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PROPOSED PLAN FOR REMEDIAL ACTIONS AT OPERABLE UNIT 2 - DRAFT AUGUST 1994

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PROPOSED PLAN FOR REMEDIAL ACTIONS AT OPERABLE UNIT 2 DOE/EA-0953

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

AUGUST 1994

U.S. DEPARTMENT OF ENERGY
FERNALD FIELD OFFICE

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ACRONYMS

ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirement
AWWT	Advanced Wastewater Treatment facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
CPC	constituent of potential concern
CT	central tendency
DCG	derived concentration guide
DOE	United States Department of Energy
DOT	United States Department of Transportation
EPA	United States Environmental Protection Agency
ERMC	Environmental Restoration Management Contract
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FFCA	Federal Facilities Compliance Agreement
FMPC	Feed Materials Production Center
FS	Feasibility Study
FS/PP-EA	Feasibility Study/Proposed Plan - Environmental Assessment
FS/PP-DEIS	Feasibility Study/Proposed Plan - Draft Environmental Impact Statement
HI	hazard index
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
NCP	National Oil and Hazardous Substances Pollution Contingency Plan (commonly known as the National Contingency Plan)
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
O&M	operations and maintenance
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OMB	Office of Management and Budget
ORC	Ohio Revised Code
OSHA	Occupational Safety and Health Act
pCi	picoCurie
PEIC	Public Environmental Information Center
PRG	preliminary remediation goal
PRL	preliminary remediation level
RAO	remedial action objective
RCRA	Resource, Conservation, and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
ROD	Record of Decision
TCLP	toxicity characteristic leaching procedure
U.S.C.	United States Code
WEMCO	Westinghouse Environmental Management Company of Ohio
WMCO	Westinghouse Materials Company of Ohio

1.0 INTRODUCTION

This document is the Proposed Plan for Remedial Actions at Operable Unit 2 (hereinafter called the Proposed Plan) and addresses the management of the five subunits comprising Operable Unit 2 at the Fernald Environmental Management Project (FEMP). These five subunits are: the Solid Waste Landfill, the Lime Sludge Ponds, the Inactive Flyash Pile, the South Field, and the Active Flyash Pile.

This Proposed Plan fulfills the requirements of Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and has been developed in order to facilitate public participation in the remedy-selection process. A recommendation as to which remedial alternative should be selected for the final remedial action plan in the Record of Decision (ROD) will be identified for Operable Unit 2; however, this preference may be altered based upon public and/or support agency response to this Proposed Plan. Additionally, this plan describes the other remedial alternatives considered in the Feasibility Study (FS) in order to solicit public review and comment on all of the alternatives discussed.

The Proposed Plan as presented in this document represents the desired approach of the U.S. Department of Energy (DOE) based on currently available information and public input. This decision was made without the benefit of recommendations from the Fernald Citizens Task Force, which has been charged by DOE to make recommendations regarding the future use, waste disposal plans, and cleanup priorities for the Fernald property. These recommendations will be instrumental in determining the direction of cleanup for the facility. DOE recognizes that the desired future uses of the Fernald community are critical to achieving a successful cleanup and has committed to giving these desires significant weight in cleanup decisions. The Task Force recommendation, in particular, will be taken into account throughout the decision making process. Should this Proposed Plan conflict with the recommendations of the Task Force when they are released in the Fall of 1994, DOE will review this Proposed Plan in conjunction with the Task Force and, if appropriate, make changes to reflect the recommendations of the Task Force.

The FEMP site is a government-owned facility located about 17 miles northwest of downtown Cincinnati, near Fernald, Ohio, a small farming community. The FEMP site is included on the National Priorities List (NPL) established by the U.S. Environmental Protection Agency (EPA).

Inclusion on the NPL reflects the relative importance placed by the federal government on ensuring the expeditious completion of cleanup operations at the FEMP. The FEMP site facility is owned by DOE, which, as the lead agency, is responsible for conducting cleanup activities at the site under its Environmental Restoration and Waste Management Program. EPA reviews and approves CERCLA documents and determines the ROD. The Ohio Environmental Protection Agency (OEPA) is a support agency for the review of these documents.

It is DOE policy to integrate the National Environmental Policy Act of 1970 (NEPA) into the procedural and documentation requirements of CERCLA wherever practicable. It is not DOE's intent to make a determination concerning the applicability of NEPA to CERCLA activities. On May 15, 1990, DOE published a Notice of Intent in the Federal Register which outlined the CERCLA/NEPA integration approach to evaluate the environmental impacts associated with the cleanup actions for each of the five operable units at the FEMP. Functioning as the lead CERCLA/NEPA integrated document, Operable Unit 4 produced the Feasibility Study/Proposed Plan-Draft Environmental Impact Statement (FS/PP-DEIS) to address cumulative environmental impacts for implementing the leading remedial alternatives for each FEMP operable unit. Integrated CERCLA/NEPA documents prepared subsequent to the Operable Unit 4 FS/PP-DEIS will be derived from, or fully encompassed by, the impact analysis presented in the Operable Unit 4 FS/PP-DEIS. Additional NEPA review will be performed and documented in the integrated CERCLA/NEPA documents, as appropriate, to evaluate the impacts to human health and the environment. Consistent with the DOE Notice of Intent, the resulting integrated process and documentation for Operable Unit 2 is a Feasibility Study/Proposed Plan-Environmental Assessment (FS/PP-EA). This Proposed Plan is part of that documentation.

A brief description of the organization of the Proposed Plan for Operable Unit 2 is presented below.

- Section 1.0 provides an overview of the purpose of the Proposed Plan and identifies the lead and support agencies.
- Section 2.0 discusses the FEMP site history.
- Section 3.0 identifies and describes the operable units at the FEMP site.
- Section 4.0 provides an overview of the Baseline Risk Assessment for Operable Unit 2.
- Section 5.0 briefly describes how the alternatives were selected and discusses in more detail the alternatives for Operable Unit 2.

- Section 6.0 discusses the preferred remedial alternative for Operable Unit 2 and presents a comparison with the other alternatives.
- Section 7.0 discusses the elements of community participation for the Proposed Plan.
- The Reference Section lists resources used in preparing the Proposed Plan.
- Appendix A is a summary of major applicable or relevant and appropriate requirements (ARARs) for Operable Unit 2 remedial alternatives.
- Appendix B provides a glossary of terms used throughout this Proposed Plan.

2.0 DESCRIPTION AND HISTORY OF THE FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

2.1 SITE HISTORY

During its 37 years of operation, the primary mission of the Fernald site was to process uranium into "feed" materials, which were shipped to other DOE facilities for use in the nation's atomic weapons program. The principal products were metallic fuel elements, target cores, and other uranium products for use in weapons production reactors and other programs operated by the DOE. At times, thorium, another radioactive element, was also processed and stored at the FEMP site.

2.1.1 Operating History of the FEMP Site

The Fernald site was constructed in 1950 and 1951 under the authority of the Atomic Energy Commission, later known as the Energy Research and Development Administration, and eventually as DOE. In 1951, National Lead of Ohio, Inc., entered into a contract with the Atomic Energy Commission as the Management and Operations Contractor for the facility. Operations began in 1951 upon completion of the Pilot Plant, the site's first operational facility. Production peaked in 1960, and then beginning in 1964, reduced demand led to production declines. In 1981, the Fernald site began planning to accommodate increased activity due to the government's decision to increase uranium metal production for weapons and other programs. The site was known as the Feed Materials Production Center (FMPC) until 1991.

On January 1, 1986, Westinghouse Materials Company of Ohio (WMCO), a wholly owned subsidiary of Westinghouse Electric Corporation, assumed management and operations responsibility for the FEMP site. Production ceased in the summer of 1989 due to a declining demand for uranium feed product, and plant activities were focused on environmental cleanup. In June 1991, the site was officially closed for production by an Act of Congress and was renamed the Fernald Environmental Management Project. To reflect this change, WMCO was renamed the Westinghouse Environmental Management Company of Ohio (WEMCO). Shortly thereafter, DOE developed the concept of an Environmental Restoration Management Contract (ERMC) to oversee the site's cleanup and remediation. On December 1, 1992, Fernald Environmental Restoration Management Corporation (FERMCO), a wholly owned subsidiary of Fluor Daniel, Inc., assumed responsibility for managing the restoration of the FEMP site.

2.2 SITE DESCRIPTION

The FEMP site is a 425-hectare (1,050-acre) facility located just north of Fernald, Ohio, on the boundary between Hamilton and Butler Counties. Of the total site area, 345 hectares (850 acres) are in Crosby Township of Hamilton County, and 80 hectares (200 acres) are in Ross and Morgan Townships of Butler County. Other nearby communities include Shandon, New Baltimore, Ross, and Harrison, Ohio (see Figure 2-1).

Production operations at the facility were limited to a fenced 55-hectare (136-acre) tract of land known as the Production Area, located near the center of the site. Large quantities of liquid and solid materials were generated during production operations. Prior to 1984, solid and slurried materials from uranium processing were stored or disposed of in the on-site Waste Storage Area. This area, located west of the Production Area, included six low-level radioactive waste storage pits; two earthen-bermed, concrete silos containing K-65 residues; one concrete silo containing cold metal oxides; one unused concrete silo; two lime sludge ponds; a burn pit; a clearwell; and a solid waste landfill. Areas to the southwest of the former Production Area were used to dispose of earthen materials, construction rubble, boiler plant flyash and bottom ash, and other waste.

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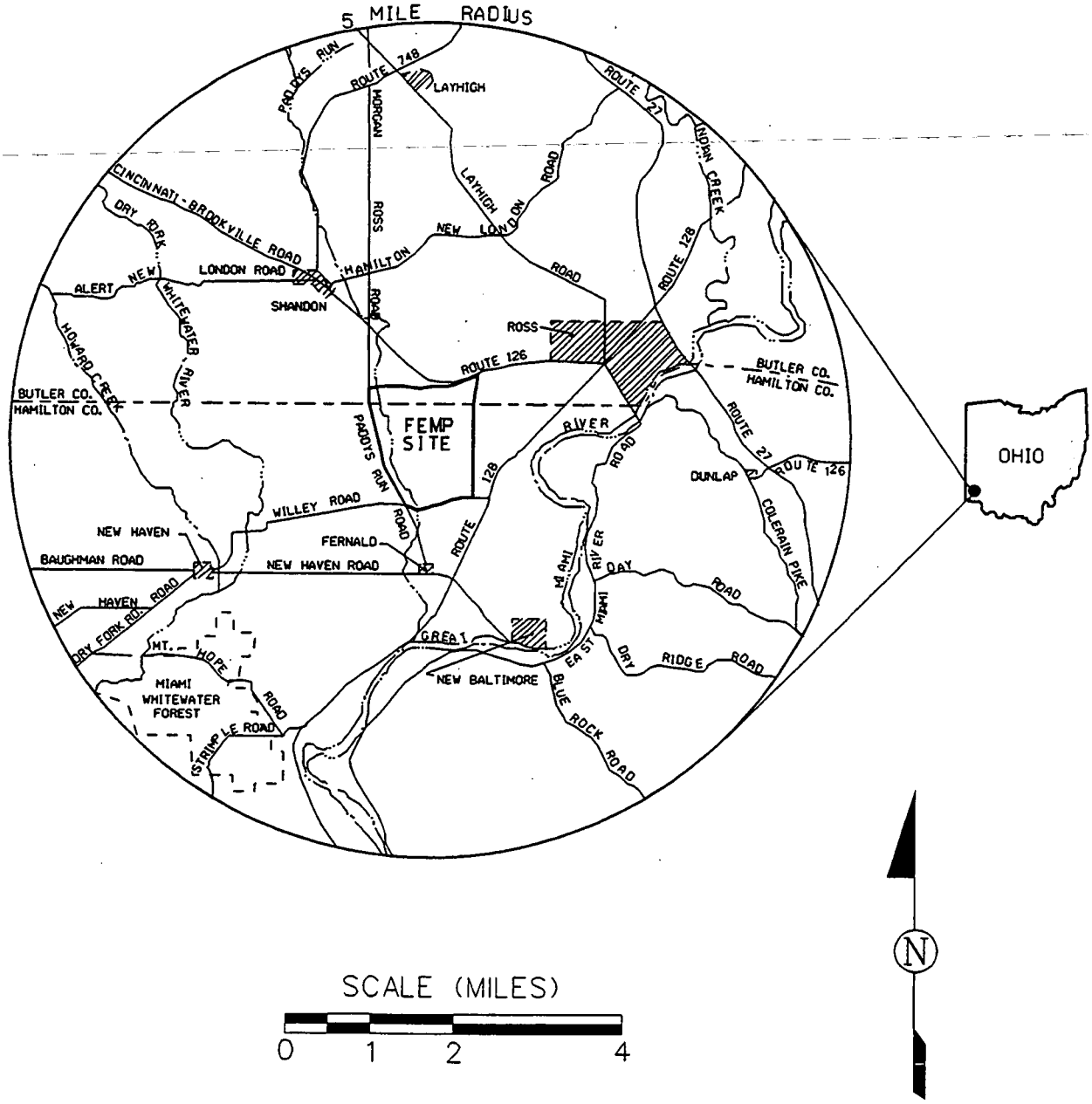

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FIGURE 2-1
FEMP FACILITY LOCATION MAP

3.0 SCOPE AND ROLE OF OPERABLE UNITS AT THE FEMP SITE

3.1 FEMP OPERABLE UNITS

In March 1985, EPA issued a Notice of Noncompliance to DOE identifying potential environmental impacts associated with the FEMP's past and ongoing operations. Between April 1985 and July 1986, conferences were held between DOE and EPA representatives to discuss the issues and to identify steps to achieve and maintain environmental compliance. Out of these meetings, a Federal Facility Compliance Agreement (FFCA) was jointly signed by DOE and EPA on July 18, 1986. A major component of this agreement was initiation of the Remedial Investigation/Feasibility Study (RI/FS). The RI/FS Work Plan (DOE 1988) identified 39 site areas for investigation.

To promote a more structured and expeditious cleanup of the FEMP, the 39 areas and related environmental issues were partitioned into five study areas called "operable units." The operable unit is a mechanism to logically group similar environmental issues at a cleanup site to expedite the RI/FS process. The division into operable units became a condition of the April 1990 Consent Agreement between EPA and DOE. This agreement was revised in September 1991 to address additional environmental issues and revise the CERCLA schedules. The revised Consent Agreement is referred to as the 1991 Amended Consent Agreement. The 1991 Amended Consent Agreement was modified on April 9, 1993 by an agreement between EPA and DOE resolving a dispute concerning EPA's denial of DOE's request for an extension of time to submit Operable Unit 2 documents. This agreement established new schedules extending the submittal dates of the Operable Unit 2 Remedial Investigation (RI) Report, FS/PP-EA, and draft ROD and also accelerated the Operable Unit 1, Operable Unit 3, and Operable Unit 5 draft ROD submission dates by 30 days each. Separate RI/FS documentation is being issued for each of the five operable units at the FEMP.

The ROD is the step following the RI/FS process; it establishes the selected remedial alternative and provides a time frame within which remediation efforts will be accomplished. A description of the five operable units and the dates that each draft ROD is scheduled to be submitted to EPA are listed below:

Operable Unit 1: Waste Pit Area

- Waste Pits 1 through 6 and the liners and berms
- Clearwell
- Burn Pit
- Berms and liners within the Operable Unit 1 boundary

Draft ROD: November 7, 1994

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Operable Unit 2: Other Waste Units

- Solid Waste Landfill
- North and South Lime Sludge Ponds
- Inactive Flyash Pile
- South Field
- Active Flyash Pile
- Berms, liners, and soils within the Operable Unit 2 boundary

Draft ROD: January 5, 1995

Operable Unit 3: Former Production Area

- Production area and production associated facilities and equipment
- All structures, utilities, tanks, drums, and equipment
- Scrap Metal Piles
- K-65 Transfer Line
- Effluent lines
- Wastes
- Fire Training Facility
- Feedstocks
- Coal pile

Draft ROD: April 2, 1997

Operable Unit 4: Silos 1 through 4

- K-65 Silos (Silos 1 and 2)
- Metal oxide silo (Silo 3)
- Empty silo (Silo 4)
- Decant sump system and buried K-65 Transfer Trench

Draft ROD: June 10, 1994

Operable Unit 5: Environmental Media

- Soils
- Flora and fauna
- Surface water and sediments
- Groundwater

Draft ROD: July 3, 1995

A sixth operable unit, known as the Comprehensive Site-Wide Operable Unit, was created pursuant to the 1991 Amended Consent Agreement. This is not a specific site area; rather, its purpose is to evaluate the remedies selected for Operable Units 1 through 5 to ensure that they are protective of human health and the environment on a site-wide basis.

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3.2 SCOPE AND ROLE OF OPERABLE UNIT 2

As listed above, Operable Unit 2 consists of the following site facilities and their associated berms, liners, and soils:

- The Solid Waste Landfill was reportedly used for the disposal of cafeteria waste, rubbish, and other types of waste from the nonprocess areas and on-site construction/demolition activities.

- The North and South Lime Sludge Ponds contain waste from the FEMP water treatment plant operations, coal pile storm water runoff, and boiler plant blowdown. The South Lime Sludge Pond is inactive and overgrown with grasses and shrubs, while the North Lime Sludge Pond is currently in use.

- The Inactive Flyash Pile was used for the disposal of ash from the boiler plant and other nonprocess wastes and building rubble such as concrete, gravel, asphalt, masonry, and steel rebar.

- The South Field was reportedly used as a burial site for FEMP nonprocess wastes such as flyash, on-site construction/demolition rubble, and soils that may have contained low levels of radioactivity. A slope at the southwest border of the South Field was used as the backstop for the FEMP security firing range for 35 years. Lead ammunition used during target practice was embedded in this slope.

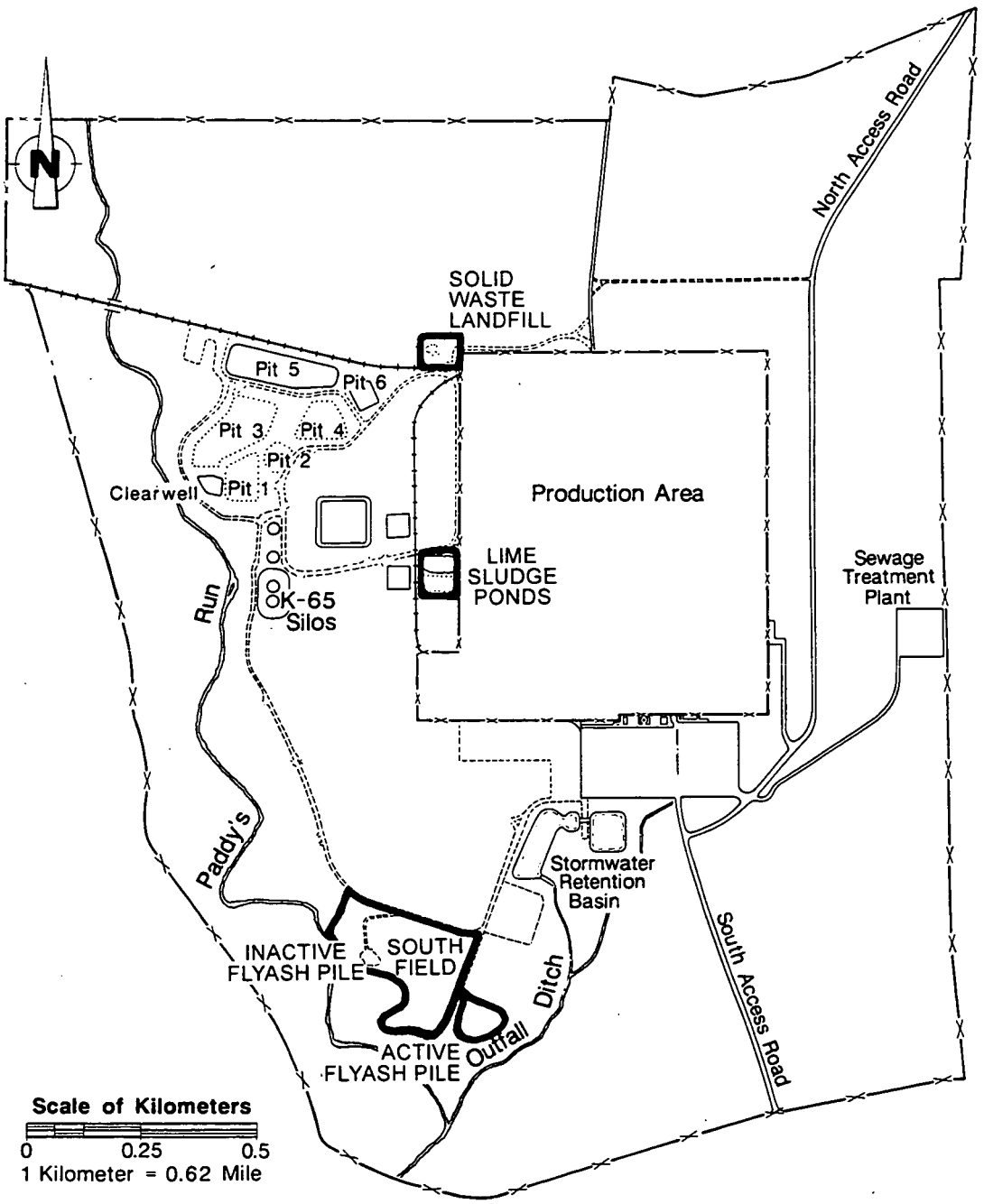
- The Active Flyash Pile was the disposal area for flyash and bottom ash from the FEMP boiler plant.

The operational histories of the Lime Sludge Ponds and Active Flyash Pile are well understood, but the operational histories of the Solid Waste Landfill, Inactive Flyash Pile, and South Field are vague and not well documented. The location of each subunit is shown in Figure 3-1.

The RI for Operable Unit 2 was conducted to develop a detailed understanding of the nature of the waste materials, the extent of the impacts on the surrounding environment, and the potential threat that Operable Unit 2 subunits pose to human health and the environment. This detailed understanding is used in the Operable Unit 2 FS to support the decision as to whether a remedial action is warranted and to support the selection of the most appropriate remedial action alternative for each subunit.

The RI Report assesses the nature and extent of contamination associated with Operable Unit 2, such as:

- the current level of constituents in the subunits and the associated impacts on surface water, groundwater, and soil



LEGEND

- Location of Operable Unit 2 Subunits
- Covered Pit
- Railroad Spur
- Fence
- Roadway

Figure 3-1: FEMP Site Map

GRAPHICS #2617

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- the pathways (e.g., air, groundwater, soil, surface water) by which contaminants could migrate from Operable Unit 2 waste units to human receptors
- the maximum concentrations and migrations in these pathways over a 1,000 year period based on complex models
- the risk to maximum exposed receptors from the current conditions and from possible future scenarios, such as continued federal control over the use of the Operable Unit 2 area or private control over the use of the Operable Unit 2 area.

The FS for Operable Unit 2 establishes cleanup levels, a range of remedial alternatives that could meet these levels, and a comparison of these alternatives based on criteria provided in CERCLA.

4.0 OVERVIEW OF THE BASELINE RISK ASSESSMENT

The potential risk from Operable Unit 2 subunits, current and future, has been calculated in the Operable Unit 2 RI as the Baseline Risk Assessment. This assessment was based on the nature and extent of the contaminants found in Operable Unit 2 during field investigations. Computer modeling was performed to predict the fate and transport of constituents of potential concern over a 1,000-year time period. The Baseline Risk Assessment is summarized in this section. For more in-depth information on the nature and extent of contamination, the methodology and results of the fate and transport computer modeling, and the methodology and details of the Baseline Risk Assessment, refer to Appendices A and B of the RI Report for Operable Unit 2. The RI Report is available for review in the Administrative Record at the Public Environmental Information Center (PEIC) (see Section 7.0 of this Proposed Plan).

4.1 DEFINITION OF RISK

The chemical and radiological constituents present within the Operable Unit 2 subunits present potential risks to human and environmental receptors. Two types of human health effects can result from exposures to radionuclides and chemicals: (1) carcinogenic (e.g., lung cancer caused by inhalation of radon) and (2) noncarcinogenic (e.g., nephritis of the kidney caused by ingestion of uranium). To limit the likelihood of someone developing cancer from exposure to contamination at a CERCLA site, the EPA has established an acceptable range of incremental lifetime cancer risk (ILCR) (from one in one million, or 1×10^{-6}, to one in ten thousand, or 1×10^{-4}). Cancer risk is defined as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. This range is referred to as the "target range" and provides a point of reference for the risk estimates presented in the Operable Unit 2 Baseline Risk Assessment.

To put this target range in the context of the background cancer rate, it is estimated that about one in three Americans will develop cancer during their lifetime from all causes, and that the risk from exposure to naturally-occurring radiation in the environment is about one in one hundred or 1×10^{-2}, primarily from radon. Thus, the EPA target range for CERCLA cleanup sites is a very small percentage of the normal cancer risk expected in the general United States population from everyday exposures and other causes. For example, the ILCR targeted by the upper end of EPA's range (i.e., 1×10^{-4}) means that if all persons in a population of 10,000 were assumed to be repeatedly exposed to

a site's contaminants, one person might develop cancer as a result of those exposures, in addition to the estimated 3,000 cancer cases expected from all other causes.

EPA has developed a measure for noncancerous hazards from chemicals that is called a "hazard quotient" (HQ). The HQ is determined by comparing the amount of a specific chemical to which someone might be exposed at a site with the dose that the scientific community considers safe or acceptable for that chemical. An HQ of greater than 1.0 indicates that the exposure level exceeds the protective level for that chemical. Exposures to more than one chemical can result in multiple HQs. The sum of these HQs equals the hazard index (HI). If the HI exceeds 1.0, an adverse health effect might result from the estimated exposure. Because the hazards are additive, 0.2 is the hazard point of reference for the results presented in the Operable Unit 2 Baseline Risk Assessment.

For someone to be at risk from a chemical hazard, the individual must be exposed to the waste at the site. To help determine if there is a need to undertake cleanup at a CERCLA site, the EPA evaluates the risk an individual site poses, utilizing an assumption that no institutional controls are in place and no cleanup action is taken. By this approach, the primary hazards can be identified, and it can be determined whether someone who might enter the site or who uses the site in the future could be at risk. This is referred to as a baseline risk assessment.

4.2 OVERVIEW OF THE BASELINE RISK ASSESSMENT

A baseline risk assessment was conducted using EPA risk assessment methodology to provide an evaluation of the potential threat (both current and future) to human health and the environment caused by constituent releases from Operable Unit 2 in the absence of any remedial action ("no action" alternative). The assessment provides the basis for determining whether remedial action is necessary. To support this determination for Operable Unit 2, the risk for each subunit was quantified separately. The primary objectives of the Baseline Risk Assessment are to: (1) determine toxicity levels of constituents in relevant media within the boundaries of Operable Unit 2 (e.g., air, soil, water); (2) determine the transport mechanism by which constituents can be carried through the various media and the time period required to reach levels of potential concern; (3) identify potential human receptors, as well as routes of exposures; and (4) determine the magnitude of expected impact or threat and its likelihood.

4.2.1 Identification of Contaminants of Concern

The RI Report for Operable Unit 2 identified the constituents of potential concern (CPCs) present within each subunit's media. CPCs include those constituents which are present at levels above background concentrations and at levels that exceed EPA-approved screening criteria. The screening criteria used is 1×10^{-7} (ten times lower than the ILCR of 1×10^{-6}) and a HI of 0.1 (one tenth of the HI level that indicates hazard from a chemical). Modeling is used to predict constituent movement from source areas to receptor locations through various media (e.g., groundwater or air). The Operable Unit 2 Baseline Risk Assessment evaluated constituents and exposure pathways to determine their potential current and future impacts on human health. Constituents which resulted in risks to a receptor of greater than one in one million (1×10^{-6}) or which yielded a HI greater than 0.2 were designated as contaminants of concern (COCs). COCs for Operable Unit 2 are presented by subunit and media in Table 4-1. Sections 6.0 and Appendix B of the RI Report present a more detailed discussion of the COCs for each Operable Unit 2 subunit. The RI Report is available for review in the Administrative Record of the PEIC (see Section 7.0 of this Proposed Plan).

4.2.2 Exposure Scenarios for the Baseline Risk Assessment

Exposure scenarios were developed to depict what may happen in and around the FEMP site if no further remedial actions are taken. The scenarios were used to determine the need for additional cleanup activities at the site.

It is important to consider that DOE and EPA have already decided that the FEMP site will undergo cleanup and remediation. The baseline exposure scenarios are used to identify the sources of contamination and the potential routes to humans by presenting the exposure pathways for each land use scenario. The exposure scenarios evaluated include: (1) current land use with access controls; (2) current land use without access controls; (3) future land use with federal ownership; and (4) future land use with private ownership.

The land-use scenarios used to calculate risk in evaluating the different cleanup options considered for Operable Unit 2 do not necessarily represent final land-use options for the Fernald property. These land-use options and corresponding exposure assumptions were developed by DOE based on the best currently available information and public input as working examples of how future use may impact cleanup requirements. These future land-use options were carried through the decision making for this operable unit to develop the maximum and minimum cleanup goals, with the understanding that

TABLE 4-1

OPERABLE UNIT 2 CONTAMINANTS OF CONCERN

Solid Waste Landfill	Lime Sludge Ponds	Inactive Flyash Pile	South Field	Active Flyash Pile
Surface Soil				
Neptunium-237	Cesium-137	Radium-226*	Cesium-137	Cesium-137
Radium-226*	Radium-226*	Radium-228*	Neptunium-237	Neptunium-237*
Radium-228*	Radium-228*	Thorium-228*	Radium-226*	Radium-226*
Strontium-90	Thorium-228*	Thorium-232*	Radium-228*	Radium-228*
Thorium-228*	Thorium-230	Arsenic*	Strontium-90	Thorium-228*
Thorium-230	Thorium-232*	Dibenzo(a,h)anthracene	Technetium-99	Thorium-232*
Thorium-232*	Uranium-238*		Thorium-228*	Arsenic*
Plutonium-238	Uranium-total*		Thorium-230*	Beryllium
Uranium-234			Thorium-232*	
Uranium-235/236			Uranium-234	
Uranium-238*			Uranium-235/236	
Antimony			Uranium-238	
Arsenic			Uranium-total	
Beryllium			Arsenic	
Benzo(a)anthracene			Beryllium	
Benzo(a)pyrene			Aroclor-1254	
Benzo(b)fluoranthene			Aroclor-1260*	
Dibenzo(a,h)anthracene			Benzo(a)anthracene	
Indeno(1,2,3-cd)pyrene			Benzo(a)pyrene*	
			Benzo(b)fluoranthene	
			Benzo(k)fluoranthene	
			Dibenzo(a,h)anthracene*	
			Dieldrin	
			Indeno(1,2,3-cd)pyrene*	
Surface Water				
No COCs	No COCs	No COCs	No COCs	No COCs
Sediment				
Uranium-total*	No COCs	No COCs	Radium-226*	Radium-226* Arsenic*

See footnote at bottom of table.

TABLE 4-1
(Continued)

Solid Waste Landfill	Lime Sludge Ponds	Inactive Flyash Pile	South Field	Active Flyash Pile
Groundwater				
Uranium-234 Uranium-235/236 Uranium-238 Uranium-total	Uranium-234 Uranium-235/236 Uranium-238 Uranium-total	Uranium-234* Uranium-235/236* Uranium-238* Uranium-total*	Uranium-234* Uranium-235/236* Uranium-238* Uranium-total*	Radium-226 Strontium-90 Uranium-234* Uranium-235/236* Uranium-238* Uranium-total*
Perched Groundwater				
Technetium-99 Carbazole Uranium-234 Uranium-235/236 Uranium-238 Uranium-total	Neptunium-237 Strontium-90 Technetium-99 Uranium-234 Uranium-235/236 Uranium-238 Uranium-total	No COCs	No COCs	No COCs
Impact on Air (Gaseous Emissions)				
Radon-222	No COCs	Radon-222	Radon-222*	Radon-222
Great Miami River Surface Water				
No COCs	No COCs	No COCs	Radium-226* Technetium-99*	No COCs

* COCs to be considered under both the private ownership and the federal ownership scenarios. COCs not marked with an asterisk are considered for the private ownership scenario only.

the final goals would fall within this range. However, the desired future land-use options and the ultimate use of the Fernald property will not be fully determined until after the Fernald Citizens Task Force has completed its recommendations. Should this Proposed Plan conflict with the future use recommendations of the Task Force when they are released in the Fall of 1994, DOE will review the Proposed Plan in conjunction with the Task Force and, if appropriate, make changes to reflect the future use recommendations of the Task Force.

4.2.2.1 Current Land Use With Access Controls

This scenario was evaluated for current conditions assuming that DOE maintains the FEMP site as it exists with access controls. The following receptors were evaluated for this scenario: (1) trespassing youth; (2) on-property groundskeeper; (3) off-property resident farmers (adult and child); and (4) Great Miami River users.

4.2.2.2 Current Land Use Without Access Controls

A second current land-use scenario assumes that access to the FEMP site is no longer controlled and therefore, cattle are assumed to graze on the site. For this scenario, an additional receptor is the user of meat and milk products from livestock grazing on the site.

Table 4-2 summarizes the risks and hazards posed to receptors for both current land-use scenarios. The maximally exposed receptor for current land-use scenarios for each of the five subunits is the on-property groundskeeper, which had carcinogenic risks on the order of one in ten thousand (1×10^{-4}). These risks were dominated by external radiation from thorium-228, thorium-232, radium-226, and radium-228 in soil. The HIs of systematic toxic effects from each subunit to the groundskeeper were below 1.0. The HIs for the expanded trespasser were below 1.0 for the Lime Sludge Ponds, Inactive Flyash Pile, and Active Flyash Pile, but were above 1.0 for the Solid Waste Landfill and the South Field. Calculated risks to the off-property resident farmers (adult and child) approached a range on the order of one in ten million (1×10^{-7}) to one in one billion (1×10^{-9}). Total HIs for both the adult and child were well below 1.0.

4.2.2.3 Future Land Use With Federal Ownership

This scenario was evaluated for future land use assuming that the federal government maintains ownership of the FEMP site and that access controls remain in effect. The receptors evaluated under this scenario included: (1) expanded trespasser (one who makes repeated unauthorized entry to and

TABLE 4-2

CURRENT LAND USE SCENARIOS
CARCINOGENIC RISK AND HAZARD INDEX

Subunit	Risk Type[a]	Trespassing Youth	On-Property Groundskeeper	Off-Property Resident Farmer	Off-Property Resident Child	User of Meat and Milk	Great Miami River Recreational User	Great Miami River Residential User	Great Miami River Agricultural User
Solid Waste Landfill	Carcinogenic	$1.5x10^{-5}$	$3.4x10^{-5}$	$6.1x10^{-8}$	$2.7x10^{-9}$	$9.0x10^{-9}$	$2.8x10^{-10}$	$4.2x10^{-9}$	$6.5x10^{-7}$
	Noncarcinogenic	8.6	$4.3x10^{-3}$	$1.8x10^{-6}$	$6.4x10^{-6}$	$5.8x10^{-7}$	$1.1x10^{-7}$	$2.2x10^{-6}$	$1.1x10^{-4}$
Lime Sludge Ponds	Carcinogenic	$1.1x10^{-5}$	$4.5x10^{-5}$	$1.5x10^{-7}$	$1.4x10^{-8}$	$1.4x10^{-6}$	NA[c]	NA	NA
	Noncarcinogenic	$2.1x10^{-1}$	$1.3x10^{-1}$	$2.0x10^{-5}$	$9.3x10^{-5}$	$4.3x10^{-4}$	NA	NA	NA
Inactive Flyash Pile	Carcinogenic	$1.5x10^{-5}$	$5.0x10^{-5}$	$6.1x10^{-7}$	$7.9x10^{-8}$	$1.1x10^{-7}$	$8.4x10^{-9}$	$3.0x10^{-9}$	$5.0x10^{-9}$
	Noncarcinogenic	$1.0x10^{-1}$	$2.0x10^{-2}$	$5.5x10^{-5}$	$2.0x10^{-4}$	$1.4x10^{-5}$	$1.9x10^{-6}$	$4.2x10^{-6}$	$3.6x10^{-5}$
South Field	Carcinogenic	$1.0x10^{-4}$	$2.2x10^{-4}$	$6.4x10^{-7}$	$2.4x10^{-7}$	$4.5x10^{-6}$	$4.2x10^{-6}$	$6.3x10^{-8}$	$4.4x10^{-6}$
	Noncarcinogenic	53	ND[b]	$2.0x10^{-5}$	$7.2x10^{-5}$	$3.0x10^{-5}$	$8.0x10^{-7}$	$2.5x10^{-6}$	$4.0x10^{-5}$
Active Flyash Pile	Carcinogenic	$2.6x10^{-5}$	$8.0x10^{-5}$	$4.7x10^{-7}$	$6.6x10^{-8}$	$4.7x10^{-7}$	$1.4x10^{-9}$	$7.7x10^{-9}$	$3.5x10^{-9}$
	Noncarcinogenic	$3.6x10^{-2}$	$5.9x10^{-2}$	$6.2x10^{-4}$	$2.1x10^{-3}$	$3.7x10^{-3}$	$6.1x10^{-5}$	$2.1x10^{-5}$	$6.7x10^{-6}$

[a]The carcinogenic risk value is the incremental lifetime cancer risk (ILCR) and the noncarcinogenic value is the hazard index (HI).

[b]ND = not determined because toxicity data not available.

[c]NA = the indicated land use is not applicable to the subunit.

wanders freely over the site) and (2) off-property resident farmers (adult and child).

Table 4-3 summarizes the risks and hazards posed to the receptors evaluated under the future land use with federal ownership scenario. The maximally exposed receptors under this scenario for each of the five subunits is the expanded trespasser and the off-property resident farmer. The expanded trespasser had a carcinogenic risk range on the order of one in ten thousand (1×10^{-4}) to one in one-hundred thousand (1×10^{-5}). Major contributors to this risk include external radiation from thorium-228, thorium-232, radium-226, and radium-228. The HIs from each subunit to the expanded trespasser were below 1.0. Calculated risks to the off-property resident farmer approached a range on the order of one in one-hundred thousand (1×10^{-5}) to one in one-hundred million (1×10^{-8}). Both off-property resident farmer receptors (adult and child) had HIs that exceeded 1.0 from two subunits (Inactive Flyash Pile and South Field).

4.2.2.4 Future Land Use With Private Ownership

This second future land-use scenario assumes that the FEMP site is no longer owned by the federal government, that all access controls are discontinued, and that the site changes to agricultural use. For this scenario, the following receptors were evaluated: (1) reasonable maximum exposure (RME) on-property resident farmers (adult and child); (2) central tendency (CT) on-property resident farmer (adult); (3) homebuilder; (4) perched groundwater user; and (5) Great Miami River users. The RME on-property resident farmer receptor includes more conservative exposure conditions than the CT on-property resident farmer, which represents typical conditions.

Table 4-4 summarizes the risks and hazards posed to the receptors evaluated under the future land use with the private ownership scenario. The maximally exposed receptor associated with each of the five subunits under this scenario is the RME on-property resident farmer, with carcinogenic risks on the order of one in one hundred (1×10^{-2}) to one in one-hundred thousand (1×10^{-5}). The risks were primarily due to external radiation from radium-226, radium-228, thorium-228, and thorium-232 and from the ingestion of produce irrigated with groundwater contaminated with uranium. Total HIs from two subunits (Inactive Flyash Pile and South Field) exceed 1.0 for the on-property resident farmer (adult and child) (RME and CT) due mostly to ingestion of total uranium in groundwater.

4.2.3 Uncertainties

Every quantitative risk assessment is subject to uncertainty. To ensure that risk is not underestimated and that human health is protected, CERCLA guidance and the conventions followed in this report

TABLE 4-3

FUTURE LAND USE WITH FEDERAL OWNERSHIP SCENARIO CARCINOGENIC RISK AND HAZARD INDEX

Subunit	Risk Type[a]	Expanded Trespasser	Off-Property Resident Farmer	Off-Property Resident Child
Solid Waste Landfill	Carcinogenic	2.0×10^{-5}	6.8×10^{-8}	3.5×10^{-9}
	Noncarcinogenic	2.7×10^{-1}	1.8×10^{-6}	6.4×10^{-6}
Lime Sludge Ponds	Carcinogenic	2.4×10^{-5}	1.7×10^{-7}	1.6×10^{-8}
	Noncarcinogenic	2.2×10^{-1}	2.0×10^{-5}	9.3×10^{-5}
Inactive Flyash Pile	Carcinogenic	3.0×10^{-5}	7.5×10^{-5}	4.0×10^{-6}
	Noncarcinogenic	1.0×10^{-1}	1.2	2.5
South Field	Carcinogenic	1.4×10^{-4}	8.7×10^{-5}	4.2×10^{-6}
	Noncarcinogenic	8.0×10^{-2}	1.1	3.1
Active Flyash Pile	Carcinogenic	4.9×10^{-5}	1.1×10^{-5}	7.2×10^{-7}
	Noncarcinogenic	4.2×10^{-2}	1.9×10^{-1}	7.9×10^{-1}

[a]The carcinogenic risk value is the incremental lifetime cancer risk (ILCR) and the noncarcinogenic value is the hazard index (HI).

TABLE 4-4

FUTURE LAND USE WITH PRIVATE OWNERSHIP SCENARIO CARCINOGENIC RISK AND HAZARD INDEX

Subunit	Risk Type[a]	On-Property Resident Farmer (RME)[b]	On-Property Resident Farmer (CT)[c]	On-Property Resident Child	Home Builder	Perched Groundwater User	Great Miami River Recreational User	Great Miami River Residential User	Great Miami River Agricultural User
Solid Waste Landfill	Carcinogenic	2.8×10^{-3}	2.0×10^{-4}	6.4×10^{-4}	9.0×10^{-6}	2.8×10^{-3}	2.8×10^{-10}	4.2×10^{-9}	6.5×10^{-7}
	Noncarcinogenic	2.9×10^{-1}	1.2×10^{-1}	1.0	4.8×10^{-1}	ND[d]	1.1×10^{-7}	2.2×10^{-6}	1.1×10^{-4}
Lime Sludge Ponds	Carcinogenic	1.3×10^{-5}	9.3×10^{-7}	1.2×10^{-6}	NA[e]	7.7×10^{-5}	NA	NA	NA
	Noncarcinogenic	1.7×10^{-3}	7.3×10^{-4}	7.9×10^{-3}	NA	3.1×10^{-3}	NA	NA	NA
Inactive Flyash Pile	Carcinogenic	1.5×10^{-3}	8.6×10^{-5}	7.7×10^{-5}	NA	NA	8.4×10^{-9}	3.0×10^{-9}	5.0×10^{-9}
	Noncarcinogenic	22	9.8	65	NA	NA	1.9×10^{-6}	4.2×10^{-6}	3.6×10^{-5}
South Field	Carcinogenic	3.4×10^{-2}	2.0×10^{-3}	9.2×10^{-3}	1.1×10^{-5}	NA	4.2×10^{-6}	6.3×10^{-8}	4.4×10^{-6}
	Noncarcinogenic	23	11	63	5.4×10^{-1}	NA	2.5×10^{-6}	1.4×10^{-4}	4.0×10^{-5}
Active Flyash Pile	Carcinogenic	8.4×10^{-5}	4.8×10^{-6}	5.7×10^{-6}	NA	NA	1.4×10^{-9}	7.7×10^{-9}	3.5×10^{-9}
	Noncarcinogenic	9.9×10^{-1}	4.5×10^{-1}	2.8	NA	NA	6.1×10^{-6}	1.5×10^{-5}	6.7×10^{-6}

[a]The carcinogenic risk value is the incremental lifetime cancer risk (ILCR) and the noncarcinogenic value is the hazard index (HI).

[b]RME = reasonable maximum exposure.

[c]CT = central tendency.

[d]ND = not determined because toxicity data are not available.

[e]NA = The indicated receptor is not applicable to the waste subunit.

address areas of uncertainty through application of conservative (i.e., protective) assumptions. The greatest uncertainty associated with the Operable Unit 2 Baseline Risk Assessment is due to the assumptions made to estimate contaminant concentrations at points of human exposure. Specifically, the exposure point concentrations in groundwater, air, produce, beef, and milk for human receptors in the future are the most conservatively estimated.

All risk and hazard estimates for future on-property residents are subject to uncertainty because the future site ownership and access controls are unknown. Taken together and interactively, the uncertainties identified with the site data, exposure parameters, fate and transport, toxicity assessment, and risk characterization are judged to be high, thus having the potential to overestimate risk by two orders of magnitude or more.

One way to evaluate the degree of conservatism in the risk assessment methodology is to follow the risk estimation protocol, substituting natural background concentrations for the COCs that were found in place of the values actually measured at the waste site. This has been done for the Operable Unit 2 land-use and human-exposure scenarios. The use of background concentration levels in the Operable Unit 2 Baseline Risk Assessment results in a carcinogenic risk for the RME on-property resident farmers (adult and child) on the order of one in ten thousand (1×10^{-4}) or greater. The most important components of the risk are external radiation from radium-226, radium-228, and thorium-228 (and their short-lived progeny) in surface soil. The risks posed from the Active Flyash Pile, South Field, and Solid Waste Landfill are very close (within one order of magnitude) to the background risks for each the three subunits.

4.3 BASELINE ECOLOGICAL RISK ASSESSMENT

As stipulated in the Amended Consent Agreement between DOE and EPA, Operable Unit 5 is tasked with preparing the Site-Wide Ecological Risk Assessment as part of their RI. The Operable Unit 2 subunits would be remediated to meet cleanup levels based upon the human health risk assessment.

4.4 CONCLUSION

Actual or threatened releases of hazardous substances from this site, if not addressed by the preferred remedial alternative or one of the other remedial alternatives considered, may present a current or potential threat to public health and welfare or the environment.

5.0 SUMMARY OF ALTERNATIVES

This section identifies and provides a description of each of the remedial action alternatives studied in the detailed analysis phase of the FS. Remedial alternatives for Operable Unit 2 were developed by examining available technologies for cleanup that were potentially applicable to the contaminated materials within the subunits. For more in-depth information on remedial alternatives, refer to the FS Report for Operable Unit 2, available for review in the Administrative Record at the PEIC (see Section 7.0 of this Proposed Plan).

5.1 TYPES OF WASTE WITHIN OPERABLE UNIT 2 SUBUNITS

Operable Unit 2 subunits contain a mixture of waste classifications. The different types of waste based upon regulatory classification are:

- Low-level radioactive waste/residual radioactive material
- Solid waste
- Infectious waste
- Hazardous waste
- Other material not considered waste
  - Soils below the cleanup levels
  - Residual radioactive material below the cleanup levels

5.1.1 Low-Level Radioactive Waste/Residual Radioactive Material

Low-level radioactive waste is radioactive material produced from DOE activities that is not high-level radioactive waste, spent nuclear fuel, transuranic wastes, or byproduct material. Environmental media (i.e., soil, water, air) with residual concentrations of radionuclides are considered residual radioactive material. Residual radioactive materials can be released from federal control if the radioactivity is below cleanup levels; otherwise they must be contained in a manner that will be protective of human health and the environment.

5.1.2 Solid Waste

The federal definition of solid waste is any discarded material that is not specifically excluded by the regulations. Discarded material is any material which is abandoned, recycled, or "inherently waste-

like." Source, special nuclear, or by-product material, as defined by the Atomic Energy Act of 1954 as amended, is not solid waste under the federal definition.

OEPA's definition of solid waste is any unwanted residual solid or semi-solid material resulting from industrial, commercial, agricultural, and community operations. OEPA's definition does not exclude radioactive materials from being a solid waste as the federal definition does.

5.1.3 Infectious Waste

OEPA's infectious waste regulations state that generators of less than 50 pounds of infectious wastes per month who do not hold a certificate of registration with the state may transport and dispose of infectious wastes in the same manner as solid wastes. In 1993, the FEMP, with approximately 3,500 employees and subcontractors, had exceeded the 50 pounds per month level for the first time. The previous number of employees was well below this number. Because past disposal of infectious wastes in the Solid Waste Landfill is considered to have been less than 50 pounds per month based upon the past number of employees (2,900 maximum prior to 1993), any infectious waste encountered can be managed as a solid waste. Currently, accumulated infectious waste is disposed of at an off-site facility.

5.1.4 Hazardous Waste

Hazardous waste is any contaminant that is either listed by EPA in the Resource, Conservation, and Recovery Act (RCRA) regulations or is "characteristically hazardous." Because of the way RCRA organizes the list of hazardous wastes, it is necessary to know the source of the waste to determine if it is listed. A waste is characteristically hazardous if it is ignitable, corrosive, reactive, or exceeds a toxic characteristic level defined by RCRA.

With one exception, no known listed wastes were disposed of in any of the Operable Unit 2 subunits, and toxicity characteristic leaching procedure (TCLP) tests have shown that none of the subunits are characteristically toxic. The exception is the South Field Firing Range, which contains lead bullets. The lead bullets are not considered waste while they remain embedded in the soil. Once the bullets are actively managed (e.g., excavated and disposed), they will be assumed to be a mixed waste (both hazardous and radioactive) and will be managed under RCRA and DOE Orders. If any Firing Range material is found to be only hazardous, only radioactive, or neither, it will be managed as a hazardous waste, low-level radioactive waste, or solid waste, respectively, if there are contaminants above the

cleanup levels. If the material is not hazardous and does not contain contaminants above the cleanup levels, it will be managed as a soil or residual radioactive material below the cleanup levels (see Section 5.1.5).

5.1.5 Residual Radioactive Material and Soils Below the Cleanup Levels

This classification includes the Operable Unit 2 soils, debris, surface contamination, air emissions, and water discharges that meet or are below cleanup levels. These materials are not considered wastes and will be protective of human health and the environment if left in place.

5.2 OPERABLE UNIT 2 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) for Operable Unit 2 are based on site-specific contaminants and various exposure pathways. The RAOs establish goals for protecting human health and the environment from the material in the Operable Unit 2 subunits.

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). See Section 4.0 of this Proposed Plan for a more detailed discussion of acceptable risk and hazard levels.

The RAOs for Operable Unit 2 actions are the following or any combination of the following actions:

(1) Reducing the contaminant source to meet the cleanup level

(2) Restricting access to the contaminant source or media impacted by the contaminant source

(3) Reducing transport of contaminants

(4) Eliminating receptors' exposure to the contaminant source

These RAOs will be met at the Operable Unit 2 subunit areas. Table 5-1 presents each land-use scenario and the corresponding RAOs which make each scenario protective of human health and the environment.

TABLE 5-1

OPERABLE UNIT 2 SPECIFIC REMEDIAL ACTION OBJECTIVES

Land Use	Reduction of Contaminant Source	Access Restrictions to Contaminant Source or Impacted Media	Reduce or Eliminate Transport of Contaminants	Elimination of Receptors Exposure to Contaminant Source
Private Ownership	Meet specific cleanup levels (see Table 5-2)	None	None	None
Continued Federal Ownership (No Source Controls)	Meet specific cleanup levels (see Table 5-3)	Restrict use and access of Operable Unit 2 Subunits	None	None
Continued Federal Ownership Lateral Perched Water Control and Vertical Infiltration Control (Capping System)	Meet specific cleanup levels (see Table 5-4)	Restrict use and access of Operable Unit 2 Subunits	(1) Eliminate lateral movement of perched water at the Inactive Flyash Pile and South Field. (2) Reduce vertical infiltration of water through the contaminant source. (3) Eliminate surface water transport of contaminants. Eliminate air transport of contaminants.	Eliminate receptors direct contact with the waste

A multi-step process was followed to develop the Operable Unit 2 cleanup levels, also known as Preliminary Remediation Levels (PRLs). 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 (see Section 4.0 of this Proposed Plan). 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 such as capping to reduce water from carrying contaminants in the soil down to groundwater. The same two future land-use scenarios were evaluated as were in the Baseline Risk Assessment (see Sections 4.2.2.3 and 4.2.2.4 of this Proposed Plan). The receptors evaluated for each of the land use scenarios were as follows:

- Federal Ownership
  - expanded trespasser
  - off-property resident farmer

- Private Ownership
  - on-property resident farmer
  - off-property resident farmer
  - Great Miami River user

To allow for a more accurate estimate of the amount of material that needs to be "cleaned up" and the cost for cleanup, the PRLs were used to evaluate the alternatives in the Operable Unit 2 FS. The final cleanup levels, or PRLs, for Operable Unit 2 will be included in the Operable Unit 2 ROD, which will direct the remedial actions for Operable Unit 2.

The PRLs to meet the RAOs for each land use are provided in Table 5-2, Table 5-3, and Table 5-4.

5.3 GENERAL DESCRIPTION OF REMEDIAL COMPONENTS

This section offers a general description of terms used within each of the subunits' alternatives.

5.3.1 Field Screening

Prior to remediation of the Operable Unit 2 subunits, a preliminary determination would be made regarding how much material should be excavated from each of the subunits. This determination would be based upon the cleanup levels to be achieved. Excavated material would be screened in the field for radioactivity to provide protection of on-site workers and to segregate waste materials, as needed. Visual segregation may also be used to separate debris from contaminated material/soil.

TABLE 5-2

SUMMARY OF OPERABLE UNIT 2 SOIL CLEANUP LEVELS FOR PRIVATE OWNERSHIP ON-PROPERTY RESIDENT FARMER (RME)

Contaminant of Concern (COC)	Background Value[a]	Private Ownership				
		On-Property Resident Farmer (RME)[b] Cleanup Levels (pCi/g or mg/kg)				
		10^{-4} ILCR[c]	10^{-5} ILCR	10^{-6} ILCR	HI[d] 0.2	ARAR[e]
SOLID WASTE LANDFILL						
Radium-226	1.4	1.8	1.5	1.4	-	6.4
Radium-228	1.3	2.1	1.3	1.3	-	6.3
Thorium-228	1.4	1.9	1.4	1.4	-	-
Thorium-230	2.0	79	9.6	2.7	-	7.0
Thorium-232	1.4	1.6	1.4	1.4	-	6.4
Uranium-234	1.0	9.3	1.9	1.1	-	-
Uranium-235/236	0.2	8.4	1.0	0.2	-	-
Uranium-238	1.1	6.5	1.7	1.2	1.1[f]	1.1[f]
Uranium-238[g]	1.2	26.2	3.7	1.5	-	-
Uranium-Total	3.4	-	-	-	3.4	3.4
LIME SLUDGE PONDS						
Radium-226	1.4	1.8	1.5	1.4	-	6.4
Radium-228	1.3	2.1	1.3	1.3	-	6.3
Thorium-228	1.4	1.9	1.4	1.4	-	-
Thorium-230	2.0	79	9.6	2.7	-	7.0
Thorium-232	1.4	1.6	1.4	1.4	-	6.4
Uranium-234	1.0	23	3.2	1.3	-	-
Uranium-235/236	0.2	9.2	1.1	0.2	-	-
Uranium-238	1.1	15.5	2.6	1.3	1.1[f]	1.3[f]
Uranium-238[g]	1.2	26.2	3.7	1.5	-	-
Uranium-Total	3.4	-	-	-	3.4	4.0
INACTIVE FLYASH PILE						
Radium-226	1.4	1.8	1.5	1.4	-	6.4
Radium-228	1.3	2.1	1.3	1.3	-	6.3
Thorium-228	1.4	1.9	1.4	1.4	-	-
Thorium-232	1.4	1.6	1.4	1.4	-	6.4
Uranium-234	1.2	78.2	8.9	2.0	-	-
Uranium-235/236	0.2	9.2	1.1	0.2	-	-
Uranium-238	1.2	26.2	3.7	1.5	7[f]	8.3[f]
Uranium-Total	3.4	-	-	-	21	24.8
SOUTH FIELD						
Radium-226	1.4	1.8	1.5	1.4	-	6.4
Radium-228	1.3	2.1	1.3	1.3	-	6.3
Thorium-228	1.4	1.9	1.4	1.4	-	-
Thorium-230	2.0	79	9.6	2.7	-	7.0
Thorium-232	1.4	1.6	1.4	1.4	-	6.4

See footnotes at end of table.

TABLE 5-2
(Continued)

Contaminant of Concern (COC)	Background Value[a]	Private Ownership				
		On-Property Resident Farmer (RME)[b] Cleanup Levels (pCi/g or mg/kg)				
		10^{-4} ILCR[c]	10^{-5} ILCR	10^{-6} ILCR	HI[d] 0.2	ARAR[e]
SOUTH FIELD (continued)						
Uranium-234	1.2	78.2	8.9	2.0	-	-
Uranium-235/236	0.2	9.2	1.1	0.2	-	-
Uranium-238	1.2	26.2	3.7	1.5	7[f]	8.3[f]
Uranium-Total	3.4	-	-	-	21	24.8
ACTIVE FLYASH PILE						
Radium-226	1.4	1.8	1.5	1.4	-	6.4
Radium-228	1.3	2.1	1.3	1.3	-	6.3
Thorium-228	1.4	1.9	1.4	1.4	-	-
Thorium-232	1.4	1.6	1.4	1.4	-	6.4
Uranium-234	1.2	78.2	8.9	2.0	-	-
Uranium-235/236	0.2	9.2	1.1	0.2	-	-
Uranium-238	1.2	26.2	3.7	1.5	8[f]	9.3[f]
Uranium-Total	3.4	-	-	-	24	28

[a]RME = reasonable maximum exposure.

[b]Background value is from the RI Report, Table 4-1A, surface concentrations.

[c]ILCR = incremental lifetime cancer risk; value shown is ILCR plus background.

[d]HI = hazard index.

[e]ARAR = applicable or relevant and appropriate requirement.

[f]This value is determined by calculating the uranium-238 concentration in uranium-total.

[g]This PRL applies for direct contact with surface soils and becomes significant in the Solid Waste Landfill and Lime Sludge Ponds when the perched groundwater is remediated and no longer applies.

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TABLE 5-3

SUMMARY OF OPERABLE UNIT 2 SOIL CLEANUP LEVELS FOR FEDERAL OWNERSHIP EXPANDED TRESPASSER

Contaminant of Concern (COC)	Background[a]	FEDERAL OWNERSHIP Expanded Trespasser Cleanup Levels (pCi/g or mg/kg)				
		10^{-4} ILCR[b]	10^{-5} ILCR	10^{-6} ILCR	HI[c] 0.2	ARAR[d]
SOLID WASTE LANDFILL						
Radium-226	1.4	38.3	5.1	1.8	-	6.4
Radium-228	1.3	78.3	8.9	2.0	-	6.3
Thorium-228	1.4	41.3	5.4	1.8	-	-
Thorium-232	1.4	27.6	3.9	1.5	-	6.4
Uranium-234[e]	1.0	6191	620	62.9	-	-
Uranium-235/236[e]	0.2	6190	619	63.1	-	-
Uranium-238	1.2	5361	537	54.8	318.7[f]	12.9[f]
Uranium-Total	3.4	-	-	-	200	38.6
LIME SLUDGE PONDS						
Radium-226	1.4	38.3	5.1	1.8	-	6.4
Radium-228	1.3	78.3	8.9	2.0	-	6.3
Thorium-228	1.4	41.3	5.4	1.8	-	-
Thorium-232	1.4	27.6	3.9	1.5	-	6.4
Uranium-234[e]	1.0	19501	1951	196	-	-
Uranium-235/236[e]	0.2	19500	1950	195	-	-
Uranium-238	1.2	5361	537	54.8	1000[f]	45.3[f]
Uranium-Total	3.4	-	-	-	200	136
INACTIVE FLYASH PILE (WASTE/SOIL LOCATED OVER THE GREAT MIAMI AQUIFER)						
Radium-226	1.4	38.3	5.1	1.8	-	6.4
Radium-228	1.3	78.3	8.9	2.0	-	6.3
Thorium-228	1.4	41.3	5.4	1.8	-	-
Thorium-232	1.4	27.6	3.9	1.5	-	6.4
Uranium-234[e]	1.0	1251	92	8.7	-	-
Uranium-235/236[e]	0.2	1250	91	7.8	-	-
Uranium-238[e]	1.1	820	61	6.1	39.3[f]	8.3[f]
Uranium-Total[e]	3.4	-	-	-	118	24.8
INACTIVE FLYASH PILE (WASTE/SOIL LOCATED OVER <16 FEET NATURAL SOIL)						
Radium-226	1.4	38.3	5.1	1.8	-	6.4
Radium-228	1.3	78.3	8.9	2.0	-	6.3
Thorium-228	1.4	41.3	5.4	1.8	-	-
Thorium-232	1.4	27.6	3.9	1.5	-	6.4
Uranium-234[e]	1.0	321	33	4.2	-	-
Uranium-235/236[e]	0.2	320	32	3.35	-	-
Uranium-238[e]	1.1	211	22	3.2	16.7[f]	8.3[f]

See footnotes at end of table.

TABLE 5-3
(Continued)

Contaminant of Concern (COC)	Background[a]	FEDERAL OWNERSHIP				
		Expanded Trespasser Cleanup Levels (pCi/g or mg/kg)				
		10^{-4} ILCR[b]	10^{-5} ILCR	10^{-6} ILCR	HI[c] 0.2	ARAR[d]
INACTIVE FLYASH PILE (WASTE/SOIL LOCATED OVER <16 FEET NATURAL SOIL) (continued)						
Uranium-Total[e]	3.4	-	-	-	50	24.8
SOUTH FIELD (WASTE/SOIL LOCATED OVER THE GREAT MIAMI AQUIFER)						
Radium-226	1.4	38.3	5.1	1.8	-	6.4
Radium-228	1.3	78.3	8.9	2.0	-	6.3
Thorium-228	1.4	41.3	5.4	1.8	-	-
Thorium-230[e]	2.0	40002	4002	402	-	7.0
Thorium-232	1.4	27.6	3.9	1.5	-	6.4
Uranium-234[e]	1.0	1251	92	8.7	-	-
Uranium 235/236[e]	0.2	1250	91	7.8	-	-
Uranium-238[e]	1.1	820	61	6.1	57.3[f]	8.3[f]
Uranium-Total[e]	3.4	-	-	-	118	24.8
SOUTH FIELD (WASTE/SOIL LOCATED OVER <16 FEET NATURAL SOIL)						
Radium-226	1.4	38.3	5.1	1.8	-	6.4
Radium-228	1.3	78.3	8.9	2.0	-	6.3
Thorium-228	1.4	41.3	5.4	1.8	-	-
Thorium-230[e]	2.0	40002	4002	402	-	7.0
Thorium-232	1.4	27.6	3.9	1.5	-	6.4
Uranium-234[e]	1.0	321	33	4.2	-	-
Uranium 235/236[e]	0.2	320	32	3.4	-	-
Uranium-238[e]	1.1	211	22	3.2	16.7[f]	8.3[f]
Uranium-Total[e]	3.4	-	-	-	50	24.8
ACTIVE FLYASH PILE						
Radium-226	1.4	38.3	5.1	1.8	-	6.4
Radium-228	1.3	78.3	8.9	2.0	-	6.3
Thorium-228	1.4	41.3	5.4	1.8	-	-
Thorium-232	1.4	27.6	3.9	1.5	-	6.4
Uranium-234[e]	1.0	761	77.0	8.7	-	-
Uranium-235/236[e]	0.2	760	76.2	7.8	-	-
Uranium-238[e]	1.1	501	51.1	6.1	57.3[f]	9.3[f]
Uranium-Total[e]	3.4	-	-	-	172	28

[a]Background value is from the RI Report, Table 4-1A, surface concentrations.
[b]ILCR = incremental lifetime cancer risk; value shown is ILCR plus background.
[c]HI = hazard index.
[d]ARAR = applicable or relevant and appropriate requirement.
[e]Cleanup level is due to the off-property resident farmer receptor.
[f]This value is determined by calculating the uranium-238 concentration in uranium-total.

TABLE 5-4

SUMMARY OF OPERABLE UNIT 2 SOIL CLEANUP LEVELS FOR FEDERAL OWNERSHIP OFF-PROPERTY RESIDENT FARMER (WITH LATERAL GROUNDWATER MIGRATION CONTROLS AND INFILTRATION SOURCE CONTROLS)

Contaminant of Concern (COC)	Background[a]	FEDERAL OWNERSHIP		
		Off-Property Resident Farmer Cleanup Levels (pCi/g or mg/kg)		
		ILCR[b] 10^{-4}, 10^{-5}, or 10^{-6}	HI[c] 0.2	ARAR[d]
SOLID WASTE LANDFILL				
Uranium-234	1.0	>100,000	-	-
Uranium-235/236	0.2	>100,000	-	-
Uranium-238	1.1	>100,000	>30,000[e]	>30,000[e]
Uranium-Total	3.4	-	>100,000	>100,00
LIME SLUDGE PONDS				
Uranium-234	1.0	>100,000	-	-
Uranium-235/236	0.2	>100,000	-	-
Uranium-238	1.1	>100,000	>30,000[e]	>30,000[e]
Uranium-Total	3.4	-	>100,000	>100,000
INACTIVE FLYASH PILE/SOUTH FIELD/ACTIVE FLYASH PILE[f]				
Uranium-234	1.0	>100,000	-	-
Uranium-235/236	0.2	>100,000	-	-
Uranium-238	1.1	<100,000	>3,000	>3,000
Uranium-Total	3.4	-	>10,000	>10,000

[a]Background value is from the RI Report, Table 4-1A, surface concentrations.
[b]ILCR = incremental lifetime cancer risk; value shown is ILCR plus background.
[c]HI = hazard index.
[d]ARAR = applicable or relevant and appropriate requirement.
[e]This value is determined by calculating the uranium-238 concentration in uranium-total.
[f]The containment controls for the Inactive Flyash Pile, South Field, and Active Flyash Pile are performed in conjunction with lateral perched water controls.

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5.3.2 Consolidation and Containment

Containment is the term used when wastes remain in place or are consolidated within the boundary limits of the Operable Unit 2 subunit and covered. The use of covers (caps) was analyzed for any or all of the following reasons:

- to eliminate the potential of contaminants being transported in storm water run off
- to eliminate the potential of contaminants being transported in the air
- to reduce storm water infiltration so transport of contaminants to the groundwater would be minimized
- to eliminate the potential of direct human contact with the waste material.

The design and construction of the cap depends on protection of the groundwater and the regulatory classification of the waste. Figure 5-1 illustrates how consolidation and containment may look when the remediation is complete.

5.3.3 Disposal

Disposal alternatives considered are on-site disposal and off-site disposal. On-site disposal consists of moving the contaminated subunit material to a location on site that is different than the subunit's original location. The moved contaminated material would be placed in an on-site engineered disposal facility. The landfill liner and cover (cap) design would be based on the level of protectiveness needed and the regulatory classification of the waste. On-site disposal is considered if more protection is required or desired (i.e., a bottom liner, different geology) than consolidation and containment (i.e., capping in place). Figure 5-2 illustrates how an on-site disposal facility may look.

Off-site disposal consists of transporting contaminated material from a subunit to an engineered disposal facility located off site. Operable Unit 2 material would be transported by rail or truck to the selected disposal facility. In order to develop a cost estimate, a representative commercial facility (Envirocare in Clive, Utah) and transportation by rail were assumed.

Both on-site and off-site disposal facilities would have certain criteria that all waste must meet in order to be accepted for disposal at the facility. These "waste acceptance criteria" may include, among other things, maximum concentrations of contaminants, maximum moisture content, and packaging requirements. The maximum contaminant concentrations for the on-site waste acceptance

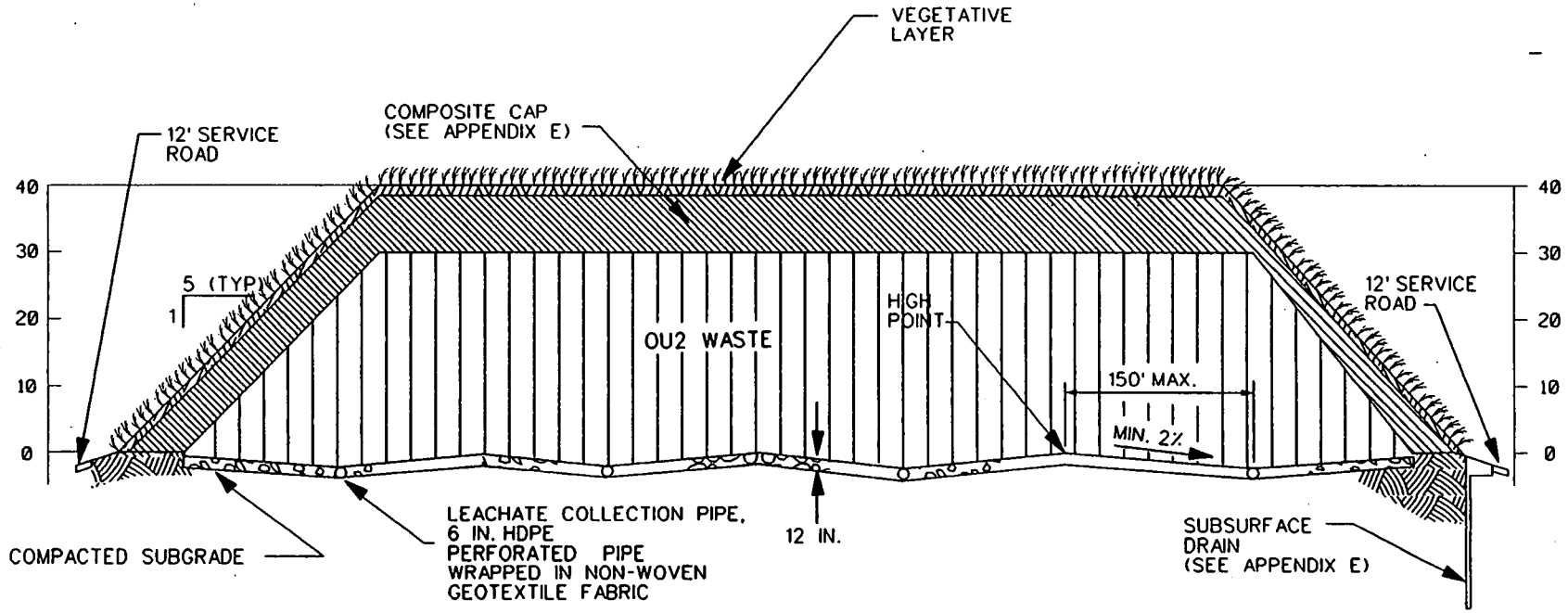

FIGURE 5-1
TYPICAL SECTION CONSOLIDATION AND CONTAINMENT
(NOT TO SCALE)

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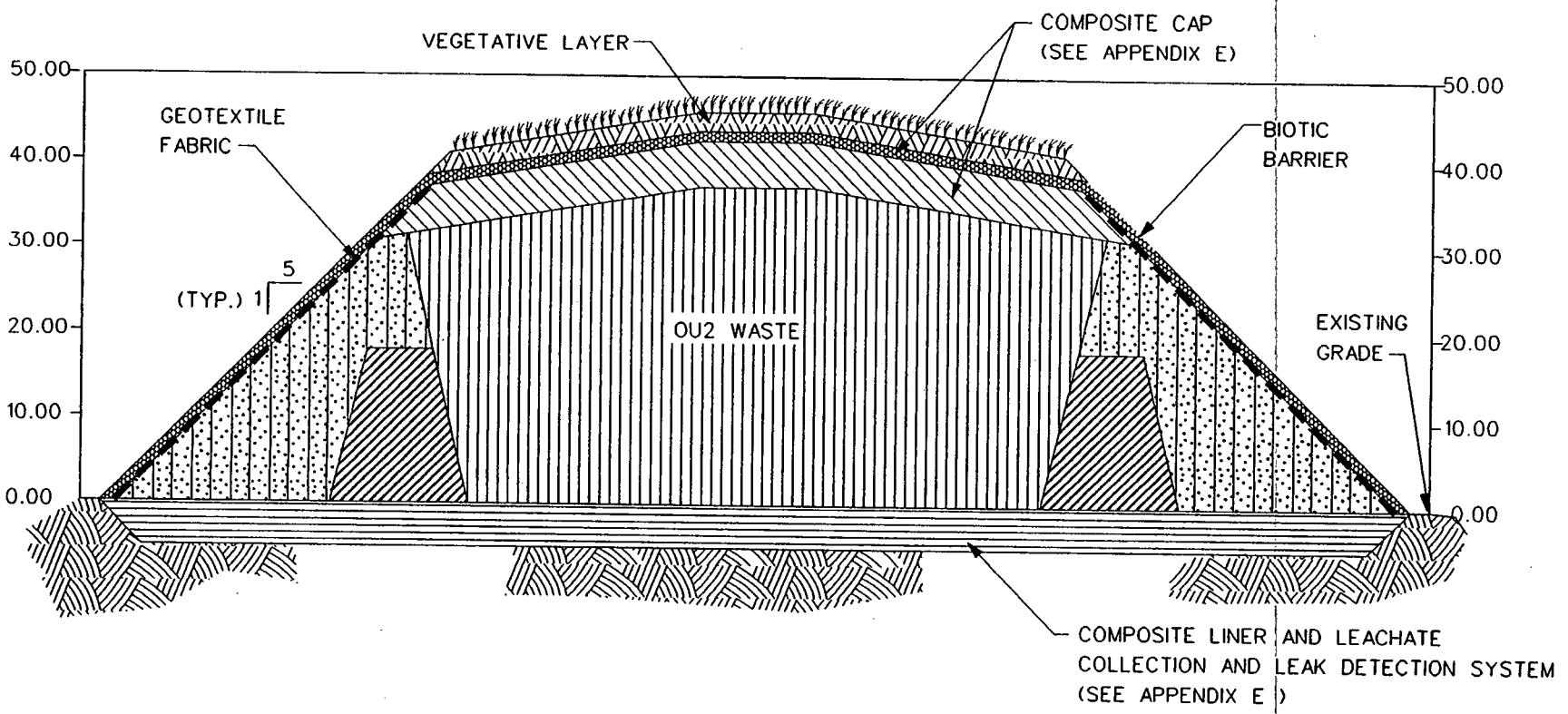

FIGURE 5-2
TYPICAL SECTION ON-SITE DISPOSAL FACILITY
(NOT TO SCALE)

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criteria would be more stringent than those for the off-site waste acceptance criteria. Therefore, if waste that is intended for on-site disposal does not meet the on-site waste acceptance criteria it would be sent for off-site disposal instead.

5.3.4 Drying

Drying would be used to remove excess moisture from a medium, such as soil. The process would be used to prepare the medium for disposal or for other treatment processes that require dry material because of technical or administrative requirements. Drying would be done at the waste-specific staging areas after the material has been removed from the subunit.

5.3.5 Stabilization

Stabilization would be performed by mixing the lime sludge from the Lime Sludge Ponds with a material (flyash and/or cement). Stabilization would be performed in place and would provide the lime sludge with the structural stability to support a cap over the subunit.

5.3.6 Perched Groundwater Collection System

A perched groundwater collection system would be required for one alternative. The collection system would remove perched groundwater encountered during remedial activities and collect perched groundwater after remediation. This water would be pumped through a collection system to a holding tank where solids would be removed, and then transferred to the Advanced Wastewater Treatment (AWWT) facility, where the water would be treated to remove contaminants. The treated perched groundwater would then be safely discharged in compliance with the site's National Pollutant Discharge Elimination System (NPDES) permit.

5.3.7 Costs

Costs consist of capital costs and operations and maintenance (O&M) costs associated with an alternative. The capital costs include those costs related to waste excavation, treatment, disposal, and health and safety. O&M costs include any associated long-term maintenance and monitoring which would be required until remedial objectives are achieved. For purposes of the cost estimate, a maximum duration of 30 years is used. For clarity, the costs presented in the alternative descriptions are present worth costs in 1994 dollars (see the Glossary for a definition of present worth costs).

5.4 OPERABLE UNIT 2 REMEDIAL ALTERNATIVES

The FS considered the following alternatives for Operable Unit 2:

- Alternative 1 - No Action
- Alternative 2 - Consolidation and Capping
- Alternative 3 - Excavation and Off-Site Disposal
- Alternative 4 - Excavation and Off-Site Disposal with Treatment of Fraction Exceeding Waste Acceptance Criteria
- Alternative 5 - Excavation and On-Site Disposal
- Alternative 6 - Excavation and On-Site Disposal With Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria
- Alternative 7 - Excavation and On-Site Disposal with Treatment of Fraction Exceeding Waste Acceptance Criteria
- Alternative 8 - Excavation and Treatment with On-Site Disposal

These alternatives were screened against three general criteria: effectiveness, implementability, and cost. The intent of this evaluation and screening was to select those alternatives that would meet the remedial objectives and achieve long-term protection of human health and the environment. Based on this screening, Alternatives 1, 2, 3, and 6 were selected for detailed analysis:

- Alternative 1 - No Action
- Alternative 2 - Consolidation and Capping
- Alternative 3 - Excavation and Off-Site Disposal
- Alternative 6 - Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria

As in Section 5.0 of the FS Report, this summary of alternatives assumes continued federal ownership of the site. With the exception of areas that would continue to contain wastes (e.g., consolidated areas in the subunits and the on-site disposal facility), the primary difference between the federal-ownership scenario and the private-ownership scenario is the volume of contaminated material/soil that would be removed to meet the remedial action objectives. The cleanup levels to meet the RAOs for the private-ownership scenario are presented in Table 5-2. The volume difference is approximately two and one-half times more volume for the private ownership scenario than the federal ownership scenario. The resulting differences to the comparative analysis will be discussed in Section 6.3.

Section 4.0 of the FS Report describes all alternatives considered and provides a full explanation of the screening process. The following descriptions outline the four alternatives chosen for detailed analysis. The alternative descriptions include the engineering and institutional controls that would be

required, estimates of the quantities of waste to be handled, implementation time, and costs. Also included are the residual risks and hazards that would exist after the completion of remedial action.

5.4.1 No Action Alternative

The no action alternative is retained throughout the FS process as required by the National Oil and Hazardous Substances Pollution Contingency Plan (commonly known as the National Contingency Plan, or the NCP) [40 Code of Federal Regulations (CFR) §300.430(e)(6)]. This alternative provides a baseline against which other alternatives can be evaluated. Under this alternative, no remedial action would be taken, and the material would be left "as is," without the implementation of any containment, removal, treatment, or other mitigating actions. This alternative would not reduce the toxicity, mobility, or volume of contamination at the site. The contents of the subunits would remain in place. In addition, this alternative would not provide monitoring of soil or groundwater, nor would it provide access restrictions to limit exposure to the waste material.

5.4.2 Alternative 2: Consolidation and Capping

Alternative 2 includes consolidation of material within or near each of the subunits. A cap is then constructed over the waste materials.

At the Solid Waste Landfill, material along the south side of the landfill would be removed to allow placement of a proper foundation for the capping system adjacent to the railroad track. Also, material close to a sand layer in the southeast corner of the landfill would be excavated and would be replaced by clean clay to halt the migration of contaminants into the sand layer. All consolidation would be toward the northeast corner of the landfill to simplify the design geometry and construction of the cap.

At the North Lime Sludge Pond, free-standing water would be pumped to the AWWT facility for treatment and discharge to the Great Miami River. The top 0.9 meters (3 feet) of lime sludge would then be stabilized in place by mixing with flyash and/or cement to support the cap. The existing K-65 Slurry Line Trench, located south of the Lime Sludge Ponds, would be removed in conjunction with the consolidation activities. The trench and piping material would be moved to the staging/material preparation area, processed for size reduction, and placed within the limits of the consolidation area. A new slurry line and trench would be constructed south of the consolidation area.

At the Inactive Flyash Pile, South Field, and Active Flyash Pile, waste material with COCs above the cleanup levels that directly overlies the Great Miami Aquifer or that is in an area where there is limited natural soil protecting the aquifer [less than 4.9 meters (16 feet)] would be excavated and moved to the northeast area of the South Field where the depth of natural soil is at least 4.9 meters (16 feet) thick. All existing waste material within the floodplain (portions of the Inactive Flyash Pile and South Field) would be excavated and consolidated in the northeast portion of the South Field. Prior to the actual excavation and movement of this material, the area in the northeast of the South Field would be graded, compacted, and covered with a drainage layer of gravel.

Soil containing lead from the Firing Range, which is assumed to be mixed waste, would be excavated, treated, packaged, and transported to an off-site facility for disposal. The quantity of soils requiring off-site disposal is estimated at 230 cubic meters (300 cubic yards). Any Firing Range material that is not found to be hazardous after testing, would be managed with the other South Field material.

Sands under the Inactive Flyash Pile/South Field area serve as a lateral pathway by which perched groundwater and leachate from the consolidated waste may enter the Great Miami Aquifer. During the excavation and consolidation of the materials at the Inactive Flyash Pile, South Field, and Active Flyash Pile, a subsurface drain would be constructed along the southwestern and southeastern sides of the consolidation area to collect groundwater from the perched aquifer underlying the area and to collect drainage from the gravel layer constructed prior to placement of the consolidated material. The subsurface drain would discharge by gravity into a pumping station. Figure 5-3 illustrates how the subsurface drain may look. Collected leachate/groundwater would be pumped to the AWWT facility for treatment and discharge to the Great Miami River.

Construction water in the subunit areas would be collected, as required, to maintain a dry excavation and transferred to the AWWT facility for treatment and discharge to the Great Miami River.

Following the completion of consolidation activities at each subunit, excavated areas would be backfilled, as necessary, with clean material and the entire consolidation area at each subunit would be graded to blend with the surrounding topography. The consolidation operation for the subunits would be coordinated with the remedial actions associated with Operable Units 1, 3, 4, and 5.

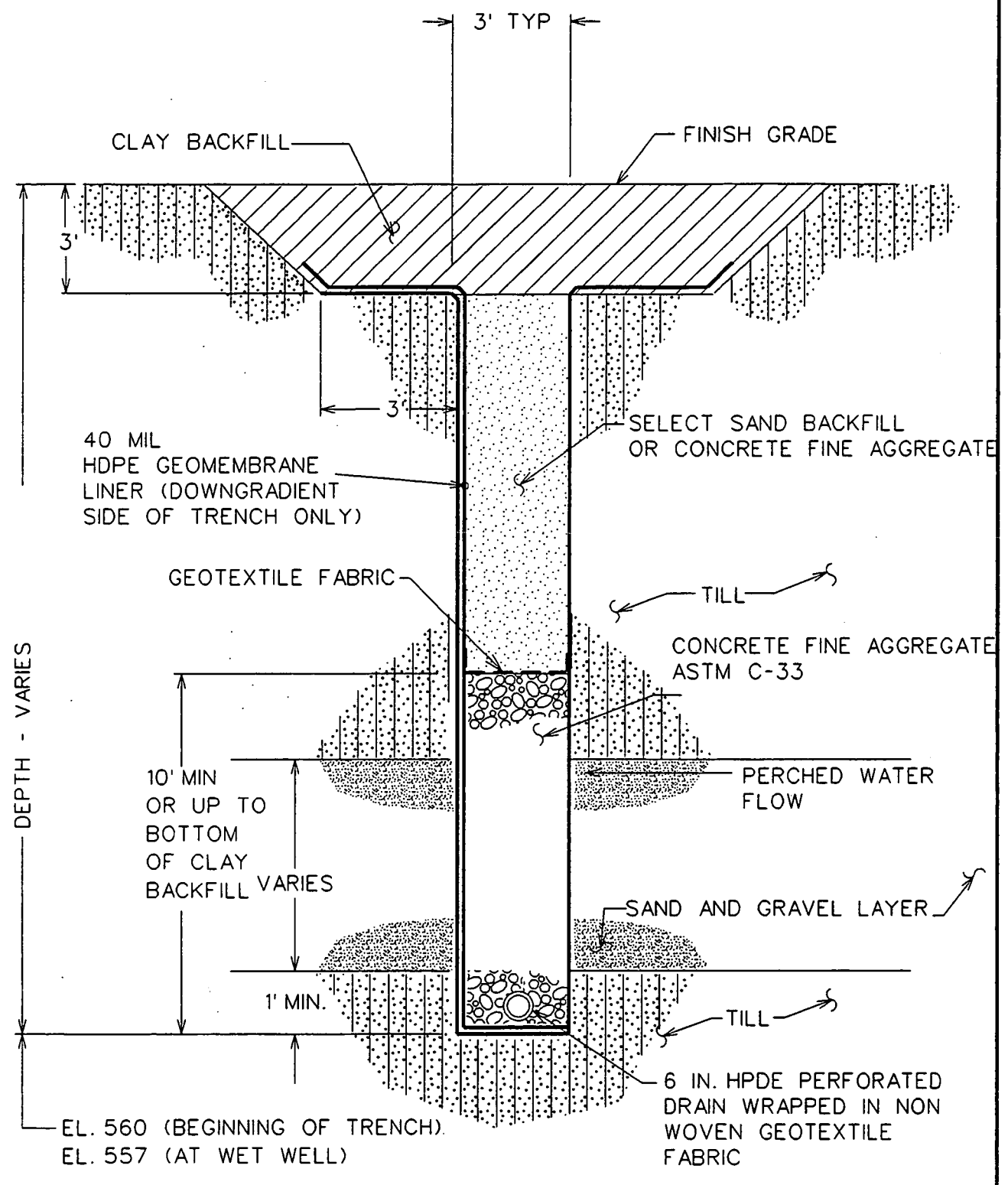

FIGURE 5-3
TYPICAL SECTION - SUBSURFACE DRAIN

This alternative would include access restrictions (fencing) and groundwater monitoring as institutional controls at each of the consolidated areas.

• Capital cost:	$ 55.7 million	• Months to implement:	51
• O&M costs:	$ 14.0 million	• Quantities of waste to be handled:	251,400 cubic yards
• Present worth cost:	$ 69.6 million		
• Residual risk:	1.2×10^{-6}	• Residual hazard:	1.3×10^{-1}

The cleanup levels for the areas under the cap are presented in Table 5-4 and the levels for the areas not covered by a cap are presented in Table 5-3.

5.4.3 Alternative 3: Excavation and Off-Site Disposal

Alternative 3 includes excavation of all materials with COC concentrations above the cleanup levels, material processing for size reduction and moisture control (if required), and off-site disposal.

At the North Lime Sludge Pond, free-standing water would be pumped to the AWWT facility for treatment and discharge to the Great Miami River. The lime sludge would then be excavated and dried, as necessary, to meet the waste acceptance criteria for the off-site disposal facility.

Debris (e.g., concrete, drums, steel, pallets, etc.) from all subunits would be visually segregated, moved to the staging/material preparation area, processed for size reduction, placed in containers, and shipped to an off-site disposal facility. Soil and other wastes (flyash and lime sludge) would be placed directly in containers suitable for shipment by rail or truck and transported to an off-site disposal facility.

Soil containing lead from the Firing Range, which is assumed to be mixed waste, would be excavated, treated, packaged, and transported to an off-site facility for disposal. The quantity of soils requiring off-site disposal is estimated at 230 cubic meters (300 cubic yards). Any Firing Range material that is not found to be hazardous after testing, would be managed with the other South Field material.

Excavation would be completed to the required depth established by computer modeling to remove materials with COC concentrations above the cleanup levels. Upon reaching this predetermined depth, verification sampling and testing would be completed to confirm that all material with COC concentrations above their respective cleanup levels has been removed. If the results of the

verification sampling/testing indicate that contamination above cleanup levels remains, then excavation and verification sampling would be performed until acceptable test results are obtained. The remaining clean soil would either be graded to blend in with the surrounding topography, or utilized for on-going construction activities at the FEMP. Excavation operations would be coordinated with the remedial actions associated with Operable Units 1, 3, 4, and 5.

Construction water in the subunit areas would be collected as required to maintain a dry excavation, and transferred to the AWWT facility for treatment and discharge to the Great Miami River.

This alternative would include access restrictions (fencing) and groundwater monitoring as institutional controls at each subunit.

- Capital cost: $ 200.3 million
- O&M costs: $ 12.6 million
- Present worth cost: $ 212.8 million
- Residual risk: 2.5×10^{-6}
- Months to implement: 51
- Quantities of waste to be handled: 317,200 cubic yards
- Residual hazard: 2.0×10^{-2}

The cleanup levels for this alternative are presented in Table 5-3.

5.4.4 Alternative 6: Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria

Alternative 6 includes excavation of all soils with COCs above the cleanup levels, material processing for size reduction and moisture control, on-site disposal in an engineered disposal facility, and off-site disposal of a small fraction of the excavated material that exceeds the waste acceptance criteria of the on-site disposal facility.

At the North Lime Sludge Pond, free-standing water would be pumped to the AWWT facility for treatment and discharge to the Great Miami River. The lime sludge would then be excavated and dried, as necessary, before on-site disposal.

Debris (e.g., concrete, drums, steel, pallets, etc.) from all subunits would be visually segregated, moved to the staging/material preparation area, processed for size reduction, and placed in the on-site disposal facility. The remaining contaminated materials from the subunits would be excavated, as described below, and placed in the on-site disposal facility.

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Figure 5-4 depicts the proposed feasible location of the on-site disposal facility. The geology of the disposal facility location identified in the figure would be protective of human health and the environment, based on a series of soil borings made in the area. 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. 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. This alternative would include establishing a maximum concentration of wastes allowed to be disposed of in the on-site disposal facility (waste acceptance criteria). The preliminary waste acceptance criteria have been determined in the FS based on a feasible location and design of the on-site disposal facility (see Appendix E.2 of the FS Report). The final waste acceptance criteria would be determined during the remedial design process. Figure 5-5 depicts a cross-section of the proposed cap and liner system for the on-site disposal facility.

It is expected that up to 2,400 cubic meters (3,100 cubic yards) of material would not meet the waste acceptance criteria for on-site disposal. This is approximately one percent of the total amount of waste material that would be excavated. This material would be packaged and shipped to an off-site disposal facility.

Soil containing lead from the Firing Range, which is assumed to be mixed waste, would be excavated, treated, packaged, and transported to an off-site facility for disposal. The quantity of soils requiring disposal is estimated to be 230 cubic meters (300 cubic yards). Any Firing Range material that is not found to be hazardous after testing, would be managed with the other South Field material.

Excavation would be completed to the required depth established by computer modeling to remove materials with COC concentrations above the cleanup levels. Upon reaching this predetermined depth, verification sampling and testing would be completed to confirm that all material with COC concentrations above their respective cleanup levels had been removed. If the results of the verification sampling/testing indicate that contamination above cleanup levels remains, then additional excavation and verification sampling would be performed until acceptable test results are obtained. The remaining clean soil would either be graded to blend in with the surrounding topography, or utilized for on-going construction activities at the FEMP. The excavation/disposal operation for the

Operable Unit 2 subunits would be coordinated with the removal operations associated with Operable Unit 3 and Operable Unit 5.

Construction water in the subunit areas and from the on-site disposal facility construction location would be collected, as required to maintain a dry excavation, and transferred to the AWWT facility for treatment and discharge to the Great Miami River.

This alternative would include access restrictions (fencing) and groundwater monitoring as institutional controls at the on-site disposal facility and the subunits. Cap maintenance would also be performed at the on-site disposal facility.

- Capital cost: $ 90.3 million
- O&M costs: $ 20.0 million
- Present worth cost: $ 110.3 million
- Residual risk: 2.5×10^{-6}
- Months to implement: 51
- Quantities of waste to be handled: 318,100 cubic yards
- Residual hazard: 2.0×10^{-2}

The cleanup levels for this alternative are presented in Table 5-3.

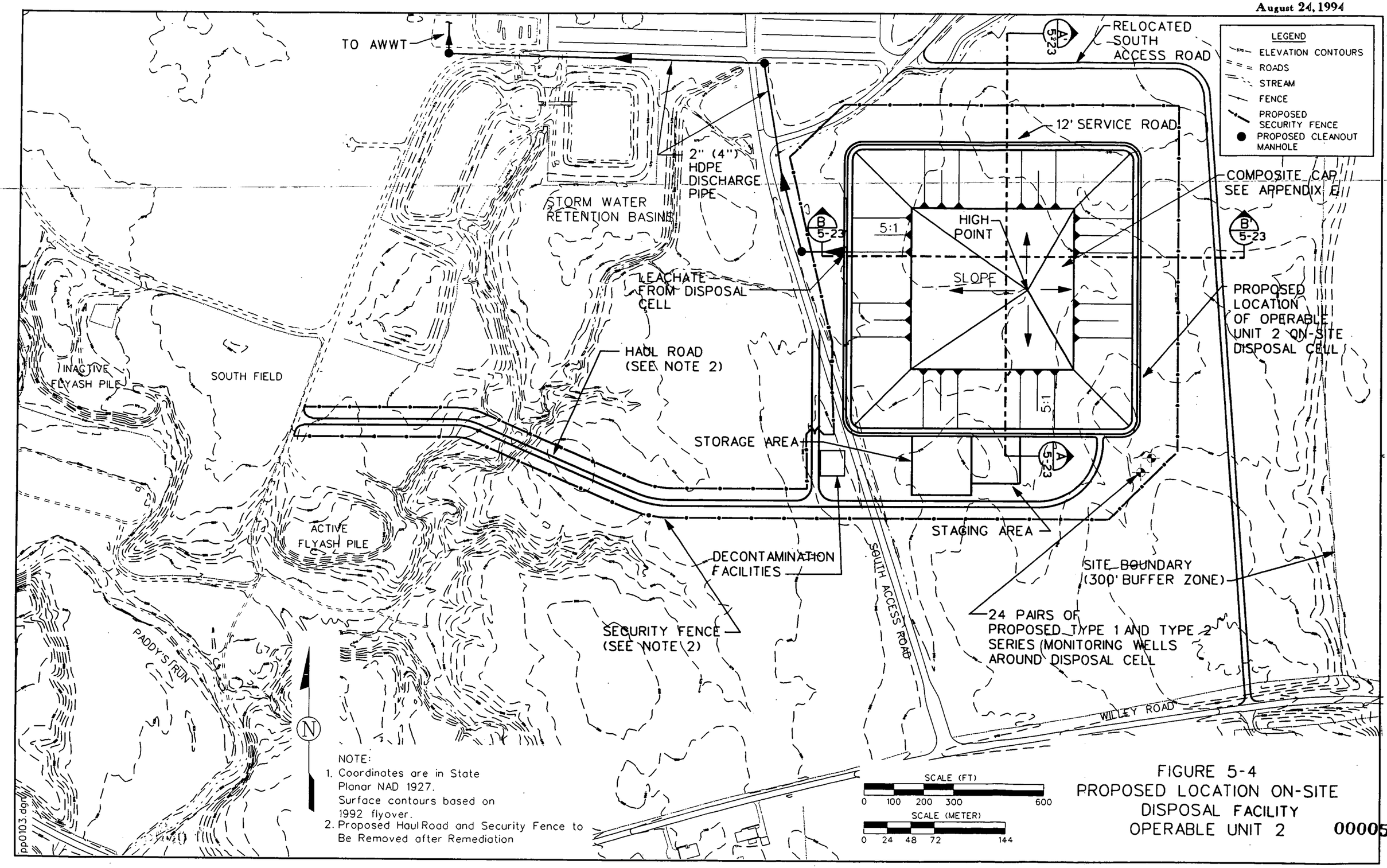
5.5 MAJOR ARARS FOR OPERABLE UNIT 2

CERCLA §121(d)(2) directs that for wastes left on site, remedial actions must comply with federal and state environmental laws that are legally applicable or are relevant and appropriate under the circumstances of the release or potential release. According to CERCLA §121(e)(1), no federal, state, or local permits are required for the portion of any removal or remedial action conducted entirely on site. Off-site actions must comply with all requirements that legally apply, including permit requirements. This section discusses the applicable or relevant and appropriate requirements (ARARs) for Operable Unit 2.

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.



NOTE:
1. Coordinates are in State Planar NAD 1927. Surface contours based on 1992 flyover.
2. Proposed Haul Road and Security Fence to Be Removed after Remediation

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FIGURE 5-4
PROPOSED LOCATION ON-SITE DISPOSAL FACILITY
OPERABLE UNIT 2

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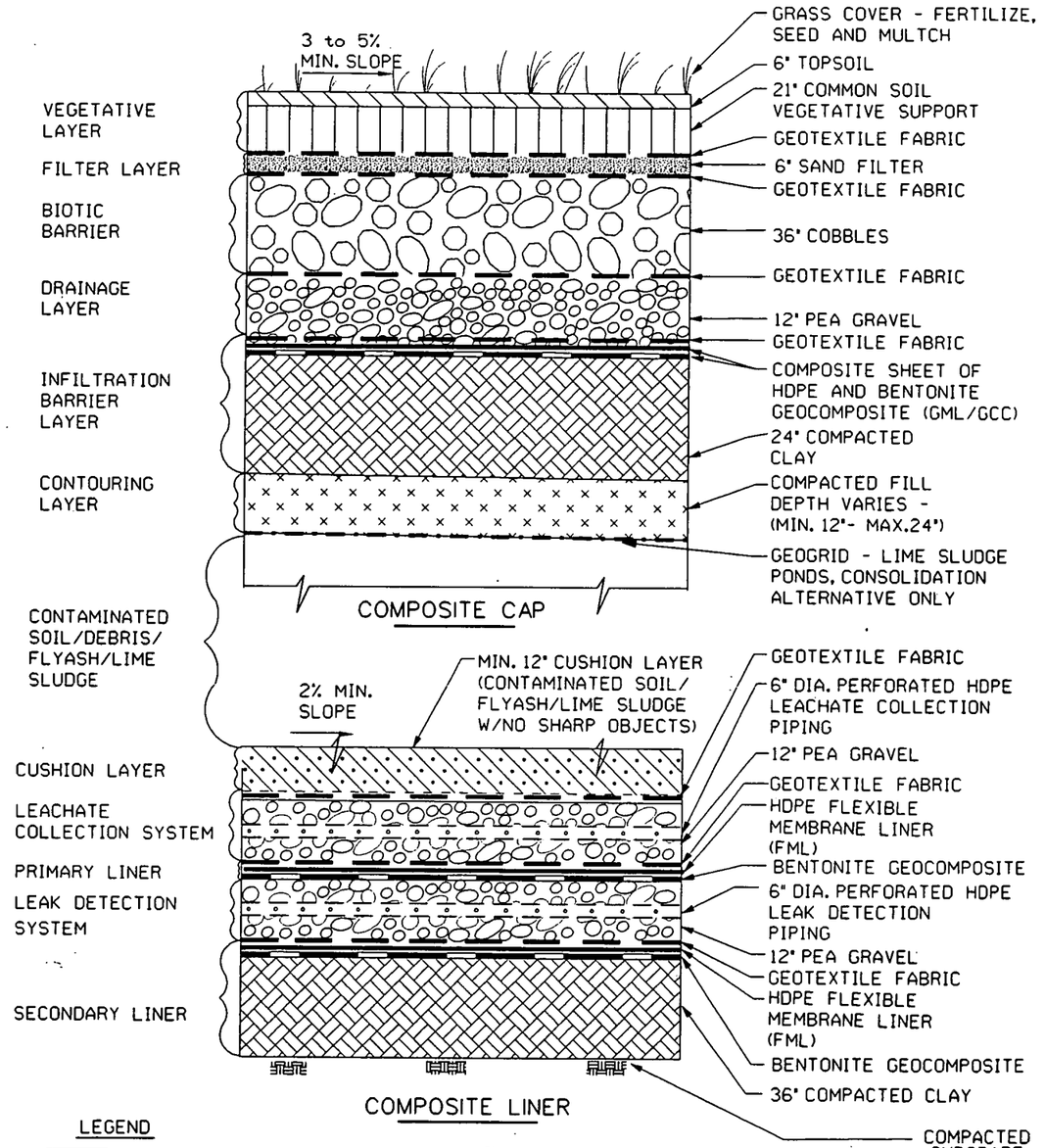

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FIGURE 5-5
TYPICAL DETAIL
COMPOSITE CAP AND LINER
(NOT TO SCALE)

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- 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 laws and regulations, State of Ohio regulations, DOE Orders, and OEPA guidance that addresses the site-specific circumstances in Operable Unit 2. The Operable Unit 2 ARARs will be finalized with the selection of the preferred remedial alternative for each subunit. The ROD will contain the final list of ARARs that will govern the remedial design and remedial action of the chosen alternatives.

Appendix A of this Proposed Plan lists the major ARARs identified for Operable Unit 2. Appendix B of the FS Report provides a complete list of ARARs.

5.5.1 No Action Alternative

There are no major ARARs for the no action alternative. A no-action decision can only be made when no remedial action is necessary because the site is already protective of human health and the environment.

5.5.2 Chemical-Specific Requirements

All Operable Unit 2 remedial alternatives must meet the chemical-specific ARARs associated with potential releases to air, surface water, groundwater, and penetrating radiation. These ARARs include federal and state maximum contaminant level goals (MCLGs) and MCLs for drinking water, the Ohio Water Quality Criteria for surface water, EPA limits for radionuclide air emissions, National Ambient Air Quality Standards, the Ohio Air Toxic Policy, and DOE dose limits for exposure to radioactivity.

5.5.3 Action-Specific Requirements

Alternatives proposing that waste remain on site would have a number of action-specific requirements that must be met. These requirements would depend on what type of disposal (i.e., consolidation/ containment or at an engineered on-site disposal facility) and the classification of the waste. The requirements include EPA regulations and DOE Orders governing the management and disposal of low-level radioactive waste/residual radioactive material and OEPA regulations for the disposal of solid waste. Specific layers of the disposal facility and the duration of protection are specified in the

action-specific requirements. If different regulatory types of wastes are disposed of together in a facility, the most stringent technical requirements would be met.

5.5.4 Location-Specific Requirements

Along with the action-specific requirements for waste disposal, there are a number of location-specific ARARs. The protection of endangered species, historical and cultural resources, floodplains, and wetlands is required by federal and state regulations. Part of the Inactive Flyash Pile and South Field are located in a 100-year floodplain area but the remedial alternatives will not adversely impact this floodplain. A small area of wetlands is located north of the Solid Waste Landfill. During remediation, contaminated sediments may be removed from the area, thus impacting the wetland. This action will be performed in accordance with the Clean Water Act and DOE NEPA assessment to minimize impacts to floodplains and wetlands (10 CFR §1022).

The most significant issue influencing the location-specific ARARs is the determination by EPA Region V (53 Federal Register 25670) that the buried valley aquifer system of the Great Miami/Little Miami Rivers of southwestern Ohio (Great Miami Aquifer) is a sole or principal source of drinking water and that contamination of this aquifer would create a significant hazard to the public health. The determination was effective July 8, 1988. The Federal Safe Drinking Water Act requires all federally-funded projects to undergo a review to ensure that the project will not adversely impact a sole source of drinking water.

OEPA has established solid waste siting criteria that prohibit locating a solid waste landfill over a sole-source aquifer [Ohio Administrative Code (OAC) 3745-27-07(B)(5)]. OEPA has also established that a solid waste disposal facility may not be located above an unconsolidated aquifer capable of sustaining a yield of 100 gallons per minute for a 24-hour period [OAC 3745-27-07(B)(9)]. The Great Miami Aquifer qualifies as both a sole-source and a 100 gallon-per-minute-yield aquifer. These requirements are derived from Ohio Revised Code (ORC) 3734.02(A) which instructs the Ohio director of environmental protection to adopt rules "in order to ensure that the facilities [solid waste] 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 3-8."

Therefore, because on-site disposal is chosen as the preferred remedial alternative, a waiver pursuant to CERCLA §121(d)(4)(D) from OAC 3745-27-07(B)(5) and (B)(9) would be required from EPA. The waiver request would be 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 pertinent standard of performance in this case is the protection of human health and the environment as established by ORC 3734.02(A). The protective standard would be attained through a combination of site geology and engineering controls.

Protection of human health and the environment is a requirement of the CERCLA process by which all remedial alternatives are evaluated in order to be considered for the preferred remedial alternative. Protective levels to meet this standard after remediation are determined through the risk assessment process using contaminant transport modeling based on the NCP acceptable risk range of 1×10^{-4} to 1×10^{-6} and compliance with MCLs. The risk assessment and transport modeling processes for Operable Unit 2 will verify that the on-site alternative is protective of human health and the environment, including the Great Miami Aquifer. These results are summarized in Section 5.0 of the FS Report and presented in detail in Appendices C and D of the FS Report.

A feasible location for the on-site disposal facility and the necessary engineering controls to meet the equivalent standard of performance to protect human health and the high-yield sole-source aquifer are addressed in Section 5.0 of the FS Report. The specific design of the engineering controls and location of the disposal facility would be finalized during the remedial design process.

5.5.5 Non-ARAR Requirements

There are a number of requirements that are not considered ARARs because both the administrative and substantive requirements are applicable to the remediation. These additional requirements include the Occupational, Safety, and Health Act (OSHA) worker protection requirements; U.S. Department of Transportation (DOT) requirements for transportation of hazardous materials; RCRA requirements for accumulation and transportation of hazardous waste (including compliance with the manifest requirements); and additional DOE Orders which are contractual obligations for all activities at a DOE facility.

6.0 EVALUATION OF ALTERNATIVES

Section 6.0 profiles the performance of the preferred remedial alternative against the nine EPA evaluation criteria, noting how the preferred alternative compares to the other alternatives under consideration. The following are the EPA evaluation criteria:

1. **Overall Protection of Human Health and Environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment engineering controls or institutional controls.

2. **Compliance with ARARs** addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes and/or provide grounds for invoking a waiver.

3. **Long-Term Effectiveness and Permanence** refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

4. **Reduction of Toxicity, Mobility, or Volume Through Treatment** is the anticipated performance of the treatment technologies that may be employed in a remedy.

5. **Short-Term Effectiveness** refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.

6. **Implementability** is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

7. **Cost** includes capital and operation and maintenance costs.

8. **State Acceptance** indicates whether, based on its review of the RI/FS and Proposed Plan, the State concurs with, opposes, or has no comment on the preferred remedial alternative.

9. **Community Acceptance** will be assessed in the ROD following a review of the public comments received on the RI/FS reports and the Proposed Plan.

The nine criteria are categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The first two criteria, overall protection of human health and the environment and compliance with ARARs, are the threshold criteria that must be satisfied in order for an alternative to be eligible for selection as the preferred remedial alternative. Criteria three through seven are the primary balancing criteria that are used to weigh major trade-offs among alternatives. State and

community acceptance are the modifying criteria that are taken into account after public comment is received on the Proposed Plan.

6.1 OPERABLE UNIT 2 PREFERRED REMEDIAL ALTERNATIVE

The following is the preferred remedial alternative for Operable Unit 2:

- Alternative 6 - Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria

Based on current information, the preferred remedial alternative appears to provide the best balance of trade-offs among the alternatives with respect to the nine criteria that EPA uses to evaluate alternatives. It is expected that the preferred remedial alternative satisfies the statutory requirements in CERCLA Section 121(b) and that the selected alternative:

- Be protective of human health and the environment
- Comply with ARARs (or justify a waiver)
- Be cost-effective
- Utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and
- Satisfy the statutory preference for treatment as a principal element or justify not meeting the preference.

6.2 COMPARATIVE ANALYSIS OF ALTERNATIVES

The following section summarizes the information presented in Section 6.0 of the FS Report for Operable Unit 2, and relies upon the detailed analysis of alternatives presented in Section 5.0 of the same report.

As listed in Section 5.0 of this Proposed Plan, the following are the remedial alternatives (the preferred remedial alternative is underlined):

Alternative 1	No Action
Alternative 2	Consolidation and Capping
Alternative 3	Excavation and Off-Site Disposal
Alternative 6	Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria

Table 6-1 provides a summarized comparative analysis of alternatives for Operable Unit 2.

TABLE 6-1

SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES OPERABLE UNIT 2

Alternative	Threshold Criteria		Primary Balancing Criteria				
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Present Worth Cost ($millions)
1 - No Action	Not protective	ARARs not applicable	Not effective or permanent	No treatment	Highly effective; no risks	None	0
2 - Consolidation and Capping	Protective for continued federal ownership with access controls; not protective for private ownership.	Complies with all ARARs	Effective, with concerns over permanence because of inability to monitor leaks	Minimal treatment (Firing Range soil) so no significant effect on toxicity, mobility, or volume, but capping system would minimize the potential for migration	Effective - minimal risk to community and workers	Reliable technology; administratively easy to implement	69.6
3 - Excavation and Off-Site Disposal	Highly protective for both federal and private ownership land-use scenarios.	Complies with all ARARs	Highly effective and permanent	Minimal treatment (Firing Range soil) so no significant effect on toxicity, mobility or volume, but disposal in off-site facility would minimize the potential for migration	Effective - moderate risk to community and workers	Reliable technology; administratively possible to implement, but may be time consuming to obtain necessary permits and approvals	212.8
6 - Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria	Protective for both federal and private ownership land-use scenarios.	Would require EPA waiver from OEPA prohibition on siting a disposal facility above a high-yield sole-source aquifer; waiver would be based on achieving a standard of equivalent performance which is protection of human health and the environment; complies with all other ARARs	Effective and permanent	Minimal treatment (Firing Range soil) so no net effect on toxicity, mobility or volume, but disposal in on-site facility would reduce the potential for migration	Effective - moderate risk to workers, minimal risk to community	Reliable technology; administratively implementable	110.3

6.2.1 Overall Protection of Human Health and the Environment

Alternative 1, No Action, would not be protective of human health and the environment because no remedial activities would be conducted. The Baseline Risk Assessment for Operable Unit 2 concludes that, without remediation, Operable Unit 2 presents potentially unacceptable risks to human health and the environment.

The remaining alternatives, collectively referred to as "action" alternatives, would provide long-term protectiveness. Alternative 2, Consolidation and Capping, would provide protection by consolidating the contaminated material in three areas, capping this material, and installing a subsurface drainage system in the South Field area. These measures would eliminate direct contact, reduce exposure to an acceptable level, and mitigate the potential migration of contaminants to the Great Miami Aquifer. This alternative would not be protective of the on-property resident farmer. Therefore, continued federal ownership with access restrictions would be required. Assessing the effectiveness of the containment systems is only possible by monitoring the groundwater around the consolidation areas. This uncertainty would be minimized by regular inspection and maintenance of the capping systems.

For Alternative 3, Excavation and Off-Site Disposal, protectiveness would be obtained by removal of the contaminated materials to cleanup levels. The material would then be transported to an off-site disposal facility.

Alternative 6, Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Criteria, protectiveness would be provided by the removal of the contaminated material to cleanup levels. Protectiveness would be maintained through disposal of the removed material in an on-site disposal facility. The facility would utilize engineering design to preclude human and ecological contact with the contaminated material. The facility would also be designed so that it would not pose unacceptable impacts to the Great Miami Aquifer.

Alternative 3 would be more protective of human health and the environment than Alternative 6, since off-site disposal of all contaminated material would remove the source of contamination from the site. Alternative 6 would be more protective of human health and the environment than Alternative 2 because of the centralization of contaminated material in the on-site disposal facility and the additional protectiveness of the facility's liner, leachate collection system, and leak detection system. In

addition, there are uncertainties associated with whether consolidation and capping would be a permanent solution.

6.2.2 Compliance with ARARs

Except for Alternative 1, each of the Operable Unit 2 remedial alternatives would either comply with the chemical-, action-, and location-specific ARARs, or meet the requirements for an ARAR waiver from the EPA. ARARs are not pertinent to Alternative 1, the No Action alternative, since no remediation activities would occur.

Alternative 6, On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria, would meet the location-specific ARARs with an ARAR waiver of one requirement. To protect human health and the environment, OEPA regulations have established that new solid waste disposal facilities should not be constructed over a sole source aquifer or aquifers that yield greater than 100 gallons per minute. Because the Great Miami Aquifer that underlies the FEMP is a sole-source aquifer and yields more than 100 gallons per minute, a waiver is requested to locate an on-site solid waste disposal facility on the FEMP. EPA allows waivers to ARARs if a standard of equivalent performance is attained. In this case, a waiver is justified because the disposal facility would meet the standard of equivalent performance of protecting human health and the environment based on the transport modeling and the residual risk assessment contained in the FS Report.

A summary of the major ARARs is attached to this Proposed Plan as Appendix A.

6.2.3 Long-Term Effectiveness and Permanence

Alternative 1, No Action, would not provide long-term effectiveness since no remedial activities would occur. The Operable Unit 2 Baseline Risk Assessment concludes that without remediation, Operable Unit 2 presents unacceptable risks to human health and the environment.

Alternative 2, Consolidation and Capping, would entail consolidation of contaminated material to provide protection of the Great Miami Aquifer and to facilitate construction of the capping system. A capping system would be installed which will restrict access to the contaminated material and mitigate the potential for exposure. A subsurface drainage system would be constructed in the South Field area to provide extra protection to the Great Miami Aquifer. However, none of the systems would include a liner with leak detection. Continued protectiveness of the cap system would require long

term maintenance of the facility and groundwater monitoring around the units. Federal ownership with access restrictions would be required to maintain the permanence of the remedy.

Alternative 3, Excavation and Off-Site Disposal, would provide the most effective long-term protection of human health and the environment since contaminated material would be excavated and disposed of at an approved off-site disposal facility.

Alternative 6, Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria, would include disposal of contaminated material at an on-site, engineered disposal facility. This disposal facility would restrict access to the contaminated material and mitigate the potential for exposure. The disposal facility, unlike capping the waste, would be able to collect leachate that may migrate from the waste by the liner/leachate collection system, and monitor leaks before they reach the groundwater. The liner system would provide additional protectiveness against future impact to the Great Miami Aquifer. The permanence of the facility would be ensured by federal ownership with access restrictions.

Table 6-2 summarizes the long-term impacts on the environment from the Operable Unit 2 remedial alternatives.

6.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 1, No Action, does not include treatment and would not result in a reduction of toxicity, mobility, or volume.

The remaining alternatives would include treatment of construction water at the AWWT facility prior to monitoring and discharge to the Great Miami River. These alternatives would also include stabilization/solidification of lead contaminated mixed waste and transport to an off-site disposal facility. Alternative 2, Consolidation and Capping, would include treatment of perched groundwater collected in the subsurface drain from the South Field area.

Alternative 3, Excavation and Off-Site Disposal, would include crushing/shredding and dewatering/ drying of selected contaminated material. These treatments would have an insignificant change in the total volume for disposal and no change in the toxicity or mobility of contaminants. The need for additional treatment to meet an off-site disposal facility's waste acceptance criteria is not anticipated.

TABLE 6-2

SUMMARY OF LONG-TERM AND SHORT-TERM ENVIRONMENTAL IMPACTS

Areas of Impact	Long Term				Short Term			
	Alternative 1	Alternative 2	Alternative 3	Alternative 6	Alternative 1	Alternative 2	Alternative 3	Alternative 6
Soil and Geology	No impact	6.6 ha committed[a] to containment	6.5 ha committed at off-site disposal facility	5.3 ha committed to on-site disposal facility	No impact	14.2 ha disturbed	14.7 ha disturbed	30.4 ha disturbed
Water Quality and Hydrology	Continued migration of contaminants to surface and groundwater	No impact	No impact	No impact	Continued migration of contaminants to surface and groundwater	Minimal impact, assuming controls	Minimal impact, assuming controls	Minimal impact, assuming controls
Air Quality	Potential release to ambient air	No impact	No impact	No impact	Potential release to ambient air	Fugitive dust emissions	Fugitive dust emissions	Fugitive dust emissions
Biotic Resources	Potential release to ecological receptors	Loss of 0.8 ha managed grassland, 5.6 ha introduced grassland/leased pasture and old field, 2.6 ha early/mid-successional and riparian woodlands,[b] 4.0 ha pine plantation, and 0.10 ha wetlands habitat	Loss of 5.6 ha introduced grassland/leased pasture and old field, 2.6 ha early/mid-successional and riparian woodlands, and 0.10 ha wetlands habitat	Loss of 19.8 ha introduced grassland/leased pasture and old field, 3.4 ha early/mid-successional and riparian woodlands, and 0.26 ha wetlands habitat	Potential release to ecological receptors	Habitats disturbed	Habitats disturbed	Habitats disturbed
Wetland and Floodplain	Potential release to wetlands and floodplain	Potential loss of 0.10 ha wetlands; no floodplain impact	Potential loss of 0.10 ha wetlands; no floodplain impact	Potential loss of 0.26 ha wetlands; no floodplain impact	Potential release to wetlands and floodplain	Potential for runoff and limited excavation in wetlands and floodplain	Potential for runoff and limited excavation in wetlands and floodplain	Potential for runoff and limited excavation in wetlands and floodplain
Socioeconomic and Land Use	Restriction of site's future use	Restriction of site's future use (20.6 ha)	Potential future use of site	Restriction of site's future use (14.2 ha)	Restriction of site's future use	8.7 percent increase for CMSA revenue over 30 years[c]	26.5 percent increase for CMSA revenue over 51 months	13.7 percent increase for CMSA revenue over 30 years
Cultural Resources	No impact	No impact	No impact	No impact	No impact	No impact due to identification and management	No impact due to identification and management	No impact due to identification and management
Transportation	No impact	No impact	No impact	No impact	No impact	Minor traffic increase during remedial activities	Minor traffic increase during remedial activities	Minor traffic increase during remedial activities

[a]Commitment of acreage is at the FEMP unless otherwise indicated. Note that 1.0 acre = 0.4 hectares (ha)
[b]Impacts to woodlands and wetlands from potential on-site borrow activities are not included.
[c]Most of the consolidated metropolitan statistical area (CMSA) revenue increase would occur during the performance of the alternative (i.e., 51 months) with minimal increase during operation and maintenance activities (if required).

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Alternative 6, Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria, would include crushing/shredding and dewatering/drying of selected contaminated material disposed of in an on-site disposal facility. No significant change in toxicity, mobility, or volume is expected. The need for additional treatment of the material to meet an off-site disposal facility's waste acceptance criteria is not anticipated.

6.2.5 Short-Term Effectiveness

The No Action alternative would be highly effective relative to short-term risks since there would be no remedial activities. Therefore, there would be no additional risk to workers or the community around the FEMP site.

For Alternative 2, Consolidation and Capping, contaminated material would only be excavated to remove it from direct contact with the Great Miami Aquifer and to facilitate placement of the capping system at each subunit. This alternative would result in minimal risk to site workers and the public because much of the material remains in place at the subunits. Placement of the cap in the Solid Waste Landfill and Lime Sludge Ponds areas would result in disturbance to wetlands.

Alternative 3, Excavation and Off-Site Disposal, would involve removal and disposal of contaminated material at an off-site disposal facility. This alternative would entail excavation and off-site transport of contaminated material. This would result in increased exposure to on-site workers during handling (drying, crushing/shredding, packaging, and loading) and the public during transportation. These exposure potentials would be managed in accordance with a Health and Safety Plan and applicable transportation requirements and are, therefore, considered acceptable. Excavation of contaminated material in the Solid Waste Landfill and Lime Sludge Ponds areas would result in disturbance to wetlands.

Alternative 6, the preferred remedial alternative, would involve removal of contaminated material and disposal in an on-site engineered disposal facility. During excavation activities and placement of the material in the disposal facility, there would be potential exposure to the workers. This exposure potential would be managed in accordance with a Health and Safety Plan and, therefore, is considered acceptable. There would be minimal risks to the community. Excavation of contaminated material in the Solid Waste Landfill and Lime Sludge Ponds areas would result in disturbance to wetlands.

Alternative 1 would provide the best short-term effectiveness since no remedial activities would occur. Alternative 2 would provide slightly better short-term effectiveness than Alternative 6 because less contaminated material is excavated, and small amounts of contaminated material is treated and transported off-site for disposal in both alternatives. Alternative 3 would provide the least short-term effectiveness because of the potential to expose the community to contaminated material during transportation to an off-site disposal facility.

Table 6-2 summarizes the short-term impacts on the environment from the Operable Unit 2 remedial alternatives.

6.2.6 Implementability

There would be no implementation required for Alternative 1 because no remedial activities would be involved. For the remaining alternatives, removal and treatment of perched groundwater at the AWWT facility would be both technically and administratively implementable.

Alternative 2 would be the most implementable of the action alternatives. Consolidation of the materials would be relatively simple and the capping system at each subunit would be readily constructable. A minimum amount of material (lead-contaminated soil from the Firing Range) would require off-site disposal, so no issues are anticipated that would affect the administrative feasibility of this action.

Alternative 3, Excavation and Off-Site Disposal, would not require the construction of caps or a disposal facility at the FEMP, but would require a significant quantity of contaminated material to be disposed off-site. The off-site disposal would be subject to various local, state, and federal requirements and would require coordination with jurisdictional agencies. Therefore, this alternative would be administratively possible to implement, but may be time consuming. Issues associated with transportation and public acceptance could arise.

Alternative 6, the preferred alternative, would require a waiver from the EPA to construct an on-site disposal facility over a high-yield sole-source aquifer. The design and proposed feasible location of the on-site disposal facility would protect human health and the environment from Operable Unit 2 waste material. Therefore, this alternative would be administratively implementable, since the

disposal facility would meet the criteria for an EPA waiver of the OEPA siting criteria based upon achieving a standard of equivalent performance.

Alternative 2 would be the most implementable of the "action alternatives" because reliable technology would be used and no issues are anticipated with the administrative implementability. Alternative 6 is considered more implementable than Alternative 3 because an EPA waiver from OEPA siting requirements has been discussed with the appropriate agencies and indications are that a waiver is possible, whereas transportation and public acceptance of the transport of contaminated material to the off-site facility affects several states and regulatory agencies.

6.2.7 Cost

Alternative 1 would be the least costly since there would be no remedial activities. Of the remaining alternatives. Alternative 2 is the next least costly at $69,644,000 followed by Alternative 6 at $110,327,000, with Alternative 3 as the most expensive at $212,795,000.

Based on assumptions concerning field operations, the construction duration of each alternative falls within a narrow range (i.e., plus or minus 4 months). It was, therefore, assumed that the construction time for each of the alternatives was the same.

6.3 SUMMARY OF COMPARATIVE ANALYSIS

All of the action alternatives meet the two threshold criteria of protection of human health and the environment and compliance with ARARs. The comparison of the balancing criteria shows that the action alternatives have differences, but not major differences.

Consolidation and capping is the lowest-cost alternative, but does not offer an engineered liner with leachate collection and leak detection to ensure cap integrity. However, monitoring of the groundwater wells at the edge of the subunit would ensure the protection of the groundwater for off-property users.

Excavation and disposal at an off-site facility would remove the source of contamination from the site. Thus, this alternative is considered to be the most protective. However, this alternative would cost almost twice as much as the preferred alternative. Additionally, the public would be concerned about transportation of wastes off site.

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The preferred remedial alternative, Excavation and On-Site Disposal with Off-Site Disposal of the Fraction Exceeding Waste Acceptance Criteria, offers an increased effectiveness over the other on-site alternative, consolidation and capping. This is based on an engineered liner that allows for leachate collection and leak detection monitoring. By combining all the waste into one disposal location, the preferred remedial alternative also allows increased flexibility in land use options, a reduced buffer area, and centralized operations and maintenance.

The geology of the disposal facility location would be protective of human health and the environment, based on a series of soil borings made in the area. However, the disposal facility location, design, and waste acceptance criteria would 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.

As previously indicated, the detailed analysis of alternatives in Section 5.0 of the FS Report, and the comparative analysis in this section are based on the future land-use scenario assuming continued federal ownership and access controls with a cleanup risk level (PRL) of 1×10^{-6}. Differences that would result from a private ownership land-use scenario have been noted throughout Sections 4.0 and 5.0 of the FS Report. All of these differences are primarily associated with two factors: (1) level of protectiveness and (2) volume of material with COC concentrations above the cleanup levels. The major impact of the latter factor is on cost, which is due to varying risk-based cleanup criteria associated with the land-use scenarios.

Alternative 2, Consolidation and Capping, would not be protective of the on-property resident farmer under the private ownership land-use scenario. Alternatives 3 and 6 would be protective if contaminated material with COC concentrations above the cleanup levels for the on-property resident farmer is removed from the subunits.

Table 6-3 summarizes the present-worth cost of the various alternatives for the federal and private ownership land-use scenarios and varying cleanup risk levels (PRLs). As indicated, the cost differences between alternatives remain relatively constant with varying cleanup risk levels (PRLs). However, the cost difference between Alternatives 3 and 6 widens when private ownership is considered.

TABLE 6-3

COMPARISON OF NET PRESENT WORTH COSTS ALTERNATIVE LAND-USE SCENARIOS AND CLEANUP RISK VALUES (PRLs) OPERABLE UNIT 2

Alternative	Net Present Worth Cost ($millions)			
	Federal Ownership		Private Ownership	
	Target ILCR = 10^{-5}	Target ILCR = 10^{-6}	Target ILCR = 10^{-5}	Target ILCR = 10^{-6}
1 - No Action	0	0	0	0
2 - Consolidation and Capping	61.2	69.6	NA	NA
3 - Excavation and Off-Site Disposal	175.6	212.8	321.8	464.9
6 - Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria	92.9	110.3	105.5	148.3

Indicates land-use scenario and PRL risk value used for comparative analysis.

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In conclusion, Alternative 6 (Excavation and On-Site Disposal with Off-Site Disposal of Fraction Exceeding Waste Acceptance Criteria) for the Federal ownership scenario meeting a target risk of 1 x 10^{-6} is the preferred remedial alternative for Operable Unit 2. Except for cost, the factors associated with varying land-use scenarios and cleanup risk levels (PRLs) do not significantly alter the comparative analysis of alternatives. The comparative analysis indicates that for costs, all "action" alternatives are sensitive to the target risk, Alternative 6 is moderately sensitive to land use, and alternative 3 is extremely sensitive to land-use. These factors demonstrate the flexibility of the Operable Unit 2 preferred remedial alternative. However, the cost of remediation of the FEMP site, as a whole, may be very sensitive to various land use and target risks.

The Operable Unit 2 preferred remedial alternative will be reviewed and modified, if necessary, based upon the proposed land-use recommended in the Operable Unit 5 Proposed Plan and the recommendations of the Fernald Citizens Task Force, expected in Fall 1994.

7.0 COMMUNITY PARTICIPATION

Input from the public is an important element of the decision-making process for cleanup actions at the FEMP site. Comments on the proposed remedial actions at the FEMP site will be received during a public review period following issuance of the Draft FS/PP-EA for Operable Unit 2. Oral comments may be presented at a formal public meeting that will be conducted (date, time, and place to be determined). Written comments may be submitted at the public meeting or mailed to either of the following addresses before the close of the public comment period:

Mr. Gary Stegner
Director, Public Information
U.S. Department of Energy
Fernald Field Office
P.O Box 538705
Cincinnati, OH 45253-8705
(513) 648-3131

Mr. Jim Saric
U.S. Environmental Protection Agency, Region V
77 West Jackson Blvd.
5HRE8J
Chicago, IL 60604
(312) 886-0992

Information relevant to the proposed remedial actions, including the RI Report, Baseline Risk Assessment, FS Report, Proposed Plan, and supporting Operable Unit 2 technical reports is provided in the Administrative Record. The Administrative Record is located at the PEIC, just south of the FEMP site. For information regarding the PEIC, call (513) 738-0164.

PUBLIC ENVIRONMENTAL INFORMATION CENTER

10845 Hamilton-Cleves Highway

Harrison, OH 45030

Monday and Thursday, 9 a.m. to 8 p.m.

Tuesday, Wednesday, and Friday, 9 a.m. to 4:30 p.m.

Saturday, 9 a.m. to 1 p.m.

An identical Administrative Record is also maintained at the EPA in Chicago, Illinois. The address for the EPA is:

U.S. Environmental Protection Agency, Region V

77 West Jackson Blvd.

Chicago, IL 60604

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REFERENCES

Consent Agreement Under CERCLA Sections 120 and 106(a), 1990, U.S. Environmental Protection Agency and U.S. Department of Energy, Administrative Docket No. V-W-90-C-057.

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APPENDIX A

SUMMARY OF MAJOR APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED CRITERIA

Citation	Requirement	Summary of Requirement
CHEMICAL-SPECIFIC REQUIREMENTS		
40 Code of Federal Regulations (CFR) §141	EPA National Primary Drinking Water Standards	Drinking water maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for radionuclides, organic contaminants, and inorganic contaminants
Ohio Administrative Code (OAC) 3745-81	Ohio Drinking Water Regulations	Drinking water MCLGs and MCLs for radionuclides, organic contaminants, and inorganic contaminants
OAC 3745-1-07	Ohio Water Quality Criteria	Ohio warmwater habitat, human health, and agricultural water quality criteria
40 CFR §61.92	National Emission Standards for Hazardous Air Pollutants	Dose limit of 10 mrem/year to the public from DOE radionuclide air emissions
40 CFR §192.02(b)	Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings	Limits for radon-222 emissions from radioactive material at disposal facilities
DOE Order 5400.5	Radiation Protection of the Public and the Environment	Derived concentration guides (DCGs) for water effluent and air emissions
40 CFR §50	National Primary and Secondary Ambient Air Quality Standards	National ambient air quality standards for carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur oxides
40 CFR §192.20	Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings	Limits of radium-226, radium-228, thorium-230, and thorium-232 in soil from residual radioactive material
DOE Order 5400.5	Radiation Protection of the Public and Environment	

Citation	Requirement	Summary of Requirement
CHEMICAL-SPECIFIC REQUIREMENTS (continued)		
DOE Order 5400.5 DOE Order 5820.2A	Radiation Protection of the Public and the Environment Radioactive Waste Management	Dose limits for individual members of the public from radioactive releases
40 CFR §192.21(f) and §192.22(b) DOE Order 5400.5 Chapter 1(4) and Chapter II(2)	Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings Radiation Protection of the Public and the Environment	Radionuclide emissions should be reduced to levels that are As Low As Reasonably Achievable (ALARA)
ACTION-SPECIFIC REQUIREMENTS		
CERCLA Compliance with Other Laws Manual Section 2.7	Land Disposal of Waste	Defines placement/disposal of waste
42 United States Code (U.S.C.) §2014 (e)(2), (ee) 42 U.S.C. §10101(12), (16),(23)	Atomic Energy Act Nuclear Waste Policy Act	Defines low-level radioactive waste
DOE Order 5400.5 Chapter IV	Radiation Protection of the Public and the Environment	Defines residual radioactive material
42 U.S.C. §6903(27) 40 CFR §§ 261 and 263	Resource, Conservation, and Recovery Act	Defines Federal hazardous waste, solid waste, and remediation waste and exempts flyash and bottom ash from the definition of hazardous waste

Citation	Requirement	Summary of Requirement
	ACTION-SPECIFIC REQUIREMENTS (continued)	
OAC 3745-27-01,-03	Ohio Solid Waste Disposal Regulations	Defines State solid waste and exempts flyash, bottom ash, construction debris, and lime sludge from the definition of solid waste
OAC 3745-27-01(V) OAC 3745-27-30(A),(E),(H) Ohio Revised Code (ORC) 3734.021(A)(1)(c),(d)	Ohio Infectious Waste Regulations	Defines infectious waste
OEPA Policy PP 01 03 200	Ohio Petroleum Contaminated Soil Policy	Exempts environmental media, such as soil, from the definition of hazardous waste if the waste constituents have been removed
DOE Order 5820.2A DOE Order 6430.1A	Radioactive Waste Management General Design Criteria	Requirements for the management and disposal of low-level radioactive waste
40 CFR §192	Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings	Requirements for the control of uranium and thorium byproduct material
DOE Order 5400.5 Chapter IV	Radiation Protection of the Public and the Environment	Requirements for the control of residual radioactive material
40 CFR §§ 257 and 258 OAC 3745-27	U.S. EPA Solid Waste Disposal Regulations Ohio Solid Waste Disposal Regulations	Design criteria for solid waste disposal

Citation	Requirement	Summary of Requirement
LOCATION-SPECIFIC REQUIREMENTS		
40 CFR §6.302(h)	Procedure for Implementing the National Environmental Policy Act	Requirements for the protection of Federal and State endangered and threatened species
50 CFR §17	Endangered and Threatened Wildlife and Plants	
50 CFR §402	Interagency Cooperation - Endangered Species Act	
ORC 1518.02, 1531.25 OAC 1501:18-1	Ohio Endangered Species Regulations	
40 CFR §6.302(a),(b)	Procedure for Implementing the National Environmental Policy Act	Requirements for the protection of floodplains and wetlands
10 CFR §1022	DOE Compliance with Floodplain/Wetlands Environmental Review Requirements	
42 U.S.C. §1424(e)	Safe Drinking Water Act	Requirements for construction in the area of a sole-source aquifer
DOE Order 5820.2A	Radioactive Waste Management	Requirements for low-level radioactive waste disposal site selection
Joint Nuclear Regulatory Commission (NRC)-EPA Guidance on Siting of Mixed Low-Level and Hazardous Waste Units (March 13, 1987)	Radioactive Waste Facility Siting Guidelines	Requirements for the siting of a radioactive disposal facility in an area with highly vulnerable hydrogeology
OAC 3745-27-07 and associated guidance	Ohio Solid Waste Disposal Regulations	Restricts the location of a solid waste disposal facility

Citation	Requirement	Summary of Requirement
NON-ARAR REQUIREMENTS		
OSHA Worker Protection Requirements 29 CFR §§ 1904 and 1910	Worker Safety	These regulations establish requirements to protect workers who could be exposed to radiation, noise, hazardous wastes, or other contaminants or hazards at the remediation site.
DOT Requirements for Transportation of Hazardous Materials 49 CFR §§ 171-173 and 177-179	Transportation of Wastes Off Site	No one may transport hazardous materials on public highways except in accordance with these regulations: • Part 171 - General requirements for transporting hazardous materials. • Part 172 - This part establishes shipping papers, marking, labeling, placarding, and emergency response information requirements. • Part 173 - This part establishes packaging and other shipping requirements for hazardous materials, including radioactive materials. • Part 177 - This part establishes requirements for the transporter. • Part 178 - This part establishes specifications for shipping containers. • Part 179 - This part establishes specifications for tanks cars.
Resource, Conservation, and Recovery Act 40 CFR §262.20	Transportation of Hazardous Waste	A generator who transports, or offers for transportation, hazardous waste for off-site treatment, storage, or disposal must prepare a Manifest Office of Management and Budget (OMB) control number 2050-0039 on EPA form 8700-22, and, if necessary, EPA form 8700-22A, according to the instructions included in the Appendix to Part 262.
Resource, Conservation, and Recovery Act 40 CFR §§ 262.30 - 262.33	Transportation of Hazardous Waste	Before transporting hazardous waste or offering hazardous waste for transportation off site, a generator must package, label, mark, and placard the waste in accordance with §§ 172, 173, 178, and 179 of the Department of Transportation regulations listed above (49 CFR).

Citation	Requirement	Summary of Requirement
NON-ARAR REQUIREMENTS (continued)		
Resource, Conservation, and Recovery Act 40 CFR § 262.34	Hazardous Waste Accumulation Time	A generator may accumulate hazardous waste on site for 90 days or less without a permit or without having interim status, provided that it is stored according to the requirements of this section. A generator who accumulates hazardous waste for more than 90 days is an operator of a storage facility and is subject to the requirements of 40 CFR Parts 264 and 265 and the permit requirements of 40 CFR Part 270 unless he has been granted an extension to the 90-day period. Such extension may be granted by EPA if hazardous wastes must remain on-site for longer than 90 days due to unforeseen, temporary, and uncontrollable circumstances.
Resource, Conservation, and Recovery Act 40 CFR §263	Transportation of Hazardous Waste	Persons transporting hazardous waste within the United States must comply with the regulations of this part, including manifest requirements and management of accidental hazardous waste discharges.
DOE Order 1540.1	Contractual obligation for activities at DOE facilities	Materials Transportation and Traffic Management
DOE Order 5440.1E	Contractual obligation for activities at DOE facilities	NEPA Compliance Program
DOE Order 5480.1B	Contractual obligation for activities at DOE facilities	Environmental, Safety, and Health Program for DOE Operations
DOE Order 5480.4	Contractual obligation for activities at DOE facilities	Environmental Protection, Safety, and Health Protection Standards
10 CFR §835 DOE Order 5480.11	Contractual obligation for activities at DOE facilities	Radiation Protection for Occupational Workers
DOE Order 5483.1A	Contractual obligation for activities at DOE facilities	Occupational Safety and Health Programs for DOE Employees at Government-Owned, Contractor-Operated Facilities
DOE Order 5700.6C	Contractual obligation for activities at DOE facilities	Quality Assurance

APPENDIX B
GLOSSARY

This glossary has been prepared as part of the effort to familiarize the reader with the specific vocabulary used in discussions about environmental restoration and waste management at the FEMP site.

access controls - Controls used to limit access to the FEMP site such as fencing or security guards.

Active Flyash Pile - This subunit of Operable Unit 2 was the disposal area for flyash from the FEMP boiler plant. The Active Flyash Pile is located just east of the South Field.

Administrative Record - Documents RI/FS activities for each operable unit. The documents in the Administrative Record are used to make decisions for the FEMP remediation program as well as for short-term protective measures (removal actions) implemented until a final remediation plan can be put into effect. The Administrative Record is made available for public review so that community members have the opportunity to provide comments to DOE on proposed cleanup activities at the FEMP site. The Administrative Record for the FEMP site is located at the Public Environmental Information Center (see definition below).

Advanced Wastewater Treatment (AWWT) Facility - A treatment facility to be constructed at the FEMP site for treatment of construction water, perched water, and groundwater.

applicable requirements - Those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance found at a CERCLA site. Any state or federal statute that pertains to protection of human health and the environment in addressing specific conditions or use of a particular cleanup technology.

applicable or relevant and appropriate requirements (ARARs) - See applicable requirements above; and relevant and appropriate requirements below.

baseline risk assessment - An assessment of the potential threat (current and future) to human health and the environment caused by the release of hazardous substances in the absence of any remedial action. The assessment provides the basis for determining whether remedial action is necessary.

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(Continued)

capital cost - Consists of direct and indirect costs and includes those costs associated with waste excavation, treatment, disposal, engineering, and health and safety.

central tendency (CT) receptor - Referenced in Section 4.0 of this Proposed Plan, CT utilizes mostly average exposure scenarios; therefore, it represents a less conservative exposure.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - The law through which Congress provided the authority, framework, and procedures for the cleanup of uncontrolled hazardous waste sites; also known as the Superfund program.

contaminant - Any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions, or physical deformations in such organisms or their offspring.

constituents of potential concern (CPCs) - Those compounds present in environmental media at levels that exceed background and that may present a risk to human health.

contaminants of concern (COCs) - For purposes of the Operable Unit 2 Baseline Risk Assessment, COCs are constituents which resulted in risks to a receptor of greater than one in one million (1×10^{-6}) and a hazard index of greater than 0.2.

drying - A process used to remove excess moisture from a media such as soil. For purposes of Operable Unit 2, the drying process would be used to prepare the media for other processes or technologies that require dry material because of technical or administrative requirements.

engineering controls - Designed controls (e.g., a landfill cap or disposal facility) that reduce the movement of contaminants to the environment.

expanded trespasser - One who makes repeated unauthorized entry to and wanders freely over the site.

fate and transport modeling - Modeling that is used to assess constituent movement from source areas to receptor locations through various media (i.e., groundwater or air). The modeling is used in conjunction with monitoring data and estimates constituent concentrations at exposure

GLOSSARY
(Continued)

point locations where measured constituent concentration data are not available such as off-site locations or constituent distribution in the future.

feasibility study (FS) - A study undertaken to develop and evaluate options for remedial action. The FS emphasizes data analysis and is generally performed concurrently, and in an interactive fashion, with the remedial investigation (RI), using data gathered during the RI.

Fernald Citizens Task Force - A citizens advisory group formed to develop a public consensus about cleanup solutions and future courses of action at Fernald.

Great Miami Aquifer - A source of groundwater underlying portions of the FEMP site that has been designated by the EPA as a sole-source aquifer.

hazard index (HI) - Developed by EPA, HI is used when a person may be exposed to more than one contaminant; it is the sum of hazard quotients (HQs) (see next definition).

hazard quotient (HQ) - Developed by EPA to address the possibility that someone could contract an adverse health effect other than cancer from contamination at a CERCLA site. HQ is determined by comparing the amount of a specific constituent that someone might be exposed to with the dose that the scientific community considers safe or acceptable for that constituent.

Inactive Flyash Pile - This subunit of Operable Unit 2 was used for the disposal of flyash from the boiler plant and other nonprocess wastes and building rubble such as concrete, gravel, asphalt, masonry, and steel rebar. The Inactive Flyash Pile is located approximately 2,000 feet southwest of the former Production Area.

incremental lifetime cancer risk (ILCR) - The incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. The EPA has determined that an acceptable ILCR is from one in one million (1×10^{-6}) to one in ten thousand (1×10^{-4}).

institutional controls - Future physical controls such as fencing, deed restrictions, and security guards, which limit access to a site or an operable unit.

K-65 Slurry Line Trench - A trench that runs just south of the South Lime Sludge Pond that once carried waste material to the Operable Unit 4 silos. The trench is included in Operable Unit

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(Continued)

3 and may be relocated during remediation of the Lime Sludge Ponds.

land use scenario - Predictions about the future use of the FEMP site. Scenarios included federal and private ownership of the area and different people living and working in and on the FEMP site area.

Lime Sludge Ponds - This subunit of Operable Unit 2 consists of the North and South Lime Sludge Ponds that contain waste from the FEMP water treatment plant operations, coal pile storm water runoff, and boiler plant blowdown. The South Lime Sludge Pond is inactive and overgrown with grasses and shrubs, while the North Lime Sludge Pond is currently in use. The Lime Sludge Ponds are located in the southeast corner of the Waste Storage Area.

maximum contaminant level (MCL) and maximum contaminant level goal (MCLG) - Maximum concentrations of contaminants allowable in drinking water. Remediation of Operable Unit 2 subunits must meet the non-zero MCLG or the MCL, whichever is more protective.

National Priorities List (NPL) - This list is compiled by the EPA pursuant to CERCLA section 105 and consists of the sites in the United States where there have been significant uncontrolled releases of hazardous substance. These sites are priorities for long-term remedial evaluation and response.

operable unit - The term for a discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration or eliminates or mitigates a release, threat of a release, or pathway of exposure. The FEMP has been divided into five operable units.

operation and maintenance (O&M) costs - Costs associated with long-term maintenance and monitoring of an operable unit.

picocurie (pCi) - A measurement of radioactivity. A picocurie is a trillionth of a curie, representing about 2.2 radioactive particle disintegrations per minute. A curie is the basic unit used to describe the amount of radioactivity in a sample of material. It is based upon the approximate decay rate of 1 gram of radium, which is 37 billion disintegrations of radioactive particles per second. Picocuries are often expressed in units related to a liquid volume unit such as picocuries per liter (pCi/L).

preliminary remediation goals (PRGs) - Levels of COCs in the waste, soil, surface water, and groundwater that will maintain the risk to human receptors within the EPA target range.

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(Continued)

preliminary remediation levels (PRLs) - Cleanup levels that are achieved by modifying the PRG for a specific COC based on a number of factors including access controls and engineering controls.

present worth costs - Costs in 1994 dollars that include capital investments and operations and maintenance costs. The present worth costs take into account the inflation rate and investment rate of return.

Proposed Plan - A public participation document that summarizes the Feasibility Study and facilitates public participation in the remedy selection process by: (1) identifying the preferred alternative for a remedial action at a site and explaining the reasons for the preference; (2) describing other remedial options considered in detail in the RI/FS reports; (3) soliciting public review and comment on all the alternatives described; and (4) providing information on how the public can be involved in the remedy selection process.

Public Environmental Information Center (PEIC) - An information repository that houses the Administrative Record and is located approximately 1.5 miles south of the FEMP site. The PEIC contains additional materials to help the public understand cleanup activities at the FEMP, such as newspaper clippings, the Annual Environmental Report, fact sheets, and text books. See Section 7.0 of this Proposed Plan for additional information on the PEIC.

radionuclide - A synthetic or natural radioactive particle, with a distinct atomic weight number.

reasonable maximum exposure (RME) - Referenced in Section 4.0 of this proposed plan, RME is intended to represent a conservative exposure scenario that is above the average estimated exposure level.

Record of Decision (ROD) - A document that establishes the final remedial action to be carried out for an operable unit or a site.

relevant and appropriate requirements - The cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

remedial action objective (RAO) - Goals for protecting human health and the environment

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(Continued)

from the material in the Operable Unit 2 subunits. The final remedial action must meet these objectives.

remedial investigation (RI) - A process undertaken to determine the nature and extent of the contamination caused by the release. The RI emphasizes data collection and site characterization and is generally performed concurrently, and in an interactive fashion, with the FS. The RI includes sampling and monitoring, as necessary, and includes the gathering of sufficient information to determine the necessity for remedial action and to support the evaluation of remedial alternatives. Fate and transport modeling and a baseline risk assessment are performed in the RI.

residual risk and hazard - The human health risk and hazard left after remediation is complete.

risk assessment - A study to determine the risks posed to public health or the environment as a result of site contamination. A baseline risk assessment for a specific operable unit supplements a RI.

Solid Waste Landfill - This subunit of Operable Unit 2 was reportedly used for the disposal of cafeteria waste, rubbish, and other types of waste from the nonprocess areas and on-site construction/demolition activities. The Solid Waste Landfill is located in the northeast corner of the Waste Storage Area.

South Field - This subunit of Operable Unit 2 was reportedly used as a burial site for FEMP nonprocess wastes such as flyash, on-site construction/demolition rubble, and soils that may have contained low levels of radioactivity. The South Field is located southwest of the former Production Area between the Active and Inactive Flyash Piles.

stabilization - A treatment process involving the mixing of one material with another to produce a material with improved handling or structural characteristics.

waste acceptance criteria - Disposal facility standards that waste must meet in order to be accepted for disposal at that facility. The standards may include, among other things, maximum concentrations of contaminants, maximum moisture content, and packaging requirements.

Waste Storage Area - An area located west of the former Production Area that received wastes generated from the site processes.

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