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AGENDA, OVERHEADS AND HANDOUTS FROM THE WORKSHOP ON THE CLEANUP OF THE FERNALD WASTE PITS MARCH 29, 1994

03/29/94

DOE-FN/PUBLIC
50
HANDOUTS
OU1

- 5376

CLEANING UP FERNALD'S WASTE PIT AREA

March 29, 1994 • 7 p.m.
Ross Fire House, Cincinnati-Brookville Road, Ross

Agenda

Why are we here . . . . . Dave Lojek

How we propose to clean up the waste pits . . . Terry Hagen

What are the risks of this proposed action . . . . . Randy Janke

What we plan to do with Pit 6 . . . . . Bob Fellman

What comes next . . . . . Steve Houser

Questions are welcome any time during the presentations

BASIC ELEMENTS OF THE FEASIBILITY STUDY

- DEVELOP REMEDIAL ACTION OBJECTIVES
- IDENTIFY/SCREEN REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS
- DEVELOP/SCREEN PRELIMINARY REMEDIAL ALTERNATIVES
- CONDUCT DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES
- CONDUCT COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

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REMEDIAL ACTION OBJECTIVES

- REDUCE POTENTIAL HUMAN AND ECOLOGICAL EXPOSURE TO CONTAMINATION TO ACCEPTABLE LEVELS
  - REMEDIATE WASTES SO THAT POTENTIAL DIRECT CONTACT - TYPE EXPOSURES ARE EFFECTIVELY CONTROLLED
  - REMEDIATE WASTES SO THAT RELEASES TO GROUNDWATER ARE ELIMINATED OR CONTROLLED TO ACCEPTABLE LEVELS

CERCLA SCREENING CRITERIA

- EFFECTIVENESS
- IMPLEMENTABILITY
- COST

-58276

PRELIMINARY ALTERNATIVES SCREENED IN THE FEASIBILITY STUDY

- ALTERNATIVE 1 - NO ACTION
- ALTERNATIVE 2 - IN SITU CONTAINMENT
- ALTERNATIVE 3 - IN SITU TREATMENT AND CONTAINMENT
- ALTERNATIVE 4 - REMOVAL, TREATMENT, AND ON-PROPERTY DISPOSAL

  ALTERNATIVE 4A - REMOVAL, TREATMENT (VITRIFICATION), AND ON-PROPERTY DISPOSAL

  ALTERNATIVE 4B - REMOVAL, TREATMENT (CEMENTATION), AND ON-PROPERTY DISPOSAL

  ALTERNATIVE 4C - REMOVAL, TREATMENT (LOW TEMPERATURE DRYING), AND ON-PROPERTY DISPOSAL

- ALTERNATIVE 5 - REMOVAL, TREATMENT, AND OFF-SITE DISPOSAL

  ALTERNATIVE 5A - REMOVAL, TREATMENT (LOW TEMPERATURE DRYING), AND OFF-SITE DISPOSAL AT NTS

  ALTERNATIVE 5B - REMOVAL, TREATMENT (LOW TEMPERATURE DRYING), AND OFF-SITE DISPOSAL AT A PERMITTED COMMERCIAL DISPOSAL FACILITY

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STATUS OF ALTERNATIVE SUGGESTED IN DECEMBER PUBLIC WORKSHOP

- SUGGESTED ALTERNATIVE: EXCAVATION, TREATMENT (VITRIFICATION), OFF-SITE DISPOSAL

- SUGGESTED ALTERNATIVE CONSIDERED BUT NOT CARRIED FORWARD FOR ANALYSIS

  - QUANTITATIVE RISK EVALUATION INDICATES WASTES CAN BE SAFELY TRANSPORTED WITHOUT VITRIFICATION (RISK ASSESSMENT INCLUDES ACCIDENT SCENARIO)

  - VITRIFICATION DOES NOT IMPACT ABILITY TO MEET OFF-SITE WASTE ACCEPTANCE CRITERIA

  - IMPLEMENTABILITY OF VITRIFICATION ON <u>OU1 WASTES</u> MODERATELY UNCERTAIN

  - ALTERNATIVE NOT COST-EFFECTIVE

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WHY REMOVE THE WASTE FROM THE PITS

- ASSURE GROUNDWATER PROTECTION
  - WASTE PIT CONTENTS IN CLOSE PROXIMITY TO GREAT MIAMI AQUIFER FORMATION
  - SIGNIFICANT PORTIONS OF WASTES ARE SATURATED
  - WASTE PIT LAYOUT PREVENTS EFFECTIVE LEACHATE COLLECTION

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ALTERNATIVES UNDERGOING DETAILED ANALYSIS

- ALTERNATIVE 4A - REMOVAL, TREATMENT (VITRIFICATION), AND ON-PROPERTY DISPOSAL
- ALTERNATIVE 4B - REMOVAL, TREATMENT (CEMENTATION), AND ON-PROPERTY DISPOSAL
- ALTERNATIVE 5A - REMOVAL, TREATMENT (LOW TEMPERATURE DRYING), AND OFF-SITE DISPOSAL AT NTS
- ALTERNATIVE 5B - REMOVAL, TREATMENT (LOW TEMPERATURE DRYING), AND OFF-SITE DISPOSAL AT A PERMITTED COMMERCIAL DISPOSAL FACILITY

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CERCLA EVALUATION CRITERIA

THRESHOLD CRITERIA

- OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
- COMPLIANCE WITH ARARs

BALANCING CRITERIA

- LONG-TERM EFFECTIVENESS AND PERMANENCE
- REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT
- SHORT-TERM EFFECTIVENESS
- IMPLEMENTABILITY
- COST

MODIFYING CRITERIA

- STATE ACCEPTANCE
- COMMUNITY ACCEPTANCE

PREFERRED ALTERNATIVE IN DRAFT PROPOSED PLAN

- ALTERNATIVE 5B - REMOVAL, TREATMENT (LOW TEMPERATURE DRYING), AND OFF-SITE DISPOSAL AT A PERMITTED COMMERCIAL DISPOSAL FACILITY

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BASIS FOR IDENTIFICATION OF PREFERRED ALTERNATIVE

- TECHNICAL IMPLEMENTABILITY MORE CERTAIN
  - EXCAVATION, DRYING, AND TRANSPORTATION ARE ROBUST, PROVEN TECHNOLOGIES
  - HANDLES WASTE HETEROGENEITY BETTER THAN VITRIFICATION AND CEMENT SOLIDIFICATION

BASIS FOR IDENTIFICATION OF PREFERRED ALTERNATIVE

- LONG-TERM EFFECTIVENESS MORE CERTAIN THAN FOR ON-SITE DISPOSAL
  - NO USABLE GROUNDWATER OR SURFACE WATER RESOURCES AT EVALUATED DISPOSAL LOCATION
  - NO RESIDENT HUMAN POPULATION IN VICINITY OF PROPOSED DISPOSAL LOCATION

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BASIS FOR IDENTIFICATION OF PREFERRED ALTERNATIVE

- COST EFFECTIVENESS
  - COST ESTIMATES SHOW SLIGHT COST ADVANTAGE FOR PREFERRED ALTERNATIVE

COST ESTIMATES

ALTERNATIVE 4A: VITRIFICATION, ONSITE DISPOSAL
CAPITAL COST $639,094,175

ALTERNATIVE 4B: CEMENTATION, ONSITE DISPOSAL
CAPITAL COST $504,195,700

ALTERNATIVE 5A: DRYING, OFFSITE DISPOSAL AT NTS
CAPITAL COST $856,102,280

ALTERNATIVE 5B: DRYING, OFFSITE DISPOSAL AT COMMERCIAL FACILITY
CAPITAL COST $457,773,376

REMEDIAL ALTERNATIVE RISKS

- **What Is The Overall Objective?**
  - Ensure Protection of Human Health
  - Ensure Protection of the Environment
- **What Is The Result At The FEMP**
  - Alternative Risks Must Be Protective
  - Alternatives Must Meet Or Exceed ARARs, Regs, Etc.

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REMEDIAL ALTERNATIVE RISKS

- What Risks Are Considered?
  - Human Health Risks From Exposures To Contamination
    - » Risks During Remedial Action
    - » Risks After Remedial Action
    - » Risks Related To Transportation
  - Acute Injuries Such As From Construction Activities
- Who Is Affected By These Risks?
  - The Public
    - » Considers those living near and far from FEMP
  - Work Force
    - » Considers those directly and in-directly involved

HOW ARE RISKS EVALUATED?

- **Remedial Risks Are Compared To Baseline**
  - Baseline Assumes "No-Action"
    - » Current and Future Exposure Scenarios
    - » Wide Variety of Exposure Pathways
    - » RME, CT, and Sensitive Populations
- **Remedial Action Risks**
  - Activities Associated With Each Alternative
  - Provides Basis For Determining Engineering Controls
- **Residual Risks**
  - Risks Posed By Residual Contamination
  - Provides Basis For Developing "Final" Clean-Up Levels

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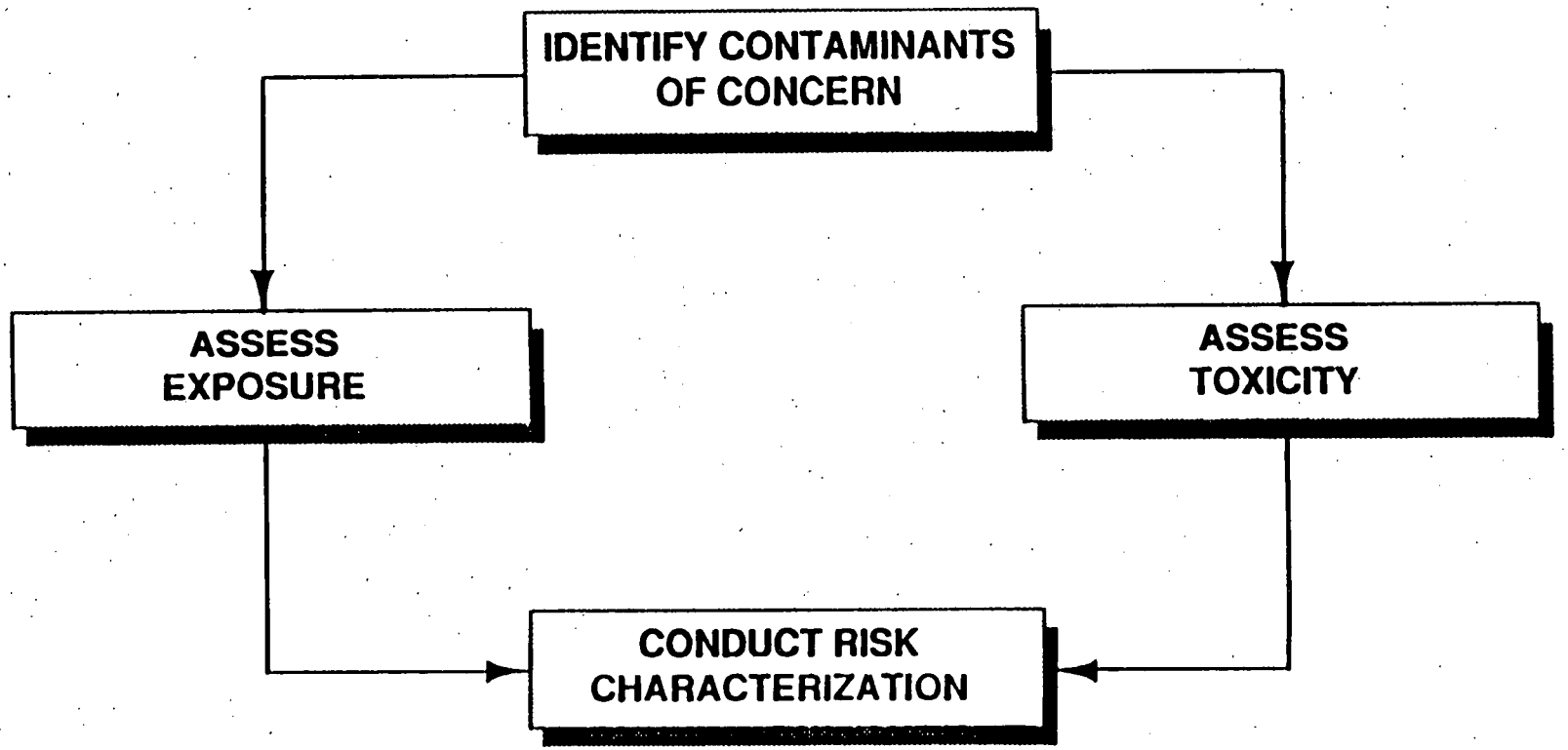
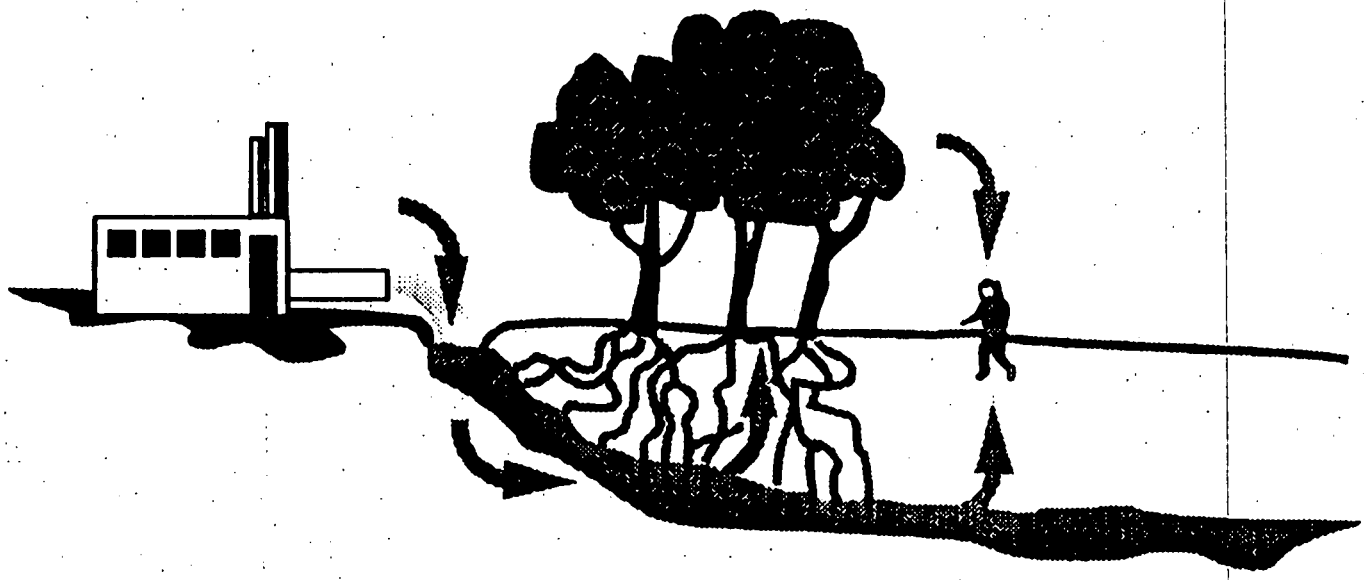
RISK ASSESSMENT IN SUPERFUND



THE BASELINE RISK ASSESSMENT: ASSESSING EXPOSURE



- WHO?
- WHERE?
- HOW MUCH?

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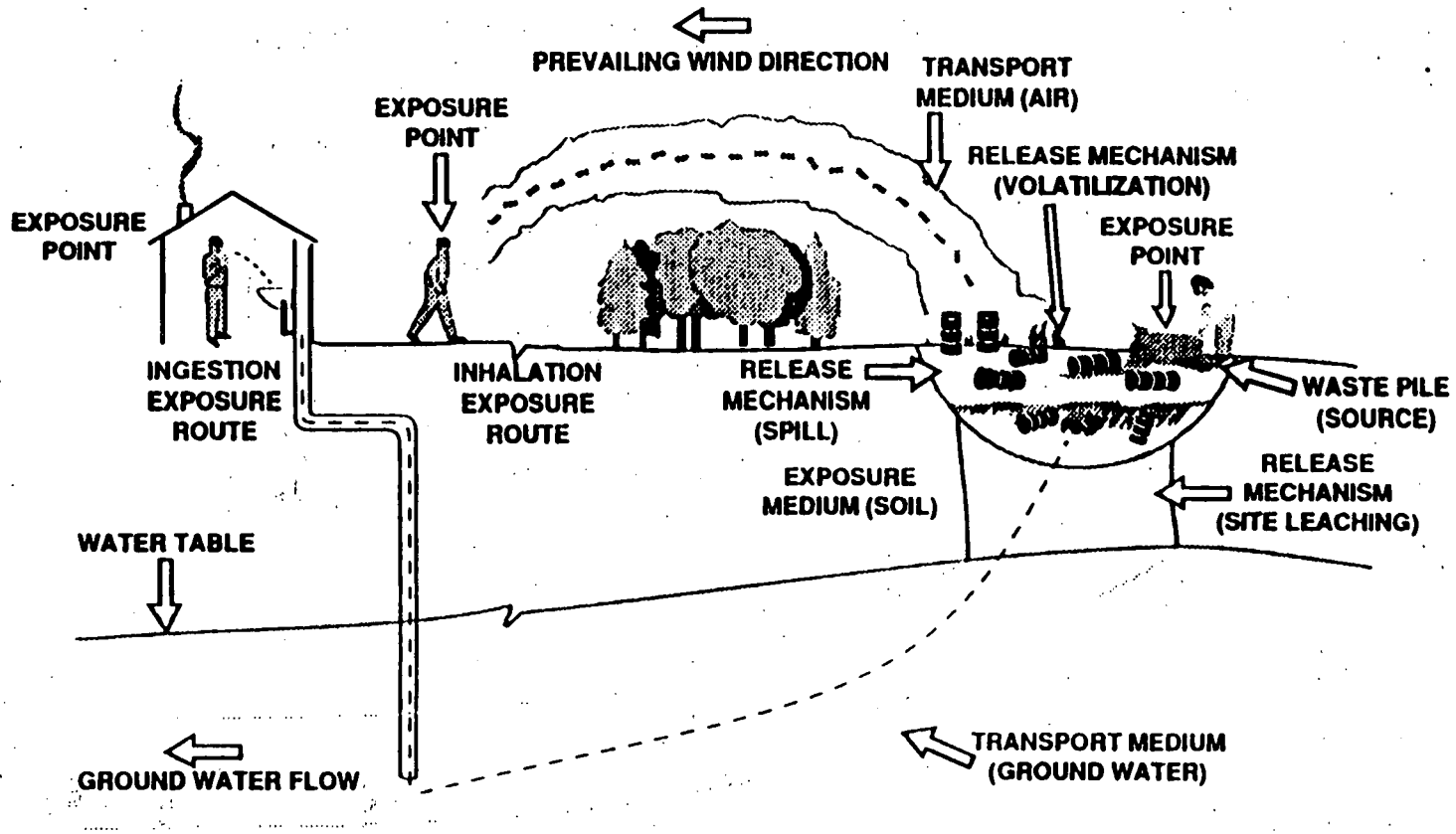
ILLUSTRATION OF EXPOSURE PATHWAYS



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HOW ARE RISKS EVALUATED?

- Exposure Scenarios
  - Evaluating Activities Where People Are Exposed
    - » Farming (on- and off-property)
    - » Trespassers (child and adult)
    - » Workers (handling, excavating, monitoring, etc.)
- Exposure Pathways
  - Evaluating Exposure Routes
  - Inhalation, Ingestion, and Direct Modes Addressed
  - Short and Long Term Exposures
- Sources - Receptors - Pathways
  - RMEs, CTs, and Sensitive Populations
  - Waste, Soil, Air, etc.

158 76

HOW IS SIGNIFICANCE DETERMINED?

- Source Strength
  - How Much Of A Contaminant is Present?
  - What Kind of Contaminant is Present?
- Route of Exposure
  - How Does The Contaminant Affect The Body?
- Rate of Exposure
  - How Quick?
- Duration of Exposure
  - How Long?

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REMEDIAL ACTION RISKS

- Exposure Activities
  - Excavation
  - Drying, Vitrification, and Cementation
  - Handling, Packaging, and Transportation
  - Monitoring and Sampling

- Engineering Controls
  - Resuspension of Dusts and Debris
  - Proper Health and Safety measures
  - Proper Handling of Waste Waters and Effluents

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RESIDUAL RISKS

- Exposure Activities
  - Similar To Baseline Risk Assessment
  - Exposures To Soil, Water, and Air
  - Variety of Land Uses Considered

- Engineering Controls
  - Permanent Government Ownership
  - Institutional and Engineering Controls
    - » Deeds and Restrictions
    - » Fences, Signs, etc.
    - » Filling and Capping "Former" Pit Areas
  - Remove Contaminated Soils To Maximum Extent Practical

REMEDIAL ALTERNATIVE RISKS

- **Alternative Risks Meet The Threshold Criteria**
  - Cumulative Risks Are Less Than 1×10^{-4} (1 in 10,000)
  - Hazard Index Less Than 1/10
  - Covers On- and Off-Property Exposures
  - Acute And Chronic Exposures Are Addressed

- **What Does This Mean?**
  - The Public Is Protected
  - Workers Are Protected
  - The Environment Is Protected

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CLEANING UP FERNALD'S WASTE PIT AREA

PLANNING FOR

THE ENGINEERING & DESIGN PHASES

- Refine Engineering Data Base : A Field Program
- Demonstrate The Best Operational Approach: A Pilot Study

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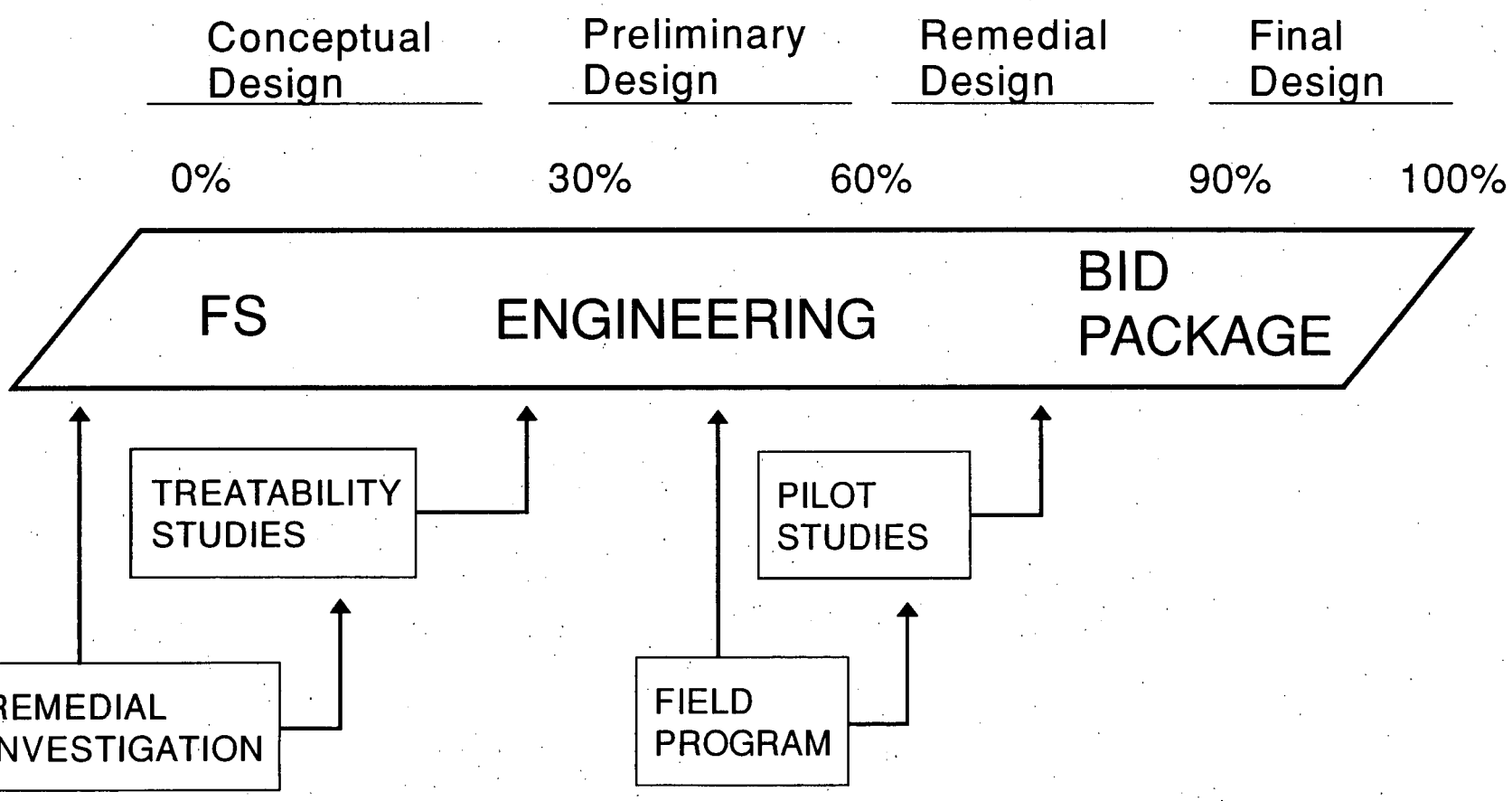
REFINING & FINALIZING THE ENGINEERING DESIGN



FIELD & PILOT STUDY GOALS & OBJECTIVES

- Necessary For All Alternatives Evaluated In Detail In The FS/PP

  - Information Supports Remedial Design
  - Essential For Operations Planning
  - Information Important for Responsive Bids

- Objectives

  - Demonstrate Best Excavation Techniques and Dryer Operation
  - Optimizes Health and Safety Controls - ALARA
  - Demonstrate Effectiveness of Emissions Controls
  - Determine Infrastructure Requirements
  - Refine Cost Estimates & Schedules

- Constraint

  - Availability of Funding

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FIELD PROGRAM DESCRIPTION

Objective: Identify Best Methods & Equipment for Excavation

Target Pits: Pits 1, 2 and 3

ACTIVITY	PURPOSE	METHOD
Dewatering	Determine Best Method to Remove Water From Waste	• Wellpoints • Wide Diameter Wells • Electro-osmosis
Excavating	Select Best Methods & Equipment	• Wet Excavation • Dry Excavation
Pit Sampling	Obtain Feedstock for Pilot Studies and Samples for Lab Tests	• Excavation & Temp Storage in White Metal Boxes • Obtain Lab Samples
Testing: Field & Lab	Refine and Expand the Geotech Data Base.	• Standard Penetration Tests • Cone Penetrometer • Grain Size • Moisture Content • Specific Gravity • Other

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PILOT STUDY DESCRIPTION

- PHASE I -- Short Term Batch Runs
  - 10 yd^3 Samples from Pits 1, 2 and 3
  - Define Operating Control Parameters
    - Moisture Content
    - Residence Time
    - Temperature
- PHASE II -- Removal and Drying of the Entire Contents of Pit 6
  - 9600 yd^3 Wastes; 485,000 gal Water; 2400 yd^3 Soils
  - Demonstrate:
    - Five-day, 24 Hr, 200 ton/day Operation
    - Size Reduction
    - Dryer Operation
    - Offsite Disposal
  - Demonstrate Optimal Excavation Techniques for Pit 6

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SAFEGUARDS AND CONTROLS

ACTIVITY	PROTECTIVE MEASURES
DEWATERING	• Treatment For Solids and Metals
EXCAVATION	• PPE for Workers -- Level B • Air-Supplied Excavation Equipment • Personnel Monitoring • Perimeter Monitoring • Existing FEMP Monitoring • Dust Suppression: Tarps, Water and Surfactant Spraying • Runoff Control(Grading, Berms)
CRUSHER/MIXER	• Enclosed Structure
DRYER	• AQCS: HEPA Filtration Scrubber (As Required) • Stack and Perimeter Monitoring
PACKAGING AND SHIPPING	• Enclosed Conveyor • Loading Under Ventilated Hood • Dust Suppression

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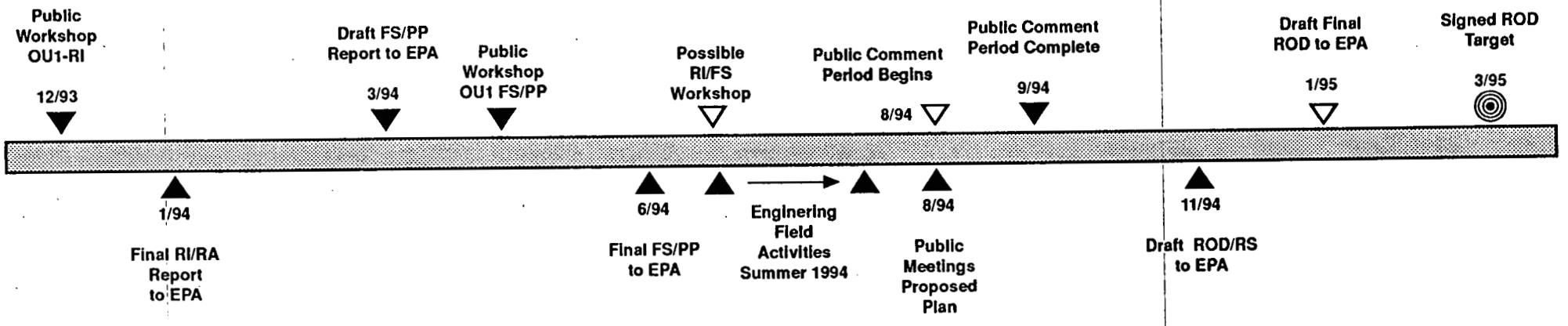
CURRENT OU1 SCHEDULE
"LOOK-AHEAD"



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Operable Unit 1
Waste Pit Area

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March 29, 1994, Workshop

EVALUATION FORM

Thank you for coming to tonight's meeting. We'd like your opinion on DOE's proposed plan to clean up the Waste Pit Area and other aspects of the meeting. Please complete this evaluation form before you leave.

---

1. How well do you understand DOE's proposed plan to clean up the Waste Pit Area?

   _____ Very well
   _____ Well
   _____ Not very well
   _____ Not at all

   If not, why?

2. DOE has proposed to clean up the Waste Pit Area by excavating the contents of the waste pits, treating it, and shipping it to an off-site disposal facility. What concerns, if any, do you have with this proposed action?

3. How satisfied are you with the answers given to questions?

   _____ Very satisfied
   _____ Somewhat satisfied
   _____ Satisfied
   _____ Not satisfied
   _____ Very dissatisfied

   Why?

4. Did you find the exhibits and/or handouts informative?

5376 ____ Yes
____ No

If no, why?

5. How did you learn about tonight's meeting?

____ Newspaper story

____ Newspaper ad

____ Flyer

____ Friend or neighbor

____ Television story

____ From a Fernald employee

____ From a Fernald envoy

____ Letter from DOE

____ Other: _____

6. In order to gain a better understanding of how well we communicate with all of our stakeholders, please check all of the following that apply.

____ Area resident

____ Member of FRESH

____ Member of Fernald Citizens Task Force

____ Fernald employee

____ DOE employee

____ Member of another organization (please specify) _____

____ Other _____

7. What did you like most about the meeting?

Operable Unit 1
Waste Pit Area
Draft Feasibility Study/Proposed Plan

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What is the Waste Pit Area?

The Waste Pit Area is a study area known as Operable Unit 1, a well-defined 37.7-acre area located in the northwest portion of the U.S. Department of Energy's Fernald Environmental Management Project. The Fernald facility operated from 1952 until 1989; its primary function was to provide high-purity uranium metal products that were used in making nuclear weapons.

Operable Unit 1 consists of the following site facilities and their associated environmental media:

- Waste Pits 1 through 6 and their contents
- Burn Pit and its contents
- Clearwell and its contents
- Miscellaneous structures and facilities such as berms, liners, concrete pads, underground piping, utilities, and fencing

In all, there are more than 600,000 cubic yards of contaminated material associated with the waste pits.

As a result of past processing and disposal activities, the site is radioactively and chemically contaminated. Low-level radioactive wastes generated in chemical and metallurgical processes were disposed of in the Waste Pit Area. The major contaminants of concern include uranium, thorium, arsenic, lead, copper, silver, cyanide, pesticides, and various solvents used on site.

Because of the nature of the contamination at the Fernald site, it is on the National Priorities List of the U.S. Environmental Protection Agency, meaning it has high priority for cleanup attention. The U.S. Department of Energy is responsible for cleanup activities at the site, and is conducting a Remedial Investigation and Feasibility Study.

The objective of the Remedial Investigation and Feasibility Study process is to gather and evaluate information to support a decision about which cleanup remedy is the most appropriate action for addressing the radioactive and chemical contamination at the site.

The U.S. Department of Energy submitted in early March 1994 its draft Feasibility Study and Proposed Plan to the U.S. Environmental Protection Agency. The Feasibility Study evaluates alternatives for cleanup; the Proposed Plan identifies the preferred cleanup remedy for the Waste Pit Area.

What is the Preferred Cleanup Remedy?

The U.S. Department of Energy's proposal to clean up the Waste Pit Area is removal of the wastes, treatment, and disposal off-site. Specifically, the wastes would be excavated, treated by drying and then shipped by rail to a permitted commercial disposal facility.

The estimated cost of this cleanup proposal is about $457 million. The U.S. Department of Energy estimates that it will take about 8 years to complete this project.

How is the Cleanup Decision Developed?

A wide range of potential cleanup technologies and process options were identified, based on the information about the nature and extent of contamination

found in the Waste Pit Area during the Remedial Investigation. In the Feasibility Study, these individual technologies and process options were screened against the criteria of effectiveness, implementability, and cost.

Once the technologies and process options were evaluated, those surviving the screening process were combined to form preliminary cleanup alternatives. Eight cleanup remedies initially were developed in the Feasibility Study for the Waste Pit Area.

The Feasibility Study documents how these kinds of options were evaluated and identifies those that met the screening criteria.

Nine evaluation criteria have been developed by the U.S. Environmental Protection Agency for the detailed and comparative analysis stage of the Feasibility Study process. They include:

Threshold Criteria

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)

Balancing Criteria

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria

- State acceptance
- Community acceptance

The final two modifying criteria will be evaluated following public and agency comments on the Proposed Plan and will be addressed in the Record of Decision once a final cleanup decision is made.

How Do I Become Involved in Decision Making?

In addition to the formal public comment period on the Proposed Plan, which is anticipated to occur later this summer, the U.S. Department of Energy is interested in your observations at any time. Community acceptance is one of the evaluation criteria that must be considered in developing the cleanup decision.

A workshop on the draft Feasibility Study and Proposed Plan is scheduled for 7 p.m. on March 29, 1994, at the Ross Fire House on Cincinnati-Brookville Road in Ross. You also can contact Dave Lojek, the U.S. Department of Energy's manager of Operable Unit 1, at (513) 648-3127 with questions and comments.

How Do I Get More Information?

You can get more information about the Operable Unit 1 Feasibility Study and Proposed Plan, as well as other documents related to the Remedial Investigation and Feasibility Study at the Public Environmental Information Center (PEIC), located near the Fernald site in the JAMTEK Building, 10845 Hamilton-Cleves Highway, Harrison, Ohio, 45030. The hours are:

- 9 a.m. to 8 p.m., Monday and Thursday
- 9 a.m. to 4:30 p.m., Tuesday, Wednesday, and Friday
- 9 a.m. to 1 p.m., Saturday

For more information, call the PEIC at (513) 738-0164.

EXECUTIVE SUMMARY

INTRODUCTION

This feasibility study (FS) has been prepared to support the decision-making process for remediation of the Fernald Environmental Management Project (FEMP) Operable Unit 1, known as the Waste Pit Area. The Fernald site consists of a 425-hectare (1,050-acre) area about 29 kilometers (18 miles) northwest of Cincinnati in southwestern Ohio. The FEMP is listed on the National Priorities List of the U.S. Environmental Protection Agency (EPA), meaning it has high priority for cleanup attention. The U.S. Department of Energy (DOE) is responsible for cleanup activities at the site under its Environmental Restoration and Waste Management Program.

Formerly known as the Feed Materials Production Center, the Fernald facility operated from 1952 to 1989. The facility's primary function was to provide high-purity uranium metal products to support U.S. defense programs. Production operations were suspended in 1989 and focus shifted to environmental restoration and waste management activities at the site. As a result of past processing and disposal activities, the site became radioactively and chemically contaminated.

The Remedial Investigation/Feasibility Study (RI/FS) at the Fernald site is conducted in accordance with the terms of the 1991 Amended Consent Agreement between DOE and EPA entered into under Sections 120 and 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. The objective of the RI/FS process is to gather and evaluate information to support a decision about which cleanup remedy is the most appropriate action for addressing the environmental concerns identified at the FEMP. The Ohio Environmental Protection Agency (OEPA) is also participating in the RI/FS process at the Fernald site.

The FEMP must also comply with the requirements of the Resource Conservation and Recovery Act (RCRA). Any RCRA closure requirements that must be met will be incorporated into the CERCLA process.

For remedial action sites, it is DOE policy to integrate National Environmental Policy Act (NEPA) values into the procedural requirements of CERCLA, wherever practicable. To support cleanup decisions for contaminated material at the Fernald site, RI/FS documents under CERCLA have been written to incorporate NEPA values. The content of the documents prepared for this project is not intended to represent a statement on the legal applicability of NEPA to remedial actions conducted under CERCLA.

This Feasibility Study has integrated NEPA requirements at the level of an Environmental Assessment. The Operable Unit 1 Feasibility Study, with the Proposed Plan, constitutes the Environmental Assessment. Thus, this report is identified as the Operable Unit 1 Feasibility Study/Proposed Plan-Environmental Assessment (FS/PP-EA). The Feasibility Study and Proposed Plan contain the NEPA impact analysis for each remedial alternative for Operable Unit 1; the discussion of any potential impacts is provided in Section 4.0 of the Feasibility Study and Section 6.0 of the Proposed Plan. In addition, this Feasibility Study provides the NEPA cumulative impact analyses associated with implementing cleanup actions for each of the five operable units. The resources analyzed to determine potential impacts include socioeconomic, environmental, and cultural. For NEPA purposes, Operable Unit 1 will undergo the EA process. At the completion of this process, a determination will be made as to whether an EIS is necessary or whether the proposed action would have no significant impacts resulting in the issuance of a Finding of No Significant Impact (FONSI).

Under the terms of the Amended Consent Agreement, cleanup activities have been categorized by environmental issues into five study areas, called operable units. Remediation of each operable unit is an incremental step toward comprehensively addressing Fernald site problems. Distinct RI/FS documents are being developed for each of the five operable units. Those documents include:

- The Remedial Investigation, which presents information on the nature and extent of contamination
- The Baseline Risk Assessment, which evaluates health and environmental effects that might occur if no cleanup action were taken
- The Feasibility Study, which evaluates alternatives for cleanup

- The Proposed Plan, which summarizes key information from the Remedial Investigation, Baseline Risk Assessment, and Feasibility Study, and identifies the preferred alternative for remedial action
- The Responsiveness Summary, which provides responses to public comments to the Proposed Plan
- The Environmental Assessment, which addresses NEPA values
- The Record of Decision, which documents the cleanup decisions made for each operable unit

The Remedial Investigation and Baseline Risk Assessment for Operable Unit 1 were published in draft in October 1993 and have been revised to reflect comments from EPA and OEPA. The revised drafts were submitted to EPA and OEPA on February 8, 1994 (DOE 1994a). These documents, as well as the Site-Wide Characterization Report (DOE 1993b), are incorporated into the Operable Unit 1 Feasibility Study/Environmental Assessment by reference. The results of the feasibility study, when combined with input from support agencies and from the general public on the preferred remedial alternative and the other remedial alternatives identified in the Proposed Plan, will form the basis for selecting the remedial action. Input from the public and other interested parties will be obtained during the time frame that the Proposed Plan will be available for public review and comment—during the summer of 1994 and documented in the Responsiveness Summary. The alternative(s) selected for implementation will be documented in the Record of Decision for Operable Unit 1, a draft of which is scheduled to be submitted to EPA and OEPA on November 6, 1994. Operable Unit 1 reports are available in the Administrative Record, located near the FEMP in the JAMTEK Building, 10845 Hamilton-Cleves Highway, Harrison, Ohio, 45030.

OPERABLE UNIT 1 DESCRIPTION

Operable Unit 1 known as the Waste Pit Area—a well-defined 37.7-acre area located in the northwest portion of the FEMP property.

Operable Unit 1 is located within the Waste Storage Area, west of the former Production Area. Operable Unit 1 consists of the following site facilities and their associated environmental media:

- Waste Pits 1 through 6 and their contents

- Burn Pit and its contents
- Clearwell and its contents
- Miscellaneous structures and facilities such as berms, liners, concrete pads, underground piping, utilities, and fencing

This feasibility study presents information to support selection of the most appropriate cleanup remedy for Operable Unit 1. The analyses in this report address: (1) remedial technologies that could be applied to the various contaminated media, including the practicability of various treatment options; (2) the specific areas and media to be remediated; (3) the goals for cleanup levels; (4) potential health and environmental impacts associated with cleanup; and (5) the disposal location for contaminated material generated by site cleanup activities.

To facilitate the analyses in this FS, the components of Operable Unit 1 were grouped into three categories:

- Waste pit contents and associated material, which includes the contents of Waste Pits 1 through 6, the contents of the Clearwell and the Burn Pit, pit liners, berms and grossly contaminated portions of the pit covers. The feasibility study identifies a full range of potential process options and technologies and screens them to develop preliminary remedial alternatives. These identified preliminary remedial alternatives are further screened with a detailed analysis completed in the FS for those alternatives surviving the screening process.
- Residual water, which includes surface water, perched groundwater incidental to waste pit remediation, and residual process water. Treatment of residual water would be performed at the FEMP Advanced Wastewater Treatment (AWWT) facility. Operable Unit 1 would be responsible for extraction and conveyance of residual water to the AWWT facility. The AWWT has been designed to handle these types of flows and has sufficient excess capacity. This is discussed in Section 3.0 of the FS. This strategy for addressing residual water is common to all alternatives undergoing detailed analysis in the FS.
- Contaminated surface soil and soils beneath the waste pits. Proposed remediation levels will be established for these soils and those with contamination above these levels will be excavated. Operable Unit 5 has taken the lead in evaluating remedial alternatives most appropriate to this type of waste stream. This includes completion of ongoing treatability studies.

These soils will be managed following excavation by the methodologies specified in the Operable Unit 5 Record of Decision for the process area soils. Depending on the final remedy selected by Operable Unit 5 for the soils, some of the less contaminated waste pit cover soils may also be managed in this fashion. This strategy is common to all alternatives undergoing detailed analysis in the feasibility study.

Groundwater in the Great Miami Aquifer is not addressed as a source medium within this Operable Unit 1 Feasibility Study. Potential remediation of groundwater contamination for the entire FEMP site is being addressed as part of Operable Unit 5. Thus, within this report, groundwater is considered as an environmental receptor medium.

OPERABLE UNIT 1 REMEDIAL INVESTIGATION AND BASELINE RISK ASSESSMENT CONCLUSIONS RELEVANT TO THE FEASIBILITY STUDY

As stated earlier, the Operable Unit 1 Draft Final Remedial Investigation Report, inclusive of the Operable Unit 1 Baseline Risk Assessment, has been forwarded to the U.S. and Ohio EPA. The baseline risk assessment concluded that the wastes of Operable Unit 1 present a potentially unacceptable risk to human health and the environment. As discussed earlier, the FS identifies and evaluates a range of alternatives to implement required remedial action to address this potential risk. While all the findings of the RI are relevant to the FS, the following general findings are particularly important in developing and evaluating remedial alternatives:

- First, there is a very large volume (over 600,000 cubic yards) of contaminated material associated with the waste pits.
- Second, the waste pit contents are heterogeneous both in terms of contaminant type and concentration and also in the physical makeup of the wastes.
- Third, that while there is a potential increased risk associated with direct contact exposures, a principal potential threat is associated with exposure to groundwater contaminated by the waste pits. Two important findings are associated with this. Large volumes of contaminated pit materials are in very close proximity to the geologic formation of the sole-source Great Miami Aquifer. In addition, significant portions of the waste pit contents exhibit an elevated moisture content (some are saturated) meaning that there is a large pool of contaminated leachate available for migration into the aquifer formation.

- Finally, while radiological contaminants are the principal sources of risk, there are also potentially unacceptable risks associated with volatile and semi-volatile organic chemicals and heavy metals. Elevated concentrations of these contaminants are found in each of the waste pits. The potential implementability and effectiveness of the identified remedial alternatives must be evaluated in specific consideration of the above findings.

FEASIBILITY STUDY PROCESS AND CONCLUSIONS

Remedial action objectives (RAOs) have been developed for each of the contaminated media within Operable Unit 1. At the most general level, these RAOs (provided in Section 2.0 of this FS), can be summarized as eliminating or reducing to acceptable levels human and ecological exposure to contaminated media. Proposed remediation levels for surface soils and soils beneath the pits are established in Section 2.0 of the FS. These levels will be finalized in the Operable Unit 5 Record of Decision (see Section 2.2).

In light of the Operable Unit 1-specific characteristics and factors described above, a wide range of potential remedial technologies and process options are identified. In Section 2.0 of the FS, these individual technologies and process options are screened against the criteria of effectiveness, implementability and cost. As an example of this process, bioremediation was identified as a potential remedial technology. But because biological treatment is not effective in addressing the principal threats associated with radioactivity, this option is one of many that were not retained for detailed analysis in the FS. Other options, however, such as a variety of mechanical waste removal technologies, were considered potentially viable for Operable Unit 1. Section 2.0 documents how technologies and process options were evaluated and identifies those that survived the screening. Table 2-2 in the FS provides a concise list of the initial screening of technologies and process options for Operable Unit 1.

Once the technologies and process options are screened, those surviving the screening process are combined to form preliminary remedial alternatives. Eight cleanup remedies initially were developed in this FS. Section 3.0 discusses how the preliminary remedial alternatives identified in this report were developed and screened. It also identifies and explains the differences in the FS analyses and those performed in the Operable Unit 1 Initial Screening of Alternatives (ISA) Report, completed in

1991. As explained in Section 3.0, the FS is based on a base of information that is more developed than what was available at the time the ISA Report was prepared. Table 3.1 identifies the technologies and options assembled to form cleanup alternatives.

Preliminary Remedial Alternatives

The eight preliminary remedial alternatives that were identified are:

- Alternative 1 -- No Action
  - Under this alternative, no further action would be taken at Operable Unit 1. The No-Action Alternative was retained to provide a baseline for comparison in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).
- Alternative 2 - In Situ Containment
  - Under this alternative, the waste would be isolated by slurry walls and subsurface drains at the perimeter of the pits and by an infiltration-limiting multimedia cap over the pit area.
- Alternative 3 - In Situ Treatment and Containment
  - This alternative is identical to Alternative 2 with the addition of a waste solidification step. Waste solidification would involve mixing grout with the upper portions of selected pits.
- Alternative 4 -- Removal, Treatment, and On-Property Disposal

  Alternative 4A -- Treatment Consists of Vitrification
  - Under this alternative, wastes would be turned into a glass-like matrix and placed in an engineered disposal cell at the Fernald site.

  Alternative 4B -- Treatment Consists of Cement Solidification
  - Under this alternative, the waste would be cement solidified and placed in an engineered disposal cell at the Fernald site.

  Alternative 4C -- Treatment Consists of Thermal Drying
  - Under this alternative the wastes would be dried with no additional treatment and placed in an engineered disposal vault at the Fernald Site.
- Alternative 5 -- Removal, Treatment Consisting of Thermal Drying, and Disposal Off Site

  Alternative 5A -- Disposal at the Nevada Test Site
  - Under this alternative, the waste would be excavated, treated by drying to meet waste acceptance criteria, and shipped by rail to a point near Las Vegas and then trucked to the Nevada Test Site for disposal.

Alternative 5B -- Disposal at a Representative Permitted Commercial Disposal Facility

- Under this alternative, the waste also would be excavated and treated by drying to meet waste acceptance criteria, then shipped by rail to a representative permitted commercial disposal facility.

Institutional controls are an element in each of these alternatives.

Results of Detailed and Comparative Analyses

These preliminary remedial alternatives were screened, again using the criteria of effectiveness, implementability, and cost. On the basis of this screening, Alternatives 1, 4A, 4B, 5A, and 5B were judged to be appropriate for consideration in the detailed analysis portion of this feasibility study. Alternatives 2, 3, and 4C were screened out for further consideration. The basis for screening out these alternatives is discussed in detail in Section 3.0 of the FS. In summary, Alternatives 2 and 3 were judged to be ineffective in mitigating potentially unacceptable impacts to the Great Miami Aquifer. Alternative 4 C was screened out because it added no value over that presented by Alternative 4B but it had a slightly higher cost and short-term risk potential.

The objectives of the detailed/comparative analysis are: (1) to further define the reasonable alternatives that have been carried forward from the alternative screening phase of the CERCLA process; (2) to individually assess each alternative against the evaluation criteria as specified in the NCP (40 CFR 300.430); and (3) to compare alternatives with each other to assess the relative performance of each alternative with respect to each evaluation criterion.

Nine evaluation criteria have been developed to address the CERCLA requirements as stated in the NCP (40 CFR 300.430). They are:

Threshold Criteria

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)

Assessments against these two criteria relate directly to evaluation against regulatory requirements. An alternative must satisfy these threshold criteria to be selected as a remedial action.

Balancing Criteria

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria

- State acceptance
- Community acceptance

The final two modifying criteria will be evaluated following public and agency comments on the Proposed Plan and will be addressed in the Record of Decision once a final remedial action decision is made.

Except for the No-Action Alternative, the remedial alternatives for Operable Unit 1 would provide a permanent solution to the environmental problems in Operable Unit 1. Each action alternative would reduce exposures and risks to humans and the environment by removing sources of contamination, treating the waste, and isolating the treated materials from the environment in a disposal facility. For each of the remedial alternatives, an equal degree of protectiveness of human health and the environment is provided by removal of contaminated pit wastes and soils to attain health-based action levels. That protectiveness is maintained in Alternatives 4A and 4B by treating the waste to limit contaminant mobility. The wastes are then disposed in a facility designed to preclude human and ecological intrusion and to reduce impacts to groundwater to acceptable levels. Protectiveness is maintained in Alternatives 5A and 5B by drying the wastes and disposing of them at engineered disposal facilities in the arid west where, due to harsh climatic conditions, there are no resident human populations in the immediate vicinity or usable surface water or groundwater resources.

With one exception, all of the action alternatives can be designed to meet identified ARARs. The exception involves Alternatives 4A and 4B. Specifically, the State of Ohio, at OAC 3745-27-07(B)(5), prohibits sanitary waste landfills from being constructed over sole source aquifers. The Great Miami Aquifer beneath the site has been designated a sole source aquifer. This citation has been determined to be relevant and appropriate to Operable Unit 1 remedial actions. Accordingly, a waiver or exemption from this regulation would be required to implement either Alternative 4A or 4B.

Two options were considered for the primary treatment technology for Alternatives 4A and 4B. The first is chemical stabilization/solidification, which would involve mixing the waste with cement to generate a cement-like product. The second is treatment by vitrification, which would involve melting the waste in a ceramic melter to generate a fritted glass-like product. Prior to both vitrification and cement solidification, the wastes would be dried. The primary treatment for Alternatives 5A and 5B is physical treatment in the form of drying. Alternatives 4A and 4B offer significant advantages in reduction in contaminant mobility over Alternatives 5A and 5B. Alternative 4A is the most advantageous relative to reduction in toxicity because, due to the high temperatures involved, any residual volatile organics and some semi-volatile organics can be destroyed. There is no significant difference among the other alternatives in reduction in toxicity through treatment. Cement solidification would result in a significant volume increase while each of the other alternatives would realize a slight decrease in volume.

As designed, all action alternatives provide an adequate measure of long-term effectiveness and permanence. This is accomplished by the removal of contaminated materials, and by treatment and disposal in an engineered facility. Alternatives 5A and 5B would be equally effective at reducing residual risks permanently. They are also more effective than Alternatives 4A and 4B, since the pit waste material would be removed from the site. Of particular note is the fact that in the event of releases from the disposed wastes in Alternatives 5A and 5B, the likelihood of impacting receptors is very low due to harsh socioeconomic and climatic factors at the disposal facility. Releases from disposed waste in failure scenarios for Alternatives 4A and 4B represent a more significant threat

primarily due to the presence of the sole source Great Miami Aquifer and a large nearby residential population.

The technical implementability of Alternatives 5A and 5B is judged to be equal and relatively straightforward as the principal remedial elements (excavation, drying, transportation) are robust technologies that are routinely implemented in industry. Waste heterogeneity should not significantly impact the ability to implement these alternatives. There are greater uncertainties associated with the technical implementability of Alternatives 4A and 4B. Appendix C of this document summarizes treatability work specific to these alternatives. Cement solidification has been previously applied to low-level radioactive wastes at other sites with varying degrees of success. The cement solidification facility would be difficult to operate due to the heterogeneous nature of the wastes in the pits. Heterogeneity also impacts the implementability of vitrification. There are additional uncertainties associated with vitrification because a full-scale facility for vitrification of wastes similar to those in Operable Unit 1 has not been constructed elsewhere. The start-up of a first-of-a-kind facility is expected to be difficult. There are no known administrative barriers against implementation of Alternatives 4A and 4B, except for the ARAR issue of the state prohibition against on-property disposal over a sole-source aquifer. Obtaining a waiver or exemption from this regulation would be moderately difficult. While Alternatives 5A and 5B must comply with a variety of transportation regulations, there are no known regulations which would prohibit shipment of Operable Unit 1 wastes.

The short-term risks (excluding transportation) to off-site individuals and non-remediation workers would be approximately the same for all four action alternatives. During transportation of waste materials, Alternative 5A would result in slightly higher risks to communities along the transportation route than Alternative 5B. No transportation risks are associated with Alternatives 4A and 4B. The short-term risks (excluding transportation) to remediation workers would be approximately the same for Alternatives 4A and 4B, with 4B having a slightly higher potential for accidents than 4A. The short-term risks for on-site workers of Alternatives 5A and 5B (excluding transportation and package handling) would be equal, and somewhat lower than Alternatives 4A and 4B, due to the higher potential for accidents associated with on-property disposal. However, there would be the potential

for exposures and accidents associated with transportation and package handling. Taking these risks into account, Alternative 5A would have higher dose equivalents and potential accidents for remediation workers than any of the other action alternatives. Alternative 5B, with less waste handling, would have the potential for substantially fewer accidents than the other alternatives, even after the addition of risks associated with transportation.

Cost estimates are used in the feasibility study process under CERCLA to eliminate those remediation alternatives which are significantly more expensive than competing alternatives but do not offer commensurate performance or overall protection of human health and the environment. The cost estimates developed are order-of-magnitude estimates with an intended accuracy range of -30 to +50 percent. Estimates are considered to be order-of-magnitude because of the uncertainties in the information used to develop the estimates.

The estimated present value costs are:

- Alternative 1: $0
- Alternative 4A: $446,690,000
- Alternative 4B: $388,609,000
- Alternative 5A: $645,870,000
- Alternative 5B: $348,202,000

Section 4.0 of the feasibility study describes in detail and compares each alternative to the above evaluation criteria.

ORGANIZATION OF THE FEASIBILITY STUDY

The Operable Unit 1 Feasibility Study includes five sections and 10 appendices, as follows:

- Section 1.0, Introduction
  - Contains information about the purpose and organization of the report; site background; and a summary of Operable Unit 1 nature and extent of contamination, contaminant fate and transport, and baseline risk assessment
- Section 2.0, Identification and Screening of Technologies and Processes
  - Identifies the range of cleanup technologies and process options that were developed into preliminary remedial alternatives and documents how the technologies were evaluated

- Section 3.0, Development and Screening of Alternatives
  - Presents the development and screening of remedial alternatives assembled from combinations of the technologies and process options evaluated in Section 2.0
- Section 4.0, Detailed Analysis of Alternatives
  - Discusses the detailed analysis of the alternatives that passed the screening process, evaluating each alternative against the nine EPA criteria; NEPA impact analysis for each alternative has been integrated into this section.
- Section 5.0, Comparative Analysis
  - Compares the final remedial action alternatives; distinguishes the relative advantages and disadvantages of each alternative so that the preferred remedial action can be identified in the Proposed Plan
- Appendix A, Operable Unit 1 Remedial Investigation Data Summary
  - Summarizes information contained in the Remedial Investigation about the nature and extent of contamination in Operable Unit 1
- Appendix B, Description of Technologies and Process Options
  - Describes the representative technologies and process options evaluated for Operable Unit 1 wastes
- Appendix C, Treatability Studies for Operable Unit 1
  - Summarizes studies of treatment options for Operable Unit 1 wastes
- Appendix D, Public Health and Occupational Risk Consideration
  - Evaluates residual risks associated with the action alternatives
- Appendix E, Cost Estimates
  - Discusses the costs, and the assumptions made in estimating those costs, for the various remedial alternatives
- Appendix F, Analysis of Potential ARARs for Operable Unit 1
  - Identifies and evaluates the Applicable, Relevant, and Appropriate Requirements that apply to Operable Unit 1 and analyzes compliance with these requirements
- Appendix G, NEPA Cumulative Impact Analysis
  - Discusses the impacts, including socioeconomic, etc., of Operable Unit 1 remediation
- Appendix H, Wetland/Floodplain Assessment
  - Discusses the assessment of impacts to wetlands, as required by federal regulations
- Appendix I, Comprehensive Response Action Risk Evaluation
  - Evaluates the total cumulative residual risk to human health estimated to remain after the proposed cleanup of the Fernald site is complete

- Appendix J, Waste Acceptance Criteria
  - Discusses the acceptance criteria for waste at the Nevada Test Site and the representative permitted commercial disposal facility

Generally, it is expected that the preferred remedial action alternative identified in the Proposed Plan for Operable Unit 1 will consist of the alternative that performs best when evaluated against the nine criteria. The Proposed Plan will be issued for public review and comment with Operable Unit 1's integrated Feasibility Study/Proposed Plan-Environmental Assessment (this document). The final remedy for Operable Unit 1 will be determined after public consideration of the Proposed Plan and review of any significant new information that may become available subsequent to submittal of the Feasibility Study/Proposed Plan-Environmental Assessment. The alternatives selected for implementation will be documented in the Operable Unit 1 Record of Decision.