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PROPOSED PLAN FOR REMEDIAL ACTIONS AT OPERABLE UNIT 2 DOE/EA-0953 DRAFT APRIL 1994 REF: 5500, 5501, 5502, 5503, 5504, 5505, 5506

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

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

APRIL 1994

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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
CAMU	Corrective Action Management Unit
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
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
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
RCRA	Resource, Conservation, and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
ROD	Record of Decision
TBC	To Be Considered
TCLP	toxicity characteristic leaching procedure
TU	Temporary Unit
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 five subunits comprising Operable Unit 2 at the Fernald Environmental Management Project (FEMP). These five subunits include: the Solid Waste Landfill, the Lime Sludge Ponds, the Inactive Flyash Pile, the South Field, and the Active Flyash Pile.

This document 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 each Operable Unit 2 subunit; however, this preference may be altered based upon public and/or support agency response to this document. Additionally, the Proposed Plan will describe the other remedial alternatives considered in the Feasibility Study (FS) Report 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 expedient completion of cleanup operations at the FEMP. The FEMP site facility is owned by DOE, who, 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. 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. CERCLA/NEPA integrated documents prepared subsequent to Operable Unit 4 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 this documentation.

The following provides a brief description of the organization of the Proposed Plan for Operable Unit 2:

- Section 1.0 provides an overview of the purpose for the proposed plan and identifies the lead and support agencies.
- Section 2.0 discusses the FEMP site history as it has evolved.
- 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 describes briefly how the alternatives were selected and discusses in more detail the alternatives for the five subunits of Operable Unit 2.

- Section 6.0 discusses the preferred remedial alternative for each of the Operable Unit 2 subunits and presents a comparison with the other alternatives.
- Section 7.0 discusses the elements of community participation for the Proposed Plan.
- A reference list of resources used in preparing the Proposed Plan is included.
- 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 the 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 reached its peak in 1960, 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 the site was renamed the Fernald Environmental Management Project. To reflect this change, WMCO was renamed the Westinghouse Environmental Management Company of Ohio (WEMCO). Shortly thereafter, the 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 (1050 acre) facility located just north of Fernald, Ohio, a small farming community, and lies 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 former 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 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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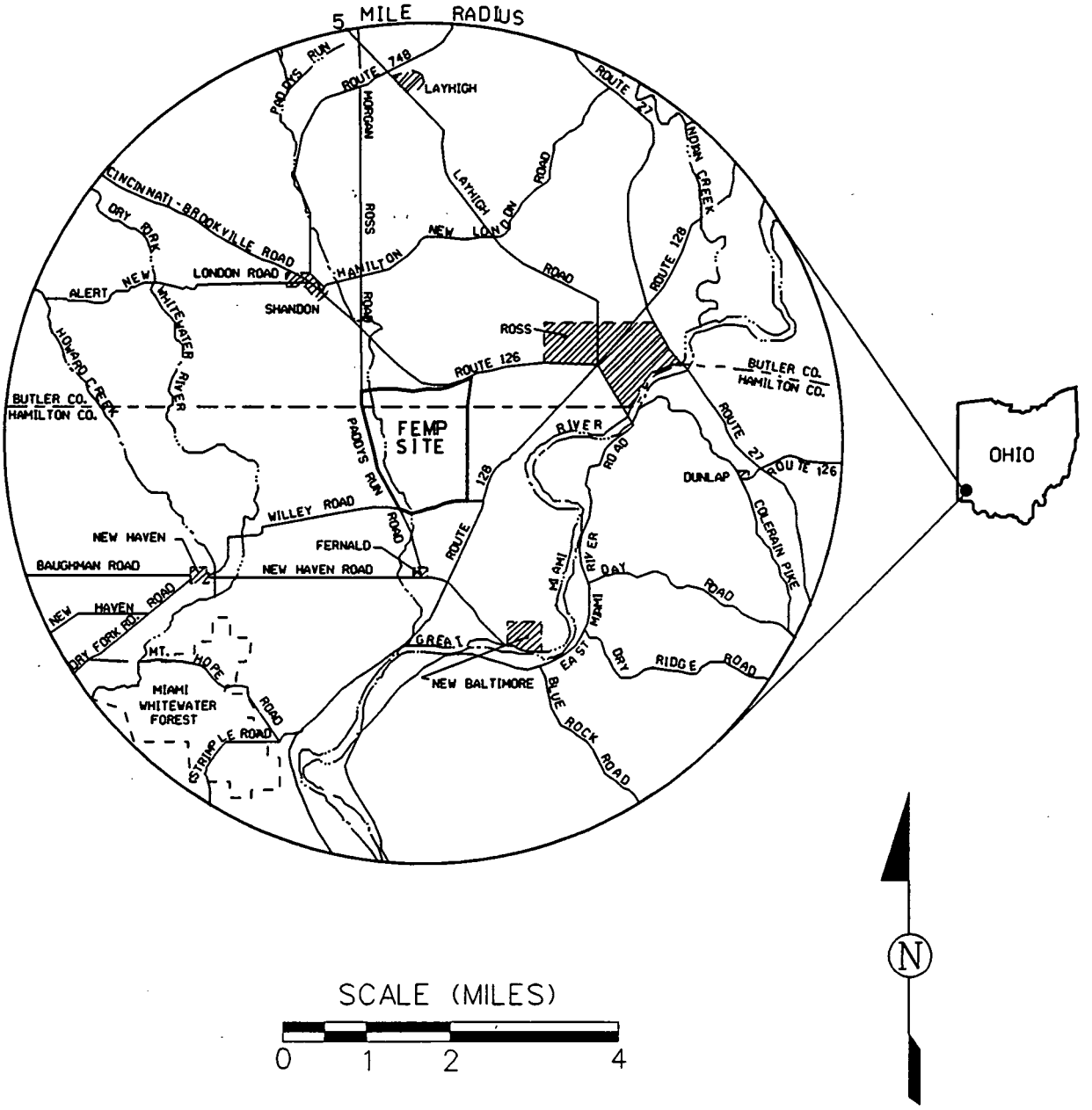

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FIGURE 2-1
FEMP FACILITY LOCATION MAP

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3.0 SCOPE AND ROLE OF OPERABLE UNITS AT THE FEMP SITE

3.1 FEMP OPERABLE UNITS

In March 1985, the 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 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 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 by 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 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 1-4
- 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 added as a provision of the 1991 Amended Consent Agreement. This is not a specific site area; rather, the 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.

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. Field investigation results, however, reveal that some apparent process wastes have also been placed in the landfill.

- 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. Field investigation results also reveal that soil of unknown origin and some apparent process waste has been placed in the subunit.

- 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 deposited in this slope.

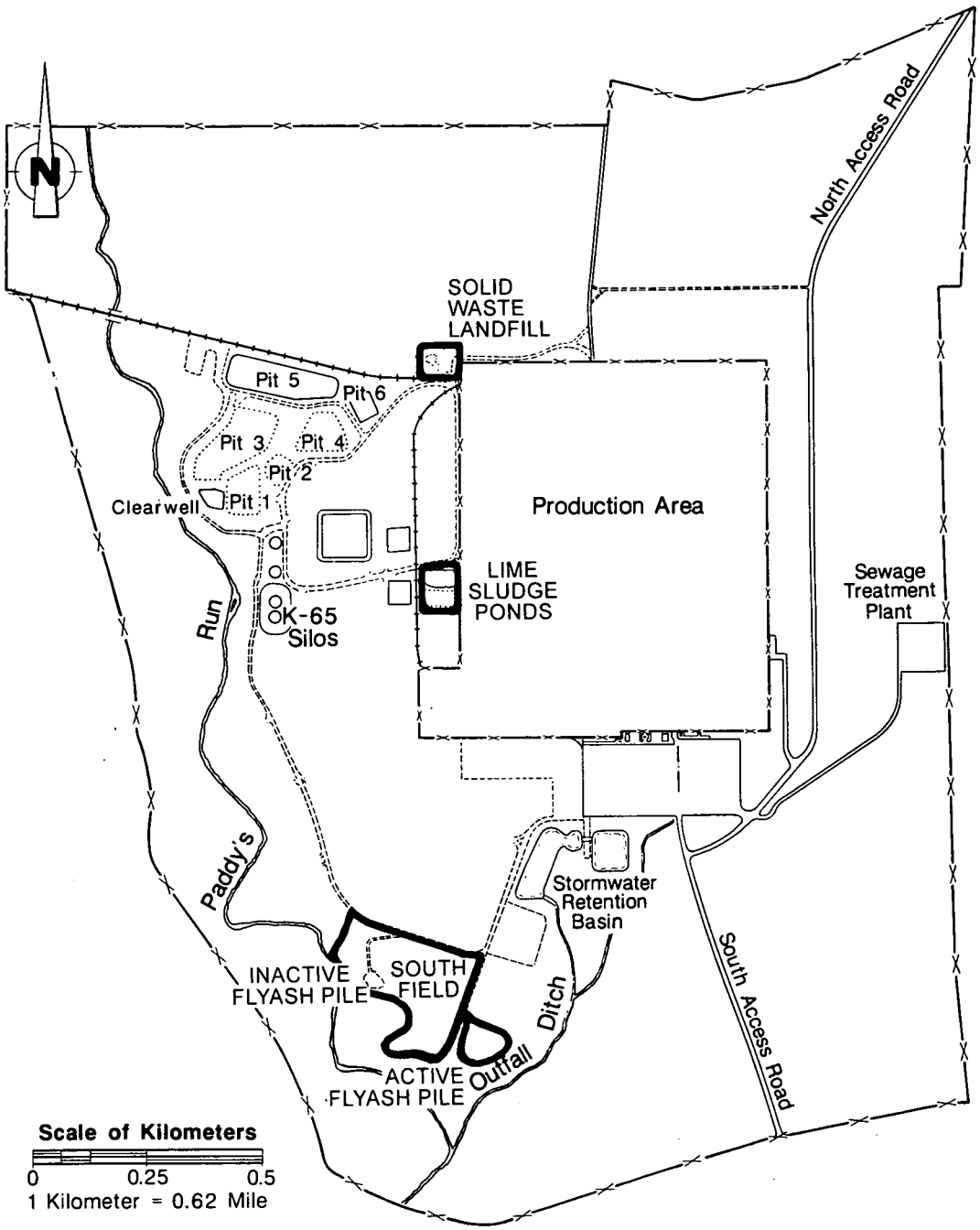
- The Active Flyash Pile was the disposal area for flyash from the FEMP boiler plant.

The operational histories of the Lime Sludge Ponds and Active Flyash Pile are well understood while 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 has been conducted to develop a detailed understanding of the nature of the waste materials, their 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 associated impact 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

- the pathways (e.g., air, groundwater, soil, surface water) that contaminants could migrate from Operable Unit 2 waste units to human receptors;
- the maximum concentrations in these pathways over a 1000 year period based on complex models; and
- 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 Report for Operable Unit 2 establishes cleanup levels, a range of remedial alternatives to meet these levels, and a comparison of these alternatives based on criteria provided in the CERCLA law.

4.0 OVERVIEW OF THE BASELINE RISK ASSESSMENT

The potential risk for 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 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 getting cancer from contamination at a CERCLA site, the EPA has established a 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}] associated with possible exposures. 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 radiation naturally occurring 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 get 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 that someone might be exposed to 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. The HI value is used as the 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 establish the need to undertake cleanup at a CERCLA site, the EPA evaluates the risk an individual site possesses, 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 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 or not remedial action is necessary and the justification for performing remedial actions. 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 extent 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 an HI of 0.2 or one fifth 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 present 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 an 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 7.4.1 through 7.4.5 of the RI Report present a more detailed discussion of the COCs for each Operable Unit 2 subunit. This 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 support completion of a baseline risk assessment to depict what may happen in and around the FEMP site if no further remedial actions or cleanup is taken. The scenarios were used to determine the need for additional cleanup activities at the site.

It is important to consider that the DOE and EPA have already decided that the FEMP site will undergo cleanup and remediation. The baseline exposure scenarios are used to show if cleanup is necessary and 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 this operable unit do not necessarily represent final land use options for the Fernald property. These land use options and corresponding exposure assumptions were developed by the DOE based on the best currently available information and public input as working examples of how future use may impact cleanup requirements. These future use alternatives were carried through the decision making for this operable unit to develop a working understanding of likely cleanup levels and goals.

TABLE 4-1

OPERABLE UNIT 2 CONTAMINANTS OF CONCERN

Solid Waste Landfill	Lime Sludge Ponds	Inactive Flyash Pile	South Field	Active Flyash Pile
SOIL				
cesium-137 neptunium-237 radium-226 radium-228 thorium-228 thorium-230 technetium-99 plutonium-238 uranium-234 uranium-235/236 uranium-238 arsenic beryllium chromium benzo(a)pyrene benzo(b)fluoranthene carbazole 4,4-DDE dibenzo(a,h)anthracene indeno(1,2,3-cd)pyrene	cesium-137 neptunium-237 radium-226 radium-228 thorium-228 thorium-230 uranium-234 uranium-235/236 uranium-238 arsenic beryllium Aroclor-1254 benzo(a)anthracene benzo(a)pyrene benzo(b)fluoranthene dibenzo(a,h)anthracene indeno(1,2,3-cd)pyrene	cesium-137 neptunium-237 radium-226 radium-228 thorium-228 uranium-234 uranium-235/236 uranium-238 arsenic beryllium dibenzo(a,h)anthracene	cesium-137 neptunium-237 radium-226 radium-228 thorium-228 thorium-230 thorium-232 uranium-234 uranium-235/236 uranium-238 arsenic beryllium chromium Aroclor-1254 Aroclor-1260 benzo(a)anthracene benzo(a)pyrene benzo(b)fluoranthene benzo(k)fluoranthene dibeno(a,h)anthracene dieldrin indeno(1,2,3-cd)pyrene	neptunium-237 radium-226 radium-228 thorium-228 uranium-234 uranium-235/236 uranium-238 arsenic beryllium
GROUNDWATER				
no COCs	no COCs	uranium-234 uranium-235/236 uranium-238	uranium-234 uranium-235/236 uranium-238	uranium-234 uranium-238
PERCHED GROUNDWATER				
technetium-99 carbazole	no COCs	no COCs	no COCs	no COCs

However, the desired future use alternatives 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, and 3) off-property farmers (adult and child).

4.2.2.2 Current Land Use Without Access Controls

A second current land use scenario assumes the FEMP site no longer maintains access controls and therefore, the grazing of cattle is assumed to occur on the site. For this scenario, an additional receptor is assumed plausible. This 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 ($1x10^{-4}$). These risks were dominated by external radiation from thorium-228 and radium-226 and dermal contact with beryllium in soil. The HIs of systematic toxic effects from each subunit to the groundskeeper were well below 1.0. Calculated risks to the off-property farmers (adult and child) approached a range on the order of one in a million ($1x10^{-6}$) to one in a billion ($1x10^{-9}$). Total HIs for both the adult and child were well below 1.0, therefore, no increased risk from the noncarcinogenic toxic effects is predicted.

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 and 2) off-property farmers (adult and child).

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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
Solid Waste Landfill	Carcinogenic	$1.6x10^{-5}$	$2.4x10^{-5}$	$4.6x10^{-8}$	$6.2x10^{-9}$	$3.9x10^{-7}$
	Noncarcinogenic	$3.9x10^{-1}$	$1.4x10^{-1}$	$5.5x10^{-6}$	$2.6x10^{-5}$	$6.1x10^{-5}$
Lime Sludge Ponds	Carcinogenic	$2.8x10^{-5}$	$4.7x10^{-5}$	$2.3x10^{-7}$	$4.9x10^{-8}$	$5.5x10^{-6}$
	Noncarcinogenic	$2.1x10^{-1}$	$1.4x10^{-1}$	$1.1x10^{-4}$	$2.0x10^{-4}$	$1.8x10^{-3}$
Inactive Flyash Pile	Carcinogenic	$3.3x10^{-5}$	$5.0x10^{-5}$	$8.6x10^{-8}$	$8.3x10^{-9}$	$3.2x10^{-8}$
	Noncarcinogenic	$1.2x10^{-1}$	$4.5x10^{-2}$	$3.1x10^{-5}$	$1.3x10^{-4}$	$7.2x10^{-5}$
South Field	Carcinogenic	$8.0x10^{-5}$	$6.5x10^{-4}$	$7.0x10^{-7}$	$3.0x10^{-7}$	$4.2x10^{-6}$
	Noncarconogenic	$3.6x10^{-1}$	$4.1x10^{-2}$	$1.2x10^{-5}$	$4.9x10^{-5}$	$1.7x10^{-5}$
Active Flyash Pile	Carconogenic	$6.5x10^{-5}$	$9.2x10^{-5}$	$1.7x10^{-6}$	$5.0x10^{-7}$	$6.5x10^{-6}$
	Noncarconogenic	$1.1x10^{-1}$	$9.9x10^{-2}$	$4.2x10^{-3}$	$1.6x10^{-2}$	$4.7x10^{-2}$

[a]The carconogenic risk value is the Incremental Lifetime Cancer Risk (ILCR) and the noncarcinogenic value is the Hazard Index (HI).

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 receptor under this scenario for each of the five subunits is the expanded trespasser which had a carcinogenic risk range on the order of one in ten thousand ($1x10^{-4}$) to one in one-hundred thousand ($1x10^{-5}$). Major contributors to risk include external radiation from thorium-228 and radium-228 and dermal contact with beryllium in soil. The HIs from each subunit to the expanded trespasser were below 1.0. Calculated risks to the off-property farmers (adult and child) approached a range on the order of one in ten thousand ($1x10^{-4}$) to one in one-hundred million ($1x10^{-8}$). Both receptors 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 and that all access controls are discontinued and 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, and 4) perched groundwater user. The RME on-property farmer receptor includes more conservative exposure conditions than the CT on-property farmer which represents typical conditions. Recreational users (adult and child) of the Great Miami River were also evaluated for the future whether the FEMP site is maintained by the federal government or changes to agricultural use.

Table 4-4 summarizes the risks and hazards posed to the receptors of the future land use assuming private ownership scenario. The maximally exposed receptor by each of the five subunits under this scenario is the RME on-property farmer with carcinogenic risks on the order of one in one thousand ($1x10^{-3}$). The risks were primarily due to external radiation from radium-228 and thorium-228, and dermal contact with beryllium in soil. Total HIs from four subunits exceed 1.0 (Inactive Flyash Pile, Active Flyash Pile, South Field, and Solid Waste Landfill) due mostly to ingestion of total uranium in groundwater.

4.2.3 Background Risks

All subunit-specific risks in the Operable Unit 2 Baseline Risk Assessment were calculated without accounting for the potential contribution from natural background concentrations of COCs. In many

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	4.4×10^{-5}	1.3×10^{-6}	1.5×10^{-7}
	Noncarcinogenic	7.4×10^{-1}	1.3×10^{-4}	6.1×10^{-4}
Lime Sludge Ponds	Carcinogenic	9.8×10^{-5}	2.4×10^{-7}	5.0×10^{-8}
	Noncarcinogenic	6.3×10^{-1}	1.1×10^{-4}	2.0×10^{-4}
Inactive Flyash Pile	Carcinogenic	1.2×10^{-4}	6.6×10^{-5}	3.2×10^{-6}
	Noncarcinogenic	4.0×10^{-1}	1.3	3.4
South Field	Carcinogenic	2.2×10^{-4}	8.1×10^{-5}	1.2×10^{-5}
	Noncarconogenic	3.8×10^{-1}	1.1	2.7
Active Flyash Pile	Carconogenic	2.4×10^{-4}	9.2×10^{-6}	8.7×10^{-7}
	Noncarconogenic	2.8×10^{-1}	1.9×10^{-1}	7.1×10^{-1}

[a]The carconogenic 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

Waste Subunit	Risk Type[a]	On-Property Farmer (RME)[b]	On-Property Resident Farmer (CT)[c]	On-Property Resident Child	Home Builder	Perched Groundwater User (Adult)	Perched Groundwater User (Child)	Great Miami River User (Adult)	Great Miami River User (Child)
Solid Waste Landfill	Carcinogenic	$1.2x10^{-3}$	$8.8x10^{-5}$	$1.2x10^{-4}$	$5.1x10^{-6}$	$5.3x10^{-3}$	$1.1x10^{-3}$	$1.0x10^{-5}$	$4.2x10^{-6}$
	Noncarcinogenic	1.5	$3.0x10^{-1}$	3.3	1.9	NA	NA	$1.4x10^{-1}$	$1.7x10^{-1}$
Lime Sludge Ponds	Carcinogenic	$1.9x10^{-3}$	$1.7x10^{-4}$	$2.1x10^{-4}$	NA[d]	$7.7x10^{-7}$	$1.4x10^{-7}$	NA	NA
	Noncarcinogenic	$2.6x10^{-1}$	$1.4x10^{-1}$	1.3	NA	$6.0x10^{-3}$	$1.2x10^{-2}$	NA	NA
Inactive Flyash Pile	Carcinogenic	$3.2x10^{-3}$	$2.7x10^{-4}$	$3.3x10^{-4}$	NA	NA	NA	$2.5x10^{-5}$	$8.2x10^{-6}$
	Noncarcinogenic	$2.3x10^{+1}$	$1.3x10^{+1}$	$5.8x10^{+1}$	NA	NA	NA	$3.8x10^{-1}$	$2.4x10^{-2}$
South Field	Carcinogenic	$3.8x10^{-3}$	$3.1x10^{-4}$	$4.5x10^{-4}$	$2.7x10^{-7}$	NA	NA	$1.1x10^{-4}$	$6.3x10^{-5}$
	Noncarconogenic	$2.2x10^{+1}$	$1.3x10^{+1}$	$5.7x10^{+1}$	0.1	NA	NA	$4.2x10^{-2}$	$6.3x10^{-2}$
Active Flyash Pile	Carconogenic	$1.9x10^{-3}$	$1.7x10^{-4}$	$6.0x10^{-4}$	NA	NA	NA	$1.3x10^{-4}$	$6.5x10^{-5}$
	Noncarconogenic	2.1	1.1	8.0	NA	NA	NA	0.2	0.2

[a]The carconogenic 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]NA - The indicated receptor is not applicable to the waste subunit.

cases, COCs in soil were only slightly above natural background concentrations; however, the risks and HIs for these site-related concentrations were often greater than one in a million ($1x10^{-6}$) and 1.0, respectively. Background contributions provide a useful point of comparison for subunit-specific risk estimates.

Substituting background COC levels in place of contaminant levels found in Operable Unit 2, resulted in a carcinogenic risk for the future on-property RME farmers on the order of one in ten thousand ($1x10^{-4}$) or greater. The most important components of risk were external radiation from radium-226, radium-228, and thorium-228. Other important risk components were ingestion of, and dermal contact with, arsenic and beryllium in soil.

4.2.4 Uncertainties

Every quantitative risk assessment is subject to sources of uncertainty. To ensure that risk is not underestimated and that human health is protected, CERCLA guidance and the conventions followed in this report 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 certain 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, hence conservatism, 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, having the potential to overestimate risk by two orders of magnitude or more. For example, if the risk is estimated on the order of one in a million ($1x10^{-6}$), an overestimate of two orders of magnitude, would reduce the risk to one in one-hundred million ($1x10^{-8}$).

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 ($1x10^{-4}$) 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. Other important results of the background evaluation is the determination that radium-228 and beryllium constitute 81 percent of the background risk. The background risk for these parameters is equal to or less than an order of magnitude of the risk from Operable Unit 2 subunits.

4.3 BASELINE ECOLOGICAL RISK ASSESSMENT

The Operable Unit 2 subunits would be remediated to meet cleanup levels based upon the human health risk assessment. It is necessary to ensure that any remaining contaminant concentrations are also protective in the long-term of ecological receptors. Projected COC residuals remaining after remedial alternatives, were compared to contaminant-specific benchmark criteria determined to be protective of ecological receptors. The selected benchmark values were derived from state and federal water criteria, soil concentrations, and toxicity studies. If the projected residual concentration was less than the benchmark value, then the proposed remedial alternative would be successful in reducing the likelihood that residual contaminants would adversely impact ecological receptors.

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 active measures considered, may present a current or potential threat to public health and welfare or the environment.

5.0 SUMMARY OF ALTERNATIVES

Section 5.0 identifies and provides a description of each of the remedial action alternatives studied in the detailed analysis phase of the FS Report. 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. These technologies include: soil washing, vitrification, solidification, stabilization, perched groundwater collection, capping, and disposal facilities.

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
- Non-toxic waste and other waste exempt from OEPA solid waste regulations
  - Flyash/bottom ash
  - Lime sludge
  - Construction debris
- 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/residual radioactive material are wastes produced from DOE activities that contain radiological components and that are not high-level radioactive waste, spent nuclear fuel, transuranic wastes, or byproduct material. Residual radioactive materials can be released from Federal control if the radioactivity is below cleanup levels or 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. Several exemptions are provided in Section 5.1.3.

5.1.3 Non-Toxic Exempted Waste

The following wastes are considered exempted waste (from OEPA Solid Waste Disposal Regulations):

- Non-toxic flyash/bottom ash - These wastes are considered non-toxic if its leachate does not exceed 30 times the Ohio Drinking Water Standard for arsenic, barium, cadmium, chromium, lead, mercury and selenium. OEPA Policy 4.07 provides requirements for disposal units of exempted wastes.
- Lime sludge - Lime sludge and other material resulting from the treatment of a water supply for drinking or industrial purposes are not required to meet solid waste regulations.
- Construction debris - Construction wastes and debris are not required to meet the OEPA solid waste regulations.

5.1.4 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. The FEMP, with approximately 2,500 employees and subcontractors, has just exceeded the 50 pounds per month level. The previous number of employees are well below this number. Past disposal of infectious wastes in the Solid Waste Landfill is considered to be solid waste based on generation of less than 50 pounds per month. Currently accumulated infectious waste is disposed of at an off-site facility.

5.1.5 Hazardous Waste

Hazardous waste is any contaminant that is either listed by EPA in the Resource, Conservation, and Recovery (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 the RCRA.

No known listed wastes were disposed 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. One exception is the South Field firing range which contains lead bullets. While the lead bullets are not considered waste if they stay in the soil, the firing range material may be managed as hazardous waste under RCRA if the material is excavated and actively managed for disposal.

5.1.6 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.

5.2 GENERAL DESCRIPTION OF REMEDIAL COMPONENTS

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

5.2.1 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 field screened for radioactivity to provide protection of on-site workers and to segregate waste materials, as needed.

5.2.2 Consolidation and In Situ Containment

In situ 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 minimize potential of contaminants being transported in storm water run-off;
- to reduce storm water infiltration to minimize transport of contaminants to the groundwater; and
- to minimize the potential of direct human contact with the waste material.

The design and construction of the in situ cap is dependent on the level of protectiveness needed and the regulatory classification of the waste. Figure 5-1 illustrates what in situ containment may look like.

5.2.3 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 a disposal facility. The landfill liner and cover (cap) design would be based upon the level of protectiveness needed and the regulatory classification of the waste. On-site disposal is considered if more protection is required (i.e., a bottom liner, different geology) than in situ containment (i.e., capping in place). Figure 5-2 illustrates what a disposal facility may look like.

Off-site disposal consists of transporting contaminated material from a subunit to engineered disposal facilities located off site. Operable Unit 2 waste for off-site disposal must meet an off-site facility's waste acceptance criteria. Once it is demonstrated that the criteria are met, material would be transported by railroad or truck to the selected facility.

5.2.4 Drying

Drying would be used to remove excess moisture from a media, such as soil. The process would be used to prepare the media 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.

5.2.5 Vitrification

Vitrification is a treatment process used to encapsulate contaminated material in a glass product. The addition of silica would be required to create the glass product for most Operable Unit 2 wastes. Treatability studies are required to determine system requirements and efficiencies. Vitrification reduces the amount of waste material and the potential mobility of the contaminants. Operable Unit 2 proposes the use of a mobile vitrification facility due to the small amount of material to be vitrified and the ease of preparation. The mobile unit would be self-contained in trailers and positioned near the subunit proposing its use.

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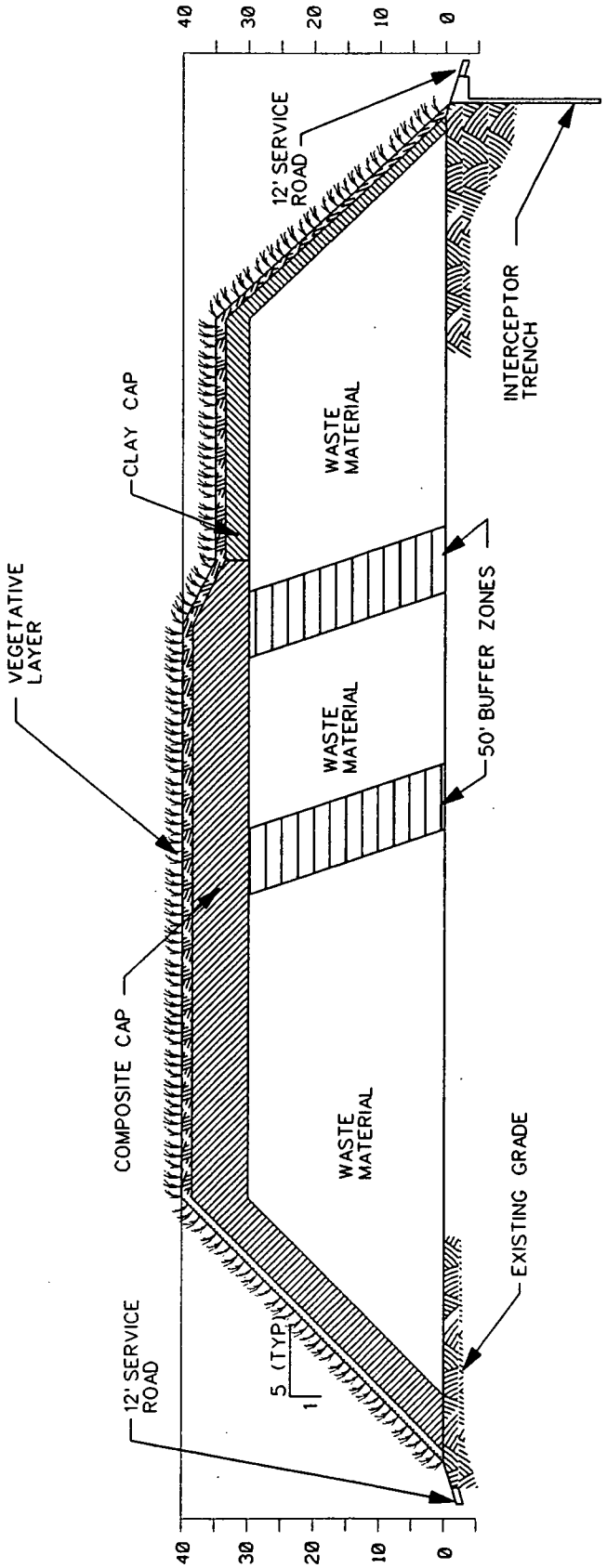

FIGURE 5-1
TYPICAL SECTION CONSOLIDATION AND IN-SITU CONTAINMENT
(NOT TO SCALE)

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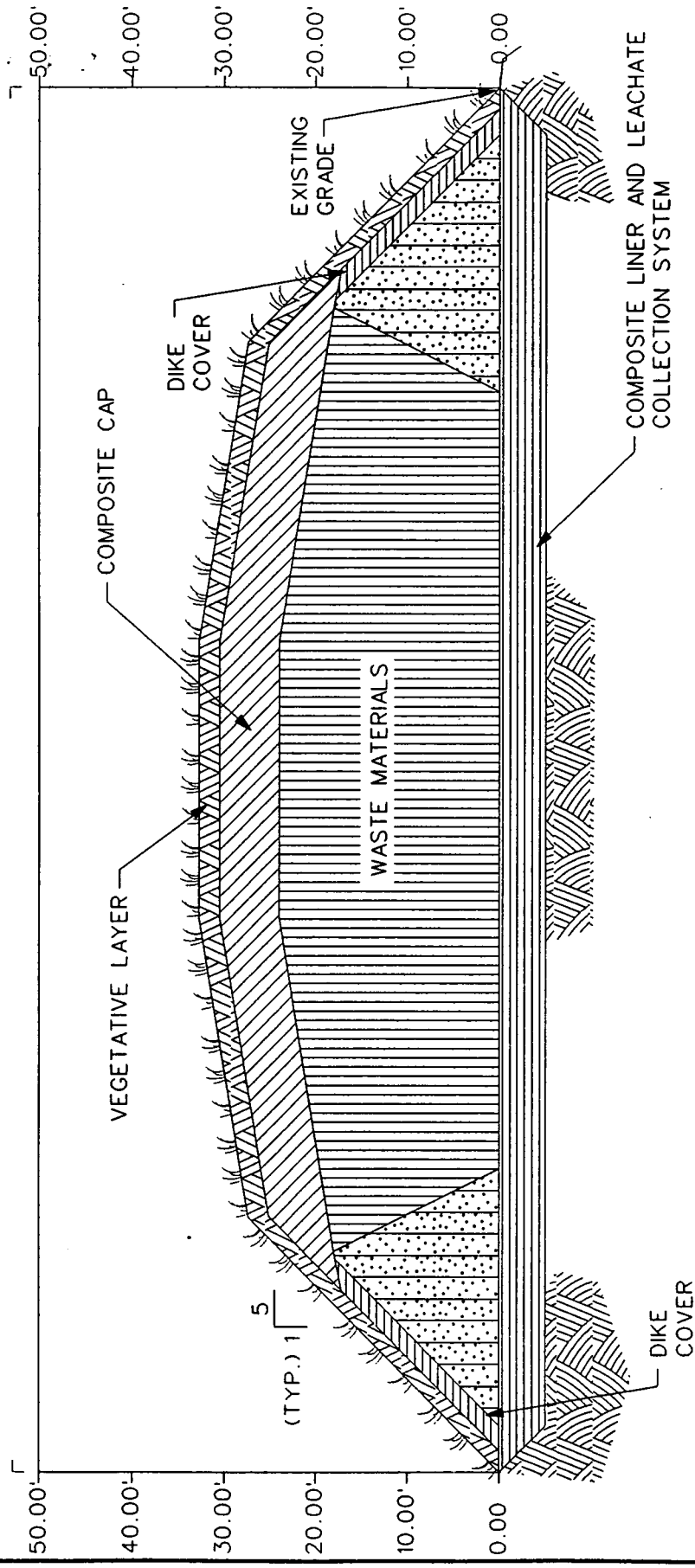

FIGURE 5-2
TYPICAL SECTION ON-SITE DISPOSAL CELL
(NOT TO SCALE)

5.2.6 Solidification

Solidification involves the physical binding or attaching of the removed waste material to a binder material in order to prevent contaminants in the waste from leaching into the soil or groundwater once the material is disposed. The binder to be used for the Operable Unit 2 subunits would be portland cement. The exact combination of waste material and portland cement would be determined through treatability studies. Solidification would be performed in an area adjacent to the on-site disposal facility.

5.2.7 Soil Washing

The soil washing process utilizes physical separation and chemical extraction for the removal of contaminants from soil. Soil washing would be performed at Operable Unit 5's soil washing facility. Removal of uranium is the primary goal of the proposed soil washing, which is currently under development at the FEMP. Different chemical solutions are being tested to determine the solution that best reduces contaminant mobility and levels and minimizes the increase in volume of material. Treatability studies to determine process requirements and efficiencies for specific Operable Unit 2 waste material would be required. Depending upon the effectiveness of the process and the cleanup levels, the decontaminated soil would be returned to the site or would undergo further treatment. Soil containing COCs in addition to uranium might also undergo additional treatment before being returned to the site. These requirements are currently under review.

5.2.8 Stabilization

Stabilization would be performed by mixing the lime sludge from the Lime Sludge Ponds with the flyash from the Active and Inactive Flyash Piles. This would create a material that exhibits reduced permeability and leachability. Stabilization would be performed in an area adjacent to the on-site disposal facility.

5.2.9 Perched Groundwater Collection System

A perched groundwater collection system would be required for some alternatives. The collection system would remove perched groundwater encountered during remedial activities and to 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 perched

groundwater would then be safely discharged in compliance with the site's National Pollutant Discharge Elimination System (NPDES) permit.

5.2.10 Costs

Costs consist of capital costs and operation 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 the remedial action objectives are achieved. For purposes of the cost estimate, a maximum duration of 30 years is used.

5.3 OPERABLE UNIT 2 CLEANUP LEVELS

Cleanup levels are concentration levels for the COCs in the waste and soil that will maintain the risk to human receptors in the EPA target range of one in ten thousand (10^{-4}) to one in a million (10^{-6}).

A multi-step process was followed to develop the Operable Unit 2 cleanup levels also known as Proposed Remedial Levels (PRLs). The first step of the process was to develop risk-based Preliminary Remedial Goals (PRGs) which are levels based on results of the baseline risk assessment (see Section 4.0 of this Proposed Plan) that are protective of human health. Risk-based PRGs were then modified based on a number of factors including future land use, 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. Like the baseline risk assessment, two future land use scenarios were evaluated: 1) federal ownership which assumes that the government retains ownership of the site and maintains access controls, and 2) private ownership which assumes that the site reverts to agricultural property (with no access controls) and is used for farming. The receptors evaluated for each of the land use scenarios were as follows:

- Federal Ownership
  - expanded trespasser
  - off-property farmer
- Private Ownership
  - on-property farmer
  - off-property farmer

To allow for a more accurate estimate of the amount of material that needs to be "cleaned up" and cost for the cleanup, the PRLs were used to evaluate the alternatives in the Operable Unit 2 FS. PRLs are the levels which are achieved by adding the background concentration level to the modified PRG level for a specific COC. 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 for the preferred alternatives are based on the following modifiers:

- Federal ownership;
- Access controls;
- Installation of cap; and
- Control and removal of perched water.

The PRLs for the preferred remedial alternatives are provided in Tables 5-1 through 5-3.

5.4 OPERABLE UNIT 2 REMEDIAL ALTERNATIVES

As the wastes vary in Operable Unit 2, a separate set of remedial alternatives has been developed for each subunit. Table 5-4 lists the remedial alternatives being considered for each subunit. Included in the alternative descriptions are the engineering and institutional controls that would be required, estimates of the quantities to be handled, and estimates of implementation time and costs.

5.4.1 No Action Alternative for All Subunits

The first alternative for each of the subunits is the no action alternative. This alternative is retained throughout the FS process as required by the National Contingency Plan (40 CFR §300.430(e)(6)). This alternative provides a comparative baseline against which other alternatives can be evaluated. Under this alternative, no remedial action will be taken, and the material is considered to 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 the volume of contamination at the site. The contents of the subunit would remain in place. In addition, this alternative does not provide monitoring of soil or groundwater nor does it provide access restrictions or deed restrictions to limit exposure to the waste material.

5.4.2 Solid Waste Landfill Remedial Alternatives

This section presents the four alternatives that were evaluated for the Solid Waste Landfill during the detailed analysis phase of the Operable Unit 2 FS. Post-remediation risk due to COCs present at the

TABLE 5-1

SUMMARY OF OPERABLE UNIT 2 MODIFIED SOIL PRELIMINARY REMEDIAL GOALS (PRGs)[a] FOR THE EXPANDED TRESPASSER WITH ADMINISTRATIVE CONTROLS

COC	ADMINISTRATIVE CONTROLS Expanded Trespasser (pCi/g or mg/kg)			ARAR/ TBC	Background 95th %
	10^{-4} ILCR[b]	10^{-5} ILCR	10^{-6} ILCR		
CARCINOGENIC					
Cesium-137	1.1E+2	1.1E+1	1.1		0.849
Neptunium-237	5.0E+2	5.0E+1	5.0		0.0
Plutonium-238	1.8E+4	1.8E+3	1.8E+2		0.0
Radium-226	1.2E+4	1.2E+3	1.2E+2	5[c]	1.47
Radium-228	77	7.7E+0	7.7E-1	5[c]	1.170
Thorium-228	39	3.9E+0	3.9E-1		1.341
Thorium-230	1.1E+5	1.1E+4	1.1E+3	5[d]	1.897
Thorium-232	1.1E+5	1.1E+4	1.1E+3	5[d]	1.269
Uranium-234	1.1E+5	1.1E+4	1.1E+3		1.037
Uranium-235/236	9.1E+2	9.1E+1	9.1		0.142
Uranium-238	5.6E+3	5.6E+2	5.6E+1		1.122
Arsenic	1.9E+3	1.9E+2	1.9E+1		9.704
Beryllium	4.8E+2	4.8E+1	4.8		0.6
Chromium	1.5E+5	1.5E+4	1.5E+3		17.057
Benzo(a)anthracene	4.7E+3	4.7E+2	4.7E+1		0.0
Benzo(a)pyrene	7.0E+2	7.0E+1	7.0		0.0
Benzo(b)fluoranthene	5.7E+3	5.7E+2	5.7E+1		0.0
Benzo(k)fluoranthene	1.3E+4	1.3E+3	1.3E+2		0.0
Dibenzo(a,h)anthracene	6.3E+2	6.3E+1	6.3		0.0
Indeno(1,2,3-cd)pyrene	2.6E+3	2.6E+2	2.6E+1		0.0
Aroclor-1254	3.5	3.5E-1	3.5E-2		0.0
Aroclor-1260	3.5	3.5E-1	3.5E-2		0.0
Dieldrin	7.6E+3	7.6E+2	7.6E+1		0.0

COC	ADMINISTRATIVE CONTROLS Expanded Trespasser (pCi/g or mg/kg)			ARAR/ TBC	Background 95th %
	HI[e] = 0.1	HI = 0.2	HI = 1.0		
CARCINOGENIC					
Arsenic	2.0E+2	4.1E+2	2.0E+3		5.78
Uranium - Total	3.8E+1	7.7E+1	3.8E+3		2.54 mg/kg

[a]Modified soil PRGs in this table represent the minimum PRGs for any of the Operable Unit 2 subunits. Specific subunits modified soil PRGs for the expanded trespasser are presented in Appendix C.
[b]ILCR - Incremental Lifetime Cancer Risk
[c]First 15 cm (i.e., 6 inches) depth (40 CFR 192) for radium-226 + 5 progeny.
[d]First 15 cm (i.e., 6 inches) depth [DOE Order 5400.5 Chapter IV (4)(a)(2),(3)] TBC.
[e]HI - Hazard Index

TABLE 5-2

ACTIVE FLYASH PILE MODIFIED SOIL PRGS AND PRLS PROTECTIVE OF THE GREAT MIAMI AQUIFER USING A CAP

COCs Impacting Groundwater	Modified Soil PRG-Carcinogenic Risk Based[a] (pCi/g)			Background (pCi/g)	PRLs[a] [PRG+Background (pCi/g)]		
	10^{-4} ILCR[b]	10^{-5} ILCR	10^{-6} ILCR		10^{-4} ILCR	10^{-5} ILCR	10^{-6} ILCR
Source Material Over the Great Miami Aquifer and on the Terrace Face							
Uranium-234	11000	1090	99.8	1.04	11000	1090	100.8
Uranium-238	6190	611	53.7	1.12	6190	612	54.8
Source Material on the Top of the Terrace (Glacial Till)							
Uranium-234	404000	40100	3620	1.04	404000	40100	3620
Uranium-238	228000	22400	1930	1.12	228000	22400	1930

[a]Modified soil PRGs and PRLs are given for off-property farmer.

[b]ILCR - Incremental Lifetime Cancer Risk

TABLE 5-3

MODIFIED SOIL PRGS AND PRLS PROTECTIVE OF THE GREAT MIAMI AQUIFER USING A CAP AND ENGINEERING CONTROLS FOR PERCHED WATER

COCs Impacting Groundwater	Modified Soil PRG-Carcinogenic Risk Based[a] (pCi/g)			Background (pCi/g)	PRLs[a] [PRG+Background (pCi/g)]		
	10^{-4} ILCR[b]	10^{-5} ILCR	10^{-6} ILCR		10^{-4} ILCR	10^{-5} ILCR	10^{-6} ILCR
INACTIVE FLYASH PILE							
Source Material Over the Great Miami Aquifer and on the Terrace Face							
Uranium-234	16500	1640	155	1.04	16500	1640	156
Uranium-235/236	16500	1640	164	0.14	16500	1640	164
Uranium-238	9290	919	8.23	1.12	9290	920	9
Source Material on the Terrace Face							
Uranium-234	254000	25200	2330	1.04	254000	25200	2330
Uranium-235/236	255000	25400	2540	0.14	255000	25400	2540
Uranium-238	144000	14100	1210	1.12	144000	14100	1210
SOUTH FIELD							
Source Material Over the Great Miami Aquifer and on the Terrace Face							
Uranium-234	68400	6810	667	1.04	68400	6810	668
Uranium-235/236	68100	6810	681	0.14	68100	6810	681
Uranium-238	38500	3840	367	1.12	38500	3840	368
Source Material on the Top of the Terrace (Glacial Till)							
Uranium-234	4120000	418000	40300	1.04	4120000	418000	40300
Uranium-235/236	4170000	417000	41700	0.14	4170000	417000	41700
Uranium-238	2350000	235000	21800	1.12	2350000	235000	21800

[a]Modified soil PRGs and PRLs are given for off-property farmer.

[b]Incremental Lifetime Cancer Risk

TABLE 5-4

SUMMARY OF OPERABLE UNIT 2 SUBUNIT ALTERNATIVES

Operable Unit 2 Subunit	Alternative	Description
Solid Waste Landfill	1	No Action
	2	Off-Site Disposal
	3	On-Site Disposal
	4	Consolidation/Containment
Lime Sludge Ponds	1	No Action
	2	Off-Site Disposal
	3	On-Site Disposal
	4	In Situ Containment
	5	On-Site Disposal with Lime Sludge Stabilization
Inactive Flyash Pile	1	No Action
	2	Off-Site Disposal
	3	On-Site Disposal
	4	Vitrification and On-Site Disposal with Flyash Stabilization
	5	Solidification and On-Site Disposal with Flyash Stabilization
	6	Soil Washing and On-Site Disposal with Flyash Stabilization
	7	Consolidation/Containment
	8	On-Site Disposal with Flyash Stabilization
South Field	1	No Action
	2	Off-Site Disposal
	3	On-Site Disposal
	4	Vitrification and On-Site Disposal
	5	Solidification and On-Site Disposal
	6	Soil Washing and On-Site Disposal
	7	Consolidation/Containment
Active Flyash Pile	1	No Action
	2	Off-Site Disposal
	3	On-Site Disposal
	4	On-Site Disposal with Flyash Stabilization
	5	Consolidation/Containment

remediated Solid Waste Landfill were not estimated since all alternatives would eliminate any potential exposures to surface soil and the groundwater is not impacted.

5.4.2.1 Alternative 1: No Action

See discussion above in Section 5.4.1.

5.4.2.2 Alternative 2: Off-Site Disposal

Contaminated material with concentrations above the private ownership scenario cleanup levels in the Solid Waste Landfill area would be excavated. This material would be visually segregated, staged, shredded or crushed, as appropriate, packaged, and disposed of at an off-site disposal facility. The excavated area would be backfilled with clean material, regraded, and revegetated. Water generated during the remedial action would be pumped to the AWWT facility.

- Capital Cost: $146,046,600
- O&M Costs: $0
- Present Worth: $146,046,600
- Months to implement: 24.5
- Quantity of waste: 79,300 cubic yards

5.4.2.3 Alternative 3: On-Site Disposal

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Solid Waste Landfill area would be excavated. The material would be visually segregated, staged, shredded or crushed, as appropriate, and deposited in an on-site disposal facility. The excavated area would be managed as discussed in Alternative 2. Water generated during the remedial action and leachate from the disposal facility would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility.

- Capital Cost: $6,768,800
- O&M Costs: $1,403,600
- Present Worth: $8,172,200
- Months to implement: 12.5
- Quantities of waste: 16,200 cubic yards

5.4.2.4 Alternative 4: Consolidation/Containment

The contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Solid Waste Landfill area would be consolidated and capped. Water generated during the

remedial action would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the capped Solid Waste Landfill area.

- Capital Cost: $4,982,700
- O&M Costs: $2,159,600
- Present Worth: $7,141,700
- Months to implement: 14.5
- Quantities of waste: 23 cubic yards

5.4.3 Lime Sludge Ponds Remedial Alternatives

This section presents the five alternatives that were evaluated for the Lime Sludge Ponds during the detailed analysis phase of the Operable Unit 2 FS. Post-remediation risk due to COCs present at the Lime Sludge Ponds was not estimated since all alternatives would eliminate any potential exposures to surface soil and the groundwater is not impacted.

5.4.3.1 Alternative 1: No Action

See discussion above in Section 5.4.1.

5.4.3.2 Alternative 2: Off-Site Disposal

Contaminated material with concentrations above the private ownership scenario cleanup levels in the Lime Sludge Pond area would be excavated. This material would be staged, dried as necessary, packaged, and disposed of at an off-site disposal facility. The excavated area would be backfilled with clean material, regraded, and revegetated. Water generated during the remedial action would be pumped to the AWWT facility.

- Capital Cost: $55,149,900
- O&M Costs: $0
- Present Worth: $55,149,900
- Months to implement: 16.5
- Quantities of waste: 35,500 cubic yards

5.4.3.3 Alternative 3: On-Site Disposal

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Lime Sludge Pond area would be excavated. This material would be dried as necessary and deposited in an on-site disposal facility. The excavated area would be managed as discussed in Alternative 2. Water generated during the remedial action and leachate from the disposal facility would be pumped

to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility.

- Capital Cost: $6,302,300
- O&M Costs: $1,483,400
- Present Worth: $7,785,400
- Months to implement: 14.5
- Quantities of waste: 16,500 cubic yards

5.4.3.4 Alternative 4: In Situ Containment

The lime sludge and contaminated material above the Federal ownership scenario cleanup levels in the Lime Sludge Pond area would be consolidated and capped. The K-65 Slurry Line trench would be relocated to allow construction of the cap. Debris from the K-65 Slurry Line (concrete and piping) will be crushed/shredded and placed in the Lime Sludge Ponds with the contaminated material for capping. Water generated during the remedial action would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the capped Lime Sludge Pond area.

- Capital Cost: $9,054,900
- O&M Costs: $2,389,800
- Present Worth: $11,444,500
- Months to implement: 15.5
- Quantities of waste: 150 cubic yards

5.4.3.5 Alternative 5: On-Site Disposal with Lime Sludge Stabilization

The lime sludge and contaminated material above the Federal ownership scenario cleanup levels would be excavated and staged, the lime sludge would be stabilized, and both materials would be deposited in an on-site disposal facility. The excavated area would be managed as discussed in Alternative 2. Water generated during the remedial action and leachate from the disposal facility would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility.

- Capital Cost: $7,751,600
- O&M Costs: $1,483,400
- Present Worth: $9,234,600
- Months to implement: 39
- Quantities of waste: 18,200 cubic yards

5.4.4 Inactive Flyash Pile Remedial Alternatives

This section presents the eight alternatives that were evaluated for the Inactive Flyash Pile during the detailed analysis phase of the Operable Unit 2 FS.

5.4.4.1 Alternative 1: No Action

See discussion above in Section 5.4.1

5.4.4.2 Alternative 2: Off-Site Disposal

Contaminated material with concentrations above the private ownership scenario cleanup levels in the Inactive Flyash Pile area would be excavated. This material would be visually segregated, staged, packaged, and disposed at an off-site disposal facility. The excavated area would be backfilled with clean material, regraded, and revegetated. Water generated during the remedial action would be pumped to the AWWT facility. Because all contamination would be removed, there is no post-remediation risk associated with this alternative.

- Capital Cost: $136,687,600
- O&M Costs: $0
- Present Worth: $136,687,600
- Months to implement: 25
- Quantities of waste: 103,000 cubic yards

5.4.4.3 Alternative 3: On-Site Disposal

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Inactive Flyash Pile area would be excavated and visually segregated into flyash, soil, and debris. Debris would be shredded/crushed, as appropriate, and all material would be deposited in an on-site disposal facility. The excavated area would be managed as discussed in Alternative 2. Water generated during the remedial action, perched groundwater collected during and after remediation, and leachate from the disposal facility would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk associated with this alternative is 4.7×10^{-6} for the expanded trespasser and 3.6×10^{-6} for the off-property farmer. The HI is less than 1.0 for both scenarios.

- Capital Cost: $28,698,600
- O&M Costs: $1,403,600
- Present Worth: $30,102,100
- Months to implement: 33.5
- Quantities of waste: 100,400 cubic yards

5.4.4.4 Alternative 4: Vitrification and On-Site Disposal with Flyash Stabilization

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Inactive Flyash Pile area would be excavated and visually segregated into flyash, soil, and debris. Flyash would be staged, stabilized, and deposited in an on-site disposal facility. The contaminated soil would be staged and screened for radioactivity. The soil that is above the expanded trespasser cleanup levels would be vitrified and deposited with the remaining soil in an on-site disposal facility. The debris would be managed as discussed in Alternative 3 with the excavated area managed as discussed in Alternative 2. Water generated during the remedial action, perched groundwater collected during and after remediation, and leachate from the disposal facility would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk and hazard associated with this alternative are the same as Alternative 3.

- Capital Cost: $416,539,400
- O&M Costs: $1,403,600
- Present Worth: $417,942,800
- Months to implement: 33.5
- Quantities of waste: 104,800 cubic yards

5.4.4.5 Alternative 5: Solidification and On-Site Disposal with Flyash Stabilization

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Inactive Flyash Pile area would be excavated and visually segregated into flyash, soil, and debris. Flyash would be staged, stabilized, and deposited in an on-site disposal facility. The contaminated soil would be staged and screened for radioactivity, and if found to be above the expanded trespasser cleanup level, would be solidified and deposited in the on-site disposal facility. The remaining contaminated soil would be deposited in the same disposal facility. The debris would be managed as discussed in Alternative 3 with the excavated area managed as discussed in Alternative 2. Water generated during the remedial action, perched groundwater collected during and after remediation, and leachate from the disposal facility would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk and hazard associated with this alternative are the same as Alternative 3.

- Capital Cost: $34,044,300
- O&M Costs: $1,447,800
- Present Worth: $35,491,500
- Months to implement: 33.5
- Quantities of waste: 109,500

5.4.4.6 Alternative 6: Soil Washing and On-Site Disposal with Flyash Stabilization

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Inactive Flyash Pile area would be excavated and visually segregated into flyash, soil, and debris. Flyash would be staged, stabilized, and deposited in an on-site disposal facility. The contaminated soil would be staged and screened for radioactivity. The soil that is above the expanded trespasser cleanup levels would be transported to the Operable Unit 5 Soil Washing facility for treatment and subsequent disposal by Operable Unit 5. The residual waste from the soil washing process would be dried, packaged, and disposed at an off-site disposal facility. The remaining soil would be deposited in an on-site disposal facility. The debris would be managed as discussed in Alternative 3, with the excavated area managed as in Alternative 2. Water generated during the remedial action, perched groundwater collected during and after remediation, and leachate from the disposal facility would be collected and pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk and hazard associated with this alternative are the same as Alternative 3.

- Capital Cost: $37,333,100
- O&M Costs: $1,403,600
- Present Worth: $38,736,500
- Months to implement: 33.5
- Quantities of waste: 104,800 cubic yards

5.4.4.7 Alternative 7: Consolidation/Containment

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Inactive Flyash Pile area would be excavated and consolidated in the northern portion of the subunit. A cap would then be constructed over the consolidated material. Water generated during the remedial action and perched groundwater collected during and after remediation would be pumped to the AWWT facility. Institutional controls would include physical barriers, and groundwater monitoring in the capped area. The post-remediation risk and hazard associated with this alternative are the same as Alternative 3.

- Capital Cost: $17,896,500
- O&M Costs: $2,522,500
- Present Worth: $20,419,700
- Months to implement: 34
- Quantities of waste: 100,400 cubic yards

5.4.4.8 Alternative 8: On-Site Disposal with Flyash Stabilization

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Inactive Flyash Pile area would be excavated and visually segregated into flyash, soil, and debris. Flyash would be staged, stabilized, and deposited in an on-site disposal facility. The contaminated soil would be staged and deposited in the on-site disposal facility. The debris would be managed as discussed in Alternative 3, with the excavated area managed as discussed in Alternative 2. Water generated during the remedial action, perched groundwater collected during and after remediation, and leachate from the disposal facility would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk and hazard associated with this alternative are the same as Alternative 3.

- Capital Cost: $34,289,700
- O&M Costs: $1,403,600
- Present Worth: $35,693,000
- Months to implement: 33.5
- Quantities of waste: 104,800 cubic yards

5.4.5 South Field Remedial Alternatives

This section presents the seven alternatives that were evaluated for the South Field during the detailed analysis phase of the Operable Unit 2 FS.

5.4.5.1 Alternative 1: No Action

See discussion above in Section 5.4.1.

5.4.5.2 Alternative 2: Off-Site Disposal

Contaminated material with concentrations above the private ownership scenario cleanup levels in the South Field area would be excavated and visually segregated into contaminated soil and debris. This material would be staged, shredded or crushed as appropriate, dried as necessary, packaged, and disposed at an off-site disposal facility. Any firing range soils that fail the RCRA TCLP test would be managed as a RCRA hazardous waste and disposed at an off-site disposal facility. The excavated area would be backfilled with clean material, regraded, and revegetated. Water generated during the remedial action would be pumped to the AWWT facility. Because all contamination is removed, there would be no post-remediation risk associated with this alternative.

- Capital Cost: $288,190,400
- Months to implement: 50
- O&M Costs: $0
- Quantities of waste: 217,000 cubic yards
- Present Worth: $288,190,400

5.4.5.4 Alternative 3: On-Site Disposal

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the South Field area would be excavated and visually segregated into contaminated soil and debris. The contaminated soil would then be screened for radioactivity. The soil that is below the expanded trespasser cleanup levels would be used as berm material for the on-site disposal facility. The remaining contaminated soil would be disposed in an on-site disposal facility. Any firing range soils that fail the RCRA TCLP test would be managed as a RCRA hazardous waste and disposed at an off-site disposal facility. The debris would be shredded/crushed, as appropriate, and deposited in an on-site disposal facility. Water generated during the remedial action, perched groundwater collected during and after remediation, and leachate from the disposal facility would be pumped to the AWWT facility. The excavated area would be managed as discussed in Alternative 2. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk associated with this alternative is 4.2×10^{-6} for the expanded trespasser and 1.3×10^{-6} for the off-property farmer. The HI is less than 1.0 for both scenarios.

- Capital Cost: $20,769,000
- Months to implement: 23
- O&M Costs: $3,130,400
- Quantities of waste: 49,600 cubic yards
- Present Worth: $23,899,700

5.4.5.4 Alternative 4: Vitrification and On-Site Disposal

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the South Field area would be excavated and visually segregated into soil and debris. The contaminated soil would then be screened for radioactivity. The soil that is below the expanded trespasser cleanup levels would be used as berm material for the on-site disposal facility. The remaining soil would be vitrified and disposed of in an on-site disposal facility. Any firing range soils that fail the RCRA TCLP test would be managed as a RCRA hazardous waste and disposed at an off-site disposal facility. The debris would be managed as discussed in Alternative 3 with the excavated area managed as discussed in Alternative 2. Water generated during the remedial action, perched groundwater collected during and after remediation, and leachate from the disposal facility would be pumped to the

AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk and hazard associated with this alternative are the same as Alternative 3.

- Capital Cost: $209,824,700
- O&M Costs: $3,130,400
- Present Worth: $212,955,500
- Months to implement: 23
- Quantities of waste: 49,600 cubic yards

5.4.5.5 Alternative 5: Solidification and On-Site Disposal

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the South Field area would be excavated and visually segregated into soil and debris. The contaminated soil would then be screened for radioactivity. The soil that is below the expanded trespasser cleanup levels would be used as berm material for the on-site disposal facility. The remaining contaminated soil would be solidified and disposed of in the on-site disposal facility. Any firing range soils that exceed the RCRA TCLP test would be managed as a RCRA hazardous waste and disposed at an off-site disposal facility. The debris would be managed as discussed in Alternative 3 with the excavated area managed as discussed in Alternative 2. Water generated during the remedial action, perched groundwater collected during and after remediation, and leachate from the disposal facility would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk and hazard associated with this alternative are the same as Alternative 3.

- Capital Cost: $21,356,300
- O&M Costs: $3,130,400
- Present Worth: $24,487,200
- Months to implement: 23
- Quantities of waste: 51,100 cubic yards

5.4.5.6 Alternative 6: Soil Washing and On-Site Disposal

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the South Field area would be excavated and visually segregated into soil and debris. The contaminated soil would be staged and screened for radioactivity. The soil that is below the expanded trespasser cleanup levels would be used as berm material for the on-site disposal facility. The remaining contaminated soil would be transported to the Operable Unit 5 Soil Washing facility for treatment and subsequent disposal by Operable Unit 5. The residual waste from the soil washing process would be

dried, packaged, and disposed at an off-site disposal facility. Any firing range soils that fail the RCRA TCLP test would be managed as a RCRA hazardous waste and disposed at an off-site disposal facility. The debris would be managed as discussed in Alternative 3 with the excavated area managed as discussed in Alternative 2. Water generated during the remedial action, perched groundwater collected during and after remediation, and leachate from the disposal facility would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk and hazard associated with this alternative are the same as Alternative 3.

- Capital Cost: $22,375,400
- O&M Costs: $3,130,400
- Present Worth: $25,506,200
- Months to implement: 23
- Quantities of waste: 49,600

5.4.5.7 Alternative 7: Consolidation/Containment

The contaminated material in the southern portion of the South Field with concentrations above the federal ownership scenario cleanup levels would be excavated and consolidated in the northeastern portion of the subunit. Any firing range soils that fail the RCRA TCLP test would be managed as a RCRA hazardous waste and disposed at an off-site disposal facility. The remaining portion of the South Field would be regraded to facilitate construction of a cap over the consolidated portion of the South Field area. Water generated during the remedial action and perched groundwater collected during and after remediation would be pumped to the AWWT facility. Institutional controls would include physical barriers. The post-remediation risk associated with this alternative is 9.5×10^{-6} for the expanded trespasser and 4.1×10^{-7} for the off-property farmer. The HI is less than 1.0 for both scenarios.

- Capital Cost: $10,008,900
- O&M Costs: $1,262,400
- Present Worth: $11,270,500
- Months to implement: 23
- Quantities of waste: 38,100 cubic yards

5.4.6 Active Flyash Pile Remedial Alternatives

This section presents the five alternatives that were evaluated for the Active Flyash Pile during the detailed analysis phase of the Operable Unit 2 FS:

5.4.6.1 Alternative 1: No Action

See discussion above in Section 5.4.1

5.4.6.2 Alternative 2: Off-Site Disposal

Contaminated material with concentrations above the private ownership scenario cleanup levels in the Active Flyash Pile area would be excavated and visually segregated into flyash and soil. These materials would then be staged, dried as necessary, packaged, and disposed of at an off-site disposal facility. The excavated area would be backfilled with clean material, regraded, and revegetated. Water generated during the remedial action would be pumped to the AWWT facility. Because all contamination is removed, there could be no post-remediation risk associated with this alternative.

- Capital Cost: $76,217,800
- O&M Costs: $0
- Present Worth: $76,217,800
- Months to implement: 20
- Quantities of waste: 75,300 cubic yards

5.4.6.3 Alternative 3: On-Site Disposal

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Active Flyash Pile area would be excavated and visually segregated into flyash and soil. These materials would then be staged and deposited in an on-site disposal facility. The excavated area would be managed as discussed in Alternative 2. Water generated during the remedial action and leachate from the disposal facility would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk associated with this alternative is 1.5×10^{-5} for the expanded trespasser and 4.1×10^{-6} for the off-property farmer. The HI is less than 1.0 for both scenarios.

- Capital Cost: $16,021,200
- O&M Costs: $1,443,000
- Present Worth: $17,464,000
- Months to implement: 23.5
- Quantities of waste: 71,700 cubic yards

5.4.6.4 Alternative 4: On-Site Disposal with Flyash Stabilization

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Active Flyash Pile area would be excavated and visually segregated into flyash and soil. Flyash and soil would be staged, the flyash would be stabilized, and both materials would be deposited in an on-

site disposal facility. The excavated area would be managed as discussed in Alternative 2. Water generated during the remedial action and leachate from the disposal facility would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring at the disposal facility. The post-remediation risk and hazard associated with this alternative are the same as Alternative 3.

- Capital Cost: $19,699,500
- O&M Costs: $1,443,000
- Present Worth: $21,142,200
- Months to implement: 23.5
- Quantities of waste: 78,200 cubic yards

5.4.6.5 Alternative 5: Consolidation/Containment

Contaminated material with concentrations above the Federal ownership scenario cleanup levels in the Active Flyash Pile area would be consolidated in the northern portion of the area. A cap would then be constructed over the consolidated material. Water generated during the remedial action and perched groundwater collected would be pumped to the AWWT facility. Institutional controls would include physical barriers and groundwater monitoring in the capped area. The post-remediation risk associated with this alternative is 1.4×10^{-5} for the expanded trespasser and 4.1×10^{-6} for the off-property farmer. The HI is less than 1.0 for both scenarios.

- Capital Cost: $11,763,000
- O&M Costs: $2,388,700
- Present Worth: $14,151,700
- Months to implement: 27
- Quantities of waste: 71,700 cubic yards

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 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 are legally applicable, including permit requirements. This section discusses the applicable or relevant and appropriate requirements for Operable Unit 2.

The definitions of ARARs are:

- Applicable requirements are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site.

- Relevant and appropriate requirements are cleanup standards, standards of control, and other substantive environmental protection requirements criteria, or limitations promulgated under Federal or State law 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.

- "To Be Considered" criteria (TBCs) is a category created by EPA that includes non-promulgated criteria, advisories and guidance issued by Federal or State government that are not legally binding and do not have the status of potential ARARs. However pertinent TBCs will be considered along with the ARARs in determining the necessary level of cleanup or technology requirements.

Sources of Operable Unit 2 ARARs are Federal laws and regulations, Ohio regulations, DOE Orders, and OEPA guidance that addresses the site-specific circumstances in 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.

- 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.

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 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 to reduce, control, or mitigate exposure because the site is already protective of human health and the environment. If the alternative meets the protectiveness threshold criteria, then compliance with ARARs would not be pertinent to the selection of the no-action alternative.

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 groundwater, 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 be disposed at an on-site disposal facility would have a number of action-specific requirements that must be met. These requirements would depend on what type of disposal (i.e., in situ or at a separate facility) and the classification of the waste. For waste that would remain in situ, or in place, it would be necessary to construct a cap to contain the waste and reduce water from seeping through it. The major action-specific ARARs for the in situ disposal alternatives would be design requirements for the protective cap. The OEPA has set requirements for solid waste and exempted waste cap designs. The cap design for radioactive waste containment is based on the duration of protection required by EPA in 40 Code of Regulations (CFR) §192. If different regulatory types of wastes are contained together in a subunit, the most stringent technical requirements would be ARARs.

Waste that would be removed from the subunit and placed in a new on-site disposal facility would be subject to all ARARs dealing with disposal of that particular waste type. In addition to the cap requirements, there may be requirements for the construction of a liner for the disposal facility and waste placement. The requirements for disposal of radioactive material are from 40 CFR §192 and DOE Orders 5820.2A and 6430.1A. Solid waste would be disposed according to 40 CFR §257, 40 CFR §258, and Ohio Administrative Code (OAC) Chapter 3745-27. Exempted waste (i.e., lime

sludge, flyash, and construction debris) would be managed in accordance with OEPA Policy 4.07 for the disposal of exempted wastes. If different regulatory types of wastes are disposed together in a subunit, the most stringent technical requirements would be ARARs.

5.5.4 Location-Specific Requirements

Along with the action-specific requirements for on-site 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 0.2 acre 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).

In addition to resource protection, location-specific requirements include siting criteria for waste disposal facilities when new placement of waste occurs. These include a restriction on siting a waste disposal facility over a sole-source aquifer. The FEMP overlies the Great Miami Aquifer which was designated as a sole-source aquifer by EPA in 1988. The on-site disposal of Operable Unit 2 wastes would be performed under the Corrective Action Management Unit (CAMU) regulations (40 CFR §264.552) which state that consolidation and/or treatment of wastes and contaminated media into a CAMU would not be considered as new placement/disposal of wastes, and therefore would not invoke siting restrictions. The designation of specific CAMUs relates to managing remediation wastes together which have similar properties, rather than managing waste according to its physical location.

The concept of the CAMU is supported by OEPA's regulation OAC 3745-27-09(Y) which directs that if an analysis determines that the design, construction, and final closure plan of a landfill facility does not constitute the best available technology (i.e., adequate protection for human health and the environment), engineering modifications to the landfill facility may be required to provide additional protection. This rule directs that if additional protection is required, the siting criteria outlined in paragraph (B) of OAC 3745-27-07 shall not be applied when considering the improvement to the landfill facility.

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 alternatives against the nine EPA evaluation criteria, noting how the preferred alternatives compare 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.

The following are the preferred remedial alternatives for each subunit in Operable Unit 2:

- Solid Waste Landfill - Alternative 4 - Consolidation/Containment
- Lime Sludge Ponds - Alternative 4 - In Situ Containment
- Inactive Flyash Pile - Alternative 7 - Consolidation/Containment
- South Field - Alternative 7 - Consolidation/Containment
- Active Flyash Pile - Alternative 5 - Consolidation/Containment

Table 6-1 summarizes the long- and short-term environmental impacts associated with the Operable Unit 2 preferred remedial alternatives. Table 6-2 provides the post-remediation risk levels and cost for each of the preferred remedial alternatives. For comparison, the risk to the expanded trespasser from background concentrations in soil is 3.3×10^{-6}. To determine the additional post-remediation risk above background for each preferred remedial alternative, subtract the expanded trespasser background risk given above from the post-remediation risk provided in the table. For example, the expanded trespasser post-remediation risk from the Inactive Flyash Pile preferred remedial alternative is 1.4×10^{-6} above background risk. HI levels are not provided in this table because they are less than 1.0 for each subunit.

Based on current information, these remedial alternatives appear 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 alternatives satisfy the statutory requirements in CERCLA Section 121(b) and that the selected alternatives:

- 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

TABLE 6-1

SUMMARY OF ENVIRONMENTAL IMPACTS FOR THE OPERABLE UNIT 2 PREFERRED REMEDIAL ALTERNATIVES[a]

Alternative	Soil and Geology	Water Quality and Hydrology	Air Quality	Biotic Resources	Wetlands and Floodplains	Socioeconomics and Land Use	Cultural Resources	Transport Impacts
Solid Waste Landfill #4	1.3 ha[b] disturbed **0.7 ha committed to containment**	No impact assuming controls **No long-term impact**	Fugitive dust emissions **No long-term impact**	1.3 ha of managed field habitat disturbed **0.7 ha of managed field habitat lost**	Limited excavation to 0.1 ha of wetlands **No long-term floodplain impact** **Potential loss of 0.1 ha of wetlands**	1.0 percent increase for CMSA[c] **Restriction of site's future use**	No impact due to identification & management **No long-term impact**	Minor traffic increases **No long-term impact**
Lime Sludge Ponds #4	2.0 ha disturbed **1.0 ha committed to in situ containment**	No impact assuming controls **No long-term impact**	Fugitive dust emissions **No long-term impact**	Disturbance (e.g., noise, fugitive dust) to surrounding wildlife **1.0 ha of introduced grassland habitat lost**	Runoff, fugitive dust, and sedimentation to 0.02 ha of wetlands **No long-term floodplain impact**	1.4 percent increase for CMSA **Restriction of site's future use**	No impact due to identification & management **No long-term impact**	Minor traffic increases **No long-term impact**
Inactive Flyash Pile #7	2.6 ha disturbed **1.9 ha committed to containment**	No impact assuming controls **No long-term impact**	Fugitive dust emissions **No long-term impact**	Riparian habitat disturbed **1.8 ha of early/mid-successional woodland habitat lost** **1.9 ha introduced grassland and old field habitat lost**	Runoff, sedimentation, and limited excavation to floodplain **No long-term wetland or floodplain impact**	2.5 percent increase for CMSA **Restriction of site's future use**	No impact due to identification & management **No long-term impact**	Minor traffic increases **No long-term impact**
South Field #7	6.0 ha disturbed **0.7 ha committed to containment**	No impact assuming controls **No long-term impact**	Fugitive dust emissions **No long-term impact**	Riparian habitat disturbed **5.3 ha introduced grassland and old field habitat lost**	Runoff, sedimentation, and limited excavation to floodplain **No long-term wetland or floodplain impact**	1.4 percent increase for CMSA **Restriction of site's future use**	No impact due to identification & management **No long-term impact**	Minor traffic increases **No long-term impact**
Active Flyash Pile #5	2.3 ha disturbed **2.2 ha committed to containment**	No impact assuming controls **No long-term impact**	Fugitive dust emissions **No long-term impact**	Riparian and old field habitat disturbed **2.2 ha intoduced grassland and old field habitat lost**	Runoff and sedimentation to floodplain **No long-term wetland or floodplain impact**	1.8 percent increase for CMSA **Restriction of site's future use**	No impact due to identification & management **No long-term impact**	Minor traffic increases **No long-term impact**

[a] The short-term impacts are delineated by regular type and long-term impacts are delineated by bold type.
[b] ha = hectare; 1 hectare = .4 acres
[c] CMSA = Consolidated Metropolitan Statistical Area

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TABLE 6-2

POST-REMEDIATION RISK LEVELS AND COST OF PREFERRED REMEDIAL ALTERNATIVES

Subunit and Preferred Alternative	Baseline Risk for Expanded Trespasser	Post-Remediation Risk for Expanded Trespasser	Baseline Risk for Off-Property Farmer	Post-Remediation Risk for Off-Property Farmer	Total Cost
Solid Waste Landfill (Alternative 4)[a]	4.4×10^{-5}	NA[b]	1.3×10^{-6}	NA	$7,141,700
Lime Sludge Ponds (Alternative 4)[a]	9.8×10^{-5}	NA	2.4×10^{-7}	NA	$11,444,500
Inactive Flyash Pile (Alternative 7)	1.2×10^{-4}	4.7×10^{-6}	6.6×10^{-5}	3.6×10^{-6}	$20,419,700
South Field (Alternative 7)	2.2×10^{-4}	9.5×10^{-6}	8.1×10^{-5}	4.1×10^{-7}	$11,270,500
Active Flyash Pile (Alternative 5)	2.4×10^{-4}	1.4×10^{-5}	9.2×10^{-6}	4.1×10^{-6}	$14,151,700
				TOTAL COST	$64,428,100

[a] Long-term risk due to COCs present at the remediated Solid Waste Landfill and Lime Sludge Ponds were not estimated since all alternatives eliminate any potential exposures to surface soil and the groundwater is not impacted.

[b] NA = not applicable

- Satisfy the statutory preference for treatment as a principal element or justify not meeting the preference.

6.1 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

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

6.1.1 Solid Waste Landfill

As listed in Section 5.0, the following are the remedial alternatives for the Solid Waste Landfill (the preferred remedial alternative is underlined):

Alternative 1	No action
Alternative 2	Off-Site Disposal
Alternative 3	On-Site Disposal
Alternative 4	Consolidation/Containment

Table 6-3 provides a summarized comparative analysis of alternatives for the Solid Waste Landfill.

6.1.1.1 Overall Protection of Human Health and the Environment

The Solid Waste Landfill alternatives, with the exception of the "no action" alternative, would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through engineering controls and/or institutional controls. The preferred remedial alternative, Alternative 4, would mitigate the potential for unacceptable risk from inhalation, ingestion, or dermal contact with the contaminants and external radiation through the use of in situ containment with a cap.

Because the "no action" alternative is not protective of human health and the environment, it is not considered further in this analysis as an option for the Solid Waste Landfill.

6.1.1.2 Compliance with ARARs

Compliance with ARARs is comparable for each of the Solid Waste Landfill alternatives. Alternatives 2, 3, and 4 would meet the chemical-, action-, and location-specific requirements.

TABLE 6-3

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR THE SOLID WASTE LANDFILL

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment[a]	Short-Term Effectiveness[b]	Implementability	Present Worth Cost ($1,000s)
Alternative 1 - No Action	Not protective	Not applicable	Not effective -- no action taken	No treatment	No effect -- no action taken	No implementability -- no action taken	0
Alternative 2 - Off-Site Disposal	Protective under the private ownership scenario	Complies with ARARs	Highly effective -- off-site disposal; more stringent cleanup levels are used	No treatment	Less effective -- off-site disposal would increase public risk during transport; workers and public exposed to largest volume of material	Less implementable -- subject to state and federal regulations; administratively difficult to implement due to increased coordination	146,047
Alternative 3 - On-Site Disposal	Protective under the Federal ownership scenario	Complies with ARARs	Effective -- on-site disposal; on-site facility would provide more effectiveness than cap	No treatment	Effective -- on-site disposal, but must excavate and transport; workers exposed to more material; public exposure minimal	Implementable -- construction of on-site disposal facility; concerns with siting criteria/use of CAMU	8,172
Alternative 4 - Consolidation/ Containment	Protective under the Federal ownership scenario	Complies with ARARs	Effective -- contaminated material contained under a cap	No treatment	Highly effective -- on-site disposal; worker and public exposure minimal	Highly implementable -- construction of cap; technically and administratively feasible	7,142

[a]Treatment of groundwater and construction water are not compared, since alternatives that treat groundwater and construction water (Alternatives 2 through 4) use the same treatment process (sedimentation and transport to the AWWT facility).

[b]Total duration of remediation.

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6.1.1.3 Long-Term Effectiveness and Permanence

Alternative 4, the preferred remedial alternative, would meet the necessary requirements for long-term effectiveness and permanence; however, it is the least effective compared to the other alternatives because the contaminated material would stay in place under a cap. Alternative 3 would have a higher level of long-term effectiveness through the use of an on-site disposal facility. While Alternative 2 would remove all waste to an approved off-site disposal facility, thereby eliminating the long-term risk of exposure at the Solid Waste Landfill, off-site disposal without treatment is the least preferred option under CERCLA.

6.1.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

None of the alternatives employ treatment technologies; therefore they do not provide a reduction of toxicity, mobility, or volume. Collected construction water would be treated by the AWWT under all alternatives and would reduce the volume of water impacted by contaminants.

6.1.1.5 Short-Term Effectiveness

Alternative 4, the preferred remedial alternative, would provide the highest degree of short-term effectiveness because the least amount of material would be excavated, thereby reducing potential exposure to workers, the public, and the environment. Alternative 2 provides the least short-term effectiveness because it involves excavation and off-site disposal of all contaminated material. Engineering controls and safety practices would be used to reduce the potential for risk for all alternatives.

6.1.1.6 Implementability

Alternative 4, the preferred remedial alternative, would be the most implementable because it requires the least amount of contaminated material excavation and the cap for in situ containment is a proven technology. Alternative 2 would be the most difficult to implement due to uncertainties associated with off-site disposal and the increased coordination that may be necessary to send contaminated material to another state.

6.1.1.7 Cost

The estimated cost of Alternative 4, the preferred remedial alternative, is the least at $7,141,700. Alternative 3 is only slightly more expensive at $8,172,200. Alternative 2, off-site disposal of all contaminated material, has the highest estimated cost at $146,046,600.

6.1.2 Lime Sludge Ponds

As listed in Section 5.0, the following are the remedial alternatives for the Lime Sludge Ponds (the preferred alternative is underlined):

Alternative 1	No action
Alternative 2	Off-Site Disposal
Alternative 3	On-Site Disposal
Alternative 4	In Situ Containment
Alternative 5	On-Site Disposal with Lime Sludge Stabilization

Table 6-4 provides a summarized comparative analysis of alternatives for the Lime Sludge Ponds.

6.1.2.1 Overall Protection of Human Health and the Environment

The Lime Sludge Ponds alternatives, with the exception of the "no action" alternative, would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, and/or institutional controls. The preferred remedial alternative, Alternative 4, would mitigate the potential for unacceptable risk from inhalation, ingestion, or dermal contact with the contaminants and external radiation through the use of in situ containment with a cap.

Because the "no action" alternative is not protective of human health and the environment, it is not considered further in this analysis as an option for the Lime Sludge Ponds.

6.1.2.2 Compliance with ARARs

Compliance with ARARs is comparable for each of the Lime Sludge Ponds' alternatives. Alternatives 2 through 5 would meet the chemical-, action-, and location-specific requirements.

6.1.2.3 Long-Term Effectiveness and Permanence

Alternative 4, the preferred remedial alternative, would meet the necessary requirements for long-term effectiveness and permanence; however, it is the least effective compared to the other alternatives because the contaminated material would stay in place under a cap. Alternatives 3 and 5 would provide similar levels of long-term effectiveness through the use of an on-site disposal facility, although Alternative 5 involves stabilization of lime sludge which will increase the long-term effectiveness of that alternative. While Alternative 2 would remove all waste to an off-site disposal

TABLE 6-4

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR THE LIME SLUDGE PONDS

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment[a]	Short-Term Effectiveness[b]	Implementability	Present Worth Cost ($1,000s)
Alternative 1 - No Action	Not protective	Not applicable	Not effective -- no action taken	No treatment	No effect -- no action taken	No implementation -- no action taken	0
Alternative 2 - Off-Site Disposal	Protective under the private ownership scenario	Complies with ARARs	Highly effective -- off-site disposal; more stringent cleanup levels are used	No treatment	Least effective -- off-site disposal would increase public risk during transport; workers and public exposed to largest volume of material	Less implementable -- subject to state and federal regulations; administratively difficult to implement due to increased coordination	55,150
Alternative 3 - On-Site Disposal	Protective under the Federal ownership scenario	Complies with ARARs	Effective -- on-site disposal; on-site facility would provide more effectiveness than cap	No treatment	Effective -- on-site disposal, but must excavate and transport; workers exposed to more material; public exposure minimal	Implementable -- construction of on-site disposal facility; concerns with siting criteria/use of CAMU	7,785
Alternative 4 - In Situ Containment	Protective under the Federal ownership scenario	Complies with ARARs	Less effective -- contaminated material contained under a cap	No treatment	Highly effective -- waste remains in area; worker and public exposure minimal	Highly implementable -- construction of cap; technically and administratively feasible	11,445
Alternative 5 - On-Site Disposal With Lime Sludge Stabilization	Protective under the Federal ownership scenario	Complies with ARARs	Effective -- on-site disposal; lime sludge stabilized	Stabilization -- reduces mobility of contaminants in lime sludge	Less effective -- on-site disposal, but must excavate and transport; workers exposed to more material	Implementable -- construction of on-site disposal facility; concerns with siting criteria/use of CAMU	9,235

[a]Treatment of construction water is not compared, since all alternatives that treat construction water (Alternatives 2 through 5) use the same treatment process (sedimentation and transport to the AWWT facility).

[b]Total duration of remediation

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facility, thereby eliminating the long-term risk of exposure at the Lime Sludge Ponds, off-site disposal without treatment is the least preferred option under CERCLA.

6.1.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 5 involves the stabilization of lime sludge which would reduce the mobility of the contaminants. None of the other alternatives employ treatment technologies; therefore they do not provide a reduction of toxicity, mobility, or volume. Collected construction water would be treated by the AWWT under all alternatives and would reduce the volume of water impacted by contaminants.

6.1.2.5 Short-Term Effectiveness

Alternative 4, the preferred remedial alternative, would provide the highest degree of short-term effectiveness because by the least amount of material would be excavated, thereby reducing potential exposure to workers, the public, and the environment. Alternative 5 would be the least effective because of the increased exposure to on-site workers involved in excavating and treating the lime sludge. Engineering controls and safety practices would be used to reduce the potential of risk for all alternatives.

6.1.2.6 Implementability

Alternative 4, the preferred remedial alternative, would be the most implementable because it requires the least amount of contaminated material excavation and the cap for in situ containment is a proven technology. Alternative 2 would be the most difficult to implement due to uncertainties associated with off-site disposal and the increased coordination that may be necessary to send contaminated material to another state.

6.1.2.7 Cost

Alternatives 3 and 5 have the lowest estimated costs. The preferred remedial alternative, Alternative 4, is higher at $11,444,500. Alternative 2, off-site disposal of all contaminated material, has the highest estimated cost at $55,149,900.

6.1.3 Inactive Flyash Pile

As listed in Section 5.0, the following are the remedial alternatives for the Inactive Flyash Pile (the preferred alternative is underlined):

Alternative 1	No action
Alternative 2	Off-Site Disposal
Alternative 3	On-Site Disposal
Alternative 4	Vitrification and On-Site Disposal with Flyash Stabilization
Alternative 5	Solidification and On-Site Disposal with Flyash Stabilization
Alternative 6	Soil Washing and On-Site Disposal with Flyash Stabilization
Alternative 7	Consolidation/Containment
Alternative 8	On-Site Disposal with Flyash Stabilization

Table 6-5 provides a summarized comparative analysis of alternatives for the Inactive Flyash Pile.

6.1.3.1 Overall Protection of Human Health and the Environment

All of the Inactive Flyash Pile alternatives, with the exception of the "no action" alternative, would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, and/or institutional controls. The preferred remedial alternative, Alternative 7, would mitigate the potential for unacceptable risk from inhalation, ingestion, or dermal contact with the contaminants and external radiation through the use of consolidation and in situ containment with a cap.

Because the "no action" alternative is not protective of human health and the environment, it is not considered further in this analysis as an option for the Inactive Flyash Pile.

6.1.3.2 Compliance with ARARs

Compliance with ARARs is comparable for each of the Inactive Flyash Pile alternatives. Alternatives 2 through 8 would meet the chemical-, action-, and location-specific requirements.

6.1.3.3 Long-Term Effectiveness and Permanence

Alternative 7, the preferred remedial alternative, would meet the necessary requirements for long-term effectiveness and permanence; however, it is the least effective compared to the other alternatives because the contaminated material would stay in place under a cap after consolidation. Alternatives 4 through 6 and Alternative 8 would have a higher level of long-term effectiveness based on treatment of the waste prior to on-site disposal. While Alternative 2 would remove all waste to an off-site disposal facility, thereby eliminating the long-term risk of exposure at the Inactive Flyash Pile, off-site disposal without treatment is the least preferred option under CERCLA. Alternatives 3 through 8 would require long-term collection of perched groundwater.

TABLE 6-5

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR THE INACTIVE FLYASH PILE

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment[a]	Short-Term Effectiveness[b]	Implementability	Present Worth Cost ($1,000s)
Alternative 1 - No Action	Not protective	Not applicable	Not effective -- no action taken	No treatment	No effect -- no action taken	No implementation -- No action taken	0
Alternative 2 - Off-Site Disposal	Protective under the private ownership scenario	Complies with ARARs	Most effective -- off-site disposal; more stringent cleanup levels are used	No treatment	Effective -- off-site disposal would increase public risk during transport; workers and public exposed to largest volume of material	Implementable -- subject to state and federal regulations; administratively difficult to implement due to increased coordination	136,688
Alternative 3 - On-Site Disposal	Protective under the Federal ownership scenario	Complies with ARARs	Effective -- on-site disposal; less effective than stabilized flyash	No treatment of contaminated material; long-term treatment of perched groundwater	More effective -- on-site disposal, but must excavate and transport; workers exposed to more material; public exposure minimal	More implementable -- construction of liner and cap; concerns with siting criteria/use of CAMU	30,102
Alternative 4 - Vitrification and On-Site Disposal with Flyash Stabilization	Protective under the Federal ownership scenario	Complies with ARARs	More effective -- on-site disposal; treatment of some contaminated material and flyash stabilization	Better treatment -- mobility and volume of contaminants reduced; long-term treatment of perched groundwater	Effective -- reduced risk to public through treatment and on-site disposal; workers exposed to more material	Implementable -- construction of on-site disposal facility; vitrification may be difficult to implement; concerns with siting criteria/use of CAMU	417,943
Alternative 5 - Solidification and On-Site Disposal with Flyash Stabilization	Protective under the Federal ownership scenario	Complies with ARARs	More effective -- on-site disposal; treatment of some contaminated material and flyash stabilization	Treatment reduces mobility of contaminants, but volume increases; long-term treatment of perched groundwater	Effective -- reduced risk to public through treatment and on-site disposal; workers exposed to more material	Implementable -- construction of on-site disposal facility; solidification most implementable treatment; concerns with siting criteria/use of CAMU	35,492

See footnotes at end of table

TABLE 6-5
(Continued)

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment[a]	Short-Term Effectiveness[b]	Implementability	Present Worth Cost ($1,000s)
Alternative 6 - Soil Washing and On-Site Disposal with Flyash Stabilization	Protective under the Federal ownership scenario	Complies with ARARs	More effective -- on-site disposal; treatment of some contaminated material and flyash stabilization	Best treatment -- Reduces volume of contaminated material requiring disposal; long-term treatment of perched groundwater	Effective -- reduced risk to public through treatment and on-site disposal; workers exposed to more material	Least implementable -- construction of on-site disposal facility; soil washing most difficult treatment; concerns with siting criteria/use of CAMU	38,737
Alternative 7 - Consolidation/ Containment	Protective under the Federal ownership scenario	Complies with ARARs	Least effective -- in situ containment less effective than disposal facility; groundwater extraction required for longest duration	No treatment of contaminated material; long-term treatment of perched groundwater	Most effective -- waste excavated and consolidated in area; public exposure minimal	Most implementable -- construction of cap; technically and administratively feasible	20,420
Alternative 8 - On-Site Disposal with Flyash Stabilization	Protective under the Federal ownership scenario	Complies with ARARs	Effective -- on-site disposal; flyash stabilization	Treatment reduces mobility of contaminants; long-term treatment of perched groundwater	More effective -- on-site disposal, but must excavate and transport; workers exposed to more material; public exposure minimal	More implementable -- construction of on-site disposal facility; would be more implementable without treatment; concerns with siting criteria/use of CAMU	35,693

[a]Treatment of construction water is not compared, since all alternatives that treat construction water (Alternatives 2 through 8) use the same treatment process (sedimentation and transport to the AWWT facility).

[b]Total duration of remediation

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6.1.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 4 through 6 and Alternative 8 involve treatment of the contaminated material and/or stabilization of the flyash which would reduce the mobility of the contaminants. Alternatives 4 and 6 would also reduce the volume of waste material. Alternatives 3 through 8 include treatment of the perched groundwater at the AWWT which would reduce the volume of water impacted by contaminants. Collected construction water would also be treated by the AWWT under all alternatives.

6.1.3.5 Short-Term Effectiveness

Alternative 7, the preferred remedial alternative, would provide the highest degree of short-term effectiveness because only a portion of the waste would be excavated, thereby reducing potential exposure to workers, the public, and the environment. Alternatives 4, 5, 6, and 8 would provide a similar level of short-term impacts due to the treatment which would require additional handling of material before on-site disposal. Alternative 2 provides the least short-term effectiveness because it involves off-site disposal of a large volume of contaminated material. Engineering controls and safety practices would be used to reduce the potential of risk for all the alternatives.

6.1.3.6 Implementability

Alternative 7, the preferred remedial alternative, would be the most implementable because it requires the least amount of contaminated material excavation and the cap for in situ containment is a proven technology. Alternatives 4, 5, and 6 are considered more difficult to implement because of the uncertainty of available vendors equipment, required treatability studies, and uncertainties in the effectiveness of treatment. Alternative 6 would be the most difficult to implement due to the uncertainties associated with soil washing.

6.1.3.7 Cost

Alternative 7, the preferred remedial alternative, has the lowest estimated cost at $20,419,700. Alternative 3 is the next lowest at $30,102,100. Alternative 4, vitrification and on-site disposal with flyash stabilization, has the highest estimated cost at $419,942,800.

6.1.4 South Field

As listed in Section 5.0, the following are the remedial alternatives for the South Field (the preferred alternative is underlined):

Alternative 1	No action
Alternative 2	Off-Site Disposal
Alternative 3	On-Site Disposal
Alternative 4	Vitrification and On-Site Disposal
Alternative 5	Solidification and On-Site Disposal
Alternative 6	Soil Washing and On-Site Disposal
Alternative 7	Consolidation/Containment

Table 6-6 provides a summarized comparative analysis of alternatives for the South Field.

6.1.4.1 Overall Protection of Human Health and the Environment

All of the South Field alternatives, with the exception of the "no action" alternative, would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, and/or institutional controls. The preferred remedial alternative, Alternative 7, would mitigate the potential for unacceptable risk from inhalation, ingestion, or dermal contact with the contaminants and external radiation through the use of consolidation and in situ containment with a cap.

Because the "no action" alternative is not protective of human health and the environment, it is not considered further in this analysis as an option for the South Field.

6.1.4.2 Compliance with ARARs

Compliance with ARARs is comparable for each of the South Field alternatives. Alternatives 2 through 7 would meet the chemical-, action-, and location-specific requirements.

6.1.4.3 Long-Term Effectiveness and Permanence

Alternative 7, the preferred remedial alternative, would meet the necessary requirements for long-term effectiveness and permanence; however, it is the least effective compared to the other alternatives because the contaminated material would stay in place under a cap after consolidation. Alternatives 4, 5, and 6 would have a higher level of effectiveness based on treatment of the waste prior to on-site disposal. While Alternative 2 would remove all waste to off-site disposal facility,

TABLE 6-6

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR THE SOUTH FIELD

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment[a,b]	Short-Term Effectiveness[c]	Implementability	Present Worth Cost ($1,000s)
Alternative 1 - No Action	Not Protective	Not applicable	Not effective - no action taken	No treatment	No effect -- no action taken	No implementation --no action taken	0
Alternative 2 - Off-Site Disposal	Protective under the private ownership scenario	Complies with ARARs	Most effective -- off-site disposal; more stringent cleanup levels are used	No treatment	Effective -- off-site disposal would increase public risk during transport; workers and public exposed to largest volume of material	Implementable -- subject to state and federal regulations; administratively difficult to implement due to increased coordination	288,190
Alternative 3 - On-Site Disposal	Protective under the Federal ownership scenario	Complies with ARARs	Effective -- on-site disposal; less effective than treatment prior to disposal	No treatment of contaminated material; long-term treatment of perched groundwater	More effective -- on-site disposal, but must excavate and transport; workers exposed to more material; public exposure minimal	More implementable -- construction of liner and cap; concerns with siting criteria/use of CAMU	23,900
Alternative 4 - Vitrification and On-Site Disposal	Protective under the Federal ownership scenario	Complies with ARARs	More effective -- on-site disposal; treatment of some contaminated material	Better treatment -- mobility and volume of contaminants reduced; long-term treatment of perched groundwater	Effective -- reduced risk to public through treatment and on-site disposal; workers exposed to more material	Implementable -- construction of on-site disposal facility; vitrification may be difficult to implement; concerns with siting criteria/use of CAMU	212,956

See footnotes at end of table

TABLE 6-6
(Continued)

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment[a,b]	Short-Term Effectiveness[c]	Implementability	Present Worth Cost ($1,000s)
Alternative 5 - Solidification and On-Site Disposal	Protective under the Federal ownership scenario	Complies with ARARs	More effective -- on-site disposal; treatment of some contaminated material	Treatment reduces mobility of contaminants, but volume increases; long-term treatment of perched groundwater	Effective -- reduced risk to public through treatment and on-site disposal; workers exposed to more material	Implementable -- construction of on-site disposal facility; solidification most implementable treatment; concerns with siting criteria/use of CAMU	24,487
Alternative 6 - Soil Washing and On-Site Disposal	Protective under the Federal ownership scenario	Complies with ARARs	Effective -- on-site disposal; treatment of some contaminated material; soil washing potentially more effective than other treatment	Best treatment -- Reduces volume of contaminated material requiring disposal; long-term treatment of perched groundwater	Effective -- reduced risk to public through treatment and on-site disposal; workers exposed to more material	Least implementable -- construction of on-site disposal facility; soil washing most difficult treatment; concerns with siting criteria/use of CAMU	25,506
Alternative 7 - Consolidation/ Containment	Protective under the Federal ownership scenario	Compiles with ARARs	Least effective -- in situ containment less effective than disposal facility; groundwater extraction required for longest duration	No treatment of contaminated material; long-term treatment of perched groundwater	Most effective -- waste excavated and consolidated in area; public exposure minimal	Most implementable -- construction of cap; technically and administratively feasible	11,271

[a]Treatment of groundwater is not compared, since all alternatives that treat groundwater (Alternatives 3, 4, 5, 6, and 7) use the same treatment process (sedimentation and transport to the AWWT facility).

[b]Treatment of construction water is not compared, since all alternatives that treat construction water (alternatives 2 through 7) use the same treatment process (sedimentation and transport to the AWWT facility).

[c]Total duration of remediation.

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thereby eliminating the long-term risk of exposure at the South Field, off-site disposal without treatment is the least preferred option under CERCLA. Alternatives 3 through 7 would require long-term collection of perched groundwater.

6.1.4.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 4, 5, and 6 involve treatment of the contaminated material which would reduce the mobility of the contaminants. Alternatives 4 and 6 would also reduce the volume of waste material. Alternatives 3 through 7 include treatment of the perched groundwater at the AWWT which would reduce the volume of water impacted by contaminants. Collected construction water would also be treated by the AWWT under all alternatives.

6.1.4.5 Short-Term Effectiveness

Alternative 7, the preferred remedial alternative, would provide the highest degree of short-term effectiveness because the least amount of material would be excavated, thereby reducing potential exposure to workers, the public, and the environment. Alternatives 4, 5, and 6 would provide similar levels of short-term impacts due to the treatment which would require additional handling of the material before on-site disposal. Alternative 2 provides the least short-term effectiveness because it involves excavation and off-site disposal of all contaminated material. Engineering controls and safety practices would be used to reduce the potential of risk for all alternatives.

6.1.4.6 Implementability

Alternative 7, the preferred remedial alternative, would be the most implementable because it requires the least amount of contaminated material excavation and the cap for in situ containment is a proven technology. Alternatives 4, 5, and 6 are considered more difficult to implement because of the uncertainty of available vendors equipment, required treatability studies, and uncertainties in the effectiveness of treatment. Alternative 6 would be the most difficult to implement due to the uncertainties associated with soil washing.

6.1.4.7 Cost

Alternative 7, the preferred remedial alternative, has the lowest estimated cost at $11,270,500. Alternative 3 has the second lowest estimated cost at $23,899,700. Alternative 2, off-site disposal of all contaminated material, has the highest estimated cost at $288,190,400.

6.1.5 Active Flyash Pile

As listed in Section 5.0, the following are the remedial alternatives for the Active Flyash Pile (the preferred remedial alternative is underlined):

Alternative 1	No action
Alternative 2	Off-Site Disposal
Alternative 3	On-Site Disposal
Alternative 4	On-Site Disposal with Flyash Stabilization
Alternative 5	Consolidation/Containment

Table 6-7 provides a summarized comparative analysis of alternatives for the Active Flyash Pile.

6.1.5.1 Overall Protection of Human Health and the Environment

All of the Active Flyash Pile alternatives, with the exception of the "no action" alternative, would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, and/or institutional controls. The preferred remedial alternative, Alternative 5, would mitigate the potential for unacceptable risk from inhalation, ingestion, or dermal contact with the contaminants and external radiation through the use of consolidation and in situ containment with a cap.

Because the "no action" alternative is not protective of human health and the environment, it is not considered further in this analysis as an option for the Active Flyash Pile.

6.1.5.2 Compliance with ARARs

Compliance with ARARs is comparable for each of the Active Flyash Pile alternatives. Alternatives 2 through 5 would meet the chemical-, action-, and location-specific requirements.

6.1.5.3 Long-Term Effectiveness and Permanence

Alternative 5, the preferred remedial alternative, would meet the necessary requirements for long-term effectiveness and permanence; however, it is the least effective compared to the other alternatives because the contaminated material would stay in place under a cap after consolidation. Alternative 4 would provide a higher level of long-term effectiveness because it involves treatment of the waste prior to on-site disposal. While Alternative 2 would remove all waste to an off-site disposal

TABLE 6-7

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR THE ACTIVE FLYASH PILE

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment[a]	Short-Term Effectiveness[b]	Implementability	Present Worth Cost ($1,000s)
Alternative 1 - No Action	Not protective	Not applicable	Not effective -- no action taken	No treatment	No effect -- no action taken	No implementation --no action required	0
Alternative 2 - Off-Site Disposal	Protective under private ownership scenario	Complies with ARARs	Highly effective -- off-site disposal; more stringent cleanup levels are used	No treatment	Less effective -- off-site disposal would increase public risk during transport; workers and public exposed to largest volume of material	Less implementable -- subject to state and federal regulations; administratively difficult to implement due to increased coordination	76,218
Alternative 3 - On-Site Disposal	Protective under Federal ownership scenario	Complies with ARARs	Effective -- on-site excavation and disposal	No treatment	Effective -- on-site disposal, but must excavate and transport; workers exposed to more material; public exposure minimal	More implementable -- construction of on-site disposal facility; concerns with siting criteria/use of CAMU	17,464
Alternative 4 - On-Site Disposal with Flyash Stabilization	Protective under Federal ownership scenario	Complies with ARARs	Highly effective -- on-site disposal; flyash stabilized	Stabilization -- reduces mobility of contaminants in flyash	Effective -- reduced risk to public through treatment and on-site disposal; workers exposed to more material	Implementable -- construction of on-site disposal facility; stabilization of flyash; concerns with siting criteria/use of CAMU	21,142
Alternative 5 - Consolidation/ Containment	Protective under Federal ownership scenario	Complies with ARARs	Effective -- contaminated material contained under a cap	No treatment of contaminated material; long-term treatment of perched groundwater	Highly effective -- waste remains in area; worker and public exposure minimal	Most implementable -- construction of cap; technically and administratively feasible	14,152

[a]Treatment of construction water is not compared, since all alternatives that treat construction water use the same treatment process (sedimentation and transport to the AWWT facility).

[b]Total duration of remediation.

facility, thereby eliminating the long-term risk of exposure at the Active Flyash Pile, off-site disposal without treatment is the least preferred option under CERCLA.

6.1.5.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 4 involves stabilization of the flyash which would reduce the mobility of the contaminants. Alternative 5 includes treatment of the perched groundwater at the AWWT which would reduce the volume of water impacted by contaminants. Collected construction water would also be treated by the AWWT under all alternatives.

6.1.5.5 Short-Term Effectiveness

Alternative 5, the preferred remedial alternative, would provide the highest degree of short-term effectiveness because the least amount of material would be excavated, thereby reducing potential exposure to workers, the public, and the environment. Alternative 4 would provide a lower level of short-term effectiveness than alternatives 3 or 5 due to the treatment which would require additional handling of the material before on-site disposal. Alternative 2 would provide the least short-term effectiveness in the short-term because it involves excavation and off-site disposal of all contaminated material. Engineering controls and safety practices would be used to reduce the potential of risk for all the alternatives.

6.1.5.6 Implementability

Alternative 5, the preferred remedial alternative, would be the most implementable because it requires the least amount of contaminated material excavation and the cap for in situ containment is a proven technology. Alternative 2 would be the most difficult to implement due to uncertainties associated with off-site disposal and the increased coordination that may be necessary to send contaminated material to another state.

6.1.5.7 Cost

Alternative 5, the preferred remedial alternative, has the lowest estimated cost at $14,151,700. Alternative 3 has the next lowest cost at $17,464.000. Alternative 2, off-site disposal of all contaminated material, has the highest estimated cost at $76,217,800.

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. Ken Morgan
Director, Public Information
U.S. Department of Energy
Fernald Field Office
P.O. Box 398705
Cincinnati, OH 42539-8705
(513) 648-3131

Mr. Jim Saric
U.S. Environmental Protection Agency
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.

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.

Consent Agreement as Amended Under CERCLA Sections 120 and 106(a), 1991, U.S. Environmental Protection Agency and U.S. Department of Energy, Administrative Docket No. V-W-90-C-057.

Federal Facility Compliance Agreement, 1986, U.S. Environmental Protection Agency and U.S. Department of Energy.

U.S. Department of Energy, 1988, "Remedial Investigation and Feasibility Study, Feed Materials Production Center, Fernald, Ohio, Work Plan Requirements," Rev. 3, DOE, Oak Ridge Operations Office, Oak Ridge, TN.

U.S. Department of Energy, 1993a, "Draft Remedial Investigation Report for Operable Unit 2, FEMP, Fernald, Ohio, Remedial Investigation and Feasibility Study," U.S. DOE, Fernald Office, Fernald, OH.

U.S. Department of Energy, 1993b, "Site-Wide Characterization Report, FEMP, Fernald, Ohio, Remedial Investigation and Feasibility Study," U.S. DOE, Fernald Office, Fernald, OH.

U.S. Department of Energy, 1994, "Draft Feasibility Study Report for Operable Unit 2, FEMP, Fernald, Ohio, Remedial Investigation and Feasibility Study," U.S. DOE, Fernald Office, Fernald, OH.

U.S. Environmental Protection Agency, 1989, "Guidance on Preparing Superfund Decision Documents: The Proposed Plan, The Record of Decision, Explanation of Significant Differences, The Record of Decision Amendment," EPA/540/G-89/007, EPA, Office of Emergency Remedial Response, Washington, DC.

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	

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Citation	Requirement	Summary of Requirement
CHEMICAL-SPECIFIC REQUIREMENTS (continued)		
DOE Order 5400.5	Radiation Protection of the Public and the Environment	Dose limits for individual members of the public from radioactive releases
DOE Order 5820.2A	Radioactive Waste Management	
40 CFR §192.21(f) and §192.22(b)	Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings	Radionuclide emissions should be reduced to levels that are As Low As Reasonably Achievable (ALARA)
DOE Order 5400.5 Chapter 1(4) and Chapter II(2)	Radiation Protection of the Public and the Environment	
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)	Atomic Energy Act	Defines low-level radioactive waste
42 U.S.C. §10101(12), (16),(23)	Nuclear Waste Policy Act	
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

APPENDIX A
(Continued)

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
40 CFR §264.552(a),(c)	Resource, Conservation, and Recovery Act (RCRA)	Defines the RCRA corrective action management unit (CAMU) and temporary unit (TU) and explains their uses during remediation
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

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Citation	Requirement	Summary of Requirement
LOCATION-SPECIFIC REQUIREMENTS		
OEPA Policy 4.07	Design Criteria: Disposal of Nontoxic Flyash, Bottom Ash, Foundry Sand, and Other Exempted Solid Wastes	Design criteria for exempted waste disposal
40 CFR §6.302(h) 50 CFR §17 50 CFR §402 ORC 1518.02, 1531.25 OAC 1501:18-1	Procedure for Implementing the National Environmental Policy Act Endangered and Threatened Wildlife and Plants Interagency Cooperation - Endangered Species Act Ohio Endangered Species Regulations	Requirements for the protection of Federal and State endangered and threatened species
40 CFR §6.302(a),(b) 10 CFR §1022	Procedure for Implementing the National Environmental Policy Act DOE Compliance with Floodplain/Wetlands Environmental Review Requirements	Requirements for the protection of floodplains and wetlands
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 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

Citation	Requirement	Summary of Requirement
LOCATION-SPECIFIC REQUIREMENTS (continued)		
OAC 3745-27-07 and associated guidance	Ohio Solid Waste Disposal Regulations	Restricts the location of a solid waste disposal facility
OAC 3745-27-09(Y)	Ohio Solid Waste Disposal Regulations	Allows modification of a solid waste landfill to provide additional protection of human health and the environment without invoking the siting criteria outlined in OAC 3745-27-07
OEPA Policy 4.07	Design Criteria: Disposal of Nontoxic Flyash, Bottom Ash, Foundry Sand, and Other Exempted Solid Wastes	Restricts the location of an exempt waste disposal facility
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.

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(Continued)

Citation	Requirement	Summary of Requirement
NON-ARAR REQUIREMENTS (continued)		
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).
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

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Citation	Requirement	Summary of Requirement
NON-ARAR REQUIREMENTS (continued)		
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 guard patrol.

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 Facility (AWWT) - A treatment facility to be constructed at the FEMP 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 (future and current) to human health and the environment caused by the release of hazardous substances in the absence of any remedial action. The assessment provides the

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basis for determining whether or not remedial action is necessary and the justification for performing the remedial action.

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}).

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. Drying would be done in the Operable Unit 1 drying facility after the material has been removed from the subunit.

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

fate and transport modeling - Modeling that is used to assess constituent movement from source areas to receptor locations through various

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media (i.e., groundwater or air). The modeling is used in conjunction with monitoring data and estimates constituent concentrations at exposure point locations where measured constituent concentration data are not available such as off-property 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 concensus 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 the 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. Field investigation results from the RI Report also reveal that some apparent process waste has been placed in the subunit. 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

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guards, which limit access to a site or an operable unit.

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.

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.

preliminary remediation levels (PRLs) - Cleanup levels that are achieved by adding the background concentration level to the modified PRG level for a specific COC.

Proposed Plan - A public participation document that summarizes the Feasibility Study Report 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

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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 one and a half miles south of the FEMP site. The PEIC contains additional materials to help the public understand cleanup activities at the site, 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 investigation (RI) - A process undertaken to determine the nature and extent of the problem presented 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.

risk assessment - A study to determine the nature and extent of contamination at a site and the risks posed to public health or the environment. A baseline risk assessment supplements a RI.

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soil washing - A treatment process that entails mechanically separating soil by particle size. The goal of the process is to remove the uranium concentrates that remain lodged in the fine particles of soil to an acceptable level.

solidification - A treatment process involving the physical binding or attaching of the removed waste material to a binding material. If selected as an alternative, the binder that would be used for the Operable Unit 2 subunits is portland cement.

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. Field investigation results, however, reveal that some apparent process wastes have been placed in the landfill. 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 reduce the chemical reactivity of one or more of the materials.

vitrification - A treatment process to encapsulate contaminants in a glass product. Vitrification reduces the potential mobility of the contaminants.

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

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