6346 U-007-405 .1

DRAFT PROPOSED PLAN FOR OPERABLE UNIT 5 - ***DRAFT*** - NOVEMBER 1994

11/15/94

DOE-FN EPAS
44
PP

FERNALD
Environmental Management Project

Draft Proposed Plan for Operable Unit 5

Environmental Media

Fernald Environmental Management Project, Fernald, Ohio

Public Comment Period - TBD

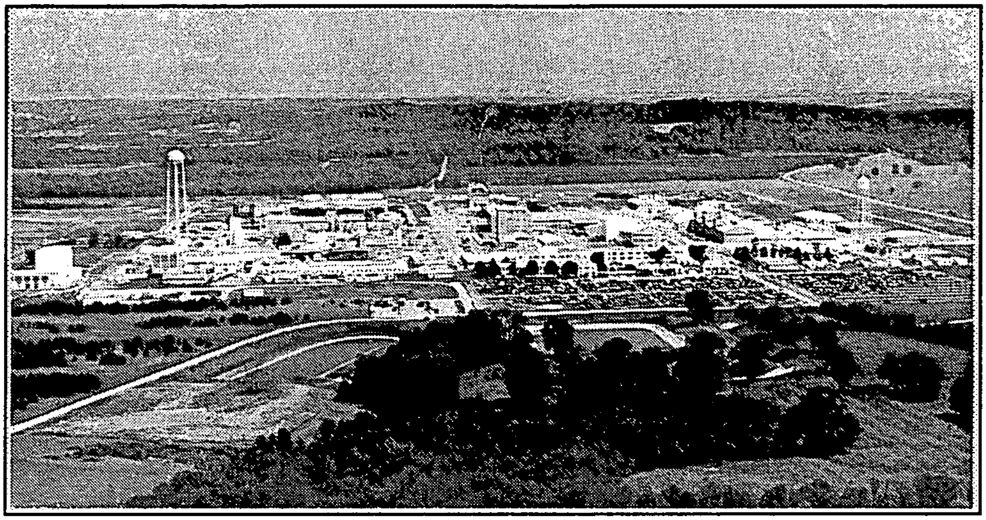

Photo of the Fernald Environmental Management Project Site

(*Editor's Note:* Technical and administrative terms are used throughout this Proposed Plan. When these terms are first used, they are printed in ***bold italics***. Explanations of these terms, document references, and other helpful notes are provided in the margins.)

Introduction

This ***Proposed Plan*** summarizes information on the range of remedial action alternatives evaluated for the radiologically and chemically contaminated environmental media that make up ***Operable Unit 5*** at the U.S. Department of Energy's (DOE's) Fernald Environmental Management Project (FEMP). The term environmental media specifically refers to groundwater, surface water, soil, sediment, flora and fauna both on and off the FEMP property. These evaluations were conducted due to the concern, on the part of DOE, involved regulatory agencies and the public, that site-related contamination in the environmental media could adversely impact human health and cause further degradation of environmental conditions. The DOE seeks public comment on the alternatives presented herein, including the preferred alternative. Opportunities to comment are listed here and at the back of this document.

Inside This Plan

Workshops

This section will present the schedule and location of public workshops.

Public Meeting

This section will present the schedule and location of the public meeting.

Proposed Plan - a document that summarizes DOE's preferred cleanup strategy, the rationale for the preference, and alternatives presented in the detailed analysis of the feasibility study. The Proposed Plan solicits public review and comment on all alternatives under consideration.

Operable Unit - a term used to describe a logical grouping of environmental issues or waste management facilities at a cleanup site.

Operable Units 1-5 - the following is a summary level description of each of the FEMP operable units.

Operable Unit 1 - waste pit area including six waste pits, a Clearwell, and a burn pit.

Operable Unit 2 - other waste units including two lime sludge ponds, two flyash piles, a disposal area containing construction rubble, and a solid waste landfill.

Operable Unit 3 - production area including plant buildings, scrap metal, equipment, and drummed waste inventories.

Operable Unit 4 - silos 1-4 (concrete waste storage silos) and support structures.

Operable Unit 5 - environmental media including groundwater in the aquifer, perched groundwater, surface water, soil, sediment, flora and fauna.

Records of Decision - a public record documenting the final determination of the selected alternative. Records of Decision follow the consideration of public comments and the requirements of CERCLA. FEMP CERCLA decisions are signed by representatives of U.S. EPA Region V and the DOE.

Remedial Investigation - identifies the nature and extent of contamination at a site. Also provides an assessment of the potential risks associated with a site.

Feasibility Study - provides a full evaluation of cleanup alternatives based on information gathered during the remedial investigation.

A proposed plan is being issued for Operable Units 1 through 5 at the FEMP; this is the fourth. Following consideration of public input on the proposed plans, ***Records of Decision*** (RODs), jointly signed by the DOE and the U.S. Environmental Protection Agency (EPA), are issued for each operable unit identifying the alternative selected for implementation.

Contaminated Environmental Media

The source of the contamination in environmental media was releases from past uranium production operations and waste management activities at the facility. The primary means by which the contaminants were released included air emissions, wastewater discharges, and leaks and spills during production operations. The termination of production operations in 1989 eliminated or reduced many of the primary sources of contaminant releases to the environment.

The primary focus of the Operable Unit 5 ***Remedial Investigation/Feasibility Study*** (RI/FS) was to: 1) establish the nature and extent of the existing contamination in environmental media at the site; 2) determine the potential for continued migration of these contaminants; and 3) identify viable remedial measures to protect human health and the environment.

Agency Involvement

The DOE Fernald Area Office prepared this plan in accordance with public participation requirements identified under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act ***(CERCLA)***, commonly called Superfund. As the owner of the FEMP, DOE is the lead agency conducting cleanup activities at the site. The DOE is performing the RI/FS at the FEMP under the terms of an ***Amended Consent Agreement*** with EPA. The Ohio Environmental Protection Agency (OEPA) is also participating in the remedy selection and cleanup process at the site.

This plan outlines the results of the Operable Unit 5 RI including assessment of potential risks to human health and the environment; summarizes the remedial action alternatives considered in the FS, and discusses the identification of a preferred alternative. The information summarized in this plan can be found in greater detail in the ***Remedial Investigation Report for Operable Unit 5*** and the ***Feasibility Study Report for Operable Unit 5***. These documents and other supporting information are available in the ***Administrative Record File***, which may be reviewed at the FEMP Public Environmental Information Center listed on page 44.

Scope of the Operable Unit 5 Remedial Decision

The remedial decision for Operable Unit 5 will yield a remedy which provides a permanent cleanup solution for addressing contaminated media at the site. The expectations for the decision include:

- The establishment of final cleanup levels for soil, sediment, and groundwater
- A remedy which uses treatment to the extent practical to address the principal threats posed by the contaminated media
- The permanent disposition of removed contaminated materials or generated treatment residuals in an appropriate on- or off-property disposal facility

- A remedy which applies institutional controls, as necessary, to complement engineering measures taken to address site contaminants
- A remedy which ensures the return of useable groundwater, including the Great Miami Aquifer, to its full beneficial uses within a reasonable time
- A remedy which ensures the short-term and long-term protection of the public and sensitive environmental receptors
- A remedy which is cost-effective and implementable and which accommodates the future application of new, more effective technologies which emerge during the conduct of remedial activities
- A remedy which accommodates the inherent uncertainties associated with the availability of future capacity at off-site licensed disposal facilities.

The cost of remedial actions, volumes of contaminated materials requiring action, and range of available remedial alternatives for Operable Unit 5 are sensitive factors in determining the final cleanup levels for the affected environmental media. These final cleanup levels are the concentration of a given contaminant which would be permitted to remain in site soil, sediment and groundwater following the implementation of remedial actions. The final cleanup levels also consider factors such as technical limitations on attaining the cleanup level (for example, attaining levels below natural background or analytical detection limits), cross-media impacts, potential impacts to sensitive ecological receptors, and cost. While the Operable Unit 5 ROD will not establish future land use for the FEMP, the possible future uses of the property and the costs of remedial actions necessary to accommodate those uses must be taken into consideration when determining the final cleanup levels for the operable unit. Projected future land uses which envision more extensive and continued exposure to site contaminants remaining after remedial actions, such as the creation of a family farm on the existing government property, would require lower cleanup levels to ensure the long-term protection of such a future land user. Lower cleanup levels typically would require the removal, containment or treatment of larger quantities of contaminated site media, both on-and off-property, resulting in increased costs for a given remedial alternative.

Preferred Alternative

DOE's preferred alternative for addressing the radiological and chemical contamination in the environmental media involves: the excavation of contaminated soil and sediment that exceed ***proposed final remediation levels*** using conventional excavation equipment; placement of the excavated materials in an on-property above-grade disposal cell; and extraction and treatment of ***Great Miami Aquifer*** groundwater containing concentrations of contaminants above established or proposed ***maximum concentration levels (MCLs).*** Contaminated zones of ***perched water*** within the glacial till presenting an unacceptable threat to the underlying aquifer would be excavated concurrently with soil removal activities. Excavated soil and sediment exhibiting concentrations of contaminants which potentially jeopardize the long-term performance of the cell would be shipped off site for disposal at an approved facility. The FEMP would continue to examine emerging technologies, as part of the preferred remedy, to identify potential waste minimization opportunities and to minimize the potential vulnerabilities to completing remedial actions due to the uncertainties in the long-term availability of off-site disposal capacity.

This alternative is recommended because it is believed to be reliable over the long term, uses proven technologies, and offers the best balance of cost and technical considerations

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - a federal law that provides a comprehensive framework to deal with the investigation and cleanup of hazardous substances released into the environment from a waste site.

Administrative Record File - documents including correspondence, public comments, RODs, and technical reports upon which the agencies base their remedial action selection.

Proposed Final Remediation Levels - contaminant-specific, concentration-based cleanup levels for environmental media proposed to be implemented as part of the preferred alternative. Cleanup levels are finalized in the issued ROD.

Great Miami Aquifer - a regionally extensive groundwater aquifer system providing potable drinking water to many communities throughout central and southwestern Ohio. The FEMP site is located over a 1050 acre portion of the almost 960,000 acre aquifer system. The Great Miami Aquifer is a designated sole-source aquifer under the federal Safe Drinking Water Act, signifying a protected status as a valued natural resource.

Maximum Concentration Levels (MCLs) - concentration-based thresholds for individual chemical constituents in drinking water established by federal and state regulation to ensure the protection of public health. One goal of CERCLA is to restore affected aquifer systems to levels, such as the MCLs, which are protective of public health.

Perched Water - groundwater residing within the clay-rich soil located above the underlying Great Miami Aquifer (see Figure 2).

among the alternatives. This alternative would be designed to be protective of human health and the environment and to comply with federal and state regulations.

Fernald Citizens Task Force - chartered by DOE in 1993, these key stakeholders will recommend future land uses and final cleanup levels for the FEMP. The Task Force input will be instrumental in determining the path of future cleanup. Should this Proposed Plan conflict with the Task Force recommendations, due in the fall of 1994, DOE will consider making revisions to accommodate Task Force input. The Task Force is scheduled to issue preliminary recommendations in November 1994. We encourage you to attend Task Force meetings and offer your views on future uses of the site and final cleanup levels.

Community Acceptance

Community acceptance is one of the criteria which DOE and EPA are committed to evaluating during the process of selecting a remedy for Operable Unit 5. These federal agencies have several mechanisms available to them to gauge the degree of community acceptance, including 1) open dialogue with citizens concerning the results of the investigation and 2) encouraging citizens to participate by commenting on the remedial alternatives. This interaction with the community is critical to the CERCLA process and to making sound environmental decisions.

To foster community input into the decision process, the DOE chartered the ***Fernald Citizens Task Force***. The Task Force, which is comprised of local residents, FEMP employees and community leaders, is focused on making recommendations to decision makers on preferred cleanup levels, waste disposition strategies and future land uses for the FEMP property. The Operable Unit 5 FS and this Proposed Plan have attempted to consider the progressive deliberations of the Task Force throughout their development.

How You Can Participate

You are invited to:

- **Read** this Proposed Plan and review additional documents in the Administrative Record File
- **Call** the FEMP DOE office (see page 44) to ask questions, request information, or make arrangements for a briefing
- **Attend** a workshop or the public meeting listed on page 1 and give verbal comments.
- **Submit** written comments (see postage paid comment form on the back cover) by TBD
- **Contact** State of Ohio or EPA Region V project managers (see page 44)

The public is encouraged to review and comment on all remedial alternatives considered for Operable Unit 5, not just the preferred alternative. All alternatives are explained in detail in the section entitled Summary of Alternatives (see page 18). Additional details on the remedial alternatives can be found in Sections 4 and 5 of the FS Report for Operable Unit 5. This report is available in the Administrative Record file.

The actual selection of the alternative to be implemented will be made only after comments received during the public comment period have been reviewed and analyzed. The DOE and EPA will consider all public comments on this Proposed Plan in preparing the ROD. Depending on comments received, the selected final remedy for Operable Unit 5 presented in the ROD could be different from the preferred alternative. All written and verbal comments received during the public comment period will be summarized and responded to in the ***Responsiveness Summary*** section of the ROD. The ROD for Operable Unit 5 is scheduled to be issued in the fall of 1995.

Responsiveness Summary - a part of the ROD that summarizes and provides responses to public comments received on the Proposed Plan during the public comment period.

Permeability - the capacity of soil to allow water to pass through it.

Site Background

The FEMP, formerly known as the Feed Materials Production Center, is a 1050-acre DOE facility located approximately 18 miles northwest of Cincinnati (see Figure 1). Fernald, Ohio is a small rural community located just south of the FEMP. The FEMP is a government-owned facility that operated from 1952 to 1989 providing in excess of 500 million pounds of high-purity uranium metal products in support of U.S. defense initiatives. The topography of the area includes gently rolling uplands with steep hillsides along major streams, such as the Great Miami River. Surface drainage on the FEMP is from east to west and south into Paddys Run, with the exception of the northeast corner which drains east toward the Great Miami River. Groundwater beneath the FEMP is found in two principal geological units: the glacial overburden (ranging in thickness between zero and 50 feet) and the sand and gravel of the Great Miami Aquifer (see Figure 2). Groundwater occurring in the glacial overburden is considered "perched," in that it is contained within silty sand lenses residing within a low-***permeability***, clay-rich soil. The underlying Great

Miami Aquifer is the principal drinking water supply for the region and is regulated as a sole-source aquifer under the Safe Drinking Water Act.

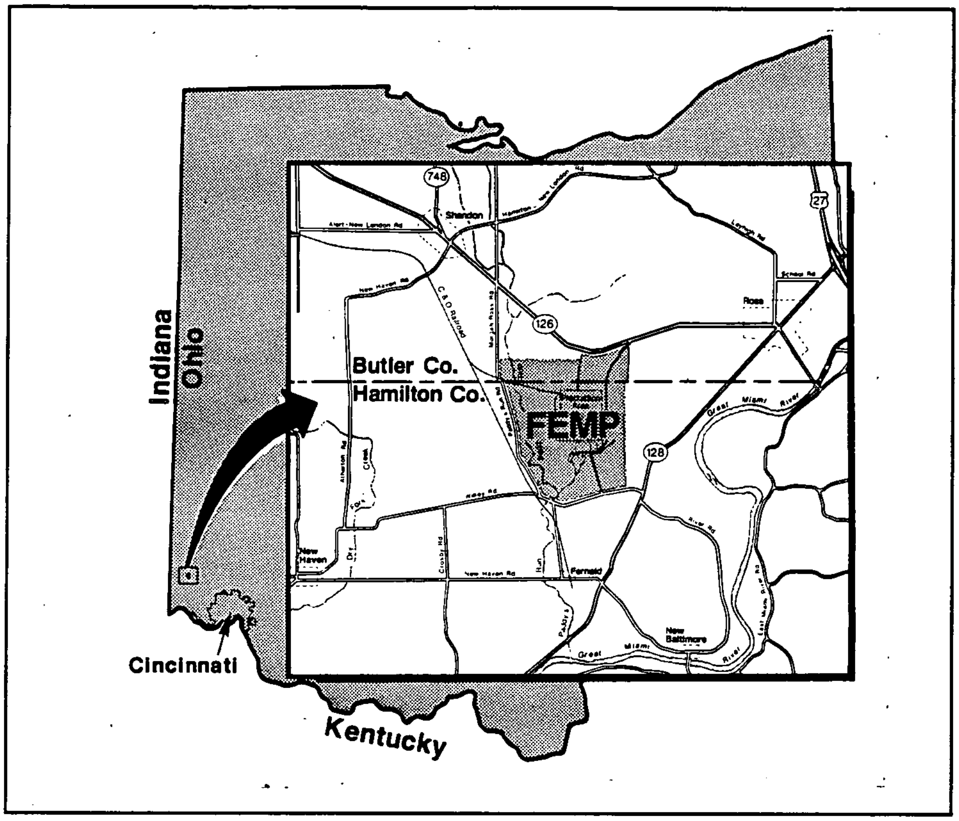

Figure 1: The FEMP is located in Southwest Ohio, approximately 18 miles northwest of downtown Cincinnati.

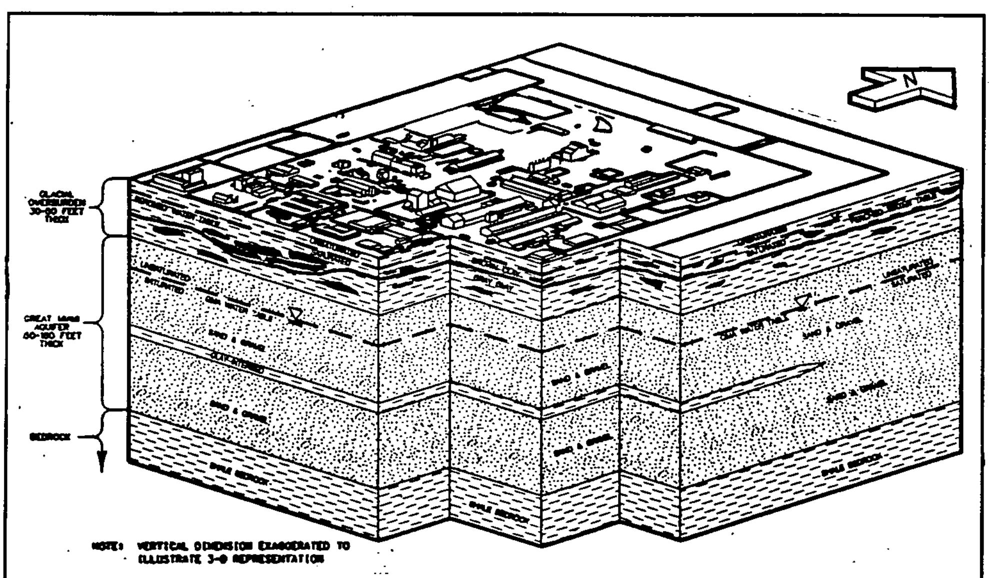

Figure 2: Conceptual Geologic Profile Beneath the FEMP

Additional Information

The **Strategic Plan for the FEMP** contains information on long range plans for the management and disposition of current waste inventories and anticipated future generation of waste materials.

The **1993 Environmental Report** contains the results of the ongoing environmental monitoring program at the FEMP. The report documents the estimated impacts that the facility may have introduced to the air, water, and soil neighboring the FEMP for calendar year 1994.

Call one of the phone numbers listed on page 44 to request a copy of the plans or visit the FEMP Public Environmental Information Center to review the documents.

Due to confirmed contaminant releases to the environment, the FEMP was placed on the *National Priorities List* in November 1989. Under CERCLA, the risks posed by hazardous substances at National Priorities List sites must be evaluated and, if necessary, appropriate remediation methods must be implemented to reduce risks to acceptable levels.

The RI/FS process was initiated at the FEMP in 1986 under a Federal Facility Compliance Agreement between the EPA and the DOE. The work plan for the study, prepared by DOE in 1988, identified 39 site areas for investigation. To enhance implementation of the RI/FS, the 39 areas were grouped into five "operable units" by combining similar waste areas or related environmental concerns. The operable unit concept was incorporated into the April 1990 Consent Agreement between EPA and the DOE. The RI/FS and any required cleanup of specific operable units at the FEMP are guided by the Consent Agreement as amended in September 1991, and associated work plans. These documents provide procedures and schedules to ensure investigations are conducted in compliance with federal and state environmental laws.

Operable Units 1-4 at the FEMP are termed "source" operable units, as they include the former production area and associated waste management areas which were the initial points of contaminant release to the environment. Operable Unit 5 addresses environmental media at the site as discussed below. Each operable unit is being managed in accordance with the schedules set in the Amended Consent Agreement, with RODs for all operable units due to be completed by July 1996.

National Priorities List - a formal listing of the nation's highest priority hazardous waste sites, as established by CERCLA, that have been identified for investigation and possible remediation. Sites are ranked by the EPA based on their potential impacts to human health and the environment.

Baseline Risk Assessment - an assessment required to be conducted under CERCLA to evaluate potential risks to human health and environment. This assessment estimates risks/hazards associated with existing and/or potential human and environmental exposures to contaminants.

Natural Background - Many of the radiological and all of the inorganic contaminants present at the FEMP naturally exist in measurable concentrations in all environmental media. These parameters include uranium, thorium, and radium, as well as arsenic, cadmium and magnesium. The background concentration of each constituent varies from point to point within a range for each media. The statistical basic background values for uranium in media at the FEMP site include:

Groundwater - 1 part per billion (ppb)
Soil - 4 parts per million (ppm)

Operable Unit 5 Description

Operable Unit 5 encompasses all environmental media both on and off the FEMP property, impacted by contaminants released from the FEMP site.

Sources of environmental media contamination from the FEMP can be described under two major categories: production operations and waste management practices. Production operations at the FEMP were limited to a fenced 136-acre tract of land known as the production area (being addressed under Operable Unit 3), located near the center of the site (Figure 3). Routine operations at the FEMP resulted in discharges to air from the process stacks and by-products which were handled in a variety of ways. Nonroutine discharges included spills and leaks. Before 1984, large quantities of solid and slurried wastes from the FEMP processes were stored or disposed of in concrete silos and in-ground pits located in the waste storage area (see Figure 3). Releases occurred from these waste management facilities as wind-induced dust or through surface water discharge. The waste storage areas are addressed under Operable Units 1, 2, and 4.

Summary of the Remedial Investigation

The RI for Operable Unit 5 included a number of tasks designed to identify the nature and extent of radiological and chemical contaminants in media, on and within the immediate vicinity of the FEMP. These tasks included sampling of soil, sediment, surface water, perched water and groundwater. Additionally, studies were conducted on the local flora and fauna, which included the identification of threatened and endangered species. The data obtained during the RI were used to conduct a ***baseline risk assessment*** and to determine the need to pursue remedial alternatives. For the purposes of this Proposed Plan, comparisons of contaminant concentrations are stated in relationship to ***natural background*** (where applicable). The Proposed Plan contains only a brief summary of the

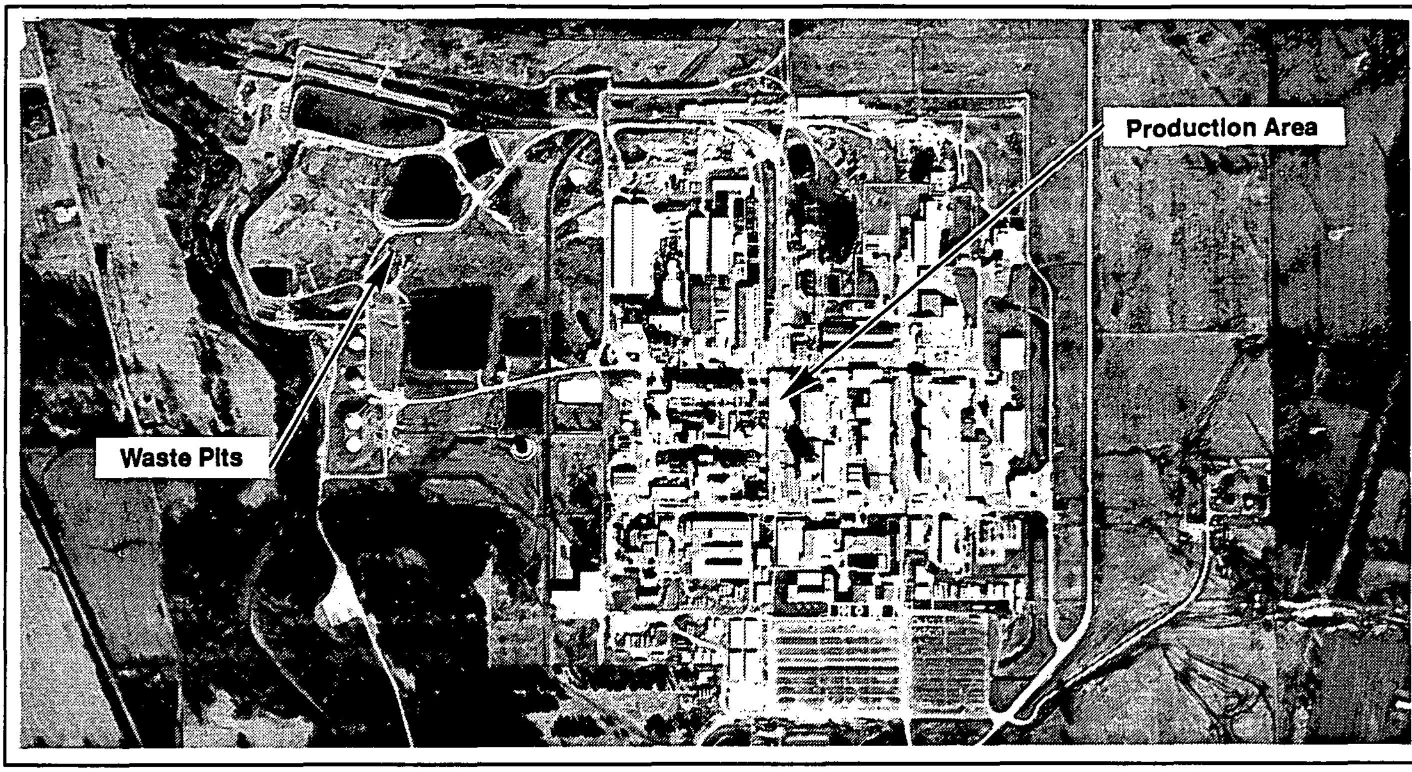

Figure 3: Aerial photograph showing the Production Area and the Waste Storage Area at the FEMP Site.

findings of the RI. The reader is directed to the Operable Unit 5 RI Report for additional information on specific contaminant concentrations.

Sampling conducted for the RI has documented that radiological and chemical contaminants from source areas have migrated to the surrounding media, both on and off the FEMP property, as discussed below. Addressing these contaminated media in a manner which ensures the long-term protection of human health and the environment is the objective of the Operable Unit 5 remedy.

parts per million (ppm) - a ratio of the mass of a contaminant to the total mass of contaminant and medium (usually soil or waater). Example: 1 ppm uranium can mean 1 gram of uranium in 1 million grams of water. Parts per million of contaminants in water can also be expressed (numerically equivalent) as milligrams per liter.

Contamination In Surface and Subsurface Soils

Contamination of surface and subsurface soils occurs within, as well as outside, the FEMP property boundaries. The highest concentrations of uranium in surface soil were found in the former production area at the location of the former scrap metal pile area (greater than 8000 *[parts per million] [ppm]*). Contamination in subsurface soil appears limited to the FEMP property. Levels of uranium, up to a hundred times background levels, were found within the FEMP property boundary in soil at depths as great as 20 feet. Some of the highest subsurface contaminant levels (greater than 400 ppm) were found near the former processing facilities where acidic uranium solutions were handled in large quantities.

Concentrations of approximately 20 ppm of uranium (approximately five times background) were identified in surface soil samples collected off-property immediately adjacent to the eastern and northeastern boundary of the FEMP. Uranium was detected at above background concentrations, but generally less than two times background levels, in a widespread area off the FEMP property; up to 11 square miles of surface soil beyond the FEMP property lines are projected to have been impacted at these low concentrations. The source of these low concentrations is emissions of dust particles to the atmosphere from plant stacks over the FEMP's 38 year production history.

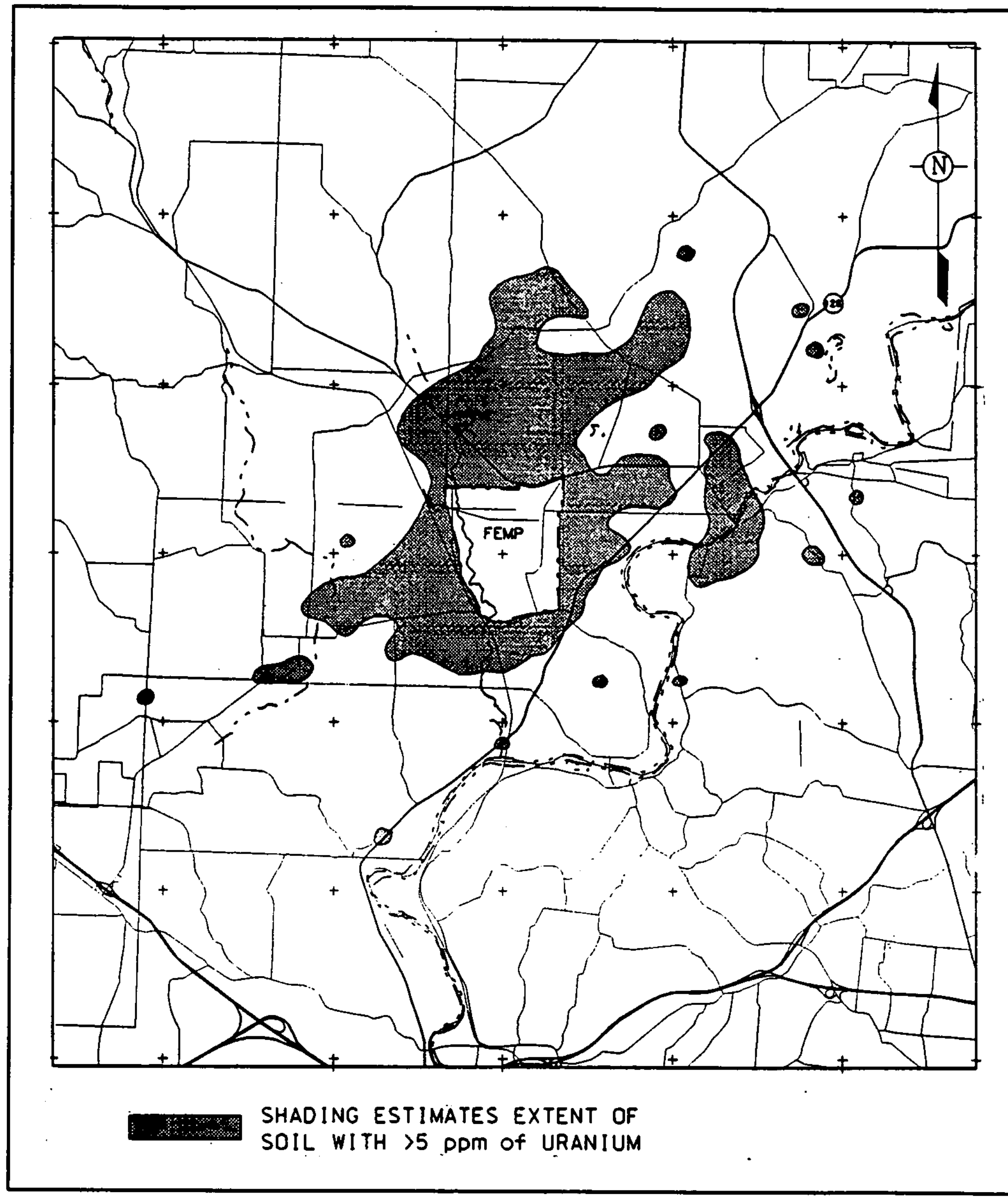

Figure 4: Estimate of Off-Property Surface Soil Potentially Impacted by FEMP Historical Operations

Figure 4 depicts the area estimated to have been impacted with above-background concentrations of uranium in surface soil due to FEMP operations. It should be noted that there is significant uncertainty associated with the measured analytical results for the range of low concentrations of uranium (5 to 7 ppm) typically detected in the affected area. It becomes increasingly difficult to differentiate the presence of site introduced contaminants as the measured values approach the range of natural background for a constituent. In the event the selected remedy contemplates removal of soil at this uranium concentration range (5 to 7 ppm), significant additional off-property sampling would be required to establish the definitive limits of the impacted areas.

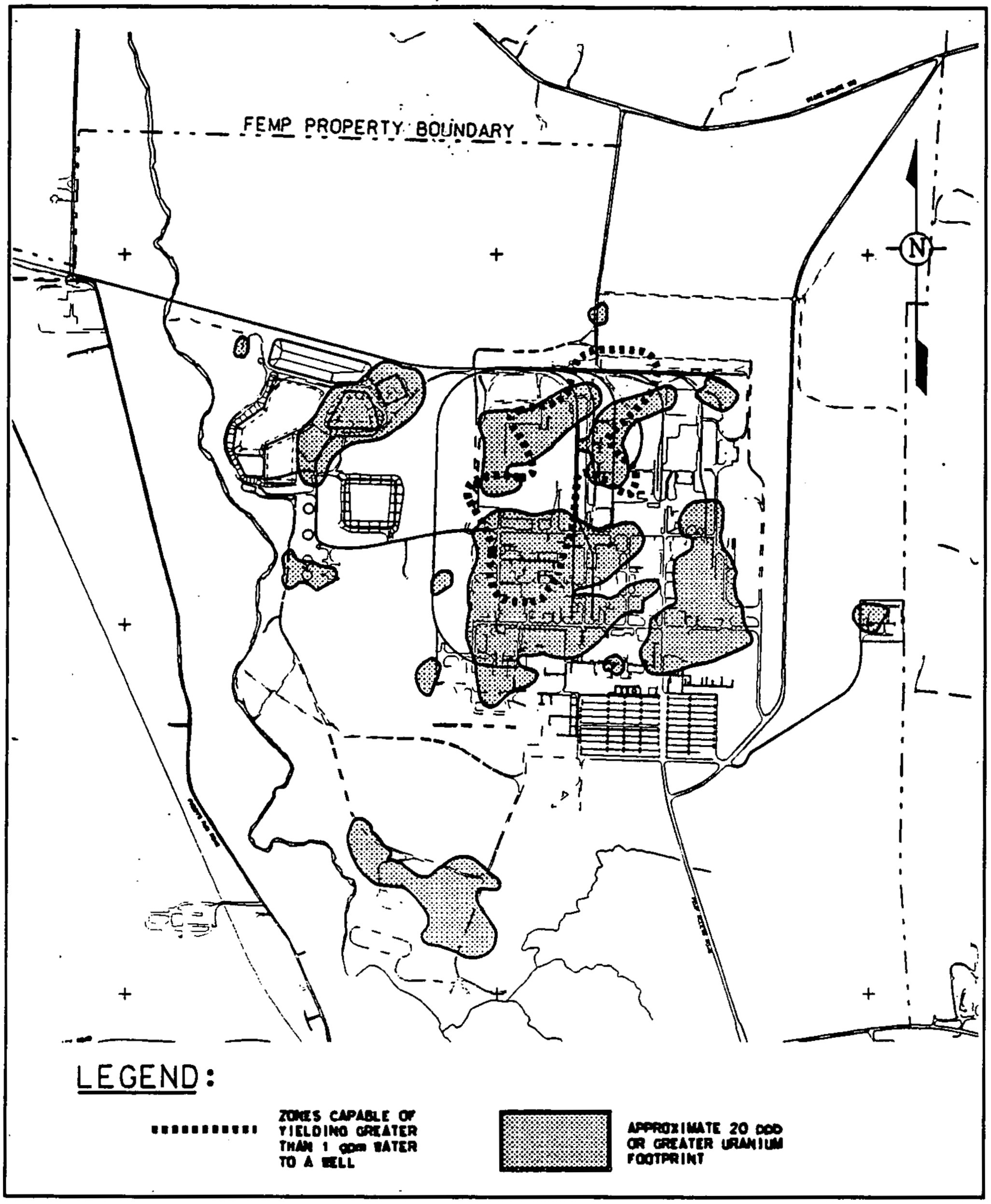

Figure 5: Impacted Areas of the Perched Groundwater System

Radium - a naturally occurring radioactive metal which was present in uranium ore and ore concentrate feed streams to the production process. Radium was removed during processing and is present in the FEMP waste streams.

Thorium - a naturally occurring radioactive metal. Thorium metal was a relatively limited product stream at the FEMP. Significant quantities of relatively pure thorium compounds remain in inventory at the site. Additionally, thorium was introduced to the FEMP production process in uranium ore and ore concentrate feed streams.

Fission and uranium activation products - radioactive elements produced as a result of a nuclear reaction. These radioactive elements were present as trace impurities in uranium recycle feed streams received at the FEMP from other DOE facilities.

Radium, thorium, fission and uranium activation products and inorganic and organic contaminants were also observed in surface and subsurface soils on the FEMP property. The areas affected by these contaminants are localized, with the highest concentrations typically found in association with areas exhibiting the highest uranium concentrations.

Contamination In Perched Groundwater
Extensive sampling of perched groundwater on the FEMP property identified the presence of site-related contaminants across much of the former production area, adjacent to the storage pits and silos, and in several other locations (see Figure 5). Concentrations of contaminants are greatest underlying several of the former production buildings. These contaminant concentrations diminish to natural background levels near the perimeter of the FEMP property.

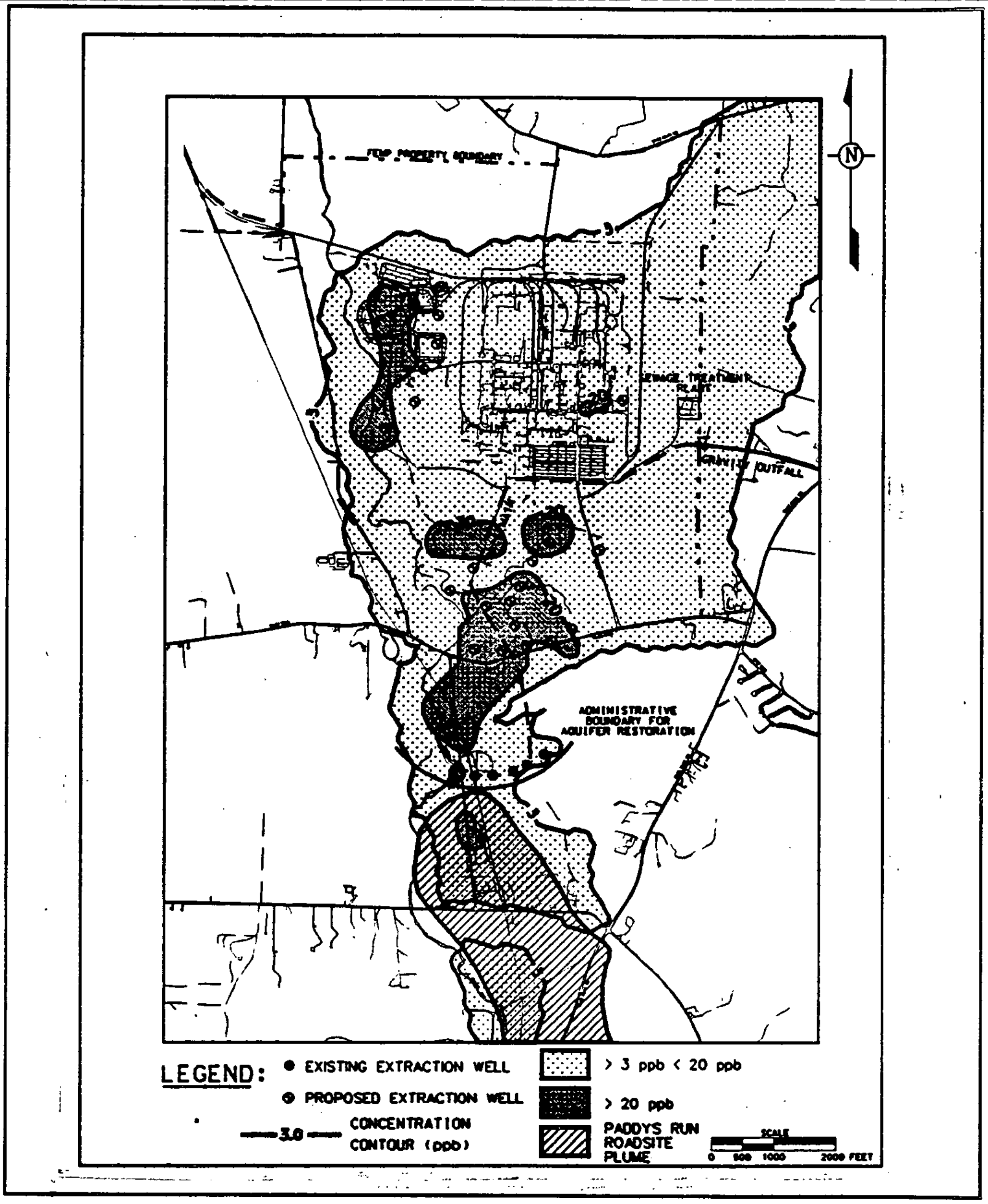

Figure 6: Impacted Areas of the Great Miami Aquifer

Contamination In Great Miami Aquifer Groundwater

Uranium, the principal site-related contaminant in the Great Miami Aquifer, is primarily found in the uppermost portion of the aquifer. Figure 6 depicts the areas of the Great Miami Aquifer which are above background (1 ppb) and appear to have been impacted by FEMP operations. As shown in the figure, significant levels of contamination exist in several areas, including:

- Localized areas beneath the former production area (up to 50 ppb of uranium)
- Beneath the waste storage area (up to 70 ppb of uranium)
- Along the length of Paddys Run from the waste storage area to approximately 1 mile south of the FEMP property (up to 350 ppb of uranium)
- Beneath a solid waste disposal area, termed the South Field, located on the southern portion of the FEMP property (up to 2100 ppb of uranium)

Above-background concentrations of uranium also exist in the groundwater along the west bank of the Great Miami River (a 100- to 200-foot wide strip), south of the confluence with Paddys Run. Concentrations of uranium in this area are typically less than 10 ppb.

Several other-site related contaminants are also present in the aquifer, occurring as localized pockets within the plume of uranium contamination.

Contamination In Surface Water
The FEMP's primary drainageways are the storm sewer outfall ditch and Paddys Run. Because the composition and spatial boundaries of surface water rapidly change, the concentrations discussed here reflect the most recent 1993 sampling results. Surface water samples collected from the storm sewer outfall ditch indicated elevated concentrations of total uranium and thorium-230 (up to 64 μg/L and 6.4 pCi/L, respectively). Improved storm water management practices implemented at the FEMP since these samples were collected have significantly reduced uranium discharges to the storm sewer outfall ditch.

Surface water samples collected from both the off-property and on-property portions of Paddys Run exhibited above-background concentrations for total uranium and total thorium. Samples collected from the Great Miami River immediately downstream from the FEMP wastewater discharge outfall line indicated concentrations of uranium ranging up to 2.8 g/L. Concentrations of uranium in the Great Miami River were found to quickly diminish downstream of the outfall line, nearing background levels within 1 mile.

Contamination In Sediment
Sediment samples were collected from the storm sewer outfall ditch, Paddys Run and the Great Miami River. Because the composition and spatial boundaries of sediment change rapidly, the concentrations discussed here reflect the most recent 1993 sampling results. In sediment samples collected from the storm sewer outfall ditch, total uranium was the most frequently detected radionuclide with concentrations ranging up to 3.3 mg/kg. Inorganic contaminant, were also detected at above-background concentrations.

Radium-226 and total uranium were detected in sediment from the on-property portion of Paddys Run in above-background concentrations (1.4 pCi/g and 22.8 mg/kg, respectively). ***Volatile organics, semivolatile organics*** and inorganics were also detected in select samples of on-property sediment. The concentration of organics in the sediment ranged up to 350 mg/kg. Off-property sediment sampling detected only uranium and zinc concentrations exceeding background (up to 11 mg/kg and 50 mg/kg, respectively).

Sediment samples from the Great Miami River indicated concentrations of total uranium (3.3 pCi/g) radium-226 (0.8 pCi/g), and total thorium (5.47 mg/kg) to be slightly above background.

Impacts To Biological Resources
Radiochemical analysis was performed on samples of vegetation, benthic macroinvertebrates, fish and small mammals collected from locations on and off the FEMP property. In general, uranium was detected in select samples at very low concentrations from all sampling groups.

Volatile Organic - a group of organic compounds that have a tendency to vaporize readily. Examples include trichlorethylene, benzene, and methane.

Semi-volatile Organic - a group of organic compounds which do not vaporize readily. Examples include phenol and naphthalene.

Removal Actions

Concurrent with the ongoing RI field investigations, a number of ***removal actions*** were implemented to minimize the potential for impacts to human health associated with existing environmental conditions at the FEMP. These removal actions included the collection and treatment of contaminated surface water runoff; efforts to minimize the migration of contaminated perched water to the Great Miami Aquifer; and measures to mitigate the further migration of groundwater contamination. Upon initiation of the final remedial action these activities will be discontinued as separate removal actions, and incorporated into the final remedial action as needed.

Summary of Site Risks

As the final step of the remedial investigation, a baseline risk assessment was conducted to evaluate current and future potential risks to human and ecological receptors associated with contaminants present at the site. Using ***conservative*** assumptions, the baseline risk assessment evaluated risks posed by the existing conditions as if no additional cleanup actions were performed at the site. Risks were evaluated for the site as it presently exists and for simulated conditions up to 1000 years into the future.

Removal Actions - cleanup actions taken to address a near-term environmental or public health concern due to the release or significant potential for release of hazardous substances. Removal actions are implemented at waste sites to address more immediate concerns while the RI/FS process is underway.

Conservative - overly cautious, careful, assumes extremely protective conditions.

Consistent with EPA policies, the results of the baseline risk assessment were compared to risk-based standards to determine if cleanup actions were warranted. The results demonstrated that the existing concentrations of contaminants in the environmental media pose risks to human and ecological receptors at a level sufficient to trigger the need for remedial actions.

Human Health Evaluation

Within the baseline risk assessment, the maximum potential exposure that a human could receive from the existing contaminated environmental media was evaluated for both current and future land use scenarios. It should be noted that the baseline risk assessment applied these potential land uses to bracket the range of risks associated with the FEMP in the event no additional cleanup actions were undertaken at the FEMP. These scenarios are summarized below.

Exposure Scenarios
The major assumptions employed to support the assessment of risk for the two representative land use scenarios include the following:

Current Land Use with Access Controls - For this scenario, the FEMP is assumed to remain under federal ownership with current access restrictions maintained. No remedial actions are assumed to take place, and site contamination is projected to spread through contact with the wind, rain and groundwater. No members of the public are projected to have established residences on the FEMP property. Human receptors projected to be hypothetically exposed under this scenario include a trespassing youth, a site worker, a visitor, and the members of an off-FEMP-property farm family.

Future Land Use Without Access Controls - For this scenario, federal ownership is assumed to be discontinued at the FEMP and a family farm is assumed to occupy the facility. Human receptors projected to be hypothetically exposed under this scenario include the members of a farm family located both on and off the existing FEMP property.

The following types of human exposure were evaluated in the baseline risk assessment:

- Inhalation of organic vapors and fugitive dust
- Ingestion of contaminated groundwater
- Direct radiation
- Incidental ingestion of contaminated soil
- Uptake into crops, meat and milk
- Dermal contact with contaminated soil, surface water and groundwater

Noncarcinogenic Health Effects

Many contaminants, such as magnesium and zinc, commonly found at waste sites are considered to present potential noncarcinogenic health risks. Examples of noncarcinogenic health risks include kidney damage and eye irritation. Additionally, several contaminants, such as uranium, have been determined to present both noncarcinogenic and carcinogenic health risks.

Potential noncarcinogenic health effects for a waste site are assessed in terms of a ***hazard index*** for each contaminant of concern. The calculated hazard index indicates the potential for the most sensitive individuals, such as children, to be adversely affected. Hazard indices are compared to a threshold value of 1, established by EPA as the level above which there is the potential of noncarcinogenic effects on exposed individuals. Estimates of the noncarcinogenic effects to the hypothetically exposed human receptors for the two land use scenarios evaluated for the baseline risk assessment are listed in Table 1. The hazard indices were estimated for a range of on and off FEMP property locations.

Hazard Index - an index used as a measure of the potential for site contaminants to present unacceptable noncarcinogenic toxic effects. When the hazard index exceeds 1, there may be concern for potential noncarcinogenic effects.

For the current land use with access controls scenario, the hazard index of 5.4 for the site worker is related to projected incidental ingestion and dermal contact with highly contaminated soil in the former production area by an individual over a 25-year period. The hazard index of 260 to the off-property child is associated with the projected incidental ingestion of soil and the consumption of groundwater, without treatment, for a period of 6 years at the maximum concentrations predicted to occur in the aquifer off the FEMP property within the next 1000 years. This estimate is based on conservative assumptions associated with exposure duration and the modeling used to predict the concentrations of the contaminants in the soil and groundwater at the closest point of potential exposure. For the future land use without access controls scenario, a hazard index of up to 840 was calculated for the hypothetical on-property resident child. The primary exposure routes for this hazard index are attributable to incidental ingestion of contaminated soil and the consumption of groundwater.

TABLE 1
SUMMARY OF BASELINE RISK ASSESSMENT RESULTS

Receptor	Exposure Duration	Range of Carcinogenic Risk[a]	Range of Noncarcinogenic Risk[b] (Hazard Index)	Primary Contributing Exposure Route
Current Land Use with Access Controls				
Site Worker (Groundskeeper)	25 years	9.9×10^{-6} to 1.4×10^{-3} (9.9 in 1,000,000 to 1.4 in 1000)	<1 to 5.4	Soil
Trespassing Youth	12 years	2.7×10^{-6} to 6.5×10^{-5} (2.7 in 1,000,000 to 6.5 in 100,000)	<1 to 1.8	Soil
Off-Property Farmer	70 years (lifetime)	5.1×10^{-4} to 1.2×10^{-2} (5.1 in 10,000 to 1.2 in 100)	>2 to 50	Groundwater/Soil
Off-Property Child	6 years	5.2×10^{-5} to 3.9×10^{-3} (5.2 in 100,000 to 3.9 in 1000)	>10 to 260	Groundwater/Soil
Future Land Use Without Access Controls				
Off-Property Farmer	70 years (lifetime)	1.7×10^{-5} to 2.3×10^{-3} (1.7 in 100,000 to 2.3 in 1000)	<1 to 37	Groundwater
Off-Property Child	6 years	6.5×10^{-7} to 2.1×10^{-4} (6.5 in 10,000,000 to 2.1 in 10,000)	<1 to 150	Groundwater
On-Property Farmer	70 years (lifetime)	6.0×10^{-3} to 2.2×10^{-2} (6.0 in 1000 to 2.2 in 100)	23 to 1500	Soil
On-Property Child	6 years	5.0×10^{-4} to 4.5×10^{-3} (5.0 in 10,000 to 4.5 in 1000)	110 to 840	Soil

[a] The NCP defines an acceptable level of carcinogenic risk as less than 1 additional incidence of cancer in 10,000 to 1,000,000 individuals (10^{-4} to 10^{-6}).

[b] A hazard index (the ratio of the level of exposure to an acceptable level) greater than 1 indicates that there may be concern for noncarcinogenic effects. Hazard indices listed are cumulative across all exposure pathways.

Slope Factor - a conservatively estimated value of an individual's probability of developing cancer as a result of a lifetime exposure to a particular level of a potential carcinogen.

National Contingency Plan - (implemented by the Code of Federal Regulations Title 40, Part 300 et seq.) - regulations implementing response actions under CERCLA, including the procedures for performing the RI/FS process and conducting removal and remedial actions to address the releases of hazardous substances.

Carcinogenic Risk

Carcinogenic risk describes the potential for a contaminant to induce human cancer and is expressed as a product of a receptor's total expected lifetime exposure to a particular contaminant and a ***slope factor*** for the contaminant. The calculated product, referred to as an incremental lifetime cancer risk (ILCR), indicates the potential increase in cancer occurrences as a result of human exposure to the carcinogenic contaminant. As described in the ***National Contingency Plan***, contaminants present in sufficient concentrations to create an excess lifetime cancer risk within or less than the range of 1 chance in 10,000 (referred to as 10^{-4}) to a 1 chance in 1,000,000 (referred to as 10^{-6}) are considered acceptable to the EPA.

As shown in Table 1, carcinogenic risks were projected to fall outside the acceptable risk range for all receptors considered under the current land use with access controls scenario, with the exception of the trespassing youth and the off-property child. Under this scenario, up to one additional residential receptor out of 100 are potentially at risk of developing cancer over a lifetime. This excess cancer risk is primarily related to ingestion of groundwater contaminated with uranium and other hazardous constituents.

This risk is estimated for a receptor who, over the individual's entire lifetime, consumes groundwater that exhibits the highest projected concentrations expected to occur in the aquifer within a period of 1000 years into the future. Similarly, carcinogenic risks are also projected to fall outside the acceptable risk range for all receptors considered under the future land use without access controls scenario.

As identified by the baseline risk assessment, the potential risks associated with the site's contaminated environmental media increases with the concentrations of contaminants in the aquifer. Therefore, contamination present in the soil and sediment at the site, if not addressed by the preferred alternative or one of the other alternatives, would continue to migrate to the Great Miami Aquifer. If no actions were taken, the continued migration of site contaminants would result in further deterioration of existing environmental conditions, potentially increasing risks to human health over the long term.

Evaluation of Risk to Ecological Receptors

A Site-Wide Ecological Risk Assessment was conducted to determine if the radiological and chemical contaminants present at the site represent a current or future risk to ecological species (i.e., flora and fauna) inhabiting the FEMP site or nearby off-property areas, including the Great Miami River. This assessment concluded that the concentration of select inorganic, organic and radiological contaminants present at the site in soil, surface water and sediment could present unacceptable risks to plants and animals. The greatest calculated risk to terrestrial and aquatic receptors (e.g., trees, animals, and fish) was determined to be attributable to elevated concentrations of uranium in the environmental media. The primary source of this risk was projected to be associated with the toxicity of uranium as a heavy metal, as opposed to its radiological properties.

Fate and Transport Modeling - computer simulations of the natural environment, performed to estimate the transport of a contaminant through environmental media in order to provide input to the baseline risk assessment.

Fate and Transport Modeling

To aid in evaluating potential risks, ***fate and transport modeling*** was used to predict the migration of site contaminants through the environment, assuming no additional cleanup actions are taken. The models used data obtained during the remedial investigation, such as contaminant concentrations, and the physical characteristics of the local geology, surface water hydrology and groundwater to predict the movement of the contaminants through the environment. The modeling was used to predict the potential deterioration of environmental conditions in the vicinity of the FEMP over a period of 1000 years.

The modeling identifies the projected future concentrations of the various contaminants to which the receptors would be exposed through inhalation, ingestion, dermal contact and direct radiation. The results of the modeling conducted to support Operable Unit 5 indicate that the amount of contaminants being released from the soil and sediment at the site to the regional aquifer will continue to increase throughout the 1000-year period. The maximum concentration of total uranium projected to occur within the aquifer approximately 1000 years in the future could exceed 9000 ppb in the event no additional remedial measures were implemented. This concentration greatly exceeds the proposed federal drinking water standard for uranium of 20 ppb. The modeling results support the baseline risk assessment conclusions that remedial actions are necessary at the site.

Remedial Action Objectives

Remedial Action Objectives - goals set in accordance with EPA guidance for protection of human health and environmental receptors from potential adverse effects of contaminants in any media. Usually include targeted cleanup goals.

Remediation Levels - contaminant-specific, concentration-based cleanup levels for environmental media. Remediation levels, which are preliminary throughout the RI/FS process, are finalized in the issued ROD.

Land Use Objective - the planning level projected future land use of the FEMP, adopted for purposes of developing and evaluating alternatives for the Feasibility Study. The land use objective represents the most conservative future use of the FEMP property which is projected to occur over the next 200 to 1000 years.

As part of the RI/FS process, ***remedial action objectives*** were developed in accordance with the National Contingency Plan and EPA guidance. The intent of the remedial action objectives is to set goals to ensure the protection of human health and the environment. The goals are designed specifically to mitigate the potential adverse effects of site contaminants present in environmental media. From the remedial action objectives, preliminary chemical-specific ***remediation levels***, which define acceptable levels of risks, are developed. For environmental media, remediation levels were developed for a range of potential residual risk levels (i.e., 10^{-6}, 10^{-5}, etc.) and a range of potential exposed receptors (i.e., resident farmer, recreational receptor, etc.). As previously discussed, a level of 10^{-6} represents the concentration of contaminants in media which would yield a calculated increase in the chance of acquiring a cancer in a 70- year lifetime of 1 in 1,000,000. This incremental chance would be in addition to the 1 in 4 chance of acquiring cancer which currently exists in the U.S. The remediation levels were developed to ensure that remedial actions reduce the projected risk to humans (presented in Table 1) to protective levels consistent with the anticipated future land use of the FEMP. These levels must also be protective of ecological receptors residing in the area.

The remedial action objectives for Operable Unit 5 include (1) eliminating, or reducing to acceptable levels, the potential for human or ecological receptors to come in contact with contaminated environmental media, and (2) prevention of off-property migration of contaminants in excess of the chemical-specific remediation levels. Chemical-specific preliminary remediation levels were established for each category of media (soil, sediment, perched groundwater, and the Great Miami Aquifer) that have been affected by site contamination.

In addition to meeting the remedial action objectives, all of the alternatives considered in the Feasibility Study were designed to achieve target ***land use objectives*** upon completion of the cleanup. A range of potential future land uses was used as the foundation for the identification, initial screening, and detailed evaluation of viable remedial action alternatives. The same potential future uses also provide the framework for identifying risk-based exposure scenarios and the hypothetical reasonable maximally exposed (RME) individuals for which land use-specific remediation levels are established.

The range of land use objectives was strategically defined to appropriately bracket the extensive combinations of future land uses potentially viable for the property. The land use objectives were developed to take into consideration the progressive deliberations and resolutions of the Fernald Citizens Task Force. The prevailing land use of the region, residential farming, was used as the point of departure for establishing potential future land uses. From this point of departure, the following future land use objectives for the FEMP property were formulated:

- ***Land Use Objective 1*** examines the viability of returning the entire on-property area to full unrestricted use following cleanup. This objective considers the potential for establishing a hypothetical family farm on any portion of the existing FEMP property. For this, and all other land use objectives, affected off-property areas were examined only in context of the existing land use in the region, residential farming.

- ***Land Use Objective 2*** provides for the establishment of an on-property, consolidated management area for contaminated soil, with unrestricted use of all remaining areas of the property. This land use objective considers the potential for establishing a hypothetical family farm, following cleanup, on any portion of the FEMP property outside the area where the contaminated materials are consolidated.

- ***Land Use Objective 3*** also provides for the consolidation of contaminated soil in a central area, but restricts the potential uses of the remaining areas of the property through the application of institutional controls. This objective considers the potential for establishing recreational, commercial/industrial, or undeveloped open space (i.e., green space) on any portion of the FEMP property outside the area where the contaminated materials are consolidated.

- ***Land Use Objective 4*** provides for minimum consolidation of contaminated soil with access and future use of the FEMP property restricted. This land use objective contemplates the FEMP property being maintained as a waste management area.

By using the land use objectives approach to formulate remedial action alternatives, decision-makers are provided with a comprehensive but manageable array of alternatives. From this array, decision-makers are provided with the required information from which to evaluate technical site constraints, required administrative controls, and the overall cost implications of moving from totally restrictive to progressively less restricted land use possibilities.

Applicable or Relevant and Appropriate Requirements (ARARs) - "applicable" requirements mean those standards, criteria, or limitations promulgated under federal or state law that are required specific to a substance, pollutant, contaminant, action, location, or other circumstance at a CERCLA site. "Relevant and appropriate" requirements mean those standards, requirements, or limitations that address problems or situations sufficiently similar to those encountered at the CERLCA site such that their use is well suited to that particular site.

As previously discussed, the Operable Unit 5 remedy does not result in a specific recommended land use for the FEMP property. The Operable Unit 5 remedy will establish final cleanup levels for the site for each media, coupled with the selection of a final disposal strategy for the materials exhibiting contaminant concentrations above those cleanup levels. The final cleanup levels for the soil and other media would establish the permissible concentration of contaminants which could remain at the site following the completion of remedial actions. The remaining concentrations of these contaminants would present a potential for exposure and risk to future users of the FEMP. The degree of exposure and risk associated with these remaining contaminant concentrations would be linked directly to the type and duration of future use of the facility. Future land uses contemplating more direct contact for longer time intervals (e.g., residential farming of the FEMP) would be expected to yield a higher calculated exposure and risk than would future uses which involve less opportunities for long-term exposure (e.g., recreational or industrial use of the FEMP). The Fernald Citizens Task Force is focused on making recommendations to the DOE, on the behalf of the local citizenry, regarding a preferred future use for the FEMP property. This recommendation is expected in November of 1994.

CERCLA does not provide for one set of cleanup criteria for universal application to waste sites, but requires that sites satisfy, or gain a waiver to, federal and state environmental laws and regulations (i.e., ***applicable or relevant and appropriate requirements [ARARs]***) which are location-, chemical-, and action-specific to the individual remediation site. In addition to meeting the risk-based remediation levels established for each land use objective, all of the viable alternatives must satisfy ARARs specified in federal and state environmental laws and regulations. Examples of the primary ARARs for the Operable Unit 5 alternatives include, but are not limited to:

- State of Ohio siting criteria for solid waste disposal facilities
- Resource Conservation and Recovery Act (RCRA) requirements for treatment of contaminated media and the design of engineered containment facilities
- Safe Drinking Water Act maximum contaminant levels (MCLs) for public water supplies
- National Pollutant Discharge Elimination System requirements for wastewater treatment and discharge
- State of Ohio rules for control of particulant emissions and fugitive dust

These primary ARARs focus on the control of solid and hazardous wastes, the maximum permissible contaminant concentrations in ground- and surface water, and the regulation of air emissions that may result from the remediation activities for Operable Unit 5. The ARARs also govern the handling of residual materials that may be generated during treatment processes.

Summary of Remedial Alternatives

Off-Site Licensed Disposal Facility - a representative commercial disposal facility permitted to accept low-level radiological and/or mixed (radiological and hazardous) waste has been used as part of the basis for evaluating alternatives in this FS. The representative facility is located near Clive, Utah. Based on a number of factors, including the duration of FEMP remedial actions and the future capacity and regulatory compliance status of the representative facility, alternative facilities may be required in the future.

There were many remedial technologies and process options initially considered for the cleanup of each of the affected media present at the FEMP. Arraying these process options together produced in excess of 2000 potential alternatives which could be applied at the site. Using the four land use objectives as a guide, 10 viable remedial alternatives were identified from the long list of available alternatives for further consideration in the initial screening step of the Feasibility Study. The alternatives were first compared against one another to identify and distinguish meaningful differences among the various alternatives, and then evaluated with respect to their effectiveness, implementability and cost. Only the alternatives judged as best or most promising on the basis of these evaluation factors were retained for further consideration and analysis. The screening process resulted in the selection of seven remedial alternatives which were sufficiently distinct, yet potentially implementable and effective.

This Proposed Plan only discusses the seven alternatives that met the initial screening criteria. In order to adequately compare the final alternatives and select an appropriate remedy for a site, EPA requires that a no-action alternative be developed and used as a baseline against which other alternatives are evaluated. Each of the seven alternatives, along with the no-action alternative, is listed below with its associated land use objective category.

No-Action Alternative - Under this alternative, no remedial actions would be taken for Operable Unit 5 contaminated media. This alternative was retained to provide a baseline for comparison in accordance with regulatory requirements.

Land Use Objective 1: Full Unrestricted Use

Alternative 1 - Excavation and Off-Site Shipment - Under this alternative, contaminated soil and sediment exceeding remediation levels would be excavated and shipped to an ***off-site licensed disposal facility.*** Shipping is anticipated to take place in covered gondola rail cars. Excavated areas would be regraded with existing site soil so as to reach a predetermined final surface grade. The use of clean, imported fill would be required, but kept to a minimum. Contaminated perched groundwater zones, deemed to represent unacceptable risks to potential human receptors (i.e., yielding greater than 1 gpm to a well) or the underlying Great Miami Aquifer, would also be excavated and disposed

000018

of at an off-site disposal facility. Although domestic wells installed over the last 30 years draw water from the underlying regional aquifer, the U.S. EPA, the Ohio EPA, and the DOE collectively agreed that a yield of 1 gpm would be considered reasonable to sustain a household. Figure 5 illustrates the extent of perched units that yield greater than 1 gpm.

Within this alternative, two differing remediation levels were examined. The first case had as an objective the protection of the projected future receptors (i.e., in this case a hypothetical on- and off-property farmer) at an ILCR of 10^{-6}. The second case was designed to provide protection to these same receptors at a 10^{-5} level.

To achieve these goals, remediation levels for soil had to be adjusted (i.e., lowered) in select areas to take into consideration the potential for continued leaching of contaminants into the aquifer at concentrations which potentially exceeded groundwater cleanup levels. These adjustments were contaminant specific and took into consideration the geologic conditions of the site and the ***solubility*** of the contaminant.

Coupled with the target risk levels for soil were equivalent goals for the cleanup of existing contamination residing in the Great Miami Aquifer. For uranium, the two groundwater restoration cases examined were to restore the aquifer to a level of 3 parts per billion (ppb) (i.e., 10^{-6} ILCR) and a level of 20 ppb. The 20 ppb level for uranium representing the proposed federal drinking water standard and is slightly lower than a 10^{-5} ILCR for groundwater. For each case a series of groundwater extraction wells would be installed as a means to flush the contaminants from the aquifer and attain the desired cleanup levels. Figure 6 identifies the configuration of wells employed for the FS to attain the 20 ppb uranium level in the aquifer, while attaining allowable drinking water MCLs for other contaminants present.

As indicated in Figure 6, an administrative boundary was established at the northern limit of the ***Paddys Run Road Site***. This corresponds to the southern extent of groundwater capture created by the South Plume Removal Action wells, which began operation in 1993. The ***South Plume Removal Action*** was initiated prior to selection of the final remedy to prevent the additional migration of contamination off site. DOE's role and involvement in the cleanup of the Ohio EPA's ongoing assessment of the Paddys Run Road Site plume, if any, will be defined separately as part of the Paddys Run Road Site response obligations and in accordance with the Paddys Run Road Site project schedule. Monitoring would continue south of the administrative boundary until such time as the need for action is established and implemented.

Figure 7 provides a graphic representation of the expected reduction of uranium concentrations in the Great Miami Aquifer due to operation of the groundwater extraction systems. Modeling performed for the FS was used to estimate the groundwater pumping rates required from the recovery wells installed to restore the aquifer system to the target cleanup levels. This modeling effort yielded an estimated maximum pumping rate of 7500 gallons per minute (gpm) for the 10^{-6} ILCR target recovery system and a maximum rate of 6300 gpm for the system pursuing cleanup to the drinking water standards (i.e., MCLs). The pumping rate for these systems would be expected to vary during the period of aquifer restoration with gradual cessation of pumping once the attainment of cleanup goals could be certified. The modeling further estimated the time to restore the aquifer for the 10^{-6} ILCR-based recovery system to be in the range of 75 years, while the MCL system was estimated to require in the range of 30 years of pumping to attain cleanup objectives. More detailed modeling would be

Solubility - the tendency of a contaminant present in soil to dissolve into surface water or groundwater.

Paddys Run Road Site - a state led CERCLA cleanup site located south of the FEMP along Paddys Run. The site involves volatile and semivolatile compounds and arsenic in the Great Miami Aquifer.

South Plume Removal Action - Cleanup actions taken to address a near-term environmental or public health due to the release or significant potential for release of a hazardous substances. Removal actions are many times implemented at waste sites to address more immediate concerns while the RI/FS process is completed.

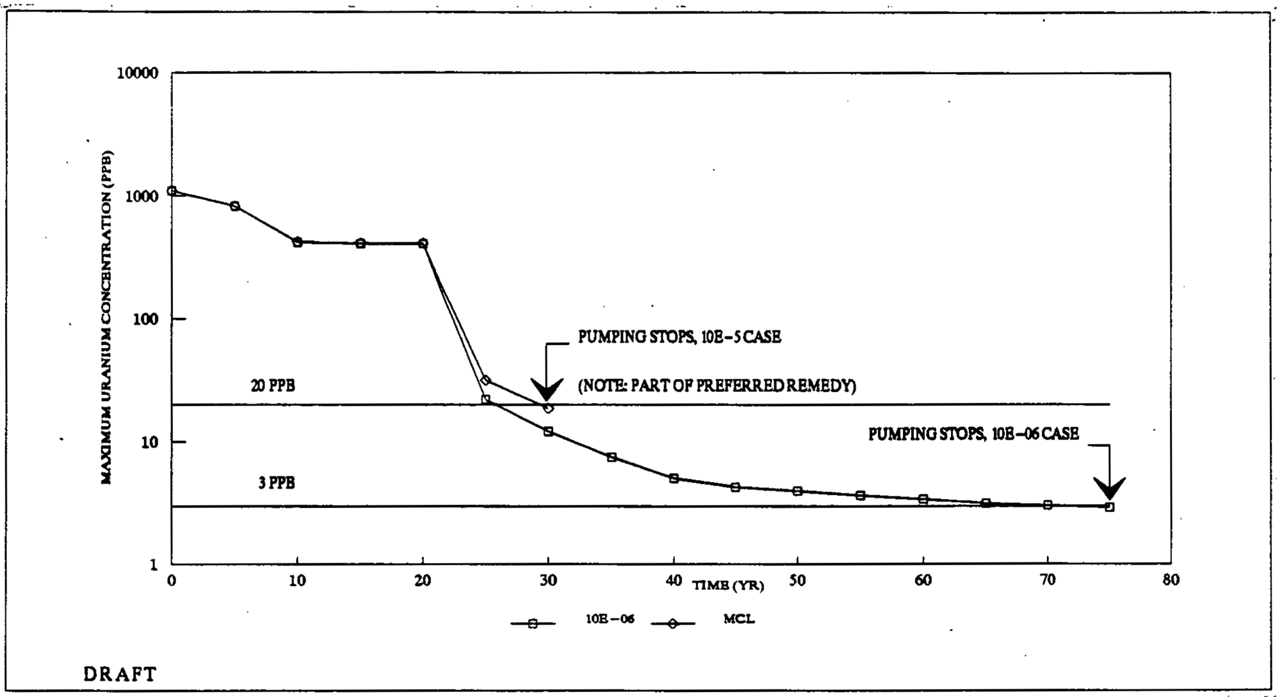

Figure 7: Reduction of Maximum Uranium Concentration in Aquifer with Pumping

conducted following remedy selection to refine these flow rates and restoration timeframes in support of the remedial design process.

Groundwater restoration systems, similar to the recovery well network contemplated at the FEMP, have been applied by industry over the last 10 to 15 years under Superfund and other environmental cleanup programs. In general, the industry experience has highlighted the inherent difficulties in successfully applying the technology to fully restoring aquifer systems in a reasonable timeframe. This industry experience has identified the importance of treating groundwater restoration as an iterative process requiring continued process evaluation, monitoring, and (if needed) modifications to optimize system performance. Consistent with industry experience, the FEMP would continue to evaluate the performance of the recovery well system and explore opportunities for applying design changes or new technologies to enhance the aquifer restoration process.

Advanced Wastewater Treatment (AWWT) Facility - an 1100 gpm ion exchange wastewater treatment plant being constructed at the FEMP. The facility is scheduled for startup in January 1995.

During the period of active aquifer restoration, alternate water would be provided to all groundwater users in the affected areas exhibiting concentrations above the remediation levels. The DOE has provided funding to the Hamilton County Department of Public Works to help support the installation of a public water supply to the FEMP area. The system is expected to be operational in the fall of 1995.

An expansion of the FEMP's ***Advanced Wastewater Treatment (AWWT)*** facility, termed the Groundwater Treatment Facility, would be constructed to treat extracted groundwater. The facility would be designed to address all major contaminants in the

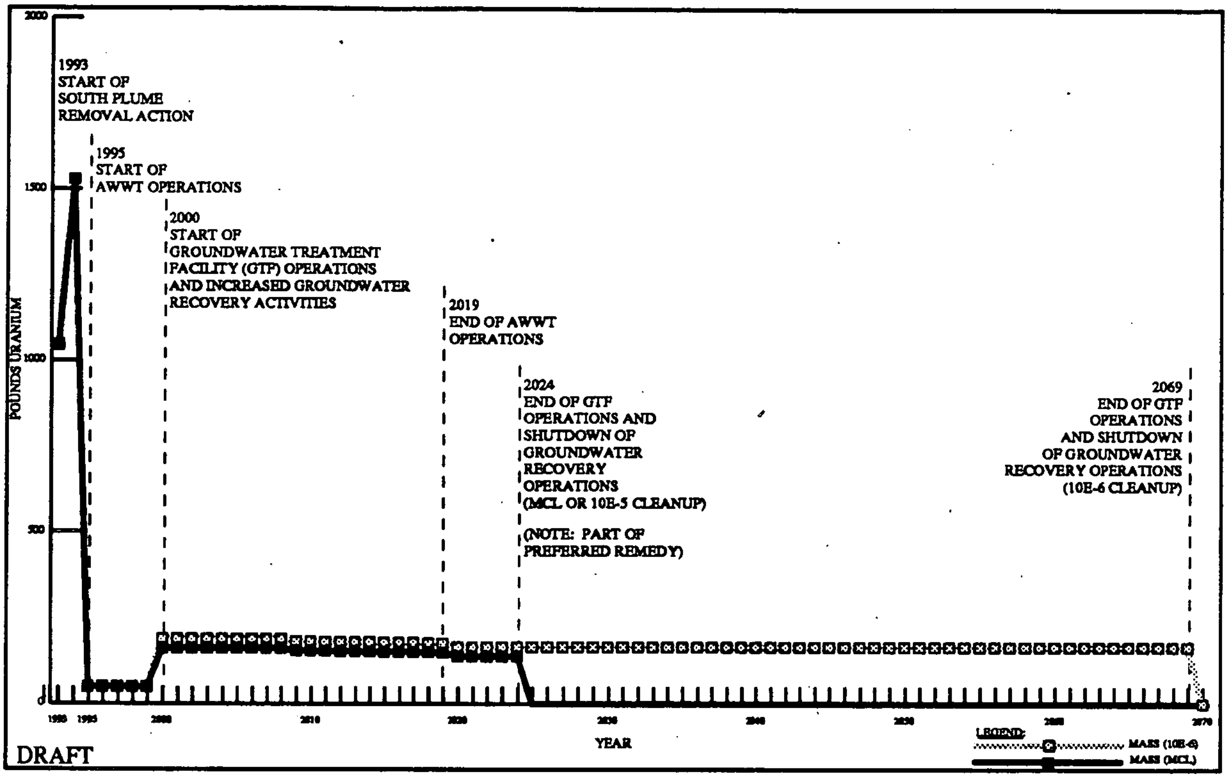

Figure 8: Estimated Uranium Discharge to the Great Miami River

recovered groundwater before discharge. For uranium, the primary contaminant, the projected groundwater treatment system would reduce the concentration in the treated water to below 20 ppb before discharge to the Great Miami River.

The specific treatment configuration, size and capacity of the Groundwater Treatment Facility would be finalized during the remedial design process. An important focus of the design process would be establishing the final size of the facility considering the previously discussed uncertainties in the effectiveness and timeframe of the aquifer restoration process.

Contaminated storm water runoff is currently being collected in retention basins from the surface of the former production area and from the Operable Unit 1 and 4 areas. Collection of this water will continue until those areas are remediated. The collected storm water would be treated before discharge to the Great Miami River. Figure 8 graphically presents the total mass of uranium from all site-related sources that is estimated to be discharged to the river following treatment for both groundwater recovery cases examined.

A summary of the uranium cleanup goals, volumes of soil requiring action, and the costs of Alternative 1 are provided below.

Present Worth Cost - the amount of money that if invested in the bank at the beginning of remediation and disbursed as needed, would be sufficient to cover all costs associated with remedial actions.

Total Project Cost - the total amount of money required to cover remedial activities. Assumes that money is acquired on an annual basis with an inflation rate of 3.7 percent per year.

SUMMARY OF ALTERNATIVE 1

	Risk Range	
On-Property Receptor	Resident Farmer	Resident Farmer
On-Property Risk Level	10^{-6}	10^{-5}
On-Property Uranium Cleanup Level (ppm)	5	15
Off-Property Receptor	Resident Farmer	Resident Farmer
Off-Property Risk Level	10^{-6}	10^{-5}
Off-Property Uranium Cleanup Level (ppm)	5	15
Excavation Volume		
- On-Property (cubic yards)	4,450,000	2,340,000
- Off-Property (cubic yards)	5,200,000	400,000
- Total (cubic yards)	9,650,000	2,740,000
Off-Site Disposal		
- Volume (cubic yards)	9,350,000	2,400,000
- Rail Cars	161,000	39,100
On-Site Disposal[a] (cubic yards)	0	0
Present Worth Cost	$4,960,000,000	$1,510,000,000
Total Project Cost	$17,100,000,000	$3,910,000,000

[a] Volume does not consider soil excavation below cleanup level to gain access to deeper contamination.

Land Use Objective 2: Establishment of a Consolidated Waste Management Area with Unrestricted Use of the Remaining Areas of the Property

Alternative 2A - Engineered Disposal Cell - Under this alternative, contaminated soil exceeding remediation levels would be excavated, consolidated to one central location on the FEMP property, and placed in an engineered above-grade disposal cell. The cell would be situated on an area displaying the best available geologic conditions.

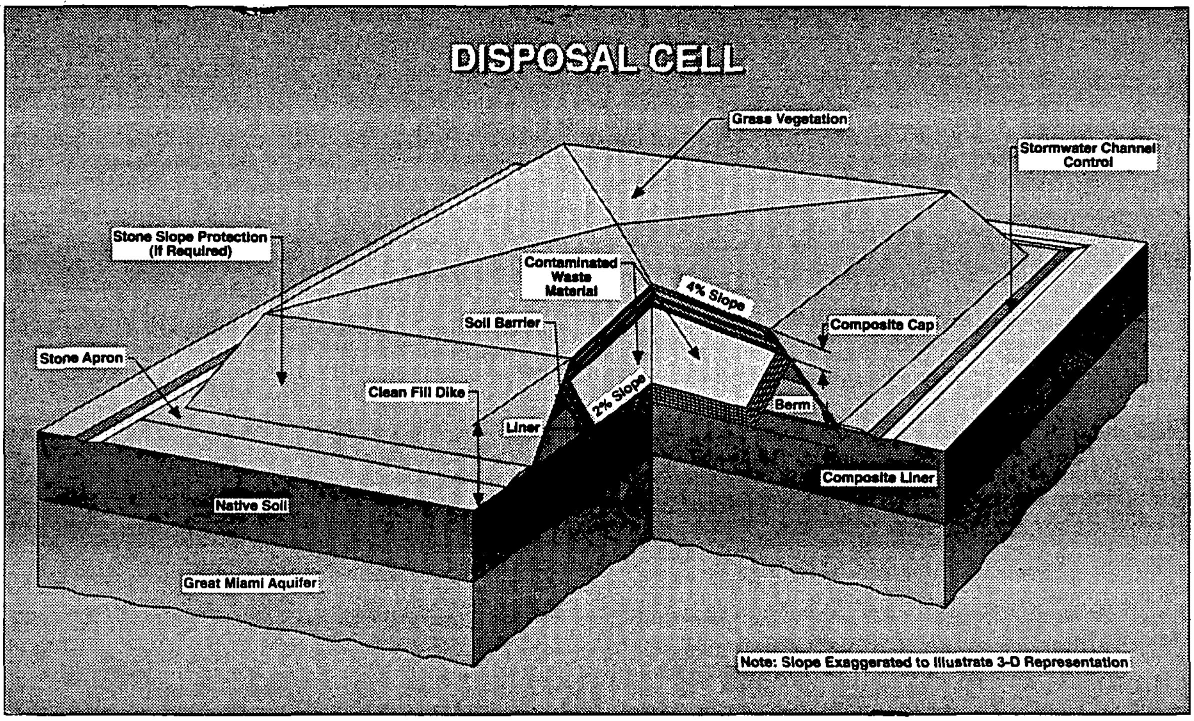

Figure 9: Conceptual Drawing of Engineered Disposal Cell

The design of the cell would include a multilayered lining and capping system. A conceptual cross section of an engineered disposal cell is presented in Figure 9. Contaminated soil not meeting the ***waste acceptance criteria*** for the disposal cell would be shipped to an off-site disposal facility, unless a more economical technology emerged which was deemed more prudent to apply to this soil to attain the acceptance criteria. As in Alternative 1, two different remediation levels were considered, target ILCR levels of 10^{-6} and 10^{-5} to the hypothetical on-property farmer.

The footprint of the disposal cell would be fenced and would remain under the continued ownership of the federal government, with restrictions placed in the property deed and permanent markers installed to eliminate human intrusion into the cell. Additionally, a long-term environmental monitoring program would be implemented with reviews of performance of the cell, conducted by EPA, at least once every five years.

The contaminated perched water excavation and Great Miami Aquifer recovery and treatment component of the alternative are the same as those associated with Alternative 1.

Waste Acceptance Criteria - the maximum concentration of a given contaminant that can be placed into a disposal facility and ensure the long-term protection of the groundwater aquifer. The waste acceptance criteria take into consideration the design of the facility, the underlying geologic conditions and the mass and solubility of the contaminant. The preliminary waste acceptance criteria for the disposal cell for uranium in soil to ensure the protection of the aquifer to proposed drinking water standards is approximately 1100 ppm. The acceptance criteria for an area where soil with low concentrations of contaminants are placed and covered with 12 inches of earth is approximately 45 ppm of uranium.

A summary of the uranium cleanup goals, volumes of soil requiring action, and the costs of Alternative 2A are provided below.

SUMMARY OF ALTERNATIVE 2A

	Risk Range	
On-Property Receptor	Resident Farmer	Resident Farmer
On-Property Risk Level	10^{-6}	10^{-5}
On-Property Uranium Cleanup Level (ppm)	5	15
Off-Property Receptor	Resident Farmer	Resident Farmer
Off-Property Risk Level	10^{-6}	10^{-5}
Off-Property Uranium Cleanup Level (ppm)	5	15
Excavation Volume		
- On-Property (cubic yards)	4,450,000	2,340,000
- Off-Property (cubic yards)	5,200,000	400,000
- Total (cubic yards)	9,650,000	2,740,000
Off-Site Disposal		
- Volume (cubic yards)	50,000	25,000
- Rail Cars	880	440
On-Site Disposal Cell[a] (cubic yards)	9,300,000	2,370,000
Present Worth Cost	$2,320,000,000	$830,000,000
Total Project Cost	$13,520,000,000	$3,020,000,000

[a] Volume does not consider soil excavation below on-property cleanup level to gain access to deeper contamination.

Alternative 2C–Off-Site Shipment - Under this alternative, contaminated soil exceeding remediation levels would be excavated with the more heavily contaminated soil shipped by gondola rail car to an off-site licensed disposal facility. Remediation levels consistent with Alternative 2A were adopted for this alternative also.

Soil exhibiting low concentrations of contaminants (e.g., less than 45 ppm of insoluble uranium) would be consolidated in a central location and placed under an earthen cover. The earthen cover would include at least 12 inches of clean fill and a vegetative cover. The area of consolidation would be maintained under the continued ownership of the federal government, with restrictions placed in the property deed and permanent markers installed to preclude human intrusion into the consolidation area.

The perched groundwater and Great Miami Aquifer remedial strategies would be consistent with those described for Alternative 1.

A summary of the uranium cleanup goals, volumes of soil requiring action, and the costs of Alternative 2C are provided below.

SUMMARY OF ALTERNATIVE 2C

	Risk Range	
On-Property Receptor	Resident Farmer	Resident Farmer
On-Property Risk Level	10^{-6}	10^{-5}
On-Property Uranium Cleanup Level (ppm)	5	15
Off-Property Receptor	Resident Farmer	Resident Farmer
Off-Property Risk Level	10^{-6}	10^{-5}
Off-Property Uranium Cleanup Level (ppm)	5	15
Excavation Volume		
- On-Property (cubic yards)	4,450,000	2,340,000
- Off-Property (cubic yards)	5,200,000	400,000
- Total (cubic yards)	9,650,000	2,740,000
Off-Site Disposal		
- Volume (cubic yards)	9,350,000	1,160,000
- Rail Cars	165,000	20,400
On-Site Disposal (cubic yards)	0[a]	1,240,000
Present Worth Cost	$4,960,000,000	$1,100,000,000
Total Project Cost	$17,100,000,000	$3,430,000,000

[a] Volume does not include clean soil excavated to access deeper contaminated material.

Land Use Objective 3: Establishment of a Consolidated Waste Management Area with Restricted Use of the Remaining Areas of the Property

Alternative 3A--Engineered Disposal Cell - Under this alternative, contaminated soil exceeding remediation levels would be excavated, consolidated into one central area and placed in an engineered disposal cell. The remedial strategy for soil, perched water and the Great Miami Aquifer is consistent with Alternative 2A. Perched water zones exhibiting concentrations of contaminants which threaten the water quality of the underlying aquifer to a level above the proposed or existing MCLs would also be excavated. This alternative considered five different cases of restricted land use with corresponding remediation levels for on- and off-property soil. For all 5 cases evaluated, the remediation level of the Great Miami Aquifer was set at the existing and proposed federal drinking water standards (i.e., 20 ppb for uranium).

The disposal cell area would remain fenced and under the continued ownership of the federal government, with restrictions placed in the deed and permanent markers installed to preclude human intrusion into the cell. The remaining areas of the site would have institutional controls applied to ensure the adopted land use strategy is maintained. An environmental monitoring program would continue with reviews of the site performed by

EPA at least once every five years. The shading on the following summary table represents the preferred alternative for Operable Unit 5.

A summary of the uranium cleanup goals, volumes of soil requiring action, and the costs of Alternative 3A are provided below.

ALARA - as low as reasonably achievable. A DOE policy to reduce exposures and the risk associated with residual contamination to levels that are "as low as reasonably achievable" considering technical, economic and social contaminants as appropriate.

SUMMARY OF ALTERNATIVE 3A

	Risk Range				
On-Property Receptor	Industrial User	Developed Park User	Undeveloped Park User	Undeveloped Park User	Undeveloped Park User
On-Property Risk Level	10^{-6}	10^{-6}	10^{-6}	10^{-6}	10^{-6}
On-Property Uranium Cleanup Level (ppm)	15	40[a]	80[a]	80[a]	80 ppm with an *ALARA* goal of 50 ppm
Off-Property Receptor	Resident Farmer	Resident Farmer	Resident Farmer	Resident Farmer	Resident Farmer
Off-Property Risk Level	10^{-5}	10^{-5}	10^{-5}	HI=1 3.5 x 10^{-5}	HI=1 3.5 x 10^{-5}
Off-Property Uranium Cleanup Level (ppm)	15	15	15	50	50
Excavation Volume					
- On-Property (cubic yards)	1,990,000	1,800,000	1,790,000	1,789,000	1,799,000
- Off-Property (cubic yards)	400,000	400,000	400,000	1000	1000
- Total (cubic yards)	2,390,000	2,200,000	2,190,000	1,790,000	1,800,000
Off-Site Disposal					
- Volume (cubic yards)	25,000	25,000	25,000	25,000	25,000
- Rail Cars	440	440	440	440	440
On-Site Disposal[b] (cubic yards)	2,340,000	1,750,000	1,750,000	1,750,000	1,750,000
Present Worth Cost	$800M	$740M	$720M	$690M	$690M
Total Project Cost	$2950M	$2660M	$2620M	$2550M	$2550M

[a] Cleanup level of 20 ppm for uranium may be required in the production area to protect the aquifer.

[b] Volume does not consider materials excavated which are below on-property cleanup levels to gain access to deeper contamination.

Alternative 3C - Off-Site Disposal - Under this alternative, contaminated soil exceeding remediation levels would be excavated, with the more heavily contaminated soil shipped by rail to a licensed off-site disposal facility. The remedial strategy for soil, perched groundwater, and the Great Miami Aquifer is consistent with Alternatives 2C and 1, respectively. The remediation levels considered for this alternative are consistent with those used for Alternative 3A. A summary of the cleanup levels, soil volumes requiring action, and the costs of Alternative 3C is discussed below.

SUMMARY OF ALTERNATIVE 3C

	Risk Range				
On-Property Receptor	Industrial User	Developed Park User	Undeveloped Park User	Undeveloped Park User	Undeveloped Park User
On-Property Risk Level	10^{-6}	10^{-6}	10^{-6}	10^{-6}	10^{-6}
On-Property Uranium Cleanup Level (ppm)	15	40[a]	80[a]	80[a]	80 ppm with an ALARA goal of 50 ppm
Off-Property Receptor	Resident Farmer	Resident Farmer	Resident Farmer	Resident Farmer	Resident Farmer
Off-Property Risk Level	10^{-5}	10^{-5}	10^{-5}	HI=1 3.5×10^{-5}	HI=1 3.5×10^{-5}
Off-Property Uranium Cleanup Level (ppm)	15	15	15	50	50
Excavation Volume					
- On-Property (cubic yards)	1,990,000	1,800,000	1,790,000	1,789,000	1,799,000
- Off-Property (cubic yards)	400,000	400,000	400,000	1000	1000
- Total (cubic yards)	2,390,000	2,200,000	2,190,000	1,790,000	1,800,000
Off-Site Disposal					
- Volume (cubic yards)	1,150,000	1,130,000	1,120,000	1,120,000	1,120,000
- Rail Cars	20,200	19,800	19,700	19,700	19,700
On-Site Disposal[b] (cubic yards)	1,220,000	652,000	652,000	652,000	652,000
Present Worth Cost	$1070M	$1010M	$990M	$960M	$960M
Total Project Cost	$3340M	$2940M	$2890M	$2810M	$2810M

[a] Cleanup level of 20 ppm for uranium in the production area is required to protect the aquifer.

[b] Volumes do not include quantity of soil below on-property cleanup level excavated to gain access to deeper contamination or to meet off-property risk goal.

Land Use Objective 4: Restricted Use of the Entire On-Property Area

Alternative 4A - Engineered Disposal Cell - Under this alternative, contaminated soil exceeding remediation levels would be excavated, consolidated to one central location on the FEMP property, and placed into an engineered disposal cell. This alternative is similar to Alternatives 2A and 3A, except that the remediation level contemplates restricted access to the entire FEMP property. A summary of the cleanup levels, soil volumes requiring action, and the costs of Alternative 4A are discussed below.

SUMMARY OF ALTERNATIVE 4A

	Risk Range	
On-Property Receptor	Trespasser	Trespasser
On-Property Risk Level	10^{-6}	10^{-6}
On-Property Uranium Cleanup Level (ppm)[a]	125	125
Off-Property Receptor	Resident Farmer	Resident Farmer
Off-Property Risk Level	10^{-5}	HI=1
Off-Property Uranium Cleanup Level (ppm)	15	50
Excavation Volume		
- On-Property (cubic yards)	1,790,000	1,789,000
- Off-Property (cubic yards)	400,000	1000
- Total (cubic yards)	2,190,000	1,790,000
Off-Site Disposal		
- Volume (cubic yards)	25,000	25,000
- Rail Cars	440	440
On-Site Disposal[b]	1,750,000	1,750,000
Present Worth Cost	720,000,000	690,000,000
Total Project Cost	2,620,000,000	2,580,000,000

[a] Cleanup level of 20 ppm for uranium in the production area may be required to protect the aquifer.

[b] Volumes do not include quantity of soil below on-property cleanup level excavated to gain access to deeper contamination or to meet off-property risk goal.

Alternative 4C - Off-Site Disposal - Under this alternative, contaminants and soil exceeding remediation levels would be excavated, with the more heavily contaminated soil shipped by rail to a licensed disposal facility. This alternative is similar to Alternative 2C and 3C, except that the remediation levels contemplate restricted access to the entire FEMP.

A summary of the cleanup levels, soil volumes requiring action, and the costs of Alternative 4C is discussed below.

SUMMARY OF ALTERNATIVE 4C

	Risk Range	
On-Property Receptor	Trespasser	Trespasser
On-Property Risk Level	10^{-6}	10^{-6}
On-Property Uranium Cleanup Level (ppm)[a]	125	125
Off-Property Receptor	Resident Farmer	Resident Farmer
Off-Property Risk Level	10^{-5}	HI=1
Off-Property Uranium Cleanup Level (ppm)	15	50
Excavation Volume		
- On-Property (cubic yards)	1,790,000	1,789,000
- Off-Property (cubic yards)	400,000	1000
- Total (cubic yards)	2,190,000	1,790,000
Off-Site Disposal		
- Volume (cubic yards)	1,120,000	1,120,000
- Rail Cars	19,700	19,700
On-Site Disposal[b]	652,000	652,000
Present Worth Cost	$990,000,000	$960,000,000
Total Project Cost	$2,890,000,000	$2,820,000,000

[a] Cleanup level of 20 ppm for uranium in the production area may be required to protect the aquifer.

[b] Volumes do not include quantity of soil below on-property cleanup level excavated to gain access to deeper contamination or to meet off-property risk goal.

Comparison and Evaluation of Alternatives

The seven alternatives were subjected to a detailed comparative evaluation process to identify the advantages and disadvantages of each alternative relative to one another. The detailed evaluation was conducted employing the criteria defined within the National Contingency Plan as the framework for identifying technical and administrative differences between the alternatives. Brief definitions and the categorization of the criteria are provided in the side bar.

REMEDIAL ACTION EVALUATION CRITERIA

Threshold Criteria:

- **Overall Protection of Public Health and the Environment**

This criterion addresses the way in which a potential remedy would reduce, eliminate, or control the risks posed by the site to human health and the environment. The methods used to achieve an adequate level of protection may be through engineering controls, treatment techniques, or other controls such as restrictions on the future use of the site. Total elimination of risk is often impossible to achieve. However, a remedy must minimize risk to ensure that human health and the environment would be protected to the extent possible.

- **Compliance with ARARs**

Compliance with ARARs, or "applicable or relevant and appropriate laws and regulations," assures that a selected remedy will meet all related federal, state, and local requirements. The requirements may specify maximum concentrations of chemicals that can remain at a site; design or performance requirements for treatment technologies; and restrictions that may limit potential remedial activities at a site because of its location.

REMEDIAL ACTION EVALUATION CRITERIA

Balancing Criteria:

- **Long-Term Effectiveness or Permanence**

This criterion addresses the ability of a potential remedy to reliably protect human health and the environment over time, after the remedial goals have been accomplished.

- **Reduction of Toxicity, Mobility, or Volume of Contaminants**

This criterion assesses how effectively a proposed remedy will address the contamination problem. Factors considered include the nature of the treatment process; the amount of hazardous materials that will be destroyed by the treatment process; how effectively the process reduces the toxicity, mobility, or volume of waste; and the type and quantity of contamination that will remain after treatment.

- **Short-Term Effectiveness**

This criterion addresses the time factor. Technologies often require several years for implementation. A potential remedy is evaluated for the length of time required for implementation and the potential impact on human health and the environment during the remediation.

- **Implementability**

Implementability addresses the ease with which a potential remedy can be put in place. Factors such as availability of materials and services are considered.

- **Cost**

Costs (including capital costs required for design and construction, and projected long-term maintenance costs) are considered and compared to the benefit that will result from implementing the remedy.

EVALUATION CRITERIA

REMEDIAL ALTERNATIVES	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH ARARs	SHORT-TERM EFFECTIVENESS	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF MOBILITY, TOXICITY, AND VOLUME	IMPLEMENTABILITY
NO ACTION	○	○	●	○	○	●
1	●	◒	◒	●	◒	◒
2A	●	◒	●	◒	◒	◒
2C	●	◒	◒	●	◒	◒
3A	●	◒	●	◒	◒	◒
3C	●	◒	◒	●	◒	◒
4A	●	◒	●	◒	◒	◒
4C	●	◒	◒	●	◒	◒

● MEETS OR EXCEEDS CRITERIA

◒ MEETS CRITERIA, WITH SOME STIPULATIONS

○ DOES NOT ATTAIN CRITERIA

Figure 10: Summary of Comparative Analysis of Operable Unit 5 Remedial Alternatives

The first two cleanup evaluation criteria, overall protection of human health and the environment and compliance with applicable or relevant and appropriate requirements, are considered threshold criteria that must be attained by the selected remedial action. The next five criteria on the list include short-term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; implementability; and cost. All five of these criteria are balanced to achieve the best overall solution. The last two cleanup evaluation criteria, state acceptance and community acceptance, are evaluated following receipt of comments on the Proposed Plan and incorporated as appropriate before making a final remedy selection in the ROD. Figure 10 presents a summary of the evaluation of Operable Unit 5 remedial alternatives.

Overall Protection of Human Health and the Environment

All of the action alternatives would provide permanent solutions and adequately protect human health and the environment. The no-action alternative would allow for continued migration of site contaminants and would not provide for the protection of human health and the environment. Alternative 1 ranks the highest in terms of the degree of protectiveness, as measured by reduced uncertainty and long-term effectiveness. Alternative 1 involves the removal of contaminated soil and sediment from the site to a permitted off-site disposal facility. This alternative provides a high level of certainty for continued long-term protectiveness and requires no provisions for perpetual institutional controls or 5-year CERCLA reviews. Future uncertainties on the availability of off-site disposal capacity could affect the implementability of this alternative, potentially causing delays in the attainment of the remedial objectives.

Alternatives applying the use of the on-property disposal cell provide the highest level of protectiveness for land uses involving on-property disposal. For alternatives relying on an engineered disposal cell, conservative design assumptions and the adoption of concentration-based waste acceptance criteria would supplement existing site geology to ensure the long-term performance of the disposal system. Modeling runs completed for the FS on the performance of the disposal cell demonstrate a high certainty (>80%) that concentrations in the aquifer underlying the cell would not exceed existing and proposed federal drinking water standards for 1000 years.

Alternatives relying on on-property disposal typically presented the lowest overall short-term risk to remediation workers and off-property residents. Short-term risks are those occurring during implementation of the remedial action and include mechanical hazards, transportation related injuries/fatalities, and impacts due to releases (i.e., fugitive dust, etc.) during construction activities. For the on-property disposal alternatives, short-term risks were directly related to the quantity of material excavated (i.e., the remediation levels) and placed in the cell. The larger the quantity excavated, the higher the associated short-term risks.

Alternatives employing the disposal cell would adequately protect flora and fauna, including aquatic life in Paddys Run and the Great Miami Aquifer. For select remediation levels (i.e., 10^{-6} ILCR to the resident farmer), significant acreage of forested wetlands and forested areas both on and off the FEMP property would be excavated. For alternatives not contemplating a residential farming land use at the FEMP, no areas of forested wetlands on or off the FEMP property should be disturbed.

Compliance With Applicable or Relevant and Appropriate Requirements

All action alternatives would comply with ARARs, except those that include an on-property disposal cell. These alternatives would require a CERCLA waiver from State of Ohio solid waste disposal facility siting requirements, and would be compliant with ARARs upon receipt of the waiver. In general, to be granted the waivers, the FEMP would be required to adopt an engineering design for the cell which would, when coupled with existing site geologic conditions, ensure the long-term protection of human health and the environment.

Each of the alternatives, except the no-action alternative, includes an aggressive aquifer pump and treat component aimed at restoring the Great Miami Aquifer to its full beneficial use within a reasonable time frame. This groundwater recovery component would reduce the existing concentration of uranium to below proposed drinking water standards at all points within the aquifer in an estimated time of 30 years. Each of the alternatives are designed to maintain concentrations in the aquifer below existing and proposed drinking water standards through engineering measures.

Each of the alternatives relying on on-property disposal (i.e., capping systems or disposal cells) would employ design considerations found in the Federal Uranium Mill Tailing standards and RCRA to ensure the long-term performance of the disposal system. These standards would require the use of multilayered capping and lining systems, the development of contaminant- and material-specific waste acceptance criteria, and use of a design which ensures protectiveness for 200 to 1000 years. Long-term monitoring, including groundwater and other indicator media, would be provided for all alternatives involving on-property disposal, as required to demonstrate the continued performance of the disposal system.

REMEDIAL ACTION EVALUATION CRITERIA

Modifying Criteria:

- **State Acceptance**

The state has an opportunity to review the FS and Proposed Plan and offer comments. A state may agree with, oppose, or have no comment on the preferred alternative.

- **Community Acceptance**

During the public comment period, interested persons or organizations may comment on the alternatives. These comments are considered by DOE and EPA in making the final selection. The comments are addressed in a document called a Responsiveness Summary, which is part of the ROD for the site.

Long-Term Effectiveness and Permanence

Long-term effectiveness is evaluated through two criteria: the magnitude of the residual risk remaining at the site after the cleanup and the adequacy and reliability of any required engineering or institutional controls. Remedial alternatives employing off-site disposal as the principal means of addressing contaminated soil and sediment would require the least amount of contaminated materials to remain at the site. Alternative 1 would include the removal of all contaminated material from the site with no long-term requirements for continued institutional controls, surveillance, or maintenance activities at the facility.

Each of the alternatives would ensure the attainment of the remediation levels through the implementation of a verification sampling program before remediation and the completion of a certification sampling program following completion of remediation activities. All alternatives would employ excavation to remove perched groundwater zones presenting unacceptable risks to future receptors or the underlying aquifer. Each alternative also employs pump and treat technologies to attain health-protective levels in the Great Miami Aquifer.

Each of the alternatives employing a disposal cell or central consolidation area relies on engineering measures and institutional controls to ensure the long-term performance of the remedy and maintain the protection of human health and the environment over time. The highest level of certainty associated with the long-term performance of the engineering controls is associated with the use of a central consolidation area which provides for more heavily contaminated soil being shipped off site for disposal. The remaining material would exhibit low concentrations of contaminants which present lower overall risks to potential intruders in the event the planned institutional controls were to fail in the future.

Long-term environmental impacts associated with the construction of the on-property disposal cell or consolidation area would permanently commit up to 301 acres of land, including up to 57 acres of terrestrial habitat in the form of woodlands and pine plantation habitat. Between 9 and 36 acres of freshwater wetlands could be lost depending on the cleanup level selected. The 100- and 500-year floodplains of Paddys Run and the Great Miami River would not be permanently altered as a result of backfilling and regrading activities. No significant long-term impacts are expected for water quality and hydrology, air quality, socioeconomics, or cultural resources.

Reduction of Toxicity, Mobility, or Volume Through Treatment

All of the alternatives rely upon treatment to address contaminated storm water and recovered groundwater before discharge to the Great Miami River. In general, two other treatment options were considered for application to Operable Unit 5 contaminated media. The first was soil washing, which involves the use of physical and chemical processes to reduce contaminant levels in soil. The second was the use of cement stabilization to address site soil, which involves mixing the soil with cement to generate a solid monolithic product. Soil washing is a promising technology for addressing contaminated soil; however, the technology is limited in its application at the FEMP due to site-related constraints (i.e., the presence of the sole-source aquifer beneath all potential treated soil backfill areas). With further development, soil washing could have application as a support technology at the FEMP when used in conjunction with a disposal technology, such as a disposal cell, to address the soil not meeting the waste acceptable criteria for the engineered disposal cell. Cement stabilization was not adopted as a major component of any of the alternatives because of the significant cost of applying the technology and the increased volumes due to the addition of cement additives.

It should be recognized that each of the proposed alternatives will require in excess of 20 years to complete soil cleanup activities and potentially in excess of 30 years to complete groundwater restoration. Additionally, for those alternatives relying on off-site disposal capacity, there is significant uncertainty in the continued availability of this capacity over the 20-year soil cleanup. During this time the FEMP will continue to evaluate emerging technologies, such as soil washing, to potentially apply to the selected remedy to promote cost effectiveness, waste minimization and to reduce potential vulnerabilities to completing the remedial action due to unavailability of off-site disposal capacity.

Short-Term Effectiveness

The evaluation of the alternatives under this criterion addresses effects during the construction and implementation phase of remedial actions. Short-term effectiveness evaluates the potential impacts to workers, the public and the environment associated with implementing a remedial alternative. Critical considerations in the assessment of the Operable Unit 5 alternatives are: the projected amount of work hours to accomplish a given alternative, the quantity of soil to be excavated, the estimated fugitive dust generated by material movements, and the haul time to the off-site disposal facility.

By definition, the no-action alternative presents the least short-term impacts. All the action alternatives involve remedial activities such as earthmoving, construction and operation of treatment facilities, and material transport. All action alternatives would create an impact and pose some risk to the environment, workers and the public. These impacts can be effectively controlled through the application of mitigative measures such as dust suppression techniques and rigorous worker health and safety programs.

In general, those alternatives relying upon off-site disposal as the principal means for material disposition present the highest overall short-term risk. The most significant element of short-term risk for these alternatives is due to the projected injuries and fatalities estimated to result as a consequence of transporting such large quantities of material.

Alternatives relying on on-site disposal in a cell would present the lowest overall risks. The most significant element of short-term risk associated with this set of remedial alternatives is attributable to projected injuries related to mechanical hazards. Such injuries would be minimized at DOE facilities, such as the FEMP, through the adoption of strict health and safety program requirements during the implementation of remedial actions.

As part of the short-term risk assessment, estimates were completed for each alternative of the projected risks to individuals neighboring the FEMP due to the conduct of remedial activities. These risks were estimated on the basis of modeling projections of the potential releases of dust during excavation, soil transport, and disposal activity. For alternatives considered in the FS, the highest calculated risk to the maximally exposed individual over the 22-year soil cleanup process would not be expected to exceed a 10^{-6} ILCR.

Short-term impacts associated with the action alternatives would include temporary on-property disruption of up to approximately 42 acres of land from construction of support facilities and up to 930 acres from soil excavation, resulting in the temporary loss of habitat. Off-property soil excavation would temporarily disturb up to 6446 acres of land (assuming cleanup at the 10^{-6} level). Appropriate engineering controls would minimize fugitive dust emissions during excavation activities.

Implementability
This evaluation criterion addresses the technical and administrative feasibility of implementing the remedial alternatives. Alternatives involving the on-property disposal of contaminated soil and sediment are considered readily implementable through the use of existing technologies and construction methods.

The availability of off-site disposal capacity over the duration of the remedial actions presents considerable uncertainty. Discussions with personnel associated with a representative off-site disposal facility indicate that the disposal site could be expanded to accommodate a greater volume of low-level radioactive or mixed wastes. The availability of this expanded capacity or alternate capacity at some future (yet to be constructed) site is unclear and is compounded by the up to 22-year duration of remedial actions to address contaminated soil and sediment. For these reasons, alternatives relying on off-site disposal are considered less implementable than the on-site alternatives, and may mean delays to accommodate administrative or capacity issues.

The aquifer restoration component of the alternatives are considered implementable through reliance on available groundwater extraction and treatment technologies. There is considerable uncertainty in the amount of time required to attain remediation levels for uranium and several other contaminants. This uncertainty is due to the limited ability to predict the tendency of the soil particles composing the aquifer system to release the contaminants to the groundwater for extraction. The FEMP will continue to investigate other technologies, such as reinjection, to enhance contaminant recovery and reduce the time needed to restore the aquifer. Reinjection would potentially involve the pumping of treated groundwater back into the aquifer to increase the rate of flow and create a flushing effect in order to speed contaminant removal.

Cost
Cost estimates are used in the FS process to provide a basis for comparison among alternatives. Estimates for FSs are typically provided to an accuracy range of +50 percent (real cost would be 50 percent higher than the estimate) to -30 percent (real cost would be 30 percent lower than the estimate) because of the uncertainties in the available information used to develop them. To provide a fair basis of comparison for alternatives, cost estimates for alternatives are presented in present worth costs. Present worth costs reflect the quantity of money which would need to be placed in a bank today at a set interest rate, termed the discount rate, to pay for the remedial action over the life of the project.

The tables previously presented summarizing each of the remedial alternatives provided the present worth costs of each of the alternatives considered for Operable Unit 5. As identified in these summary tables, the cost estimates for each alternative reflect the costs to attain differing levels of protection against residual ILCR attributable to the site following the implementation of the alternative. As the incremental risk levels become progressively more stringent, there is a corresponding increase in the contaminated soil volume that requires attention.

In general, for alternatives pursuing restoration to a 10^{-6} ILCR to the resident farmer (Alternatives 1, 2A and 2C), in excess of 80 percent of the projected cost for these alternatives are associated with addressing the cleanup of contaminated soil and the remaining 20 percent are attributed to the recovery and treatment of contaminated groundwater. For all other alternatives, approximately 60 percent of the projected costs are associated with soil cleanup and the remaining 40 percent are attributed to groundwater

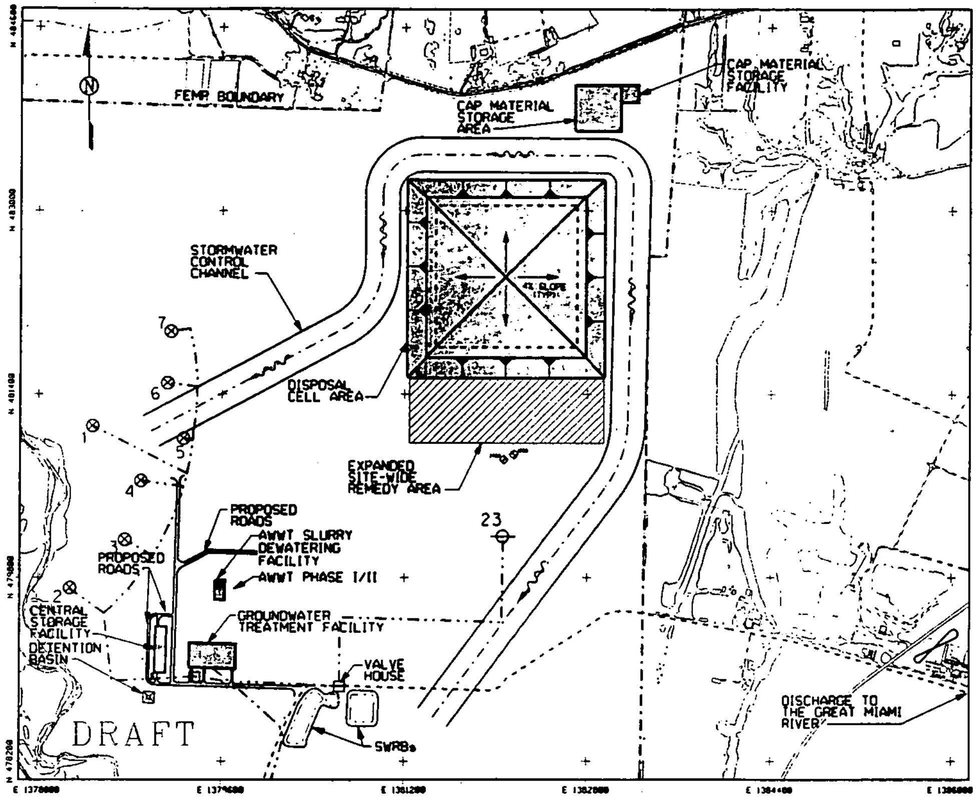

Figure 11: Site Plan of Preferred Remedy

recovery and treatment. For the groundwater recovery and treatment cost component, in excess of 90 percent of the projected costs are attributed to the construction, operation, maintenance and final dismantlement of the groundwater treatment facility.

Preferred Remedial Alternative

The preferred remedial action alternative for Operable Unit 5 is Alternative 3A, Full Excavation of Contaminated Soil; Placement in an On-property Disposal Cell; and Extraction and Treatment of Great Miami Aquifer Groundwater.
Alternative 3A is recommended because it provides a remedy which is reliable over the long-term, offers the lowest overall short-term risks, is less costly when compared to other alternatives, and employs proven technologies which are implementable. The alternative would comply with ARARs following issuance of the required waivers to State of Ohio solid waste disposal facility siting requirements. Alternative 3A involves excavation and consolidation of contaminated soil and sediment within an on-site, above-grade disposal cell. Excavated soil or sediment not meeting the waste acceptance criteria of the cell would be shipped to an off-site licensed disposal facility by truck. Alternative 3A also includes extraction and treatment of contaminated groundwater and the collection and treatment of contaminated storm water runoff. The FEMP would continue to assess emerging technologies for their viability as support options to the selected remedy in the event they were deemed cost effective and equally or more protective. Figure 11 presents a conceptual site plan of the facilities required to support the preferred alternative.

Highlights of Alternative 3A

- The most significantly Contaminated soil and sediment would be removed and confined in an engineered disposal cell or shipped off-site; contaminated perched groundwater would be removed and treated.
- The on-property engineered disposal cell would use proven reliable designs and materials.
- Contaminants remaining in on-property soil and sediment after the implementation of Alternative 3A would not result in unacceptable risks to human health and the environment and would support industrial, developed park and green space land uses.
- Uranium levels in the Great Miami Aquifer would be reduced to below proposed MCLs for drinking water; and the planned Hamilton County public water supply would provide alternate water to residences impacted by the South Plume during the period of aquifer restoration.
- Alternative 3A would include monitoring to confirm the long-term effectiveness of the remedial action.

Specifically, Alternative 3A would be designed to meet the following remedial action objectives:

- Protect the Great Miami Aquifer at concentrations not to exceed proposed or existing MCLs for site-related contaminants.
- Consolidate contaminated materials to maximize the acreage of the existing FEMP property which can be returned to a more beneficial use for the surrounding community.
- Return the Great Miami Aquifer to its full beneficial use in a reasonable time frame (approximately 30 years).
- Minimize short-term risks to human and ecological receptors during the implementation of remedial actions.
- Avoid disruption of the 26-acre forested wetland on the northwest portion of the FEMP.
- Attain a residual risk level in the range of 10^{-5} ILCR to the hypothetical RME off-property farmer.
- Attain a residual risk level in the range of 10^{-6} ILCR and a hazard index of 1 for recreational users of the FEMP property.
- Attain a residual risk level in the range of 10^{-6} ILCR for a hypothetical trespasser in the fenced area of the disposal cell.
- Ensure the long-term performance of remedial actions for a period up to 1000 years.

Soil and Sediment

Soil and sediment exceeding proposed final remediation levels (Table 2) would be excavated and placed in an engineered, above-grade disposal cell located on FEMP property. Contaminated perched water zones, which represent an unacceptable risk to the underlying Great Miami Aquifer, would also be excavated and placed in the cell. Any contaminated water generated during these excavation operations would be directed to the AWWT facility. The cell dimensions would be 1610 feet x 1610 feet x 37 feet tall (approximately 60 acres). Land within the disposal cell area would be fenced and maintained under the continued ownership of the federal government. Maintenance would include the sampling of a monitoring well network to assess the performance of the cell. Areas outside the disposal cell area could, if deemed appropriate by the federal government, be made available for alternate land uses.

The proposed final remediation levels for soil presented in Table 2 represent the 1×10^{-6} ILCR level to the undeveloped park users. For nonleachable forms of uranium in on-property soil, the listed remediation level would be 80 ppm. The preferred remedy would adopt the DOE's ALARA concept by applying available hand-held radiological instrumentation to help guide excavation and identify any isolated locations of higher contamination. To this end, the preferred remedy would establish an ALARA goal of 50 ppm of total uranium in soil. The FEMP would use the limits of available (hand-held) detection technology in an attempt to lower overall radiological contamination levels residing on and off the FEMP property. Applying ALARA in this manner is considered appropriate based upon the cost effectiveness of the approach and the estimated small (<1%) overall increases in expected volumes of excavated soil.

TABLE 2
PROPOSED FINAL REMEDIATION LEVELS

Contaminant	On-property Soil (ppm)	Off-property Soil (ppm)	Sediment (ppm)	Surface Water[a] (ppm)	Great Miami Aquifer (ppb)
Non-Leachable Uranium	80[b]	50	210	0.54	20
Leachable Uranium	20	NA	NA	NA	NA
1,2-dichloroethane	0.16	0.1	NA	NA	5.0
Trichloroethene	25	1.5	NA	NA	5.0
Antimony	10	0.6	NA	0.2	6.0
Arsenic	12	9.6	33	0.005	50
Beryllium	1.5	0.6	33	0.001	4.0
Cadmium	5.0	0.9	5.0	0.01	5.0
Magnesium	43,000	43,000	NA	1600	39,000
Manganese	1400	1400	410	0.1	900
Mercury	7.5	0.3	NA	0.0001	2.0
Silver	10	0.8	NA	0.003	50
Radium-226	1.7[d]	1.5[d]	2.9[d]	38[c]	20[c]
Strontium-90	14[d]	0.6[d]	NA	41[c]	8.0[c]
Technetium-99	30[d]	1.0[d]	NA	150[c]	940[c]
Thorium-232	1.6[d]	1.4[d]	2.4[d]	270[c]	1.2[c]
Thorium-230	280[d]	80[d]	NA	NA	15[c]

a Paddys Run and Great Miami River. For Great Miami River, applies to locations beyond the mixing zone for the FEMP's outfall line as defined by State of Ohio water quality regulations.
b ALARA goal of 50 ppm uranium would be applied
c *pCi/L*
d *pCi/g*
NA - Not Applicable

PicoCuries per liter (pCi/L) PicoCuries per gram (pCi/g) - Concentration terms expressing the total activity of a radioactive constituent present within a given mass/volume (i.e., liter or gram) of contaminant and medium (i.e., water or soil). A picoCurie is equivalent to the radioactivity present in one trillionth of one gram of pure radium.

Initially, the soil and sediment having contamination levels which exceed the waste acceptance criteria of the disposal cell would be shipped to an off-site commercial disposal facility. Emergent technologies would, however, be retained as an option for treating and dispositioning this soil in the future. Retaining emergent technologies is appropriate due to the uncertainty of the long-term availability of off-site disposal capacity. Examples of emergent technologies include soil washing and vitrification. When a method is found which would allow additional soil to cost effectively meet the waste acceptance criteria for the disposal cell, the DOE would present that technology to EPA and request approval for its use at the FEMP.

The area of excavation (i.e., footprint) required to attain the proposed final remediation levels are presented in Figure 12 for on- and off-property excavations. Table 3 presents the projected quantity of excavated soil/sediment that meets the waste acceptance criteria for the cell and the quantity of soil requiring off-site disposal. The volume projections presented in Table 3 are based on an engineering evaluation of available data. Final excavation footprints and volumes would be established through completion of a pre-excavation verification survey. Waste acceptance criteria for the cell would be finalized during remedial design but would be no greater than 1080 ppm total uranium.

TABLE 3 PROJECTED QUANTITY OF EXCAVATED SOIL FOR THE PREFERRED ALTERNATIVE	
Soil	Cubic Yards
Excavated on property	1,799,000
Excavated off property	1,000
Total	1,800,000
Placed in cell	1,750,000
Shipped off site	25,000
Excavated clean soil	25,000

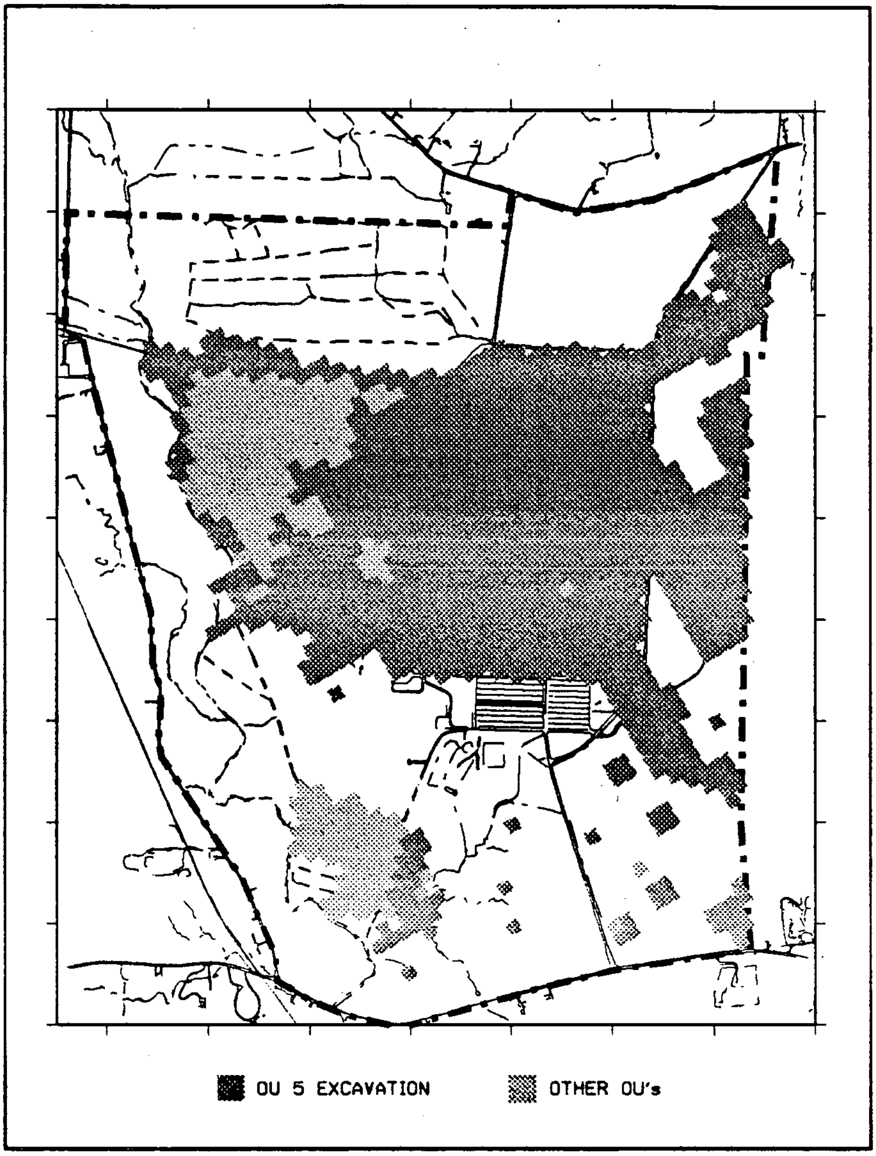

Figure 12: Excavation Footprint for Preferred Alternative

Following excavation of samples would be collected from all affected areas and analyzed to certify that cleanup objectives were attained. Excavated areas would be regraded and backfilled, as needed, with borrow material and topsoil to ensure positive drainage. A vegetative cover would be re-established on the backfilled areas.

The sequence of excavation and backfill activities depends on gaining access to contaminated soil underlying existing facilities in the former production area and the other source operable units (Operable Units 1 through 4). On the basis of available funding projections, the estimated period for attainment of remedial action objectives for soil/sediment, including construction of the on-property disposal cell, is 22 years.

Potential environmental impacts have been factored into the evaluation of alternatives for the Operable Unit 5 remedial action consistent with the values of the National Environmental Policy Act. The preferred alternative will avoid impacts to the 26 acres of forested wetlands in the northwestern part of the site and the riparian corridor along the northern portion of Paddys Run. Approximately 354 acres within the FEMP property boundary and approximately 2 acres off-property will be disturbed during soil excavation activities. However, these areas will be regraded and revegetated to approximately preremediation conditions. In the long-term, 137 acres will be committed to on-site disposal, and will include 50 acres of pine plantation, 7.5 acres of early to mid-successional woodlands and 9.0 acres of wetlands. The remainder of the acreage will include previously disturbed areas (e.g., process area) and managed fields.

Groundwater

Areas of the Great Miami Aquifer exhibiting concentrations of contaminants exceeding existing or proposed federal primary drinking water standards (for contaminants which do not have a drinking water standard, a concentration equivalent to an ILCR of 10^{-5} to a residential farming groundwater user would be used) would be subjected to groundwater extractions through the use of recovery wells. For purposes of alternative evaluation, the southern boundary of the area of aquifer restoration would be established at the northern limit of the Paddys Run Road Site contaminant plume. This corresponds to the southern extent of groundwater capture created by the South Plume Removal Action wells (see Figure 6).

Groundwater recovery would continue in the affected locations of the aquifer until the existing and proposed primary drinking water standards (or 10^{-5} ILCR for contaminants without drinking water standards) are attained. On the basis of available modeling data, the uranium concentration in all areas of the aquifer would be expected to attain the proposed drinking water standard (20 ppb) within 30 years at a maximum pumping rate of 6300 gpm. Figure 7 shows the expected reduction of uranium concentrations in the aquifer with time as a result of pumping of the required recovery wells.

It should be recognized that the process of flushing the aquifer of contaminants is chiefly controlled by the chemical interaction between the contaminant and the sand and gravel composing the aquifer system. Understanding this process of chemical interaction within the aquifer is complex and leads to significant uncertainty in the ability to adequately model the effects of groundwater recovery operations. Recognizing this uncertainty, the FEMP would, as part of the preferred alternative, continue to evaluate alternatives or emerging technologies to enhance contaminant recovery from the aquifer. These technologies could include the possible reinjection of treated groundwater back into the aquifer to speed the flushing process. If the need to apply reinjection or other enhancement technologies is deemed appropriate, approval by EPA and OEPA would be obtained before implementation.

Recovered groundwater will be treated through an expansion of the existing on-property AWWT (called the groundwater treatment facility). The expansion to the plant would apply best available demonstrated technologies to the treatment of the recovered groundwater. Following treatment, the water would be discharged to the Great Miami River. Figure 8 shows the estimated discharges of uranium to the Great Miami River as a result of implementing the preferred alternative. The size and treatment configuration would be finalized during the remedial design process.

A public water supply, partially funded by DOE, is currently being installed in the area surrounding the FEMP. This public water is envisioned to be available during the period of aquifer restoration as a source of alternate water in the off-property area impacted at levels greater than the proposed MCL for uranium.

Storm Water and Wastewater

Contaminated storm water runoff is currently collected from the surfaces of the former production area and the Operable Unit 1 and 4 areas. Storm water runoff control will continue throughout the time period required to remediate soil and sediment in all source operable units (i.e., Operable Units 1, 2, 3 and 4). Storm water would continue to be directed to the existing storm water retention basin. Following attainment of remedial objectives associated with the source operable units, the retention basin would be removed.

Storm water, along with wastewater generated during remediation, would be treated in the AWWT facility. Sedimentation sludges, regenerate sludges, spent ion exchange resins, carbon filter media, and other miscellaneous waste streams (residues) generated by the operation of the groundwater, storm water and wastewater treatment facilities would be dewatered at the AWWT facility and characterized before disposal. The residues would be disposed of in the cell during the period of active soil remediation and sent to a licensed disposal facility thereafter. In the event the residuals do not meet the waste acceptance criteria for the cell, they would be cement stabilized by a vendor-supplied sludge stabilization service.

Decontamination and Demolition

Following attainment of remedial action objectives, support facilities (including the planned wastewater treatment facilities, interim staging facilities, miscellaneous roadways, pipelines, etc.,) will be decontaminated and demolished. Construction materials will be recycled to the extent practical. Contaminated rubble generated following closure of the cell (e.g., demolition of the AWWT facility) would be dispositioned off site at a licensed disposal facility. The pumps and transmission lines associated with the recovery wells would be removed and dispositioned off site. Recovery well casings would be removed to the extent practical, and the borings abandoned in accordance with State of Ohio requirements.

Site-Wide Integration of Remedies

Of the five operable units at the FEMP, Operable Unit 5 is chronologically the fourth to issue a Proposed Plan for comment. The final operable unit, Operable Unit 3, is expected to issue a Proposed Plan in 1995. Each of the operable unit FS reports have provided a progressive evaluation of the projected FEMP site-wide remedy, using the best available information at the time, to predict postremediation site conditions. This site-wide remedy incorporates the selected, preferred (identified in a Proposed Plan), or leading alternative for each operable unit, as appropriate (identified in a ROD). The intent of the analysis is to progressively monitor the interfaces among the operable units to ensure that the final adopted site-wide remedy would be well thought out, cost effective, and ensure the long-term protection of human health and the environment.

The Operable Unit 5 FS completed such an evaluation employing the preferred Operable Unit 5 alternative in conjunction with the projected remedies listed in Table 4 for the other four operable units. These listed remedies should not be regarded as a preselection by DOE or EPA of an alternative for an individual operable unit; they were adopted for the purpose of completing the assessment of the projected postremediation site conditions.

TABLE 4
REMEDIES ADOPTED TO COMPLETE SITE-WIDE ANALYSIS

Operable Unit	Key Components
1-Waste Pits	Excavation of pit contents, caps, berms, and lining system Excavation of heavily contaminated soil underlying pits Drying of excavated soil and waste, as required Shipment of excavated material by rail to off-site disposal facility
2-Other Waste Units	Excavation of waste materials and adjacent contaminated soil Shipment to off-site disposal facility of material not meeting Acceptance Criteria of on-property cell Placement of excavated material meeting acceptance criteria in central on-property above-grade cell
3-Production Facilities and Inventories	Off-site shipment of remaining waste and production inventories (including thorium) and decontamination residues Decontamination and demolition of all structures and facilities Recycling/reuse of generated debris and equipment to maximum extent practical Off-site disposal of rubble and debris not meeting acceptance criteria of on-property cell Disposal in a central on-property cell of rubble and debris meeting acceptance criteria
4-Silos 1-4	Removal and vitrification of waste inventories Off-site disposal of vitrified waste Excavation of contaminated soil and placement of soil attaining the acceptance criteria in a central on-property disposal cell Decontamination and demolition of silo structures and support facilities Placement of rubble and debris in central disposal cell
5-Environmental Media	See preferred alternative section
Common Elements To All Operable Units	Long-term environmental monitoring program for FEMP Continued maintenance and surveillance of disposal cell Performance of reviews of site conditions by EPA every 5 years Continued federal ownership of disposal cell area Restrictions placed in FEMP property deed pertaining to future uses of the site

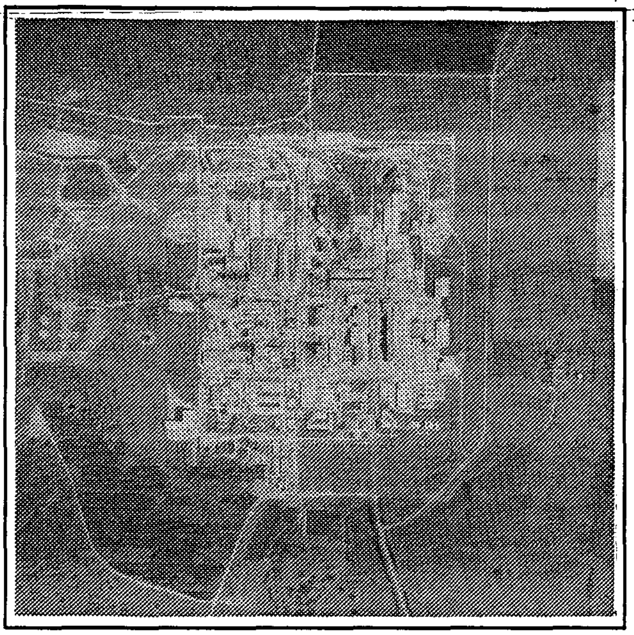

Figure 13a: Aerial Photograph of the FEMP

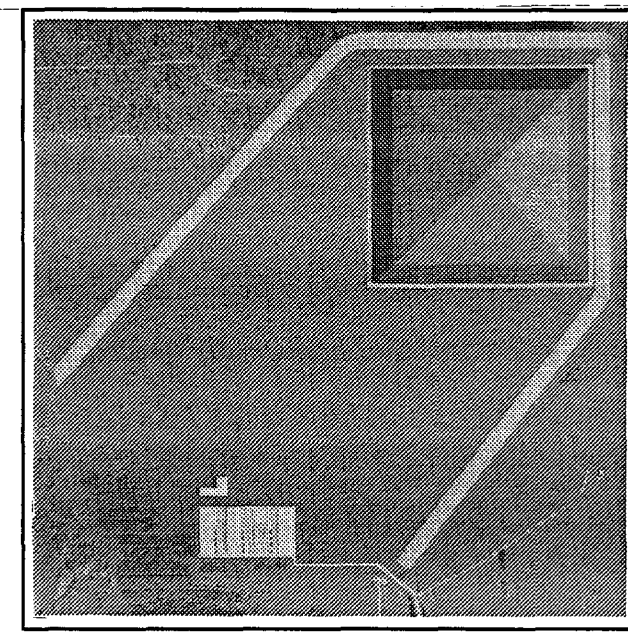

Figure 13b: Artist's Rendition of the FEMP Following Completion of the Adopted Site-wide Remedy

Table 5 presents a projected estimate of the volume of materials requiring on- or off-site disposal for the adopted site-wide remedy. In general, the site-wide remedy applies a balanced approach to site restoration. Material with higher uranium contamination, deemed to represent the principal threat at the site, would be treated (if required) and shipped offsite for disposal. Material exhibiting lower contaminant concentrations distributed over a larger volume, termed a secondary threat, would be permanently disposed of on the FEMP property in one central engineered cell. The adopted alternatives and their projected soil and waste volumes may to change as the remedy selection process is finalized in the RODs for each of the individual operable units.

TABLE 5
PROJECTED VOLUMES FOR REMEDY ADOPTED TO COMPLETE SITE-WIDE ANALYSIS

Contaminated Materials	Cubic Yards
Off-Property Disposal	775,000
On-Property Disposal	2,350,000

Figure 13 presents an artist's rendition of the appearance of the site following implementation of the adopted site-wide remedy. The proposed engineered disposal cell is estimated to be 2260 feet by 1600 feet by 40 feet high. The size of the cell is based upon the consolidation of in excess of 500,000 cubic yards of contaminated soil and construction debris from Operable Units 1 through 4 in addition to the 1.8 million cubic yards of soil contributed from Operable Unit 5. A projection of the estimated footprint of the engineered cell accommodating the site-wide remedy is shown in Figure 11. The duration of the remedial action is anticipated to take 22 years to address the source areas (i.e. pits, silos, landfill, etc.) and contaminated soil and sediment and approximately 30 years to restore the aquifer.

The analysis of the adopted site-wide remedy performed for the FS included a risk analysis of the postremedial site conditions. The purpose of this risk analysis was to determine whether the site-wide remedy could ensure the long-term protection of human health consistent with the adopted land use objective. The adopted land use objective was that of attaining a cleanup which provides for the protection of hypothetical on-property industrial and/or recreational users and an off-property farmer. This risk analysis examined the long-term performance of the disposal cell and the potential risks to future human receptors due to residual concentrations of contaminants remaining at the site in soil and groundwater following the certified completion of remedial actions at all five operable units.

The results of this risk analysis, presented in Table 6, indicates that the adopted site-wide remedy, including the use of the proposed final remediation levels listed in Table 3, would provide a maximum estimated risk to a future industrial or recreational user of the FEMP property within the 10^{-6} ILCR level. The maximum calculated risk to the hypothetical off-property farmer located immediately adjacent to the FEMP property for a 70-year lifetime would be within the 10^{-5} ILCR level.

TABLE 6
ESTIMATED SITE RISK FOLLOWING COMPLETION OF ADOPTED SITE-WIDE REMEDY

	Remaining Site Risk	
Future Land User	Carcinogenic	Noncarcinogenic
Undeveloped park user	10^{-6}	< 1
Off-property farmer	10^{-5}	< 1
Commercial/industrial user	10^{-5}	< 1
Developed park user	10^{-6}	< 1
Green space (wildlife reserve) user	10^{-6}	< 1
Great Miami River user	$< 10^{-6}$	< 1

Note: Shading denotes target receptors for adopted land use objective.

In the unlikely event the projected institutional controls (i.e., continued federal ownership, deed restrictions, etc.) established to maintain the adopted land use were to fail, the risk analysis estimated that the maximum incremental risk a hypothetical on-property farmer would receive from the postremediation site conditions was an approximate 10^{-4} ILCR.

In completing the Operable Unit 5 FS and those for the other FEMP operable units, DOE has acknowledged that uncertainties exist which may impact the course of remedial action once field work is underway. Uncertainties can be managed by emphasizing conservatism for any assumptions made and by planning for additional data evaluation and assessment as the remedial actions are implemented. By acknowledging the existence of uncertainties, bounding assumptions on the conservative side, and planning for an iterative approach to implementation of the remedial actions, DOE and FEMP stakeholders can move forward with the decision making process.

The overall conclusions of the evaluation completed in the Operable Unit 5 FS for the adopted site-wide remedy was that the Operable Unit 5 preferred remedy, in conjunction with the preferred or leading alternative for the other four operable units, would provide for the protection of human health and the environment over the long-term (i.e., up to or beyond 1000 years). The evaluation further concluded that the adopted site-wide remedy would attain the adopted land use objective (i.e., restricted use of the FEMP for industrial and recreational purposes) and provide for the long-term protection of the water quality in the Great Miami Aquifer.

Public Involvement Activities

The community is encouraged to read and provide comments on the Operable Unit 5 FS Report and this Proposed Plan. The FS describes the remedial action alternatives which were considered for the FEMP and describes the merits and shortcomings of each. This Proposed Plan puts forth a recommended remedial action alternative for Operable Unit 5 based upon the content and conclusions of the FS.

A final remedy selection will be made only after hearing and considering community comments and concerns. Based upon those comments, the preferred alternative may be modified, another alternative presented in this Proposed Plan selected, or a new alternative selected based on information gathered from the community before and during the comment period.

Once again, the public is encouraged to review and comment on the Operable Unit 5 FS and this Proposed Plan. These and other supporting documents are available from the Administrative Record, located at the Public Environmental Information Center and at EPA offices in Chicago, Illinois. Addresses for these Administrative Record locations are provided below.

Your comments may either be presented publicly at a community meeting or submitted by mail to:

Mr. Gary Stegner	Mr. Jim Saric
U.S. Department of Energy Fernald Area Office P.O. Box 398705 Cincinnati, OH 45239-8705	U.S. EPA, 5HRE 8J 77 W. Jackson Blvd. Chicago, IL 60604
513-648-3131	312-886-0992

The date, time and location of the public meeting, and dates for the comment period, will be announced in the local media and are posted at the Administrative Record locations. Addresses and hours are as follows:

Public Environmental Information Center	U.S. EPA Region V
10845 Hamilton-Cleves Highway Harrison, OH 45030	77 W. Jackson Blvd. Chicago, IL 60604
513-738-0164	312-886-0992
Monday and Thursday, 9 a.m. to 7 p.m. Tuesday, Wednesday and Friday, 9 a.m. to 4:30 p.m. Saturday, 9 a.m. to 1 p.m.	Monday-Friday, 8 a.m. to 5 p.m.

The **OHIO ENVIRONMENTAL PROTECTION AGENCY** is participating in the RI/FS and remedial action processes at the FEMP. For additional information concerning the state's role in the cleanup process at the FEMP or regarding the specifics of this Proposed Plan contact:

Tom Schneider
Fernald Project Manager
Ohio Environmental
Protection Agency
401 E. Fifth Street
Dayton, Ohio 45402-2911

(513) 285-6466