of 1×10^{-6} for a cumulative lifetime risk to an individual.	Applicable	These requirements are applicable to ~~alternatives that include~~ the on-site disposal facility.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
GROUNDWATER WELLS			
INJECTION			
Unauthorized Injection into Groundwater OAC 3745-34-07	Movement of fluid into underground sources of drinking water that contains a contaminant which may cause a violation of any primary drinking water regulation under OAC 3745-8 is prohibited.	Applicable	This requirement is applicable to injection of groundwater.
Injection of Class IV Wells OAC 3745-34-08	Injection of hazardous or radioactive waste in Class IV wells is prohibited unless approved by the Director pursuant to provisions for cleanup of releases under Chapter 3734 of the Revised Code, CERCLA (42 U.S.C. 9601-9657), or RCRA (42 U.S.C. 6901-6987).	Applicable	This requirement is applicable to injection of groundwater.
Underground Injection Control Program OAC 3745-34-01 OAC 3745-34-13	Injection into existing and new Class V wells is authorized by rule pursuant to Section 6111.043 of the Ohio Revised Code until further requirements under future rules become applicable, unless injection is of sewage, industrial wastes or other wastes, as defined in Section 6111.01 of the Ohio Revised Code, into or above an underground source of drinking water.	Applicable	This requirement is applicable to ~~all alternatives which involve~~ the reinjection of treated groundwater into the GMA rather than discharging it to the Great Miami River.
Injection of Wastes into Wells ORC 6111.043 ORC 6111.044 to ORC 611.049	These sections of the Ohio Revised Code establish a program for regulations of the injection of sewage, industrial waste, hazardous waste, and other wastes into wells in order to control pollution of the waters of the state, to prevent contamination of underground sources of drinking water, and to satisfy all requirements of the Safe Drinking Water Act regarding injection wells as defined in regulations adopted under that act.	Applicable	This requirement is applicable to ~~all alternatives which involve~~ the reinjection of treated groundwater into the GMA rather than discharging it to the Great Miami River.
OEPA Policy 5X26 Aquifer Remediation Projects	This OEPA policy outlines requirements for groundwater remediation via subsurface injection of fluids.	TBC	This OEPA policy will provide guidance for ~~alternatives contemplating~~ the reinjection of treated groundwater into the GMA.
WELL CONSTRUCTION			
Water Pollution from a Solid Waste Disposal Facility 40 CFR 257.33	Water pollution from a solid waste disposal facility is prohibited.	Applicable	This requirement is applicable for the on-property disposal facility.
Siting Monitoring Wells OAC 3745-9-04 (A)	New wells should be located where they can be maintained, and where protection of groundwater, human health and the environment is maintained.	Applicable	This requirement is applicable for the installation of new wells.

743

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
WELL CONSTRUCTION (Continued)			
Monitoring Well Construction OAC 3745-9-05 (A)(1) and (B) through (H); 06 (A)(B)(D) and (E); 07 (A), (B), (C), (E), and (F)	New wells must be constructed with the specified criteria of this requirement to avoid contamination of groundwater.	Applicable	See comment above.
Pumping Wells OAC 3745-9-08 Paragraph (C)	Pumps may only be primed with potable water.	Applicable	This requirement is applicable for all well pumps that require priming.
Monitoring Well Maintenance and Modification OAC 3745-9-09 (A) through (C), and (E) through (G)	Monitoring wells must be maintained or modified to avoid cross-contamination of groundwater.	Applicable	This requirement is applicable for all groundwater wells.
WELL ABANDONMENT			
Abandonment of Test Holes and Wells OAC 3745-09-10	Upon completion of testing, a test hole shall be either completely filled with grout or such other material as will prevent contaminants from entering groundwater.	Applicable	This requirement is applicable to all groundwater wells on the site that either will be installed or have been installed since February 15, 1975.

POLYCHLORINATED BIPHENYLS (PCBs)

PCB DISPOSAL			
Disposal Requirements TSCA 40 CFR 761.60(a)(4) Subpart D	Any nonliquid PCBs at concentrations 50 ppm or greater in the form of contaminated soil, rags, or other debris shall be disposed of in an incinerator or in a chemical waste landfill.	Applicable	In the event soil containing PCBs above 50 ppm is excavated, this requirement is applicable. PCBs were detected in soil beneath the fire training facility.

TABLE B.3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks
PCB TREATMENT			
TSCA 40 CFR 761.60(e) Subpart D	Any person who is required to incinerate PCBs or PCB items under this subpart and who can demonstrate that an alternate method of destroying PCBs or PCB items can achieve a level of performance equivalent to the requirements under 40 CFR 761.70 may submit a written request to either the Regional Administrator or the Director, Exposure Evaluation Division, for an exemption from the incineration requirements of 761.70 or 761.60. The applicant must show that the alternate method of destroying PCBs will not present an unreasonable risk of injury to health or the environment.	Applicable	This requirement is applicable only if PCB contaminated soil is greater than 50 ppm and is treated on-property using a method besides incineration.
PCB STORAGE			
Storage for Disposal TSCA 40 CFR 761.65 Subpart D	This section applies to the design of storage areas to be used for later disposal of PCBs at concentrations of 50 ppm or greater.	Applicable	This requirement is applicable for storage of PCB-contaminated soil at 50 ppm or greater.
OTHER REGULATIONS			
NOISE CONTROL			
Noise Control Act, as amended 42 USC 4901, et seq. Noise Pollution and Abatement Act 42 USC 7641	The public must be protected from noises that jeopardize health and welfare.	Applicable	Because equipment and vehicles would be involved in certain aspects of the proposed action, all substantive requirements of the act are applicable. However, appropriate engineering controls and best management practices will be implemented to reduce nuisance noise to the maximum practicable extent during conduct of the proposed actions.
HAMILTON COUNTY EARTHWORK REGULATIONS			
Erosion Control Specifications Hamilton County Earthwork Regulations	Department of Public Works -- temporary and/or permanent erosion and sediment control features and devices shall be designed and constructed in accordance with the State of Ohio Temporary Erosion Control Specifications.	TBC	~~All alternatives involving~~ This requirement is not an ARAR because it is not promulgated. This requirement will be considered for activities that involve excavation, ~~contemplate~~ erosion, and sediment control features.

TABLE B.4.A

METHOD OF COMPLIANCE WITH CHEMICAL-SPECIFIC ARARs FOR OPERABLE UNIT 5 SELECTED REMEDY

Chemical ARAR	Method of Compliance
Applicable Chemical-Specific Federal ARARs	
EPA Regulations on National Emission Standards for Hazardous Air Pollutants 40 CFR 61 National Emission Standards for Emissions of Radionuclides other than Radon from DOE Facilities Subpart H	Existing site conditions currently attain compliance with this regulation through the application of appropriate waste management and maintenance activities. Dust suppression techniques will be implemented during all phases of remedial action involving the handling of contaminated materials. Additionally, all soil treatment and wastewater treatment operations with a potential to emit radionuclides to the environment will be equipped with emission control devices (i.e., HEPA filters, etc.).
National Emission Standard for Radon Emissions from DOE Facilities 40 CFR 61 Subpart Q	The existing distribution of contaminants within the affected environmental media in Operable Unit 5 attains compliance with this requirement. The disposal facility design would accommodate sufficient barriers to ensure continued compliance.
Lead in Air 40 CFR 50.12	Compliance will be met.
Relevant and Appropriate Chemical-Specific Federal ARARs	
National Primary Drinking Water Standards, Maximum Contaminant Levels and Proposed Maximum Contaminant Levels 40 CFR 141.11, 40 CFR 141.15 and 40 CFR 141.16	The existing conditions exhibit concentrations of contaminants in the aquifer exceeding MCL or proposed MCL concentrations. Affected groundwater in the glacial till (1 gpm sustained yield) and GMA exhibiting greater than MCL or proposed MCL concentrations will be extracted with recovery wells. The pumping/excavation operation is anticipated to reduce contaminant concentrations to less than the MCLs or proposed MCLs at all points in the aquifer system at and beyond the point of compliance.
Federal Nonzero Maximum Contaminant Level Goals for Organic and Inorganic Chemicals 40 CFR 141.12, 40 CFR 141.50 and 40 CFR 141.51	See comment above

TABLE B.4.A (Continued)
METHOD OF COMPLIANCE WITH CHEMICAL-SPECIFIC ARARs FOR OPERABLE UNIT 5 SELECTED REMEDY

Chemical ARAR	Method of Compliance
Relevant and Appropriate Chemical-Specific Federal ARARs (Continued)	
The National Primary Drinking Water Standards, Maximum Contaminant Levels for Organic and Inorganic Chemicals 40 CFR 141.61 and 40 CFR 141.62	See comment above
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR 192.02, Subpart A; 192.12(a), Subpart B; 192.20, Subpart C; 192.21(f) and 192.22(b), Subpart C; 192.32(b)(2), Subpart D; 192.40-192.42, Subpart E	Select portions of the site exhibit existing concentrations exceeding these requirements. Soil excavation efforts for radioactive environmental media will reduce the concentration of radium-226/radium-228/thorium-230 to required levels, in addition to reducing other residual radioactivity levels to attain final remediation levels.
Chemicals in Drinking Water for a Solid Waste Disposal Facility 40 CFR 257.4	Waste generated from remedial activities may be disposed of in an on-property disposal facility. The disposal facility would be designed and the WAC established to ensure the continued protection of the underlying regional aquifer system. Through the engineering design, complemented by the WAC, this standard would be attained.
Chemicals in Drinking Water for a Hazardous Waste Disposal Facility 40 CFR 264.94	See comment above
Lead Soil Cleanup Standards (Resource Conservation and Recovery Act) 40 CFR 268.41	Soil exceeding these standards would be excavated and placed in the on-property disposal facility.
Applicable Chemical-Specific Ohio ARARs	
Ohio Water Quality Standards for Surface Water OAC 3745-1-04 and OAC 3745-1-07	All surface water discharges will be controlled to the Great Miami River (permitted under NPDES) and to Paddys Run during the period of active remediation. Storm water, process wastewaters, sanitary sewage, and recovered groundwater will be managed to ensure the water quality standards are attained. The AWWT system and an expansion of this facility will be employed to treat wastewater, storm water, and recovered groundwater, as required, to ensure compliance with the standards.
Relevant and Appropriate Chemical-Specific Ohio ARARs	
General Radiation Protection Standards OAC 3701-38-15(A)(1),(B)	Compliance will be met.

TABLE B.4.B

METHOD OF COMPLIANCE WITH LOCATION-SPECIFIC ARARs FOR OPERABLE UNIT 5 SELECTED REMEDY

Location ARAR	Method of Compliance
Applicable Location-Specific Federal ARARs	
16 U.S.C. 470, National Historic Preservation Act and 36 CFR 60, 60.4, 63, 800	Prior to remedial activities, surveys will be conducted to determine the presence of any cultural resources. Cultural resources identified will be either avoided or managed in consistence with this requirement as agreed upon with DOE, SHPO, and the Advisory Council in a signed programmatic agreement. Compliance will be met.
16 U.S.C. 1531, et seq., Endangered Species Act 50 CFR 402.01, 402.12, Interagency Cooperation- Endangered Species Act	Studies are being conducted to determine the presence of individuals and potential habitat of federally and state-listed animal and plant species. If habitat or individuals are found, appropriate mitigative measures would be implemented. Compliance will be met.
Archaeological Resources Protection Act (16 USC § 47099 -47011) 43 CFR 7.4 (a), Protection of Archaeological Resources	Compliance will be coordinated through Section 106 of the National Historic Preservation Act.
16 U.S.C. 431-433, Antiquities Act of 1906	Compliance will be coordinated through Section 106 of the National Historic Preservation Act.
16 U.S.C. 461-467, 469, and 470 Historic Sites Preservation Act	Compliance will be coordinated through Section 106 of the National Historic Preservation Act.
25 U.S.C. 3001, Native American Graves Protection and Repatriation Act	Compliance will be coordinated through Section 106 of the National Historic Preservation Act.
42 U.S.C. 1996, American Indian Religious Freedom Act	Prior to remedial activities, surveys will be conducted to determine the presence of these cultural resources. Cultural resources identified will be either avoided or managed in consistence with this requirement. Compliance will be met.
42 U.S.C. 1424(e), Safe Drinking Water Act	Operable Unit 5 overlies a sole source aquifer (Great Miami Aquifer), which has been contaminated by site process activities. Contaminants will be removed to health-protective levels during remedial activities. Compliance will be met.

TABLE B.4.B (Continued)
METHOD OF COMPLIANCE WITH LOCATION-SPECIFIC ARARs FOR OPERABLE UNIT 5 SELECTED REMEDY

Location ARAR	Method of Compliance
Applicable Location-Specific Ohio ARARs (Continued)	
DOE Compliance with Flood Plain/Wetlands Review Requirements 10 CFR 1022.3(a), (b)(1), (2), (3), (5), (6), (c), (d), (e): .5(b), (h), 11(a), (b), (c), .12(a), .15(a)	A wetland delineation has identified freshwater wetlands within the 1050 acre FEMP property boundary. Remedial activities relative to wetland impacts will be handled through the U.S. Army Corps of Engineers Nationwide Permit (NWP) Program where possible. When not covered by a NWP, the action will meet requirements mandated by individual permits per 33 CFR 323. Compliance will be met.
Dredge and Fill 33 CFR 323, 330, 40 CFR 230	See above comment.
Procedure for Implementing the National Environmental Policy Act 40 CFR 6.301(c)	Substantive requirements will be met through the revised secretarial policy on NEPA. Compliance will be met.
Executive Order 11990, Protection of Wetlands 40 CFR 6.302(a)	Remedial design will minimize impacts to wetlands. Any unavoidable impacts will be undertaken in accordance with 33 CFR 323 or 330. Any potentially impacted wetlands will be mitigated. Compliance will be met.
Executive Order 11988, Protection of Floodplains	Remedial activities will minimize impacts to Floodplains. Impacted Floodplain areas would be backfilled with clean soil and regraded to avoid alteration of flow patterns or uses of the Floodplain.
Procedure for Implementing the National Environmental Policy Act 40 CFR 6.302(h)	Substantive requirements will be met through the revised secretarial policy on NEPA. Compliance will be met.
Location of Solid Waste Disposal Facilities 40 CFR 257.3-2 40 CFR 258.12	Any planned disposal facility will be located so at to attain these statutory requirements.

743

TABLE B.4.B (Continued)
METHOD OF COMPLIANCE WITH LOCATION-SPECIFIC ARARs FOR OPERABLE UNIT 5 SELECTED REMEDY

Location ARAR	Method of Compliance
Applicable Location-Specific Ohio ARARs (Continued)	
Protection of Endangered and Threatened Wildlife and Plants 50 CFR 17.21, 17.31, 17.61, 17.71, and 17.94	All Federal agencies must ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of the constituent elements essential to the conservation of a listed species within a defined critical habitat. Additional requirements apply if it is determined that a proposed activity could adversely affect these species or their habitat. Compliance will be met.
Protection and Enhancement of Cultural Environment Executive Order 11593 3 CFR 154	Compliance will be met for identification and preservation of cultural resources on Federal land, including natural landmarks.
Relevant and Appropriate Location-Specific Federal ARARs	
None Identified	
Applicable Location-Specific Ohio ARARs	
Ohio Endangered Species Regulations OAC 1501: 18-1 ORC 1518.02 and ORC 1531.25	Compliance will be met.
Hazardous Waste Facility Environmental Impact OAC 3734.05 (D)(6)(c)	Compliance will be met.
Hazardous Waste Facility Minimum Risk OAC 3734.05 (D)(6)(d)	Compliance will be met.

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TABLE B.4.B (Continued)
METHOD OF COMPLIANCE WITH LOCATION-SPECIFIC ARARs FOR OPERABLE UNIT 5 SELECTED REMEDY

Location ARAR	Method of Compliance
Applicable Location-Specific Ohio ARARs (Continued)	
Water use for Southwestern Ohio Tributaries OAC 3745-01-17 and OAC 3745-01-21	Compliance will be met.
Ohio Solid Waste Regulations OAC 3745-27-07(A) and (B) and OAC 3745-27-09(Y)	Any proposed disposal facility will be sited such that the facility and any associated leachate collection system will be located out of a floodway or floodplain.
State Water Quality Certifications OAC 3745-32-02	Required certifications would be attained prior to completing excavation or backfill operations within wetlands or waters of the United States. Compliance will be attained.
Relevant and Appropriate Location-Specific Ohio ARARs	
None Identified	

TABLE B.4.C

72

DOE METHOD OF COMPLIANCE WITH ACTION-SPECIFIC ARARs FOR OPERABLE UNIT 5 SELECTED REMEDY

Action-Specific ARAR	Method of Compliance
Applicable Action-Specific Federal ARARs	
Preparing and Transporting Hazardous Waste Off-Site 40 CFR 262.20 through 262.23, .30 and .33 Subparts B and C OAC 3745-53-20 through 31 OAC 3745-52-30 and 33	Hazardous waste that will be disposed of off site will comply with all substantive and administrative requirements.
Groundwater Monitoring Program 40 CFR 265.90(d) Subpart F OAC 3745-65-90(d)	This requirement is being met via the September 10, 1993, Ohio EPA Director's Final Findings and Orders (DFOs). These requirements will be considered during the development of a long-term monitoring program during RD/RA.
Corrective Action Management Unit 40 CFR 264.552 Subpart S	A CAMU is designated at the FEMP to include the area within the FEMP property boundaries for remedial action. Releases of contaminants that originated from the FEMP and have reached off-property areas will also be managed within the CAMU. The CAMU also includes the on-property disposal facility.
Air Emission Standards for Process Vents 40 CFR 264.1030, 264.1032 through 264.1034 Subpart AA	Units that treat soil and waste contaminated with organic compounds will comply with air emission standards by employing control devices and monitoring.
Land Disposal Restrictions and Contaminated Debris 40 CFR 268.40 through 268.44, 268.45 Subpart D OAC 3745-59	Hazardous waste and associated debris will be treated to treatment standards for off-site disposal. On-property disposal will not require land-disposal treatment standards because of management under the CAMU Rule.
Water Pollution from a Solid Waste Disposal Facility 40 CFR 257.3-3	The on-property disposal facility design will aid in compliance with this requirement.

TABLE B.4.C. (Continued)
METHOD OF COMPLIANCE WITH ACTION-SPECIFIC ARARs FOR OPERABLE UNIT 5 SELECTED REMEDY

Action-Specific ARAR	Method of Compliance
Applicable Action-Specific Federal ARARs (Continued)	
Postclosure Care 40 CFR 265.117 Subpart G OAC 3745-66-17	Postclosure care requirements will be met for residual contaminants at the site which exceed risk-based cleanup values (i.e., the on-property disposal facility). The requirement will be satisfied by including such monitoring and maintenance requirements into the operations & maintenance phase and long-term monitoring program of the CERCLA response action.
Underground Storage Tank (UST) Closure 40 CFR 280.60 through 280.66 Subpart F OAC 1301:7-7-36	All USTs and related petroleum-contaminated soil will undergo full closure per the requirements during the CERCLA remedial action.
Best Management Practices (BMP) Programs 40 CFR 125.104 Subpart K	The BMP requirements will be met via conducting the FEMP's BMP Plan. The BMP Plan will be progressively updated to accommodate changing site activities during the conduct of CERCLA remedial actions.
PCB Disposal, Treatment, and Storage 40 CFR 761.60(a)(4), (c), and 761.65 Subpart D	Soil containing PCBs will be excavated to attain the final remediation levels. Excavated soil will be dispositioned consistent with the WAC.
Noise Control 42 USC 4901 42 USC 7641	Engineering controls and best management practices will be implemented to reduce noise to the maximum extent practicable during the remedial action.
Particulate Air Emissions 40 CFR 50.6 (a), (b), (c)	Compliance will be met.
Empty Containers of Hazardous Waste 40 CFR 261.7 Subpart A OAC 3745-51-07	Containers that have held hazardous wastes will be considered empty if the requirements in the rule are met.

APPENDIX E

APPENDIX E

FERMCO BASELINE OSDF COST ESTIMATE

FERMCO
PROJECT & CONFIGURATION CONTROL
ESTIMATING SERVICES

10 MARCH 95

BASIS OF ESTIMATE

PROJECT DESCRIPTION:	SITEWIDE ONSITE DISPOSAL FACILITY
WBS NUMBER:	1.1.1.1.2.3.7
PROJECT LOCATION:	FERNALD, OHIO
PROJECT ENGINEER:	GREG JONES
ESTIMATOR:	KEN KEPLER
ESTIMATE NUMBER:	C2950204 (REV.01)
TASK ID:	2CC1

SUPPORTING DOCUMENTATION:

Verbal Scope	X	P & ID's		Work Plan	
Drawings		Equipment List		Site Walk	
Sketch	X	Specifications		Eng Mtg	X
Flow Diagrams		Site H & S Plan		Price Quotes	X

TYPE OF ESTIMATE:

Plan/Feasbl	X	Budg/Concpt	X	Title I Des	
Title II Des		Government		Independent	
Construction		Baseline	X		

BASIS OF ESTIMATE:

This Basis of Estimate represents costs to construct an onsite disposal facility to accept 2,500,000 CY's of waste/disposable material from OU2 waste units as well as OU3 and OU5. It is assumed that all waste will be delivered to the facility pre-treated to a predetermined waste acceptance criteria. All common soil or clay to be used in the construction of the liner and cap, as well as the intermediate cover, will be onsite borrow and all other materials will be offsite borrow.

These estimates are considered to be within a -30% to +50% range of accuracy (including Risk Budget), based on the level of information provided at this time.

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10 MARCH 95

ESTIMATE ASSUMPTIONS

PROJECT DESCRIPTION:	SITEWIDE ONSITE DISPOSAL FACILITY
WBS NUMBER:	1.1.1.1.2.3.7
PROJECT LOCATION:	FERNALD, OHIO
PROJECT ENGINEER:	GREG JONES
ESTIMATOR:	KEN KEPLER
ESTIMATE NUMBER:	C2950204 (REV.O1)
TASK ID:	2CC1

EXECUTION:

This project is estimated to be performed by a subcontractor working a 40-hour week, 10 hours a day, no overtime or holidays. Construction start and finish dates are indicated in Appendix D (Construction Activity Duration).

WAGE RATES:

Wage rates within the estimates are based on the current rates furnished by the local Craft Labor Board and developed into a craft mix. All Labor Dollars are considered constant 1995 dollars.

ENGINEERING:

Engineering Title I/II costs to support this project are included in WBS No.1.1.1.1.2.3.6, 2CCD.
Engineering Title III costs are included in WBS No.1.1.1.1.2.3.7, 2CT1.

PRODUCTIVITY:

A site specific factor of 1.29 has been applied to Net Chart manhours. See Appendices A and B for development and application.
Task-specific factors were applied as necessary when identified.
PPE-specific factors were applied based on level identified. See Appendix B.
An allowance for delays caused by monitoring and radiation checking is included. See Appendix C, Health Physics.
No exposure/burnout rates have been identified for this work.

NOTE: All references to "See Appendix" refer to cost estimate Appendices only.

ESCALATION:

Escalation has been excluded from these estimates. Costs are considered to be constant 1995 dollars.

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ESTIMATING SERVICES

10 MARCH 95

ESTIMATE ASSUMPTIONS

PROJECT DESCRIPTION:	SITEWIDE ONSITE DISPOSAL FACILITY
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ESTIMATE NUMBER:	C2950204 (REV.01)
TASK ID:	2CC1

DE-ESCALATION:

Page 2 of the estimate summary represents a de-escalated cost from the current year estimate (FY95) to a 1993 cost value for input into the microframe cost system.

UNIT RATES:

In general, the unit manhours, subcontract dollars, equipment dollars, and material dollars were based on 1993 MEANS. In most cases, a site productivity factor of 1.29 was applied to the Net chart unit manhours. The unit material and subcontract dollars were escalated 6% to arrive at 1995 constant dollars.

UNIT QUANTITIES:

All quantities, volumes, sizes, etc., were provided by CRU2 Engineering. All volumes of waste were considered bank cubic yards (BCY) at 10^{-6} risk level.

SWELL, DENSITY & SHRINKAGE FACTORS:

A swell or shrinkage factor was applied to the BCYs provided by CRU2 Engineering when applicable, resulting in loose cubic yards (LCY) or in-place or compacted cubic yards (ICY). Factors used are estimators judgement based on data provided in 'Fundamentals of Earthmoving' by Caterpillar Tractor Co. Density factors used are estimator's judgment based on 'Weights and Specific Gravities' in the American Institute of Steel Construction book. Weights are for bulk, heaped, or loose materials. The following factors were used:

MAT'L.	SWELL	DENSITY	SHRINKAGE
EARTH	1.25	1.275	1.2
CLAY	1.23	1.25	1.18
GRAVEL	1.12	1.275	1.075
SAND	1.12	1.275	1.075
GEN.WASTE	1.15	2.00	1.15

FERMCO
PROJECT & CONFIGURATION CONTROL
ESTIMATING SERVICES

10 MARCH 95

ESTIMATE ASSUMPTIONS

PROJECT DESCRIPTION:	SITEWIDE ONSITE DISPOSAL FACILITY
WBS NUMBER:	1.1.1.1.2.3.7
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ESTIMATE NUMBER:	C2950204 (REV.01)
TASK ID:	2CC1

HEALTH PHYSICS: (See Appendix C)

All workers at the site will participate in the Medical Monitoring & Surveillance Program and the FEMP Radiation In-Vivo & Bioassay Testing Program. Costs are for the workers' time to participate in these programs based on the Number of Workers and the Duration of Construction Activity information.
Material dollars are included in this section to provide PPEs for the worker when required. Disposable PPE's are to be provided by the subcontractor. Washable PPE's will be provided by the subcontractor for the initial changeout for each required worker, with subsequent changeouts and cost for washing and decontamination provided by FERMCO. Labor dollars are included in this section for work delays caused by rad checking.

NUMBER OF WORKERS:

Calculation: Total Direct Manhours Div. By 1813 Hours (1 Man Year) x 1.25 (attrition) Div. By the Duration of Construction in Months x 12 = number of workers per year.

(Use number of workers per year to determine CERCLA/SAT and Health Physics costs.)

G&A (Home Office Expense):

G&A are excluded from the target estimate. The G&A costs are calculated within the Micro-Frame computer system according to the plan for rebaselining.

FERMCO
PROJECT & CONFIGURATION CONTROL
ESTIMATING SERVICES

10 MARCH 95

ESTIMATE ASSUMPTIONS

PROJECT DESCRIPTION:	SITEWIDE ONSITE DISPOSAL FACILITY
WBS NUMBER:	1.1.1.1.2.3.7
PROJECT LOCATION:	FERNALD, OHIO
PROJECT ENGINEER:	GREG JONES
ESTIMATOR:	KEN KEPLER
ESTIMATE NUMBER:	C2950204 (REV.O1)
TASK ID:	2CC1

RISK BUDGET:

A cost element, based on a risk analysis calculated for this estimate to cover a statistical probability of a 50% chance of overrun/underrun to the project. The target estimate is the sum of the base estimate and the risk budget. The target estimate is the basis for the Performance Baseline. The risk budget for these projects will vary according to the results of the analysis. See the Risk Analysis at the end of each estimated alternative and refer to the Estimate Summary Sheets.

CONTINGENCY:

An amount budgeted to cover costs that may result from incomplete design, unforeseen and unpredictable conditions, or uncertainties. The amount of the contingency will depend on the status of design, procurement, construction, and the complexity and uncertainties of the component parts of the project. Contingency is not to be used to avoid making an accurate assessment of expected costs.

Contingency is calculated as the delta between the 50% chance of overrun and the 5% chance of overrun, indicated on the risk analysis. Contingency for these alternatives will vary based on the results of the risk analysis. See the risk analysis at the end of each estimated alternative and refer to the Estimate Summary Sheets.

FERMCO
PROJECT & CONFIGURATION CONTROL
ESTIMATING SERVICES

10 MARCH 95

SCOPE OF WORK

PROJECT DESCRIPTION:	SITEWIDE ONSITE DISPOSAL FACILITY
WBS NUMBER:	1.1.1.1.2.3.7
PROJECT LOCATION:	FERNALD, OHIO
PROJECT ENGINEER:	GREG JONES
ESTIMATOR:	KEN KEPLER
ESTIMATE NUMBER:	C2950204 (REV.01)

INCLUSIONS:

Costs have been included in the Field Directs for:

SITE PREPARATION
- Construction Survey
- Excavate 6" topsoil, stock for use in cell
- Access road - 6000 LF
- Storage area #1, 365' x 365', 9"thk. concrete pad
- Decon. trailer purchase
- Clear and grub surrounding area - 105 acres
- Temporary fencing - 10,000 linear feet
- Decontamination facilities - equipment - 25' x 60'
- Decontamination facilities - personnel - 11' x 11'

EROSION and SEDIMENT CONTROL
- Silt fence
- Diversion Berm
- Diversion Ditches
- Hay Bales

NORTH INTERCEPTOR TRENCH
- Excavate trench
- Riprap

CONSTRUCT LINER -
- Subgrade preparation - remove top soil, grade/compact
- Construct liner w/borrow materials
- Install leachate collection system
- Install leak detection system
- Install leachate discharge system to AWWT
- Backfill and compact - impacted cushion layer 12" thick
- Backfill and compact - remaining impacted fill
- Backfill and compact - level mD impacted fill
- Backfill generated waste
- Berm - On-site borrow

FERMCO
PROJECT & CONFIGURATION CONTROL
ESTIMATING SERVICES

10 MARCH 95

SCOPE OF WORK

PROJECT DESCRIPTION:	SITEWIDE ONSITE DISPOSAL FACILITY
WBS NUMBER:	1.1.1.1.2.3.7
PROJECT LOCATION:	FERNALD, OHIO
PROJECT ENGINEER:	GREG JONES
ESTIMATOR:	KEN KEPLER
ESTIMATE NUMBER:	C2950204 (REV.01)

CONSTRUCT CAP
- Construct cap w/borrow materials
- Top soil - 6" thick
- Grass cover - seed, mulch
- Security fence

GENERATED WASTE REMOVAL
- Construction equip. decon. facility
- Personnel decon. facility
- Temporary construction fence
- Storage area No. 1

SITE RESTORATION
- Borrowed common soil for backfill
- Borrowed top soil
- Grass cover, seed, fertilize, mulch

MONITORING WELLS
- Abandon (17) existing wells
- Install (50) pair of wells

Costs have been included in the Indirect Field Costs for:
- Contractor supervision
- Small tools and consumables
- Equipment rental
- Temporary construction facilities
- Temporary utilities and hook-up
- Job clean-up
- Safety
- Health Physics
- CERCLA and site access training
- Bond
- Subcontractor overhead and profit
- Subcontractor payroll burdens and benefits

FERMCO
PROJECT & CONFIGURATION CONTROL
ESTIMATING SERVICES

10 MARCH 95

SCOPE OF WORK

PROJECT DESCRIPTION:	SITEWIDE ONSITE DISPOSAL FACILITY
WBS NUMBER:	1.1.1.1.2.3.7
PROJECT LOCATION:	FERNALD, OHIO
PROJECT ENGINEER:	GREG JONES
ESTIMATOR:	KEN KEPLER
ESTIMATE NUMBER:	C2950204 (REV.01)

Costs for FERMCO Field Support are included in other WBS or CA's.

- Screening and confirmatory testing
- FERMCO construction management

Costs for Engineering are included in other WBS or CA's.

- Titles I,II and III (Includes cultural resource surveys, Phases I and II)

Costs have been included for Ohio State sales tax

- Subcontract material dollars at 6%

Costs have been included for Risk Budget.

Costs have been included for Contingency.

ALL OF THE ABOVE REPRESENTS SCOPE FOR THE CAPITAL COST FOR THE ALTERNATIVES.

EXCLUSIONS:

- Permits and fees
- Landlord costs
- Escalation
- G&A (home office expense)

Fernald Environmental
FERMCO
Restoration Management Corporation

INTEROFFICE MEMORANDUM

To:	Greg N. Jones, MS51-2	Date:	March 10, 1995
Location:	Fernald	Reference:	N/A
From:	Douglas L. Holmes, MS50	FERMCO #:	M:PIC:(ES):95-0023
Location:	Fernald Doug	Client:	DOE DE-AC24-92OR21972
Extension:	738-9484	Subject:	Sitewide Onsite Disposal Facility (PRELIMINARY)

c: K. G. Kepler, FERMCO, MS50
C. S. Martin, FERMCO, MS50
File Record Storage Copy 106.4.6.7

Attached are two (2) copies of the estimate for the Sitewide Onsite Disposal Facility, dated March 10, 1995.

To request an additional copy of the Estimate or for any questions, please call Ken Kepler on extension 6140

DLH:CSM:tjh
Attachments (2)

PRELIMINARY

CONTR.NO.– 4424321
CLIENT – U.S. DEPT. OF ENERGY
PROJECT – SITE WIDE ON–SITE DISPOSAL FACILITY (2,500,000 CY)
LOCATION – FERNALD, OHIO
PROJ.CTL. – OU2
WBS NO. – 1.1.1.1.2.3.7

PRELIMINARY

BUDGET ESTIMATE DETAILS

05:01 PM
CONTR.NO. 4424321
EST. NO. C2950204
BY: KEN KEPLER
DATE: 03/09/95
TASK I.D.: 2CC1

DESCRIPTION	QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	COST/UNIT MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
MONITORING WELLS – MW														
Each Pair of MW includes 40 ft. deep Type I MW and 80 ft. deep Type II MW														
a. Abandon MW at On–Site Disposal Facility	17	EA					13000.00				$221,000			$221,000
b. MW at On–Site Disposal Facility Prorated based on waste volume to be disposed at the disposal facility MW 1 Pair x 120 ft/pair	50	PR					23000.00				$1,150,000			$1,150,000
TOTAL (MONITORING WELLS)	1	LOT									$1,371,000			$1,371,000

000402

CONTR.NO. – 4424321
CLIENT – U.S. DEPT. OF ENERGY
PROJECT – SITE WIDE ON-SITE DISPOSAL FACILITY (2,500,000 CY)
LOCATION – FERNALD, OHIO
PROJ.CTL. – OU2
WBS NO. – 1.1.1.1.2.3.7

PRELIMINARY

BUDGET ESTIMATE DETAILS

05.01 PM
CONTR.NO. 4424321
EST. NO. C2950204
BY: KEN KEPLER
DATE: 03/09/95
TASK I.D.: 2CC1

DESCRIPTION		QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	COST/UNIT MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
SITE RESTORATION															
a. Onsite Borrow Common Soil, Backfill	BCY														
Decon.Facil. – Const.Equip.@ Fac.	78	94	ICY												
Decon.Facil. – Personnel @ Fac.	7	8	ICY												
	S/T	102.0	ICY	0.09	12	18.15			3.21		$220		$350		$570
b. Offsite Borrow Top Soil 6"Thk., Spread															
Decon.Facil. – Const.Equip.@ Fac.	167	200	SY												
Decon.Facil. – Personnel @ Fac.	14	17	SY												
	S/T	217.2	SY					4.04				$930			$930
c. Grass Cover – Seed, Fertilize, Mulch	SY														
Utility Mix – Hydro/Air Seeding															
Decon.Facil. – Const.Equip.@ Fac.	167	1.80	MSF												
Decon.Facil. – Personnel @ Fac.	14	0.15	MSF												
	S/T	2.0	MSF	0.30	1	18.15			6.75	25.00	$20		$10	$50	$80
TOTAL (SITE RESTORATION)		1	LOT		13						$200	$900	$400	$100	$1,600

000008

743

Site Restoration Details

CONTR.NO.– 4424321
CLIENT – U.S. DEPT. OF ENERGY
PROJECT – SITE WIDE ON–SITE DISPOSAL FACILITY (2,500,000 CY)
LOCATION – FERNALD, OHIO
PROJ.CTL. – OU2
WBS NO. – 1.1.1.1.2.3.7

PRELIMINARY

BUDGET ESTIMATE DETAILS

05:01 PM
CONTR.NO. 4424321
EST. NO. C2950204
BY: KEN KEPLER
DATE: 03/09/95
TASK I.D.: 2CC1

DESCRIPTION		QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	COST/UNIT MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
GENERATED WASTE REMOVAL TO ONSITE DISPOSAL FACILITY															
	LCY														
a. Const.Equip.Decon.Facil. @ Onsite Disp.Fac.															
Demo/Remove Concrete	62.5	50.0	BCY	2.56	165	18.15			36.50		$2,990		$1,930		$4,920
Excavate, Load :															
Sub–grade Stone	35.0	28	BCY	0.292	11	18.15			9.16		$200		$270		$470
Geo–Fabric & Liner	208.8	167	SY	0.010	2	18.15			0.10		$40		$20		$60
Posts – 4" x 4" x 9'–6"	1.3	27	EA	0.48	17	18.15			1.68		$310		$50		$360
Splash Guard	11.0	702	SF	0.04	36	18.15			0.03		$650		$20		$670
Haul & Dump Rubble	318.6	318.6	LCY	0.30	123	18.15			2.51		$2,230		$850		$3,080
b. Personnel Decon. Facil.@ Onsite Disp. Fac.															
Demo/Remove Concrete	2.8	2.20	BCY	2.56	7	18.15			36.50		$130		$90		$220
Demo/Remove Decon Trailer	400.0	10800	CF	0.003	42	18.15			0.10		$760		$1,140		$1,900
Excavate, Load :															
Sub–grade Stone	3.0	2.40	BCY	0.292	1	18.15			9.16		$20		$20		$40
Geo–Fabric & Liner	1.2	14.00	SY	0.010		18.15			0.10						
Posts – 4" x 4" x 9'–6"	0.3	6.00	EA	0.48	4	18.15			1.68		$70		$10		$80
Splash Guard	3.0	132.00	SF	0.04	7	18.15			0.03		$130				$130
Haul & Dump Rubble	410.3	410.25	LCY	0.30	159	18.15			2.51		$2,890		$1,090		$3,980
c. Temporary Construction Fencing @ Fac.															
Remove temporary construction fencing	1482.0	10000	LF	0.052	671	18.15					$12,180				$12,180
20' wide Temporary Gates @ Fac.	6.0	2.00	EA	12.75	33	18.15			340.00		$600		$720		$1,320
Haul & Dump Rubble	1488.0	1488	LCY	0.30	576	18.15			2.51		$10,450		$3,960		$14,410
d. Storage Area #I @ On–Site Disposal Fac.															
Demo/Remove Concrete	4626.3	3701	BCY	2.56	12222	18.15			36.50		$221,830		$143,190		$365,020
Demo/Remove Crushed rock	3084	2468	BCY	1.2	3820	18.15			3.62		$69,330		$9,470		$78,800
Excavate, Load :															
Geo–Fabric & Liner	1971	17763	SY	0.010	229	18.15			0.10		$4,160		$1,880		$6,040
Haul & Dump Rubble	9681	9681	LCY	0.30	3747	18.15			2.51		$68,010		$25,760		$93,770
	LCY														
TOTAL GENERATED WASTE	11898														
TOTAL (GENERATED WASTE REMOVAL)		1	LOT		21,872						$397,000		$190,500		$587,500

CONTR.NO.– 4424321
CLIENT – U.S. DEPT. OF ENERGY
PROJECT – SITE WIDE ON–SITE DISPOSAL FACILITY (2,500,000 CY)
LOCATION – FERNALD, OHIO
PROJ.CTL. – OU2
WBS NO. – 1.1.1.1.2.3.7

PRELIMINARY

BUDGET ESTIMATE DETAILS

05:01 PM
CONTR.NO. 4424321
EST. NO. C2950204
BY: KEN KEPLER
DATE: 03/09/95
TASK I.D.: 2CC1

DESCRIPTION		QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	COST/UNIT MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
CONSTRUCT CAP															
a. Contouring Layer 18" Thk.	BCY 172746	207295	ICY	0.06	16045	18.15			1.67		$291,220		$366,950		$658,170
b. Clay – (NO Bentonite) 24" Thk	BCY 230327	271786	ICY	0.060	21036	18.15			2.18		$381,800		$628,040		$1,009,840
c. Geocomposite Liner		345491	SY					7.38				$2,549,720			$2,549,720
d. Geotextile Fabric		345491	SY					2.25				$777,350			$777,350
e. Pea gravel 12" Thk, In–place	BCY 115164	123801	ICY	0.11	17567	18.15			0.77	17.00	$318,840		$101,050	$2,230,900	$2,650,790
f. Geotextile Fabric		345491	SY					2.25				$777,350			$777,350
g. Cobbels 36" Thk; In–place	BCY 345491	371403	ICY					35.52				$13,192,230			$13,192,230
h. Geotextile Fabric		345491	SY					2.25				$777,350			$777,350
i. Sand Layer 6" Thk; In–place	BCY 57593	61912	ICY	0.052	4153	18.15			1.76	5.00	$75,380		$115,500	$328,140	$519,020
j. Geotextile Fabric		345491	SY					2.25				$777,350			$777,350
k. Common Soil 21" Thk; In–place	BCY 201525	241830	ICY	0.06	18718	18.15			1.67		$339,730		$428,090		$767,820
l. Top Soil 6" Thk; In–place	BCY 57593	69112	ICY					17.00				$1,174,900			$1,174,900
m. Grass Cover – Seed, Fertilize, Mulch Utility Mix – Hydro/Air Seeding	SY 345491	3109	MSF	0.30	1203	18.15			6.75	25.00	$21,830		$22,240	$82,390	$126,460
n. Security Fence – 8' tall w/ 3–strands wire 6 ga. Aluminized		12000	LF	0.17	2632	18.15			2.28	13.40	$47,800		$29,000	$170,400	$247,200
iii. Double swing gates 20' opening		2	PR	25.60	66	18.15			340.00	560.00	$1,200		$700	$1,200	$3,100
TOTAL (CONSTRUCT CAP)		1	LOT		81,420						$1,477,800	$20,026,300	$1,691,600	$2,813,000	$26,008,700

Construct Cap Details

000440

743

CONTR.NO. – 4424321
CLIENT – U.S. DEPT. OF ENERGY
PROJECT – SITE WIDE ON-SITE DISPOSAL FACILITY (2,500,000 CY)
LOCATION – FERNALD, OHIO
PROJ.CTL. – OU2
WBS NO. – 1.1.1.1.2.3.7

PRELIMINARY

BUDGET ESTIMATE DETAILS

05:01 PM
CONTR.NO. 4424321
EST. NO. C2950204
BY: KEN KEPLER
DATE: 03/09/95
TASK I.D.: 2CC1

DESCRIPTION	QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	COST/UNIT MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
PLACEMENT OF WASTE (2,500,000 BCY) Receive waste, place and compact.														
a. Impacted Fill–Cusion Layer 12" Thk BCY 114169	142736	LCY	0.06	11048	18.15			1.67		$200,520		$252,670		$453,190
b. Impacted Fill–Spread and Compact BCY 2197511	2746889	LCY	0.06	212609	18.15			1.67		$3,858,850		$4,862,540		$8,721,390
c. Intermediate Cover – Spread and Compact 150000	187500	LCY	0.06	14513	18.15			1.67		$263,410		$331,910		$595,320
PPE Allowance is added to the following:														
d. Impacted fill BCY 8300	10375	LCY	0.06	803	18.15			1.67		$14,570		$18,370		$32,940
OU2 Quantity = 8300 BCY														
Other OU's Quantity = N/A BCY														
**PPE PRODUCTIVITY ALLOWANCE – LEVEL mD	803	HRS	110% S/T	883 1686	18.15			1.67		$16,030		$1,420		$17,450
MD = Man Day (No. of Hours worked in PPE's Divided by a 10 Hour Day) (SEE APPENDIX C)	169	MD												
TOTAL (WASTE PLACEMENT)	1	LOT		239,856						$4,353,400		$5,466,900		$9,820,300

000411

CONTR.NO.– 4424321
CLIENT – U.S. DEPT. OF ENERGY
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WBS NO. – 1.1.1.1.2.3.7

PRELIMINARY

BUDGET ESTIMATE DETAILS

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CONTR.NO. 4424321
EST. NO. C2950204
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TASK I.D.: 2CC1

DESCRIPTION	QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	COST/UNIT MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
AWWT PIPING SYSTEM														
a. Leachate Discharge Piping														
i. HDPE Carrier & containment Pipe 6" x 10' Trench Excav/Backfill,sand bed.,comp.	7000	LF	0.86	7766	18.15			11.37	22.33	$140,950		$84,370	$165,690	$391,010
ii. 50gpm Pump, controls., elec.	3	EA	60.00	232	18.15			210.00	2500.00	$4,210		$670	$7,950	$12,830
iii. HDPE Manhole – 4' dia. x 8' deep	20	EA	8.00	206	18.15			28.00	8300.00	530.00		$590	$175,960	$177,080
TOTAL (AWWT PIPING SYSTEM)	1	LOT		8,204						$145,700		$85,600	$349,600	$580,900

00041

743

CONTR.NO. – 4424321
CLIENT – U.S. DEPT. OF ENERGY
PROJECT – SITE WIDE ON–SITE DISPOSAL FACILITY (2,500,000 CY)
LOCATION – FERNALD, OHIO
PROJ.CTL. – OU2
WBS NO. – 1.1.1.1.2.3.7

PRELIMINARY

BUDGET ESTIMATE DETAILS

05:01 PM
CONTR.NO. 4424321
EST. NO. C2950204
BY: KEN KEPLER
DATE: 03/09/95
TASK I.D.: 2CC1

DESCRIPTION	QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	COST/UNIT MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
CONSTRUCT LINER Layers of Liner include: Borrow, Load, Haul, 300 ft, Place & Compact. (Soil/Clay = On–site Borrow) (Topsoil & other mat'l. = Off–Site Borrow)														
a. Subgrade Preparation														
i. Excavation of liner area 4'd x 1290' x 2390'	502431	BCY	0.037	23981	18.15			2.56		$435,260		$1,363,400		$1,798,660
ii. Disking and compaction	342567	SY	0.010	4419	18.15			0.72		$80,200		$261,450		$341,650
b. Clay – (No Bentonite) 36" Thk BCY 342567	404229	ICY	0.060	31287	18.15			2.18		$567,860		$934,090		$1,501,950
c. Geocomposite Liner	342567	SY					7.38				$2,528,140			$2,528,140
d. HDPE Liner 60 mil	342567	SY					4.75				$1,627,190			$1,627,190
e. Geotextile Fabric	342567	SY					2.25				$770,780			$770,780
f. Pea Gravel 12" Thk; In–place 114189	122753	ICY	0.11	17419	18.15			0.77	17.00	$316,150		$100,190	$2,212,010	$2,628,350
g. Composite Clay Liner	342567	SY					7.38				$2,528,140			$2,528,140
h. HDPE Liner 60 mil	342567	SY					4.75				$1,627,190			$1,627,190
i. Geotextile Fabric	342567	SY					2.25				$770,780			$770,780
j. Pea Gravel 12" Thk; In–place BCY 114189	122753	ICY	0.11	17419	18.15			0.77	17.00	$316,150		$100,190	$2,212,010	$2,628,350
k. Geotextile Fabric	342567	SY					2.25				$770,780			$770,780
l. HDPE Perforated Pipe – leachate collection 6" Dia.	10000	LF	0.30	3870	18.15			1.05	6.56	$70,240		$11,130	$69,540	$150,910
m. HDPE Perforated Pipe – leak detection 6" Dia.	10000	LF	0.30	3870	18.15			1.05	6.56	$70,240		$11,130	$69,540	$150,910
n. Berm – Common soil BCY 130000 (To accommodate ou2 waste placement for 5 YR plan)	139750	ICY	0.06	10817	18.15			1.67		$196,330		$247,390		$443,720
TOTAL (CONSTRUCT LINER)	1	LOT		113,082						$2,052,400	$10,623,000	$3,029,000	$4,563,100	$20,267,500

CONTR.NO.– 4424321
CLIENT – U.S. DEPT. OF ENERGY
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PRELIMINARY

BUDGET ESTIMATE DETAILS

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DATE: 03/09/95
TASK I.D.: 2CC1

DESCRIPTION	QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	COST/UNIT MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
NORTH INTERCEPTOR TRENCH														
a. Excavate Trench	20000	CY	0.24	6192	18.15			0.84		$112,380		$17,810		$130,190
b. Riprap	8700	CY	0.26	2896	18.15			7.15	10.10	$52,560		$65,940	$87,870	$206,370
TOTAL (NORTH INTERCEPTOR TRENCH)	1	LOT		9088						$164,900		$83,800	$87,900	$336,600

000117

743

North Interceptor Trench Details

CONTR.NO. – 4424321
CLIENT – U.S. DEPT. OF ENERGY
PROJECT – SITE WIDE ON-SITE DISPOSAL FACILITY (2,500,000 CY)
LOCATION – FERNALD, OHIO
PROJ.CTL. – OU2
WBS NO. – 1.1.1.1.2.3.7

PRELIMINARY

BUDGET ESTIMATE DETAILS

05:01 PM
CONTR.NO. 4424321
EST. NO. C2950204
BY: KEN KEPLER
DATE: 03/09/95
TASK I.D.: 2CC1

DESCRIPTION	QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	COST/UNIT MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
EROSION and SEDIMENT CONTROL														
a. Silt Fence	15000	LF	0.017	329	18.15			0.06	0.65	$5,970		$950	$10,340	$17,260
b. Diversion Berm	5000	CY	0.24	1548	18.15			0.84		$28,100		$4,450		$32,550
c. Diversion Ditches	5000	CY	0.24	1548	18.15			0.84		$28,100		$4,450		$32,550
d. Hay Bales	3000	EA	0.24	929	18.15			1.53	1.35	$16,860		$4,870	$4,290	$26,020
TOTAL (EROSION and SEDIMENT CONTROL)	1	LOT		4354						$79,000		$14,700	$14,600	$108,300

000415

CONTR.NO. – 4424321
CLIENT – U.S. DEPT. OF ENERGY
PROJECT – SITE WIDE ON–SITE DISPOSAL FACILITY (2,500,000 CY)
LOCATION – FERNALD, OHIO
PROJ.CTL. – OU2
WBS NO. – 1.1.1.1.2.3.7

PRELIMINARY

BUDGET ESTIMATE DETAILS

05:01 PM
CONTR.NO. 4424321
EST. NO. C2950204
BY: KEN KEPLER
DATE: 03/09/95
TASK I.D.: 2CC1

DESCRIPTION	QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	COST/UNIT MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
SITE PREP for LINER														
a. Construction Survey	105	AC					250.00				$26,250			$26,250
b. Clear and Grubb i. On–site Facility & Surrounding area	105	AC					1500.00				$157,500			$157,500
c. Excavate 6" Top Soil, stockpile (84700 cy) (to be placed in disposal facility as waste)	508200	SY	0.010	6785	18.15			0.72		$123,150		$390,280		$513,430
d. Access Road – 15' wide – 6" gravel	6000	LF	0.08	619	18.15			0.33	2.18	$11,230		$2,100	$13,860	$27,190
e. Temporary Construction Fencing i. Temp. fencing	10000	LF					2.32				$23,200			$23,200
ii. 20 ft. wide swing gates	2	EA					200.00				$400			$400
f. Storage Area # I – 365' x 365' Conc. 9" thk Includes Compacted Sub–Grade Re–Inforced Hypalon, Geotextile Fabric, Crushed Rock, W6 x W6 6 x 6	14803	SY					50.00				$740,150			$740,150
g. Decon Trailer –	1	LS					100000.00				$100,000			$100,000
h. Const.Equipment Decon. Facility 25 ft x 60 ft	1	LS	730.00	730	18.05		1160.00	2900.00	11980.00	$13,180	$1,160	$2,900	$11,980	$29,220
i. Personnel Decon. Facility 11'x 11'	1	LS	108.00	108	18.89		100.00	360.00	4120.00	$2,040	$100	$380	$4,120	$6,640
TOTAL (SITE PREP for LINER)	1	LOT		8242						$149,600	$1,048,800	$395,700	$30,000	$1,624,100

000245

243

CONTR.NO. – 4424321
CLIENT – U.S. DEPT. OF ENERGY
PROJECT – SITE WIDE ON–SITE DISPOSAL FACILITY (2,500,000 CY)
LOCATION – FERNALD, OHIO
PROJ.CTL. – OU2
WBS NO. – 1.1.1.1.2.3.7

PRELIMINARY

BUDGET ESTIMATE DETAILS

05 01 PM
CONTR.NO. 4424321
EST. NO. C2950204
BY: KEN KEPLER
DATE: 03/09/95
TASK I.D.: 2CC1

000417

DESCRIPTION	QUAN	UNIT	MANHOURS UNIT	MANHOURS TOTAL	FY95 RATE AVG	COST/UNIT LABOR	COST/UNIT SUB	COST/UNIT EQUIP.	MAT'L	LABOR FY95	S/C	EQUIP.	MATERIAL	TOTAL
CONSTRUCTION ACTIVITY SUMMARY														
ON–SITE DISPOSAL FACILITY														
SITE PREP for LINER	1	LS		8,242						$149,600	$1,048,800	$395,700	$30,000	$1,624,100
EROSION and SEDIMENT CONTROL	1	LS		4,354						$79,000		$14,700	$14,600	$108,300
NORTH INTERCEPTOR TRENCH	1	LS		9,088						$164,900		$83,800	$87,900	$336,600
CONSTRUCT LINER	1	LS		113,082						$2,052,400	$10,623,000	$3,029,000	$4,563,100	$20,267,500
AWWT PIPING SYSTEM	1	LS		8,204						$145,700		$85,600	$349,600	$580,900
PLACEMENT OF WASTE Receive, place and compact waste. Intermediate cover	1	LS		239,856						$4,353,400		$5,466,900		$9,820,300
CONSTRUCT CAP Construct cap. On–Site borrow of clay/soil. Off–site borrow top soil, etc.	1	LS		81,420						$1,477,800	$20,026,300	$1,691,600	$2,813,000	$26,008,700
GENERATED WASTE REMOVAL Demolish disposal support facilities and place in Disposal Facility.	1	LS		21,872						$397,000		$190,500		$587,500
SITE RESTORATION At on–site disposal facility.	1	LS		13						$200	$900	$400	$100	$1,600
MONITORING WELLS	1	LS									$1,371,000			$1,371,000
TOTAL (DIRECT FIELD COSTS)	1	LS		486,131	$18.14					$8,820,000	$33,070,000	$10,958,200	$7,858,300	$60,706,500

FERMCO RISK BUDGET ESTIMATING
INPUT DATA TABLE

PROJECT: SITEWIDE ONSITE DISPOSAL FACILITY-BUDGET
CLIENT: DOE
CONTRACT: C2-95-02-04

ACCOUNT NO.	ITEM DESCRIPTION	ESTIMATE BASE$	LOW%	LOW$	HIGH%	HIGH$	DIST. TYPE	RELA-TIONS	RANGE FACTOR
1	SITE PREP FOR LINER LABOR	149,600	-10%	$134,640	40%	$209,440	U		20%
2	SITE PREP FOR LINER S/C	1,048,800	-10%	943,920	40%	1,468,320	U		20%
3	SITE PREP FOR LINER MAT'L	30,000	-10%	27,000	25%	37,500	U		29%
4	EROSION AND SEDI. CNTRL LABOR	79,000	-10%	71,100	40%	110,600	U		20%
5	EROSION AND SEDI. CNTRL MAT'L	14,600	-10%	13,140	25%	18,250	U		29%
6	NORTH INTERCEPTOR TRNCH LABOR	164,900	-10%	148,410	40%	230,860	U		20%
7	NORTH INTERCEPTOR TRNCH MAT'L	87,900	-15%	74,715	30%	114,270	U		33%
8	CONSTRUCT LINER LABOR	2,052,400	-10%	1,847,160	40%	2,873,360	U		20%
9	CONSTRUCT LINER S/C	10,623,000	-10%	9,560,700	40%	14,872,200	U		20%
10	CONSTRUCT LINER MAT'L	4,563,100	-10%	4,106,790	30%	5,932,030	U		25%
11	AWWT PIPING SYSTEM LABOR	145,700	-10%	131,130	60%	233,120	U		14%
12	AWWT PIPING SYSTEM MAT'L	349,600	-10%	314,640	50%	524,400	U		17%
13	PLACEMENT OF WASTE LABOR	4,353,400	-10%	3,918,060	100%	8,706,800	U		9%
14	CONSTRUCT CAP LABOR	1,477,800	-10%	1,330,020	50%	2,216,700	U		17%
15	CONSTRUCT CAP S/C	20,026,300	-10%	18,023,670	50%	30,039,450	U		17%
16	CONSTRUCT CAP MAT'L	2,813,000	-10%	2,531,700	40%	3,938,200	U		20%
17	GENERATED WSTE REMOVAL LABOR	397,000	-10%	357,300	70%	674,900	U		13%
18	SITE RESTORATION LABOR	200	-10%	180	80%	360	U		11%
19	SITE RESTORATION S/C	900	-10%	810	80%	1,620	U		11%
20	SITE RESTORATION MAT'L	100	-10%	90	70%	170	U		13%
21	MONITORING WELLS S/C	1,371,000	-10%	1,233,900	40%	1,919,400	U		20%
22	INDIRECT FIELD COSTS LABOR	8,089,500	-10%	7,280,550	50%	12,134,250	U		17%
23	INDIRECT FIELD COSTS S/C	3,743,700	-10%	3,369,330	50%	5,615,550	U		17%
24	INDIRECT FIELD COSTS MAT'L	11,301,500	-10%	10,171,350	30%	14,691,950	U		25%
25	SALES TAX SUBCONTRACT MAT'L	1,149,600	-6%	1,080,624	21%	1,391,016	U		22%
26				0		0			0%
27				0		0			0%
28				0		0			0%
29				0		0			0%
30				0		0			0%
31				0		0			0%
32				0		0			0%
33				0		0			0%
34				0		0			0%
35				0		0			0%
36				0		0			0%
37				0		0			0%
38				0		0			0%
39				0		0			0%
40				0		0			0%
41				0		0			0%
42				0		0			0%
43				0		0			0%
44				0		0			0%
45				0		0			0%

000418

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000419

RISK BUDGET/OVERRUN ANALYSIS OUTPUT

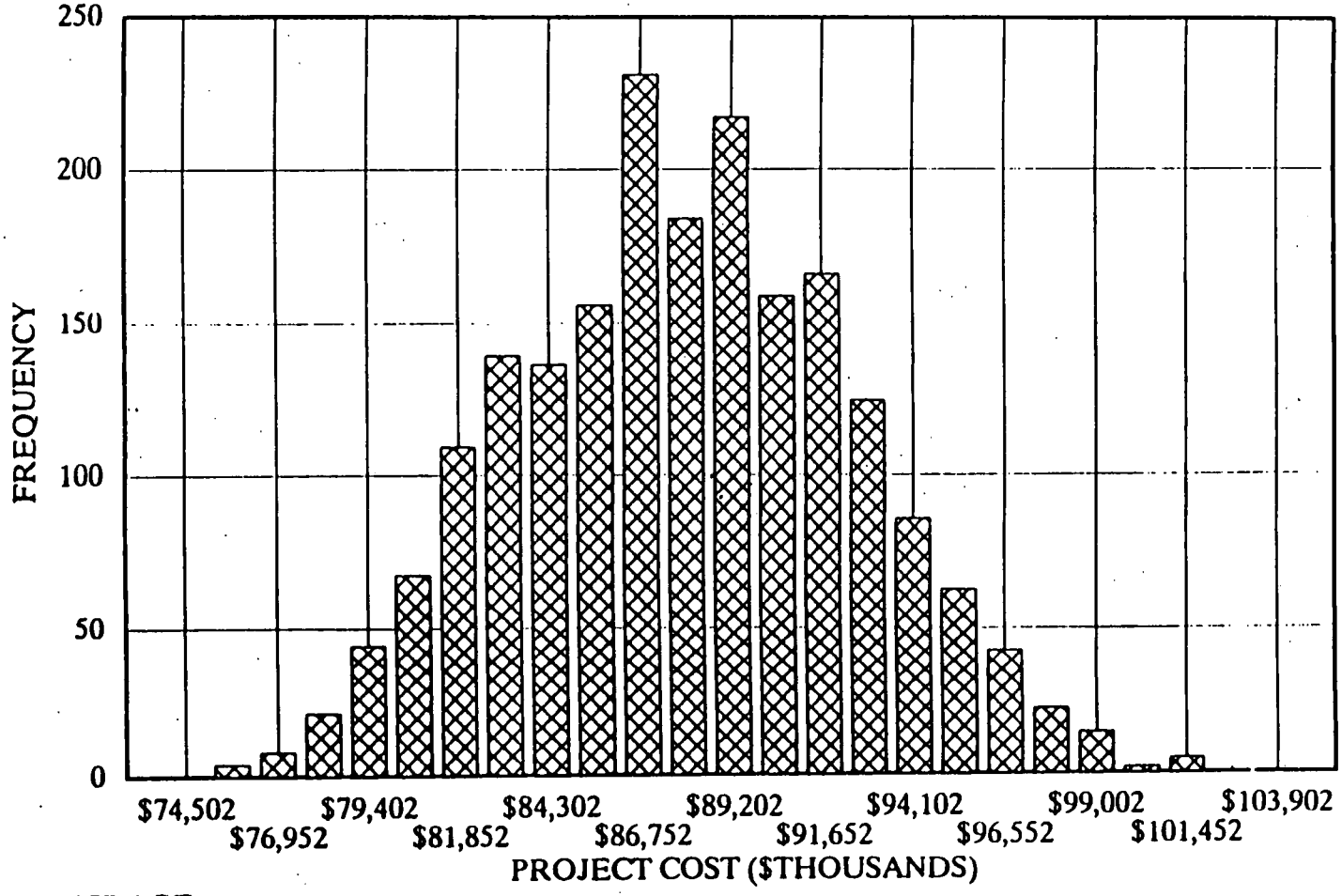
PROJECT: SITEWIDE ONSITE DISPOSAL FACILITY–BUDGET
CLIENT: DOE
CONTRACT: C2–95–02–04

DATE: 10–Mar–95
BASE ESTIMATE: $74,032,600

CHANCES OF OVERRUN	PROJECT COST W/RISK BUDGET	RISK BUDGET ADDED TO BASE ESTIMATE	%RISK BUDGET OF BASE ESTIMATE
0.00%	$107,954,716	$33,922,116	45.8%
0.05%	$100,667,592	$26,634,992	36.0%
5.00%	$95,017,181	$20,984,581	*28.3%*
10.00%	$93,275,332	$19,242,732	26.0%
15.00%	$92,159,824	$18,127,224	24.5%
20.00%	$91,382,365	$17,349,765	23.4%
25.00%	$90,587,621	$16,555,021	22.4%
30.00%	$89,898,856	$15,866,256	21.4%
35.00%	$89,122,763	$15,090,163	20.4%
40.00%	$88,522,389	$14,489,789	19.6%
45.00%	$87,986,109	$13,953,509	18.8%
50.00%	$87,326,166	$13,293,566	*18.0%*
55.00%	$86,661,142	$12,628,542	17.1%
60.00%	$86,126,143	$12,093,543	16.3%
65.00%	$85,603,264	$11,570,664	15.6%
70.00%	$84,863,656	$10,831,056	14.6%
75.00%	$84,005,129	$9,972,529	13.5%
80.00%	$83,134,469	$9,101,869	12.3%
85.00%	$82,292,906	$8,260,306	11.2%
90.00%	$81,391,821	$7,359,221	9.9%
95.00%	$79,775,203	$5,742,603	7.8%
99.95%	$74,851,501	$818,901	1.1%
100.00%	$66,670,929	($7,361,671)	–9.9%

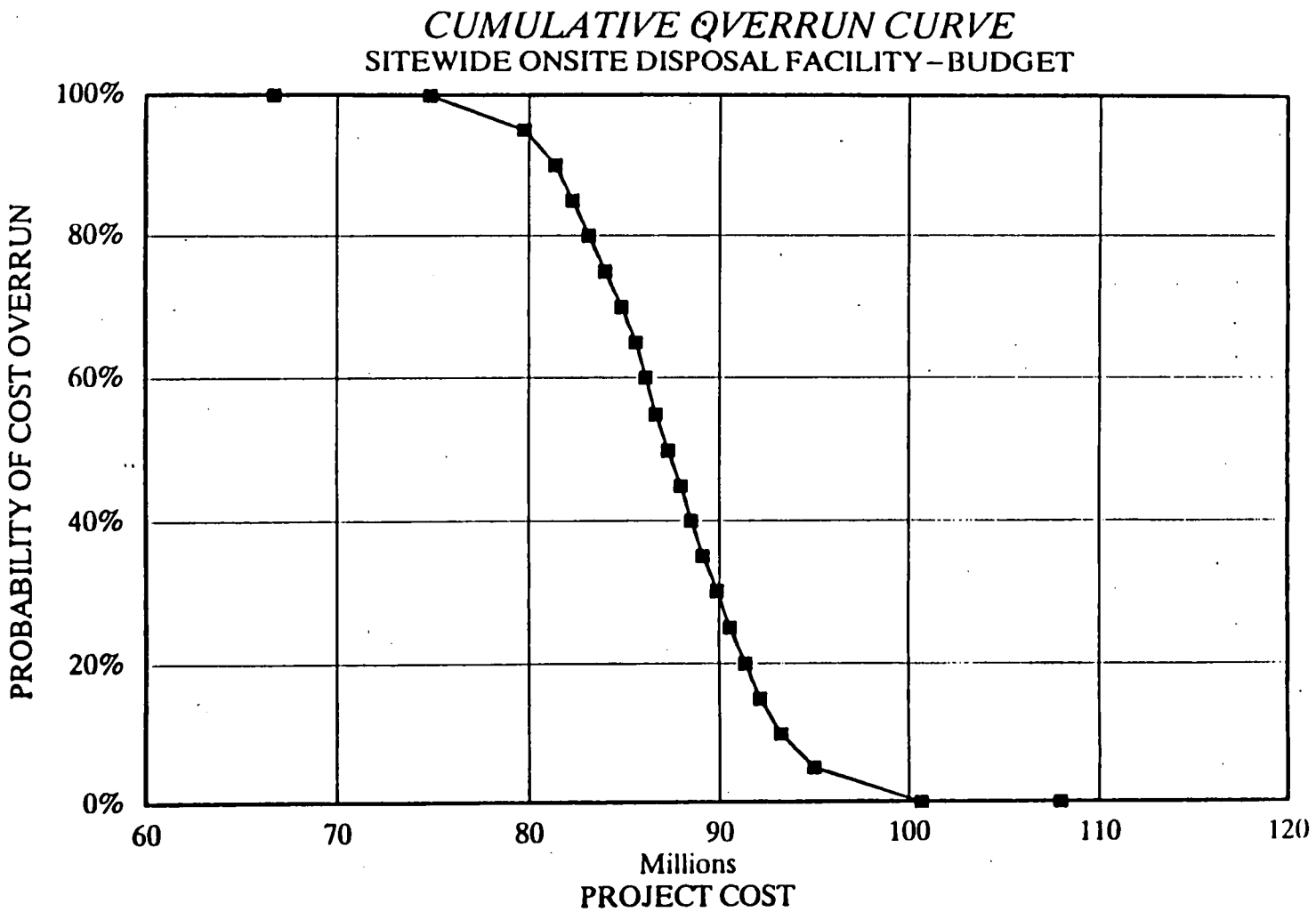
DISTRIBUTION OF 2,000 SAMPLES

SITEWIDE ONSITE DISPOSAL FACILITY – BUDGET



AVERAGE
$87,343,437

000421



BASE ESTIMATE:
$74,032,600

RISK ANALYSIS

REQUESTOR: GREG JONES
CLIENT: U.S. DEPARTMENT OF ENERGY
PROJECT: SITEWIDE ON-SITE DISPOSAL FACILITY - BUDGET
LOCATION: FERNALD, OHIO
WBS # : 1.1.1.1.2.3.7

COST IMPACT MATRIX

EST. NO: C2950204
DATE: 03/09/95
BY: KEN KEPLER
TASK # : 2CC1

COST IMPACT MATRIX TOTAL	SITE PREP for LINER LABOR $'s		SITE PREP for LINER S/C $'s		SITE PREP for LINER MAT'L. $'s		EROSION and SEDIMENT CONTRO LABOR $'s		EROSION and SEDIMENT CONTRO S/C $'s		EROSION and SEDIMENT CONTROL MAT'L. $'s	
$74,032,600	BASE EST:	$149,600	BASE EST:	$1,048,800	BASE EST:	$30,000	BASE EST:	$79,000	BASE EST:	$0	BASE EST:	$14,600
COST DRIVER %	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
LABOR EFFICIENCY	-5%	30%					-5%	30%				
MATERIAL PRICING			-5%	30%	-5%	15%					-5%	15%
CLASS OF CONTAMINATION												
NEW TECHNOLOGY												
NEW LAWS/REG'S												
QUANTITY VARIATION												
PROJECT DEFINITION	-5%	10%	-5%	10%	-5%	10%	-5%	10%			-5%	10%
(OTHER)												
TOTAL %	-10%	40%	-10%	40%	-10%	25%	-10%	40%	0%	0%	-10%	25%
TOTAL $	$134,640	$209,440	$943,920	$1,468,320	$27,000	$37,500	$71,100	$110,600	$0	$0	$13,140	$18,250

RISK PROFILE & CORRELATION FOR EACH COST ELEMENT	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP
	U		U		U		U		U		U	

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000423

RISK ANALYSIS

REQUESTOR: GREG JONES
CLIENT: U.S. DEPARTMENT OF ENERGY
PROJECT: SITEWIDE ON-SITE DISPOSAL FACILITY - BUDGET
LOCATION: FERNALD, OHIO
WBS # : 1.1.1.1.2.3.7

COST IMPACT MATRIX

EST. NO: C2950204
DATE: 03/09/95
BY: KEN KEPLER
TASK # : 2CC1

	NORTH INTERCEPTOR TRENCH LABOR $'s		NORTH INTERCEPTOR TRENCH S/C $'s		NORTH INTERCEPTOR TRENCH MAT'L. $'s		CONSTRUCT LINER LABOR $'s		CONSTRUCT LINER S/C $'s		CONSTRUCT LINER MAT'L. $'s	
	BASE EST: $164,900		BASE EST: $0		BASE EST: $87,900		BASE EST: $2,052,400		BASE EST: $10,623,000		BASE EST: $4,563,100	
COST DRIVER %	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
LABOR EFFICIENCY	-5%	30%					-5%	30%				
MATERIAL PRICING					-10%	20%			-5%	30%	-5%	20%
CLASS OF CONTAMINATION												
NEW TECHNOLOGY												
NEW LAWS/REG'S												
QUANTITY VARIATION												
PROJECT DEFINITION	-5%	10%			-5%	10%	-5%	10%	-5%	10%	-5%	10%
(OTHER)												
TOTAL %	-10%	40%	0%	0%	-15%	30%	-10%	40%	-10%	40%	-10%	30%
TOTAL $	$148,410	$230,860	$0	$0	$74,715	$114,270	$1,847,160	$2,873,360	$9,560,700	$14,872,200	$4,106,790	$5,932,030

RISK PROFILE & CORRELATION FOR EACH COST ELEMENT	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP
	U		U		U		U		U		U	

RISK ANALYSIS

REQUESTOR: GREG JONES
CLIENT: U.S. DEPARTMENT OF ENERGY
PROJECT: SITEWIDE ON-SITE DISPOSAL FACILITY - BUDGET
LOCATION: FERNALD, OHIO
WBS # : 1.1.1.1.2.3.7

COST IMPACT MATRIX

EST. NO: C2950204
DATE: 03/09/95
BY: KEN KEPLER
TASK # : 2CC1

	AWWT PIPING SYSTEM LABOR $'s		AWWT PIPING SYSTEM S/C $'s		AWWT PIPING SYSTEM MAT'L. $'s		PLACEMENT OF WASTE LABOR $'s		PLACEMENT OF WASTE S/C $'s		PLACEMENT OF WASTE MAT'L. $'s	
	BASE EST:	$145,700	BASE EST:	$0	BASE EST:	$349,600	BASE EST:	$4,353,400	BASE EST:	$0	BASE EST:	$0
COST DRIVER %	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
LABOR EFFICIENCY	-5%	30%					-5%	50%				
MATERIAL PRICING					-5%	20%						
CLASS OF CONTAMINATION												
NEW TECHNOLOGY												
NEW LAWS/REG'S												
QUANTITY VARIATION												
PROJECT DEFINITION	-5%	30%			-5%	30%	-5%	50%				
(OTHER)												
TOTAL %	-10%	60%	0%	0%	-10%	50%	-10%	100%	0%	0%	0%	0%
TOTAL $	$131,130	$233,120	$0	$0	$314,640	$524,400	$3,918,060	$8,706,800	$0	$0	$0	$0

RISK PROFILE & CORRELATION FOR EACH COST ELEMENT	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP	RISK PROFILE	CORRELATION GROUP
	U		U		U		U		U		U	

CONSTRUCTION ACTIVITY DURATION

CONT.NO. – 4424321
PROJECT – SITE WIDE ON-SITE DISPOSAL FACILITY (2,500,000 CY)
CONTROLS – CRU2
LOCATION-LOCATION:
TASK I.D. – TASK#:

WBS NO. – 1.1.1.1.2.3.7
EST. NO. – C2950204
BY – K. KEPLER
DATE – 03/09/95

ACTIVITY	EST. DATE	START DATE	MID POINT	COMPL. DATE	ACTIVITY	DURATION
CONSTRUCTION	24-Feb-95	01-Mar-97	16-Mar-2002	31-Mar-2007	121	MONTHS

EST.DATE TO MID-POINT OF ACTIVITY	
85	MONTHS

ACTIVITY DURATION IS USED IN DETERMINING NO. OF WORKERS FOR CERCLA/SAT AND HEALTH PHYSICS COSTS.

000425

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DATE: 09-Mar-95

PROJECT TITLE:
SITEWIDE ON-SITE DISPOSAL FACILITY - BUDGET
WBS#:
1.1.1.1.2.3.7

HEALTH PHYSICS

EST.NO.: C2950204
EST. : KEN KEPLER
TASK I.D. : 2CC1

MEDICAL MONITORING - IN-VIVO & BIOASSAY SURVEILLANCE

MEDICAL MONITORING & SURVIELLANCE - LOST WORKER TIME

DESC.	QTY	HRS	WKR	TOTAL HOURS	AVG. LABOR RATE	TOTAL LABOR $		
BASELINE PHYSICALS	1	4	40.3	161	$18.10	$2,920		
ANNUAL PHYSICALS	10	3	40.3	1208	$18.10	$21,860		
EXIT (TERMINATION) PHYSICALS	1	4	40.3	161	$18.10	$2,920		
SUB-TOTAL						$27,700		

FEMP RADIATION IN-VIVO & BIOASSAY SURVEILLANCE - LOST WORKER TIME

DESC.	QTY	HRS	WKR	TOTAL HOURS	AVG. LABOR RATE	TOTAL LABOR $		
MONTHLY BIOASSAY	0	1	40.3	0	$18.10	$0		
YEARLY IN-VIVO	10	4	40.3	1611	$18.10	$29,160		
EXIT (END OF PROJECT / TERMINATION)	1	4	40.3	161	$18.10	$2,920		
SUB-TOTAL						$32,080		
	WKRS	TESTS	HRS	TOTAL HOURS				
RANDOM DRUG TESTING	18	331	2	662	$18.10	$12,000		
	NO. OF WKRS. TESTED	TESTING DAYS PER YR.	AVG. NO OF TEST PER DAY	CHANCE PER DAY FOR TEST	NO. OF WKRS. FOR THIS ESTIMATE	CHANCES PER DAY FOR TEST FOR PROJECT	CONSTRUCTION WORKING DAYS	
	4000	226	18	0.0045	40.3	0.1812263	1829	
WORK DELAYS CAUSED BY RAD CHECKING	2%				$10,692,000	$213,800		

	TOTAL LABOR $'s	TOTAL MAT'L.$'s	TOTAL DOLLARS
TOTAL HEALTH PHYSICS - FORWARD TO ESTIMATE SUMMARY SHEET	$285,600	$10,300	$295,900

F:\LOTUS31\SW\BUDCELL\HLTHPHYS.WK3

DATE: 09-Mar-95

PROJECT TITLE:

HEALTH PHYSICS

SITEWIDE ON-SITE DISPOSAL FACILITY - BUDGET
WBS#:
1.1.1.1.2.3.7

EST.NO.: C2950204
EST. : KEN KEPL
TASK I.D. : 2CC1

PPE'S - PERSONAL PROTECTIVE EQUIPMENT

DESCRIPTION	UNIT	UNIT COST $'s	* NO. OF CHANGE OUTS PER WORKER PER DAY MD : MAN DAYS (TOTAL HOURS DIV. 10 HR. DAYS) *	MD	MAT'L.$'s	LEVEL		
FULL/HALF FACE MASK w/RESPIRATOR & CARTRIDGES								
TYVEK SUIT - DISPOSABLE	EA	3.20	4	0	$0	C/B		
TYVEK HOOD - DISPOSABLE	EA	6.00	4	0	$0	C/B		
TYVEK BOOT COVER - DISPOSABLE	EA	1.30	4	0	$0	C/B		
GLOVE LINER - DISPOSABLE	PR	1.40	4	0	$0	C/B		
GLOVE, LASTEX - DISPOSABLE	PR	1.50	4	0	$0	C/B		
GLOVE, WORK - DISPOSABLE	PR	0.90	4	0	$0	C/B		
APR CARTRIDGES - DISPOSABLE	PR	17.50	4	0	$0	C/B		
SUB-TOTAL		31.80	4		$0			
					$0.00	UNIT COST PER MAN DAY		
FULL DRESS w/ FACE SHIELD						Modified		
TYVEK SUIT - DISPOSABLE	EA	3.20	4	169	$2,160	D		
TYVEK HOOD - DISPOSABLE	EA	6.00	4	169	$4,060	D		
TYVEK BOOT COVER - DISPOSABLE	EA	1.30	4	169	$880	D		
GLOVE LINER - DISPOSABLE	PR	1.40	4	169	$950	D		
GLOVE, LASTEX - DISPOSABLE	PR	1.50	4	169	$1,010	D		
GLOVE, WORK - DISPOSABLE	PR	0.90	4	169	$610	D		
SUB-TOTAL		14.30	4		$9,670			
					$57.20	UNIT COST PER MAN DAY		
OTHER EQUIPMENT			WKR					
RUBBER BOOT COVERS-(1)PR.PER WORKER	PR	12.70	3		$40	D/C/B		
APR w/HALF FACE MASK - (1) PER WORKER	EA	22.30	3		$70	C		
APR w/FULL FACE MASK - (1) PER WORKER	EA	174.00	3		$520	C		
SCBA	EA	1894.00	0		$0	B		
COOL VESTS	EA	137.50	0		$0	C/B		
THERMO STRIPS	EA	50.00	0		$0	C/B		
SUB-TOTAL					$600			
TOTAL PPE's (FORWARD TO PAGE 2 OF 2)					$10,300			

OTHER PPE's SUCH AS HARD HAT, SAFETY GLASSES/GOGGLES, STEEL TOED SAFETY SHOES, HEARING PROTECTION, ARE CONSIDERED THE SUBCONTRACTORS RESPONSIBILITY AND ARE COVERED IN HIS OVERHEAD EXPENSE. COSTS OF FERMCO SUPPLIED PPE's, SUCH AS COTTON COVERALLS, EXCHANGE OF RUBBER BOOT COVERS AND RESPIRATORS FOR CHANGEOUTS AND CLEANING OF SAME IS INCURRED BY FERMCO AND COSTS ARE NOT INCLUDED AS PART OF PROJECT COSTS AT THIS TIME.

APPENDIX B

EFFICIENCY FACTORS

CONTRACT NO. :	4424321
PROJECT DESC. :	SITEWIDE ON-SITE DISPOSAL FACILITY - BUDGET
PROJECT CONTROLS :	CRU2
PROJ. LOCATION :	LOCATION:
PROJ. ENGINEER :	GREG JONES
ESTIMATOR :	KEN KEPLER
ESTIMATE NO. :	C2950204
WBS NO. :	1.1.1.1.2.3.7
TASK I.D. :	2CC1

EXAMPLE:

STANDARD CHART MANHOURS =	NET	100
EFFICIENCY FACTORS:		
*SITE SPECIFIC (SEE APPENDIX A)	29%	29
S/T = BASE UNIT MANHOURS		129

*TASK SPECIFIC (BASED ON LABOR CHARTS OR EST.KNOWLEDGE)

SEE DETAIL SHEETS or M.H.CHARTS	0%	0	N/A
S/T = NEW BASE UNIT MANHOURS		129	

*PPE SPECIFIC (BASED ON CURRENT DATA & EST. KNOWLEDGE)

LEVEL	D		Mod.'D'		C		B	
PRODUCTIVITY HOURS (AS ADDER TO BASE MH's)	0	0	1.1	142	1.5	194	1.75	226
TOTAL HOURS WITH PRODUCTIVITY		129	2.1	271	2.5	323	2.75	355

NOTE : Use a Default Productivity Factor of 2.1 for working in a contaminated area if Safety Level cannot be determined.
(SEE FERMCO ESTIMATING SERVICES REFERENCE MANUAL IM-6006 8.10)

Total hours with productivity divided by 10 hour working days = (PPE) ManDays to determine material cost of PPE's. (SEE APPENDIX C -HEALTH PHYSICS)

27 MD	32 MD	36 MD

THESE EFFICIENCY FACTORS WERE APPLIED INDIVIDUALLY THROUGHOUT THE ESTIMATE AT A TASK SPECIFIC LEVEL TO OBTAIN A MORE ACCURATE ACCOUNT OF OVERALL EFFICIENCY IMPACT DUE TO PPE REQUIREMENTS IN HANDLING CONTAMINATED AND HAZARDOUS WASTE.

APPENDIX A

000429

PROJECT – SITE WIDE ON-SITE DISPOSAL FACILITY (2,500,000 CY) SITE SPECIFIC
PROJ.LOCATION: FERNALD PLANT EFFICIENCY / MULTIPLIER ANALYSIS
ESTIMATOR : KEN KEPLER

WBS NO. : 1.1.1.1.2.3.7 EST.NO.: C2950204
TASK I.D. :2CC1 DATE : 09-Mar-95

	PERCENT OF INFLUENCE ON CHART MANHOURS						CHART MANHOURS			% OF INFLUENCE	WT'D VALUE	PROD. RESULT
	40%	50%	60%	70%	80%	90%	100%	105%	110%			
CRAFT SKILL (NOTE 1)	POOR			FAIR			STD	V.GOOD	EXCELLENT	80.00%	12.0%	9.60%
CRAFT AVAIL.(NOTE 1)		POOR		FAIR			STD			90.00%	8.0%	7.20%
CLIMATE (NOTE 2)	SEVERE	ICE/SNOW			RAIN		+40 TO +85			60.00%	20.0%	12.00%
PLANT ELEVATION		OVER 10,000FT			5,000' TO 10,000 FT		UNDER 5,000 FT			100.00%	5.0%	5.00%
WORK SPACE	<---- MULTIPLE SHIFTS-			200 SF	250 SF	300 SF	350 SF			70.00%	10.0%	7.00%
WORK WEEK							4-10s / 5-8s			100.00%	15.0%	15.00%
50 HOUR WORK WEEK	//// MULTIPLE-SHIFT ////			OVER 7 WEEKS	3 TO 7 WEEKS	UP TO 3 WEEKS						
60 HOUR WORK WEEK			OVER 7 WEEKS	3 TO 7 WEEKS	UP TO 3 WEEKS							
SHIFTWORK												
2ND SHIFT					2ND SHIFT		ONE SHIFT ONLY			100.00%	3.0%	3.00%
3RD SHIFT			3RD SHIFT							100.00%	5.0%	5.00%
PROJECT SIZE					400M MH AND UP	300M TO 400M MH	200M TO 300M MH	200M MH OR LESS		105.00%	4.0%	4.20%
PLANT TYPE				REVAMP ONLY	REVAMP & NEW	NEW IN EXIST PLT	GRASS ROOTS			70.00%	8.0%	5.60%
AREA/UNION INFLUENCE	STRONG		MILD		SOME		NONE			40.00%	10.0%	4.00%
											100.0%	77.6%

NOTES.....

1. TURNOVER HAS BEEN CONSIDERED

2. FOR EXTERIOR WORK ONLY

EFFICIENCY (AS A % OFF CHART MANHOURS) 77.6%

MULTIPLIER – (TO BE APPLIED TO CHART M.H.'S TO OBTAIN SITE M.H.'S) 1.29

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FERMCO ESTIMATING SERVICES

SUMMARY SHEET

EST FILE #: C2950204
CLIENT: US DOE
PROJECT TITLE: SITEWIDE ON-SITE DISPOSAL FACILITY - BUDGET
WBS#: 1.1.1.1.2.3.7

DATE: 09-Mar-95
ESTIMATOR: KEN KEPLER
LOCATION: FERNALD
TASK#: 2CC1

	CODE	ITEM DESCRIPTION	M/H	RATE	LABOR $	S/C $ / OTHERS	MAT'L $	TOTAL $
1		SITE PREP for LINER	8,242		$140,205	$982,935	$28,116	$1,151,256
2		EROSION and SEDIMENT CONTROL	4,354		$74,039		$13,683	$87,722
3		NORTH INTERCEPTOR TRENCH	9,088		$154,544		$82,380	$236,924
4		CONSTRUCT LINER	113,082		$1,923,509	$9,955,876	$4,276,537	$16,155,922
5		AWWT PIPING SYSTEM	8,204		$136,550		$327,645	$464,195
6		PLACEMENT OF WASTE	239,856		$4,080,006			$4,080,006
7		CONSTRUCT CAP	81,420		$1,384,994	$18,768,648	$2,636,344	$22,789,986
8		GENERATED WASTE REMOVAL	21,872		$372,068			$372,068
9		SITE RESTORATION	13		$187	$843	$94	$1,125
10		MONITORING WELLS				$1,284,901		$1,284,901
				AVG				
	DIRECT FIELD COSTS		486,131	17.00	$8,266,104	$30,993,204	$7,364,799	$46,624,107
11	SUPERVISION - CONTRACTOR		82,640		$1,405,238			$1,405,238
12	SM TOOLS/CONSM'BLS						$123,992	$123,992
13	EQUIPMENT RENTAL						$10,270,025	$10,270,025
14	TEMP. FACILITIES		3,166		$53,702		$28,959	$82,661
15	TEMP UTL'S HOOK-UP		3,166		$53,702		$28,959	$82,661
16	JOB CLEAN-UP		4,751		$80,599		$43,392	$123,992
17	SAFETY		9,503		$161,198		$86,785	$247,983
4	HEALTH PHYSICS S/C		15,779		$267,664		$9,653	$277,317
19	CERCLA	20 HR's/YR. AVG. x 40 WKRS. x	8,127		$137,862			$137,862
20	BOND					$466,257		$466,257
21	OVERHEAD & PROFIT					$3,042,339		$3,042,339
22	PAYRL BRD.&BENFT.				$5,421,515			$5,421,515
	INDIRECT FIELD COSTS		127,331		$7,581,479	$3,508,596	$10,591,766	$21,681,841
	DIRECT & INDIRECT FIELD COSTS		613,462		$15,847,583	$34,501,800	$17,956,565	$68,305,948
23	PURCHASE WASTE CONTAINERS (WPM)							
24	CERTIFICATION (WPM)							
25	TRANSPORTATION (WPM)							
26	BURIAL FEE (NTS)							
27	STORAGE COSTS (WPM)							
	WASTE MANAGEMENT COSTS							
28								
29	PROJ.MGMT-FERMCO							
30	CONSTR MGMT-FERMCO							
	FERMCO FIELD SUPPORT COSTS							
31	ENGINEERING, DESIGN, INSPECTION	A/E			FERMCO			
	ENGINEERING COSTS							
32	SALES TAX - SUBCONTRACT		$1,077,405	SALES TAX - FERMCO				$1,077,405
	SUB-TOTAL	(BASE ESTIMATE)						$69,383,353
33	G&A-FERMCO	(SEE EXCLUSION COMMENTS)						
34	ESCALATION	(SEE EXCLUSION COMMENTS)						
35	RISK BUDGET	18.0%						$12,489,033
	TARGET ESTIMATE (BASE ESTIMATE PLUS RISK BUDGET)							$81,872,386
36	CONTINGENCY	10.5%						$7,265,230

DE-ESCALATED TO FY93 DOLLARS

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FERMCO ESTIMATING SERVICES

SUMMARY SHEET

EST FILE #: C2950204
CLIENT: US DOE
PROJECT TITLE: SITEWIDE ON-SITE DISPOSAL FACILITY - BUDGET
WBS#: 1.1.1.1.2.3.7

DATE: 09-Mar-95
ESTIMATOR: KEN KEPLER
LOCATION: FERNALD
TASK#: 2CC1

	CODE	ITEM DESCRIPTION	M/H	RATE	LABOR $	S/C $ / OTHERS	MAT'L $	TOTAL $
1		SITE PREP for LINER	8,242		149,600	1,048,800	30,000	$1,228,400
2		EROSION and SEDIMENT CONTROL	4,354		79,000		14,600	$93,600
3		NORTH INTERCEPTOR TRENCH	9,088		164,900		87,900	$252,800
4		CONSTRUCT LINER	113,062		2,052,400	10,623,000	4,563,100	$17,238,500
5		AWWT PIPING SYSTEM	8,204		145,700		349,600	$495,300
6		PLACEMENT OF WASTE	239,856		4,353,400			$4,353,400
7		CONSTRUCT CAP	81,420		1,477,800	20,026,300	2,813,000	$24,317,100
8		GENERATED WASTE REMOVAL	21,872		397,000			$397,000
9		SITE RESTORATION	13		200	900	100	$1,200
10		MONITORING WELLS				1,371,000		$1,371,000
				AVG				
	DIRECT FIELD COSTS		486,131	$18.10	$8,820,000	$33,070,000	$7,858,300	$49,748,300
11	SUPERVISION - CONTRACTOR		82,840		$1,499,400			$1,499,400
12	SM TOOLS/CONSM'BLS						$132,300	$132,300
13	EQUIPMENT RENTAL						$10,958,200	$10,958,200
14	TEMP. FACILITIES		3,166		$57,300		$30,900	$88,200
15	TEMP UTL'S HOOK-UP		3,166		$57,300		$30,900	$88,200
16	JOB CLEAN-UP		4,751		$86,000		$46,300	$132,300
17	SAFETY		9,503		$172,000		$92,600	$264,600
18	HEALTH PHYSICS S/C		15,779		$285,600		$10,300	$295,900
19	CERCLA/SAT	20 HR's/YR AVG. x 40 WKRS. x 10	8,127		$147,100			$147,100
20	BOND					$497,500		$497,500
21	OVERHEAD & PROFIT					$3,246,200		$3,2[illegible]
22	PAYRL BRD.&BENFT.				$5,784,800			$5,78[illegible]
	INDIRECT FIELD COSTS		127,331		$8,089,500	$3,743,700	$11,301,500	$23,134,700
	DIRECT & INDIRECT FIELD COSTS		613,462		$16,909,500	$36,813,700	$19,159,800	$72,883,000
23	PURCHASE WASTE CONTAINERS (WPM)							
24	CERTIFICATION (WPM)							
25	TRANSPORTATION (WPM)							
26	BURIAL FEE (NTS)							N/A
27	STORAGE COSTS (WPM)							
	WASTE MANAGEMENT COSTS							
28								
29	PROJ.MGMT-FERMCO							
30	CONSTR MGMT-FERMCO							
	FERMCO FIELD SUPPORT COSTS							
31	ENGINEERING, DESIGN, INSPECTION	A/E			FERMCO			
	ENGINEERING COSTS							
32	SALES TAX - SUBCONTRACT	$1,149,600	SALES TAX - FERMCO					$1,149,600
	SUB-TOTAL	(BASE ESTIMATE)						$74,032,600
33	G&A-FERMCO	(SEE EXCLUSION COMMENTS)						
34	ESCALATION	(SEE EXCLUSION COMMENTS)						
35	RISK BUDGET	18.0%						$13,325,900
	TARGET ESTIMATE (BASE ESTIMATE PLUS RISK BUDGET)							$87,358,500
36	CONTINGENCY	10.5%						$7,773,400

FY 95 DOLLARS

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05:27 PM

FERMCO ESTIMATING SERVICES

SUMMARY SHEET

EST FILE #: C2950204
CLIENT: US DOE
PROJECT TITLE: SITEWIDE ON-SITE DISPOSAL FACILITY - BUDGET
WBS#: 1.1.1.1.2.3.7

DATE: 09-Mar-95
ESTIMATOR: KEN KEPLER
LOCATION: FERNALD
TASK#: 2CC1

	CODE	ITEM DESCRIPTION	M/H	RATE	LABOR $	S/C $ / OTHERS	MAT'L $	TOTAL $
1		SITE PREP for LINER	8,242		149,600	1,046,800	30,000	$1,226,400
2		EROSION and SEDIMENT CONTROL	4,354		79,000		14,600	$93,600
3		NORTH INTERCEPTOR TRENCH	9,088		164,900		87,900	$252,800
4		CONSTRUCT LINER	113,082		2,052,400	10,623,000	4,563,100	$17,238,500
5		AWWT PIPING SYSTEM	8,204		145,700		349,600	$495,300
6		PLACEMENT OF WASTE	239,856		4,353,400			$4,353,400
7		CONSTRUCT CAP	81,420		1,477,800	20,026,300	2,813,000	$24,317,100
8		GENERATED WASTE REMOVAL	21,872		397,000			$397,000
9		SITE RESTORATION	13		200	900	100	$1,200
10		MONITORING WELLS				1,371,000		$1,371,000
				AVG				
	DIRECT FIELD COSTS		486,131	$18.10	$8,820,000	$33,070,000	$7,858,300	$49,748,300
11	SUPERVISION - CONTRACTOR		82,840		$1,499,400			$1,499,400
12	SM TOOLS/CONSM'BLS						$132,300	$132,300
13	EQUIPMENT RENTAL						$10,958,200	$10,958,200
14	TEMP. FACILITIES		3,166		$57,300		$30,900	$88,200
15	TEMP UTL'S HOOK-UP		3,166		$57,300		$30,900	$88,200
16	JOB CLEAN-UP		4,751		$86,000		$46,300	$132,300
17	SAFETY		9,503		$172,000		$92,600	$264,600
18	HEALTH PHYSICS S/C		15,779		$285,600		$10,300	$295,900
19	CERCLA/SAT	20 HR's/YR. AVG. x 40 WKRS. x 10	8,127		$147,100			$147,100
20	BOND					$497,500		$497,500
21	OVERHEAD & PROFIT					$3,246,200		$3,246,200
22	PAYRL BRD.&BENFT.				$5,784,800			$5,784,800
	INDIRECT FIELD COSTS		127,331		$8,069,500	$3,743,700	$11,301,500	$23,194,700
	DIRECT & INDIRECT FIELD COSTS		613,462		$16,909,500	$36,813,700	$19,159,800	$72,883,000
23	PURCHASE WASTE CONTAINERS (WPM)							
24	CERTIFICATION (WPM)							
25	TRANSPORTATION (WPM)							
26	BURIAL FEE (NTS)							N/A
27	STORAGE COSTS (WPM)							
	WASTE MANAGEMENT COSTS							
28								
29	PROJ.MGMT-FERMCO							
30	CONSTR MGMT-FERMCO							
	FERMCO FIELD SUPPORT COSTS							
31	ENGINEERING, DESIGN, INSPECTION	A/E			FERMCO			
	ENGINEERING COSTS							
32	SALES TAX - SUBCONTRACT	$1,149,600	SALES TAX - FERMCO					$1,149,600
	SUB-TOTAL	(BASE ESTIMATE)						$74,082,600
33	G&A-FERMCO	(SEE EXCLUSION COMMENTS)						
34	ESCALATION	(SEE EXCLUSION COMMENTS)						
35	RISK BUDGET	18.0%						$13,325,900
	TARGET ESTIMATE (BASE ESTIMATE PLUS RISK BUDGET)							$87,358,500
36	CONTINGENCY	10.5%						$7,773,400

FY 95 DOLLARS

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WBS#: 1.1.1.1.2.3.7

FERMCO ESTIMATING SERVICES

SUMMARY SHEET

DATE: 09-Mar-95
ESTIMATOR: KEN KEPLER
LOCATION: FERNALD
TASK#: 2CC1

	CODE	ITEM DESCRIPTION	M/H	RATE	LABOR $	S/C $ / OTHERS	MAT'L $	TOTAL $
1		SITE PREP for LINER	8,242		$140,205	$982,935	$28,116	$1,151,256
2		EROSION and SEDIMENT CONTROL	4,354		$74,039		$13,683	$87,722
3		NORTH INTERCEPTOR TRENCH	9,088		$154,544		$82,380	$236,924
4		CONSTRUCT LINER	113,082		$1,923,509	$9,955,876	$4,276,537	$16,155,922
5		AWWT PIPING SYSTEM	8,204		$136,550		$327,645	$464,195
6		PLACEMENT OF WASTE	239,856		$4,080,006			$4,080,006
7		CONSTRUCT CAP	81,420		$1,384,994	$18,768,648	$2,636,344	$22,789,986
8		GENERATED WASTE REMOVAL	21,872		$372,068			$372,068
9		SITE RESTORATION	13		$187	$843	$94	$1,125
10		MONITORING WELLS				$1,264,901		$1,264,901
				AVG				
	DIRECT FIELD COSTS		486,131	17.00	$8,266,104	$30,993,204	$7,364,799	$46,624,107
11	SUPERVISION - CONTRACTOR		82,840		$1,405,238			$1,405,238
12	SM TOOLS/CONSM'BLS						$123,992	$123,992
13	EQUIPMENT RENTAL						$10,270,025	$10,270,025
14	TEMP. FACILITIES		3,166		$53,702		$28,959	$82,661
15	TEMP UTL'S HOOK-UP		3,166		$53,702		$28,959	$82,661
16	JOB CLEAN-UP		4,751		$80,599		$43,392	$123,992
17	SAFETY		9,503		$161,198		$86,785	$247,983
4	HEALTH PHYSICS S/C		15,779		$267,664		$9,653	$277,317
19	CERCLA	20 HR'S/YR. AVG. x 40 WKRS. x	8,127		$137,862			$137,862
20	BOND					$466,257		$466,257
21	OVERHEAD & PROFIT					$3,042,339		$3,[illegible]
22	PAYRL BRD.&BENFT.				$5,421,515			$5,4[illegible]
	INDIRECT FIELD COSTS		127,331		$7,581,479	$3,508,596	$10,591,786	$21,681,841
	DIRECT & INDIRECT FIELD COSTS		613,462		$15,847,583	$34,501,800	$17,956,585	$68,305,948
23	PURCHASE WASTE CONTAINERS (WPM)							
24	CERTIFICATION (WPM)							
25	TRANSPORTATION (WPM)							
26	BURIAL FEE (NTS)							
27	STORAGE COSTS (WPM)							
	WASTE MANAGEMENT COSTS							
28								
29	PROJ.MGMT-FERMCO							
30	CONSTR MGMT-FERMCO							
	FERMCO FIELD SUPPORT COSTS							
31	ENGINEERING, DESIGN, INSPECTION	A/E			FERMCO			
	ENGINEERING COSTS							
32	SALES TAX - SUBCONTRACT	$1,077,405	SALES TAX - FERMCO					$1,077,405
	SUB-TOTAL (BASE ESTIMATE)							$69,383,353
33	G&A-FERMCO	(SEE EXCLUSION COMMENTS)						
34	ESCALATION	(SEE EXCLUSION COMMENTS)						
35	RISK BUDGET	18.0%						$12,489,033
	TARGET ESTIMATE (BASE ESTIMATE PLUS RISK BUDGET)							$81,872,386
36	CONTINGENCY	10.5%						$7,285,230

DE-ESCALATED TO FY93 DOLLARS

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