G-000-108.24

5187

IMPLEMENTATION PLAN FOR THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY - ENVIRONMENTAL IMPACT STATEMENT PROCESS FOR REMEDIAL ACTIVITIES AT THE FEMP, FERNALD, OHIO VOLUME 1 OF 2 FINAL JANUARY 1994

01/31/94

DOE-FN
92
REPORT

55187

IMPLEMENTATION PLAN FOR THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY - ENVIRONMENTAL IMPACT STATEMENT PROCESS FOR REMEDIAL ACTIVITIES AT

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY - ENVIRONMENTAL IMPACT STATEMENT

Volume 1 of 2

January 1994

U.S. DEPARTMENT OF ENERGY
OFFICE OF ENVIRONMENTAL MANAGEMENT
CINCINNATI, OHIO

FINAL

0001

VOLUME 1
TABLE OF CONTENTS

	Page
List of Appendices	ii
List of Tables	iii
List of Figures	iii
List of Abbreviations and Acronyms	iv
1.0 Introduction	1-1
1.1 Site Background	1-1
1.2 NEPA/CERCLA Integration Approach	1-3
1.3 Scope and Purpose	1-5
1.3.1 Scope and Purpose of the Implementation Plan	1-5
1.3.2 Scope of the Lead FS/PP-EIS	1-6
2.0 Proposed Action and Remedial Alternatives	2-1
2.1 Operable Unit Approach	2-1
2.2 Proposed Actions for Operable Units 1, 2, 3, 4, and 5	2-1
2.2.1 Operable Unit 1	2-1
2.2.2 Operable Unit 2	2-2
2.2.3 Operable Unit 3	2-4
2.2.4 Operable Unit 4	2-4
2.2.5 Operable Unit 5	2-5
2.2.6 Comprehensive Site-Wide Operable Unit	2-6
2.2.7 Potential Response Actions	2-7
3.0 Description of the Scoping Process	3-1
3.1 Issues Identified During the Scoping Process	3-2
3.2 Related Scoping Process for the Programmatic Environmental Impact Statement for Environmental Restoration and Waste Management	3-5
4.0 FS/PP-EIS Preparation	4-1
4.1 Schedule	4-1
4.2 Development Procedures	4-2
4.3 Disclosure Statement	4-3
4.4 Agency Consultation	4-3

APPENDICES

		Location
Appendix A	FS/PP-EIS Scoping Issues	Vol. 1
Appendix B	Scoping Meeting Transcripts and Written Comments	Vol. 2
Appendix C	Scoping Issue Categories Identified on Transcripts and Written Comments	Vol. 2
Appendix D	Table of Contents for OU4 FS	Vol. 1

LIST OF TABLES

Table Number	Title	Page
3-1	FS/PP-EIS Public Scoping Issue Categories	3-6

LIST OF FIGURES

Figure Number	Title	Page
2-1	Operable Units 1 Through 4 Location Map	2-8
2-2	Operable Units 1 and 4	2-9
2-3	Lime Sludge Ponds	2-10
2-4	Flyash/South Field	2-11
2-5	Solid Waste Landfill	2-12
2-6	Operable Unit 3	2-13

LIST OF ABBREVIATIONS AND ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirements
ASI	Advanced Sciences, Inc.
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CRARE	Comprehensive Response Action Risk Evaluation
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EE/CA	Engineering Evaluation/Cost Analysis
EIS	Environmental Impact Statement
EM	Environmental Restoration and Waste Management
EPA	U.S. Environmental Protection Agency
EWMF	Engineered Waste Management Facility
FEMA	Federal Emergency Management Agency
FEMP	Fernald Environmental Management Project
FFCA	Federal Facility Compliance Agreement
FERMCO	Fernald Environmental Restoration Management Corporation
Fed. Reg.	Federal Register
FRESH	Fernald Residents for Environmental Safety and Health
FS	Feasibility Study
FS/PP-EIS	Feasibility Study/Proposed Plan-Environmental Impact Statement
HSL	Hazardous Substance List
IT	International Technology Corporation
LRA	Leading Remedial Alternative
NEPA	National Environmental Policy Act
NOI	Notice of Intent
OEPA	State of Ohio Environmental Protection Agency
OSHA	Occupational Safety and Health Administration

OU	Operable Unit
PBRA	Preliminary Baseline Risk Assessment
PCB	Polychlorinated Biphenyls
PEIS	Programmatic Environmental Impact Statement
PP	Proposed Plan
RA	Risk Assessment
RI	Remedial Investigation
RI/FS-EIS	Remedial Investigation/Feasibility Study-Environmental Impact Statement
ROD	Record Of Decision
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

1.1 SITE BACKGROUND

The Fernald Environmental Management Project (FEMP) formerly known as the Feed Materials Production Center is a facility owned by the Department of Energy (DOE) and was formerly utilized for the production of uranium metal used in defense programs. It is located on a 1050-acre site in a rural area about 18 miles northwest of Cincinnati, Ohio. The former production facilities occupy approximately 136 acres near the center of the site. The site, including all of the former production and waste management facilities, is located within Hamilton County, Ohio, with the exception of approximately 200 acres that are located in southern Butler County, Ohio. The villages of Fernald, New Baltimore, Ross, New Haven, and Shandon are all located within a few miles of the FEMP.

The former production facilities consisted of a variety of chemical and metallurgical processes that were utilized for conversion of uranium ore concentrates and recycle materials, to either uranium oxides for shipment to the gaseous diffusion plants, or machined uranium ingots and billets, for extrusion into tubular form, for fabricating fuel cores and target fuel elements. However, in recent years, the major operational emphasis was on metals production and fabrication plants. As a result of these production activities, an accumulated inventory of low-level radioactive waste, mixed waste, and contaminated material, equipment, and facilities, presenting a potentially adverse impact to the public health and the environment, exists at the FEMP. In addition, contaminated soils and groundwater concerns also exist at the FEMP.

Production activities at the site ceased in July 1989, and the overall mission of the FEMP was redirected to environmental restoration and cleanup. On February 19, 1991, DOE announced a permanent cessation of production activities at the site, and submitted a Closure Report, and a Training and Job Placement Services Plan to Congress. Following a 120-day congressional review period, the decision became permanent. As a consequence, on December 10, 1991, DOE formally announced the cancellation of the Environmental Impact Statement (EIS) for the renovation of the

FEMP Site (56 Fed. Reg. 64504) which was to address the potential environmental impacts associated with renovating the facility to continue in its production mode.

DOE is in the process of investigating the environmental effects of past and present activities at the FEMP in Fernald, Ohio. Remedial actions are being developed, assessed, and implemented to protect human health and the environment from releases or potential releases of hazardous or radioactive substances from the FEMP.

On July 18, 1986, a Federal Facility Compliance Agreement (FFCA) pertaining to environmental impacts associated with years of operation at the FEMP was signed by DOE and the U.S. Environmental Protection Agency (EPA). On November 21, 1989, the FEMP was listed on EPA's National Priorities List. Since that time, DOE and the EPA have negotiated the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sections 120 and 106(a) Consent Agreement. The agreement was signed on April 9, 1990, and became effective on June 28, 1990, following a public comment period. Under the Consent Agreement, the FEMP, which includes the original facility site plus all areas to which the contaminants have migrated, was divided into five Operable Units (OUs): OU 1-Waste Pit Area, OU 2-Other Waste Units, OU 3-Former Production Area, OU 4-Silos 1-4, and OU 5-Environmental Media. This will allow the remedial action process to proceed to completion for the most well-defined or problematic areas at the FEMP while data collection and analysis continued for other areas.

The Consent Agreement was amended in 1991 to revise the schedule for completing the environmental reviews for each of the five OUs. The Amended Consent Agreement created an additional OU, the Comprehensive Site-wide Operable Unit; and included development of a baseline risk assessment. (The lead OU, Operable Unit 4, is the first of the five OUs to issue an FS; see Subsection 4.3-Schedule). The Amended Consent Agreement was signed on September 20, 1991, and became effective on December 19, 1991.

Within the CERCLA framework, two major evaluation documents are required to support cleanup decisions for OU 4 at the FEMP:

(1) The RI report, which presents information on the nature and extent of any release, or threat of release of hazardous or radioactive substances, pollutants, or contaminants; and includes a baseline risk assessment, which evaluates potential impacts to human health and the environment that might occur if no cleanup actions were taken; and

(2) The FS report, which develops and evaluates remedial action alternatives to protect human health and the environment from releases or threatened releases of hazardous or radioactive substances, pollutants, or contaminants.

The RI and FS are the sources of information upon which DOE selects its preferred alternative and presents it in the Proposed Plan.

1.2 NEPA/CERCLA INTEGRATION APPROACH

The National Environmental Policy Act (NEPA), which was enacted in 1969, establishes the general framework and process for conducting environmental reviews of all Federal actions that have the potential to significantly impact the human environment. Under NEPA, proposed Federal actions are evaluated and planned to ensure that the environmental impacts of the action and the alternatives to such action are considered before a decision is made to proceed.

FEMP remedial activities are being conducted in accordance with both CERCLA as amended and NEPA. For remedial action sites, it is DOE policy to integrate NEPA values into the procedural and documentation requirements of CERCLA wherever practicable. DOE policy on NEPA/CERCLA integration is set forth in DOE Order 5400.4; this integration policy is not intended to represent a statement on the legal applicability of NEPA to remedial actions under CERCLA. Integration is intended to: (1) avoid duplicate effort and the larger commitment of resources that would be needed

to implement both NEPA and CERCLA separately; (2) avoid conflicts in analysis and the choice of a remedial alternative; and (3) minimize the risk of delaying remedial actions on procedural grounds.

On May 15, 1990, DOE published a Notice of Intent (NOI) to prepare a Remedial Investigation/Feasibility Study-Environmental Impact Statement (RI/FS-EIS) for remedial activities at the FEMP (55 Fed. Reg. 20183). When the NOI was issued, DOE referred to the document intended to serve NEPA purposes as the RI/FS-EIS. DOE expected that the EIS would consist of the RI, FS, and Proposed Plan (PP). As the CERCLA process and documentation are now developing, DOE believes that the FS and PP may be adequate for NEPA purposes. That is, DOE believes that the FS/PP EIS contains all of the information necessary to assess environmental impacts.

The NEPA/CERCLA integration approach presented in the NOI concluded that: (1) an RI/FS-EIS (now FS/PP-EIS) is the appropriate level of NEPA review for the lead OU; and (2) NEPA/CERCLA integration will also be provided in the remaining four OU FS/PP-NEPA reviews. It has not been determined whether these NEPA reviews will be EISs or Environmental Assessments. These reviews will be tiered from (will reference) the lead FS/PP-EIS, will present impacts specific to the OUs and update site-wide and cumulative impacts as necessary.

To permit this analysis of cumulative impacts and to implement the tiering process, DOE has performed a one-time site-wide characterization to summarize all available FEMP data as of December 1, 1991. This Site-Wide Characterization Report contains a Preliminary Baseline Risk Assessment (PBRA) that characterizes the current and potential threats to human health and the environment that may be posed by contaminants at the FEMP. In the PBRA DOE considers the risks which currently exist at the FEMP, as if no remediation or institutional controls are applied. DOE identifies in the PBRA, the Leading Remedial Alternative (LRA) for each of the OUs 1 through 5 based on all available data and best professional judgement.

In association with the lead OU FS and the FSs that follow, DOE will develop a Comprehensive Response Action Risk Evaluation (CRARE), which will evaluate the risk associated with the proposed action (preferred alternative) and will estimate the cumulative risk for remediation of OU 4 and the

other operable units (assuming the LRA for each OU is the proposed action).. The purpose of the CRARE is to measure the total potential risk during implementation of each proposed remedial action (short term) and the total potential risk which remains after the completion of each proposed remedial action (long term). The cumulative risk contribution from other OUs shall be based upon data available at the time each FS is prepared.

1.3 SCOPE AND PURPOSE

1.3.1 Scope and Purpose of the Implementation Plan

The following Implementation Plan (IP) includes a description of the proposed actions and remedial alternatives; a list of environmental issues to be considered in the FS/PP-EIS; a list of proposed agency consultations; the relationship between the NEPA and CERCLA project planning and decision-making processes; and a table of contents for the FS/PP-EIS.

The purposes of this IP are to record the results of the scoping process and to provide guidance to DOE for the preparation of the FS/PP-EIS for OU 4 and the other OUs. Two scoping meetings were held in the potentially affected communities located near the FEMP during June 1990. Both oral and written comments were received at the scoping meetings and for a specified time period after the meetings. Appropriate comments will be reflected in the scope of the FS/PP-EIS.

Appendix A addresses the EIS scoping issues that commentors raised during the scoping meetings and in written comments. Appendix B contains transcripts of the scoping meetings and the written comments received by DOE during the scoping period. Appendix C lists the scoping issue categories that DOE identified from the transcripts and written comments.

The proposed action consists of an initial remedial action of OU 4 as the lead OU in a series of tiered decisions. Details on how the FS/PP-EIS will consider site-wide environmental information and assess potential cumulative impacts from site-wide remediation, in addition to assessing the impacts of the specific alternatives under consideration for the lead OU, are provided below.

1.3.2 Scope of the Lead FS/PP-EIS

The lead FS/PP-EIS will be written for OU 4. Operable Unit 4 consists of the Silos 1-4, the silo berms, the decant tank system, and the associated contaminated soil within the OU 4 boundary. During negotiations of the Amended Consent Agreement, the detailed schedules for the operable units were revised. The NOI released May 15, 1990, identified OU2 as the lead OU. However, after submittal of the initial RI for OU 2 in 1990, the EPA had determined that the characterization effort to support the initial RI was incomplete and additional work would be required. The additional work necessary to meet and/or address the EPA requirements complicated the OU 2 schedule, and required that OU4 become the OU and a new schedule be developed for completion of the FS/PP-EIS. DOE submitted the OU4 FS and PP to EPA for their first CERCLA review on September 10, 1993.

The NEPA/CERCLA integration approach is based on the results of the scoping process, which supports the following decisions:

(1) To address the environmental impacts of the sampling program and removal activities in separate NEPA documents. This is consistent with the DOE NEPA Regulations (10 CFR Part 1021) provisions addressing removal actions as categorical exclusions.

(2) To consider in the lead FS/PP-EIS only remedial alternatives that are being developed for the FEMP, and not national DOE waste management strategies. The Consent Agreement establishes a schedule for certain remedial decisions for the Femp (e.g., containment, stabilization, remediation, and treatment of the wastes) and that schedule may initiate decisions prior to the completion of the DOE Programmatic EIS (PEIS) for Environmental Restoration and Waste Management. Other decisions (e.g., selection of disposal site for FEMP waste) may await the completion of the PEIS (See section 3.2.).

(3) To evaluate in the lead FS/PP-EIS the impacts of various site-wide alternatives, i.e., engineered waste management facility (EWMF) that may be proposed for the storage and/or disposal of wastes from some or all of the OUs.

The OU 4 FS will develop the remedial action alternatives to prevent or mitigate the migration or release of the hazardous substances, pollutants, contaminants, or hazardous constituents from OU 4 (Silos 1-4). The FS will assess the relevant impacts on human health and the environment (including direct impacts and cumulative impacts), and will estimate costs for each remedial action alternative.

2.0 PROPOSED ACTION AND REMEDIAL ALTERNATIVES

2.1 OPERABLE UNIT APPROACH

DOE's approach at the FEMP is to expedite remediation through the use of the operable unit (OU) concept. The OU is a discrete portion of the FEMP, consisting of one or more release sites, considered together for assessment and cleanup activities. This approach enables DOE to expedite remedial actions on the highest priority OUs, while awaiting necessary data and related analysis on other OUs. The primary criteria for placement of the release sites into an OU include geographic proximity, similarity of waste characteristics and site type, and the possibilities for economy of scale. The OUs are currently defined as OU 1-Waste Pit Area, OU 2-Other Waste Units, OU 3-Former Production Area, OU 4-Silos 1-4, and OU 5-Environmental Media. In addition, there is the Comprehensive Site-Wide Operable Unit. The OUs 1 through 4 are identified in Figure 2-1.

2.2 PROPOSED ACTIONS FOR OPERABLE UNITS 1, 2, 3, 4, AND 5

2.2.1 Operable Unit 1

Operable Unit 1 includes six waste pits, the burn pit, the Clearwell, the liners, and the soils within the OU 1 boundary. It is located in the northwestern portion of the FEMP (Figure 2-2). The waste pits are no longer in use. Waste Pits 1, 2, 3, and 6 were primarily used for disposal of dry radioactive waste. Waste Pits 4 and 5 also contain hazardous constituents. The estimated volume of these four Waste Pits 1, 2, 3, and 6 is 112,000 cubic yards. Waste Pits 4 and 5 were used for treatment of liquid wastes and contain uranium, thorium, and other hazardous constituents with a combined estimated volume of 329,500 cubic yards. The burn pit was used to burn waste materials, including pyrophoric and reactive chemicals, oils, and other combustible low-level radioactive material. Use of the burn pit was discontinued in 1986. The Clearwell was used as a collection and settling basin for liquid overflow from Pit 5 and for runoff from the waste storage area. Since shutdown of the process flow to Pit 5 in early 1987, use of the Clearwell has been limited to collecting surface storm water runoff from the

waste pit area. The intent of the OU 1 remedial action is to stabilize, isolate, or treat the waste and any associated contamination to prevent the release or migration of contaminants to the environment. During June 1992, the Waste Pit Area Stormwater Runoff Control Removal Action, undertaken to mitigate the discharge of contaminated runoff into Paddys Run was completed.

2.2.2 Operable Unit 2

Operable Unit 2, Other Waste Units, includes the Active Flyash Pile, the Inactive Flyash Disposal Area, the South Field, the North and South Lime Sludge Ponds, the Solid Waste Landfill, the berms, the liners, and the associated soils within the boundary of OU 2.

The lime sludge ponds, located in the waste storage area, are settling/drying beds for alkaline sludges, produced from the treatment of the raw water used to supply the FEMP. The North Lime Sludge Pond is an unlined pond of approximately (150 by 250 feet) that receives spent lime sludge (Figure 2-3). It is approximately 90 percent filled, and has a reported estimated lime sludge depth of five to eight feet. The pond is covered with up to seven feet of water which varies depending on plant operation and precipitation. Spent lime sludges from water treatment operations, as well as sludges from the neutralization of boiler plant blowdown and coal pile stormwater runoff were also pumped to the South Lime Sludge Pond and allowed to settle. The South Lime Sludge Pond, inactive since the mid-1960s, is an unlined pond in the southeast corner of the waste storage area (Figure 2-3). It is approximately 150 by 250 feet and it is now overgrown with grass and shrubs. The depth of the material in the pond is estimated to be eleven and a half feet. Together the ponds encompass an area of approximately two acres, and the sludge volume is estimated to be 11,500 cubic yards for each pond.

The flyash piles are from the onsite coal-fired boiler plant. The Active Flyash Pile is just east of the running track/South Field area, on the opposite side of the south construction road (Figure 2-4). Flyash from the coal-fired boiler plant was transported, via truck, and dumped onto the flyash pile site until December 1992. Currently flyash is shipped off site. Unsubstantiated reports in the past, have indicated that the flyash disposal area was sprayed with oils contaminated with uranium and

polychlorinated biphenyls (PCBs) as a means to control dust. The volume of flyash in this pile is estimated to be 33,000 cubic yards.

The Inactive Flyash Disposal Area is a waste area, with soil or vegetation cover located approximately 2,000 feet southwest of the production area (Figure 2-4). The northern portion of the pile is reportedly located on an old drainage area leading to Paddys Run. Disposal activities at the pile were ceased between 1964 and 1968 and the pile's volume is estimated to be 50,000 cubic yards.

Previous investigations have mentioned that waste oils contaminated with uranium and PCBs were spread on the pile for dust control. Approximately 1,000 kilograms of uranium is estimated to have been present in these waste oils. Building rubble, i.e., concrete, gravel, asphalt, masonry, and steel reinforcing bar, was also discarded at this pile.

The South Field, located at the eastern edge of the inactive flyash disposal area, was used to dispose of construction rubble that may have been contaminated with low levels of radioactivity. The flyash disposal areas and the South Field encompass an estimated 16 acres.

The solid waste landfill is located in the northeast corner of the waste storage area. The facility is organized into the original disposal area, five individual cells and an evaporation pond (Figure 2-5). The original disposal area is inactive, and the five cells are full and out of service. The cells and the adjacent disposal area have been covered with soil. The evaporation pond is also filled with soil. The Solid Waste Landfill was used for the disposal of cafeteria waste, rubbish, and other types of waste from non-process areas. Materials reportedly accepted include non-burnable and nonradioactive rubble, and double-bagged and bulk quantities of nonradioactive asbestos. Construction rubble placed in the landfill and the soil used to cover exposed wastes may have been contaminated with radionuclides. Use of the landfill ceased early in 1986. It is estimated that the volume of waste in the landfill is 10,000 cubic yards.

2.2.3 Operable Unit 3

Operable Unit 3, Former Production Area, includes the former production area, and production-associated facilities and equipment, which encompasses all the above and below-grade improvements, including but not limited to, all structures, equipment, utilities, drums, tanks, solid waste, waste product, thorium (Th), the effluent lines, the K-65 transfer line, the wastewater treatment facilities, the fire training facilities, the scrap metal piles, the feed-stocks, and the coal pile (Figure 2-6). These areas represent past, current, and/or future sources of radionuclide or chemical releases to the environment.

A Proposed Plan - Environmental Assessment for an interim remedial action has been prepared for Operable Unit 3. This interim action is being proposed as an initiative to remove contaminated buildings and other related facilities located at the Fernald site, while decisions regarding the location and method of permanent disposal of the removed materials are made through the ongoing Remedial Investigation/Feasibility Study (RI/FS) process. This decision could result in the acceleration of the remediation effort for Operable Unit 3 through the issuance of an Interim Record of Decision. In addition, numerous other removal actions have been proposed within Operable Unit 3 to address various health and safety and environmental concerns prior to the issuance of a Final Record of Decision.

2.2.4 Operable Unit 4

Operable Unit 4 includes the K-65 Silos (Silos 1 and 2), the metal oxide silo (Silo 3), the unused silo (Silo 4), the berms, the decant tank system, and the soil within the OU 4 boundary (Figure 2-2). These are located south of the waste pit area, in the northwestern portion of the FEMP. The domed waste storage silos measure 80 feet in diameter, 36 feet high to the center of the silo dome, and 27 feet to the top of the vertical walls. The walls are eight inch-thick concrete as are the outer part of the domes, which taper to a four inch thickness at the center. Silos 1 and 2 are surrounded by an earthen berm to a level of approximately 26 feet while the metal oxide silo and Silo 4 are free-standing. Silos 1 and 2 were used for the storage of radium-bearing residues, raffinates, formed

as by-products of uranium ore processing. Waste residues were received from 1952 to 1958. Waste raffinates were pumped into the silos so the solids would settle. The primary radioactive constituents of Silos 1 and 2 are radium (Ra-226), thorium (Th-230), and uranium. The majority of the waste material is silica and metallic compounds.

As a removal action, a bentonite clay cover was applied in November 1991, over the residues for Silos 1 and 2 to reduce radon emissions. Sampling of the berms and soil beneath the silos was completed in August 1991.

Silo 3 contains uranium, radium (Ra-226), thorium (Th-230), silica, and other metal oxides. Silo 4 was never used and remains empty with the exception of some infiltrated rainwater.

2.2.5 Operable Unit 5

Operable Unit 5, Environmental Media, includes: 1) groundwater, 2) surface water, 3) soil not included in the definitions of OUs 1-4, 4) sediments, 5) flora, and 6) fauna. These environmental media represent pathways and/or environmental receptors presently or potentially affected by the release of radionuclides or chemicals from the FEMP. The Great Miami Buried Valley Aquifer, the Great Miami River, Paddys Run, and the Storm Sewer Outfall Ditch are all part of OU 5.

Potential does exist for the leachate from the waste pits to migrate vertically to the Great Miami Buried Valley Aquifer which underlies the site. This aquifer serves as a principal source of domestic, municipal, and industrial water throughout the region, and was designated as a sole source aquifer by the EPA on July 8, 1988. This designation requires the EPA to review the Federal financially assisted projects planned in sole source aquifer areas and recharge zones, to determine that no significant hazard to public health exists due to the project.

A removal action has been initiated to address uranium contaminated perched groundwater found under Plants 2, 3, 6, 8, and 9. At each of the plants, potentially contaminated perched water will be pumped from the wells, sampled, stored in holding tanks, and transported by tanker truck to a central

collection tank in Plant 8. All samples will be analyzed for Hazardous Substance List (HSL) constituents. An activated carbon filtration system will be installed in Plant 8 to treat the water stored in the collection tank. The filtration system will remove volatile organic compounds (VOC) which have been determined to be in the perched water below each of the plants. The water will be sampled before and after treatment. The treated effluent will then be discharged to the existing Plant 8 treatment system.

Areas of the Great Miami Buried Valley Aquifer exhibit elevated levels of uranium both within and outside the FEMP facility fence line. Portions of a plume of contaminated groundwater extend south of the FEMP boundary and pose a potential threat to human health. To be consistent with commitments in the Amended Consent Agreement, a Removal Action to pump and treat the south plume is scheduled for completion in early 1993. OU 5 will continue to be assessed

for groundwater contamination, the migration of the South Plume, and the determination of the need for future actions for the South Plume and any additional areas of groundwater contamination.

2.2.6 Comprehensive Site-Wide Operable Unit

The Comprehensive Site-Wide OU is an evaluation of the remedies selected for OUs 1-5, including the remedial and removal actions, to ensure that they are protective of human health and the environment, on a site-wide basis as required by the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300) under CERCLA, and the applicable EPA policy and guidance. This OU will be evaluated after the last of the Records of Decision (RODs) has been issued for OUs 1-5.

For this OU, the DOE will develop a Site-Wide RI/Projected Residual Risk Assessment. The Site-Wide RI will incorporate by reference all data collected pursuant to the RIs for OUs 1-5 and the removal actions. The Site-Wide RI will summarize any data collected after finalization of the RODs for OUs 1-5. The Site-Wide RI will also gather any additional sampling data, if necessary, to support the Site-Wide FS. The Projected Residual Risk Assessment will document all risks which are anticipated to remain at the FEMP following the implementation of the response actions embodied in

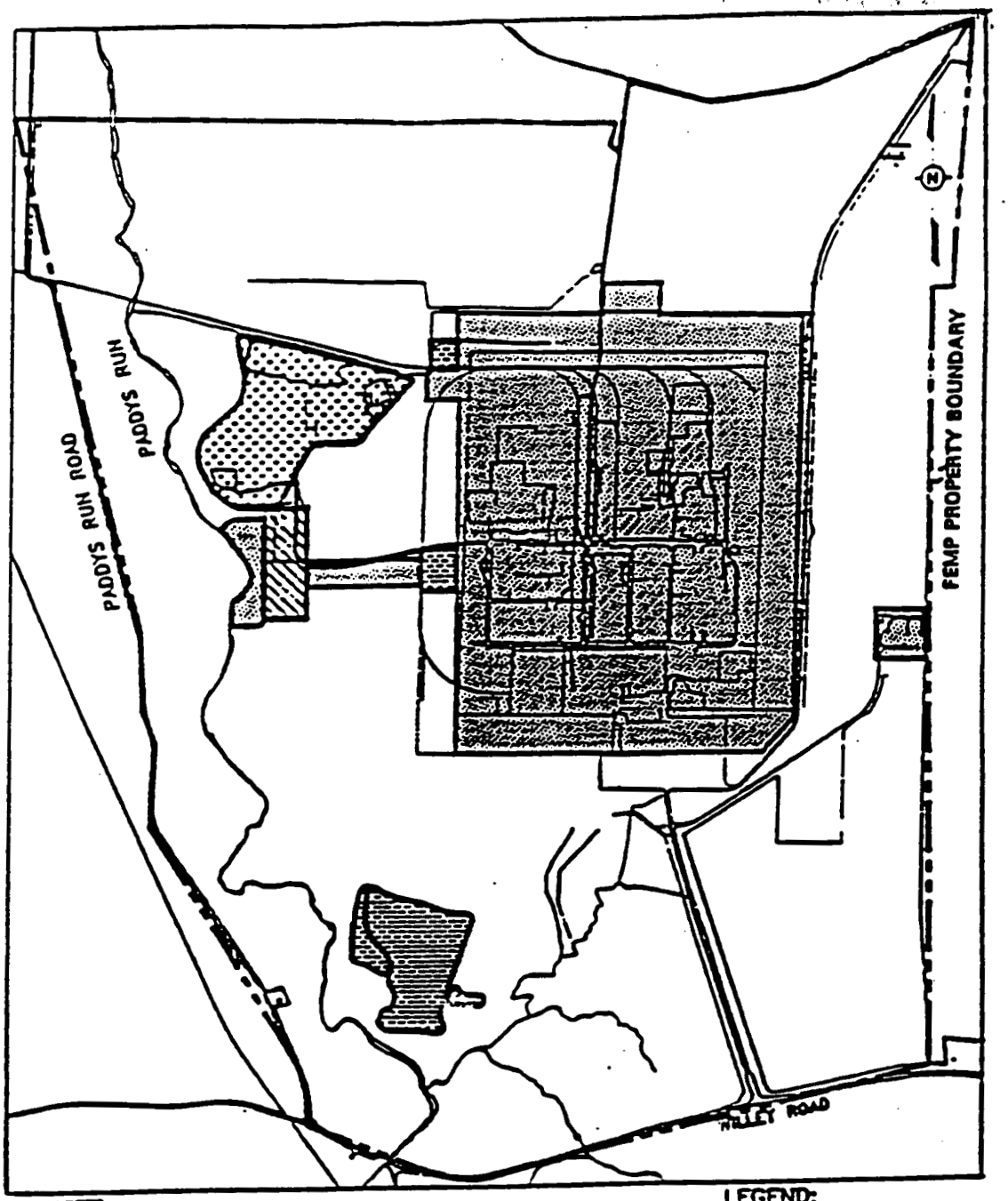
the OU 1-5 RODs and the selected removal actions. The Projected Residual Risk Assessment will be used to determine whether the previously selected response actions are protective of human health and the environment. If EPA determines that the Projected Residual Risk Assessment indicates that the previously selected response actions are protective of the human health and the environment, then an FS report will not be required.

2.2.7 Potential Response Actions

Potential response actions are being considered for evaluation for appropriate waste units within OUs 1 through 5. The response actions include, but are not limited to the following:

- No action;
- In-place stabilization/isolation of contaminated media;
- Waste treatment;
- Onsite storage;
- Onsite disposal;
- Offsite disposal; and
- Groundwater remediation.

To implement some of the above technologies, an EWMF may be required to accept waste from more than one OU. Waste acceptance criteria will be established for the EWMF. The EWMF will provide an onsite facility to store or dispose of the wastes generated during remediation of the five OUs. The EWMF will most likely consist of a large number of identical buildings/vaults which will all be built to the same design. Prior to placement in the EWMF, wastes may be processed at each OU. The impact of this site-wide facility will be evaluated in the FS/PP-EIS.



NOTE:

OPERABLE UNIT 5 INCLUDES REGIONAL GROUNDWATER, SURFACE WATER, SOILS, FLORA AND FAUNA.

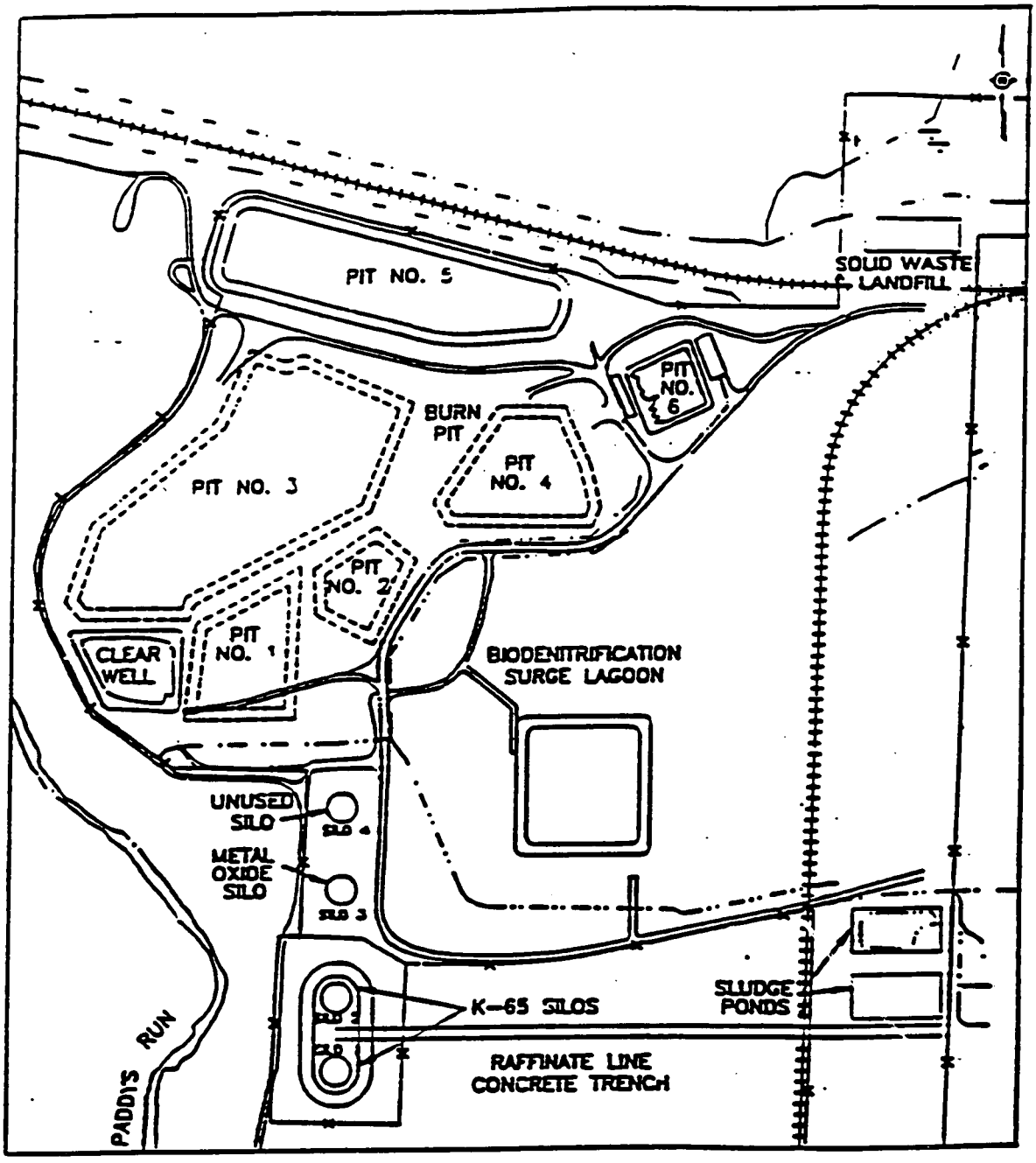
SCALE

0 600 1200 FEET

LEGEND:

- OPERABLE UNIT 1
- OPERABLE UNIT 2
- OPERABLE UNIT 3
- OPERABLE UNIT 4

FIGURE 2-1 OPERABLE UNITS 1 THROUGH 4 LOCATION MAP



SCALE

0 175 350 FEET

NOTES:

PITS 1, 2, 3 AND THE BURN PIT ARE COVERED.

PIT 4 HAS AN INTERIM CAP.

LEGEND:

RAILROAD

DRAINAGEWAYS

FENCELINE

ROADWAY

FIGURE 2-2 OPERABLE UNITS 1 AND 4

0022

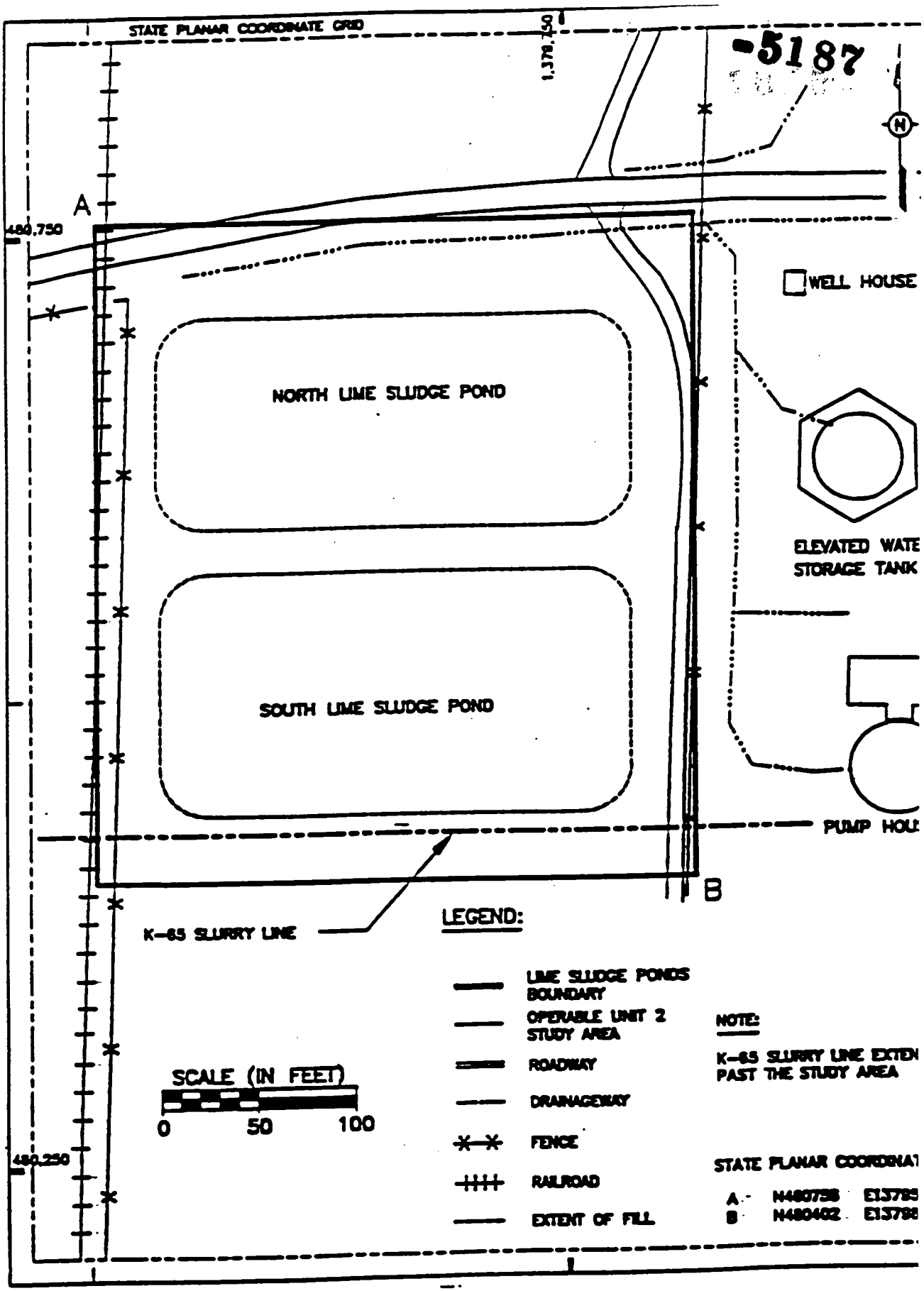


FIGURE 2-3 LIME SLUDGE PONDS

0023

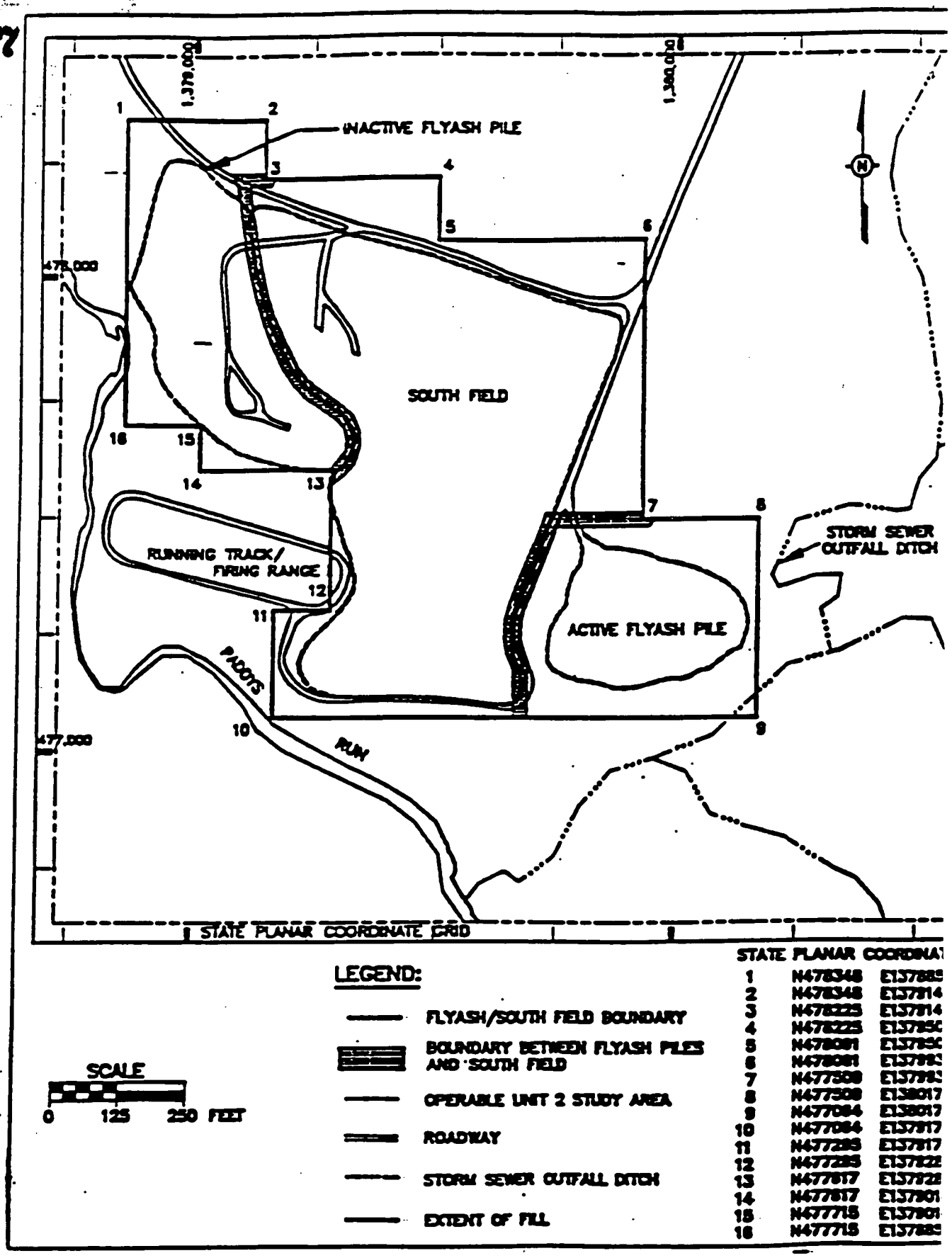
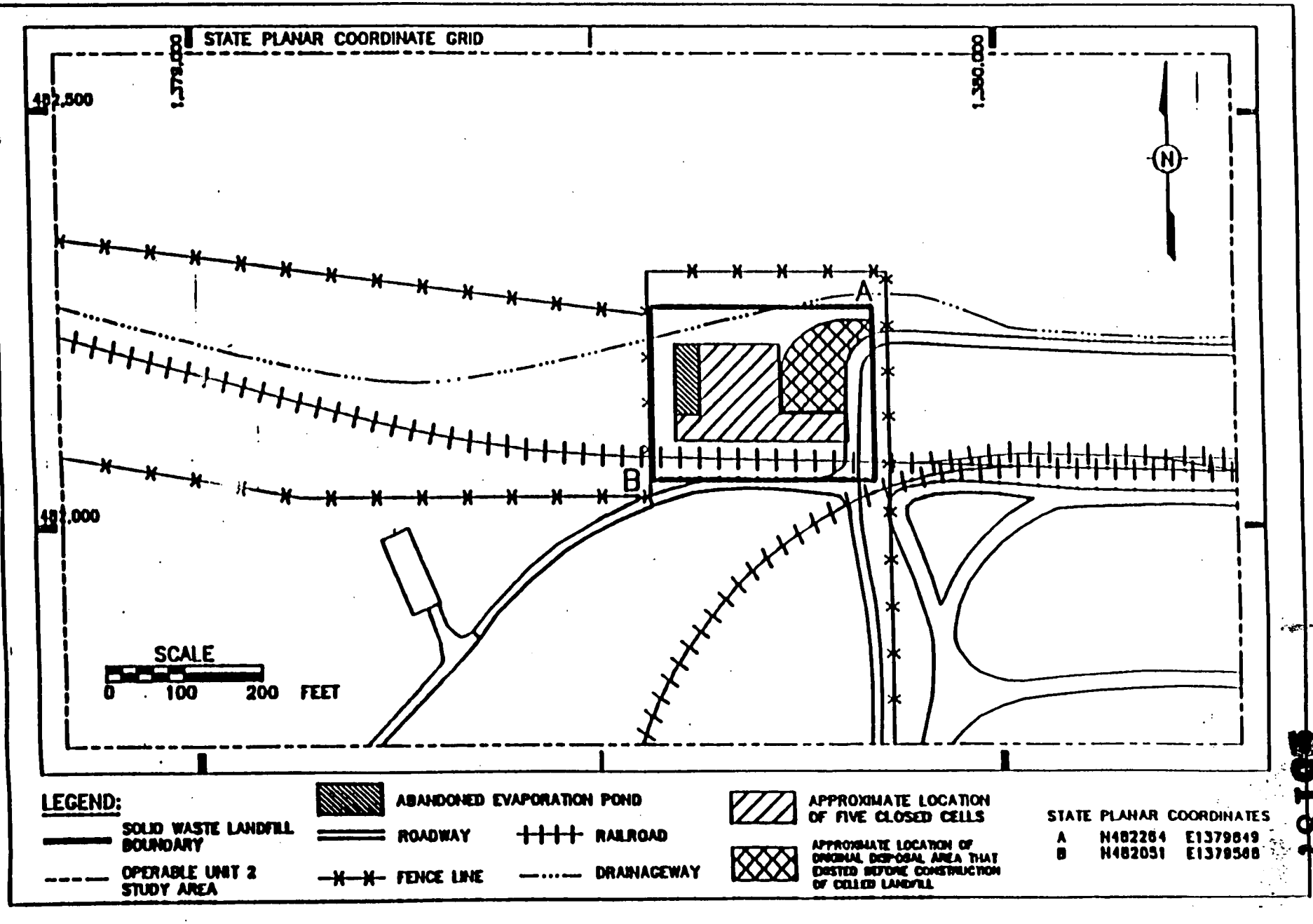


FIGURE 2-4 FLYASH/SOUTH FIELD

0024


STATE PLANAR COORDINATE GRID
482,500
482,000
1,379,000
1,380,000
N
A
B
SCALE
0 100 200 FEET
LEGEND:
SOLID WASTE LANDFILL BOUNDARY
OPERABLE UNIT 2 STUDY AREA
ABANDONED EVAPORATION POND
ROADWAY
FENCE LINE
RAILROAD
DRAINAGEWAY
APPROXIMATE LOCATION OF FIVE CLOSED CELLS
APPROXIMATE LOCATION OF ORIGINAL DISPOSAL AREA THAT EXISTED BEFORE CONSTRUCTION OF CELLED LANDFILL
STATE PLANAR COORDINATES
A N482264 E1379649
B N482051 E1379568

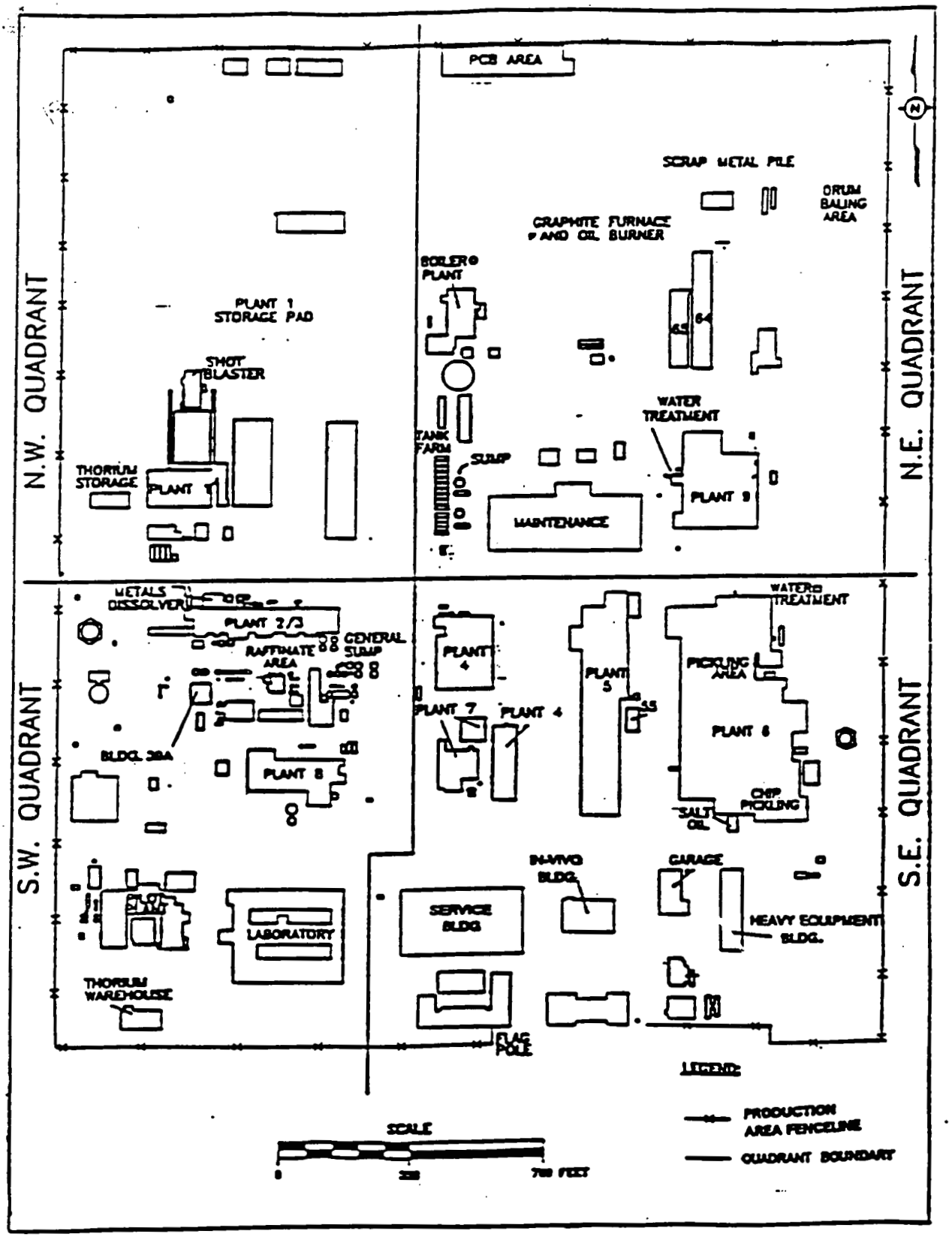


FIGURE 2-6 OPERABLE UNIT 3
(DOES NOT INCLUDE SEWAGE TREATMENT PLANT, OUTFALL LINE, AND K-65 TRANSFER LINE)

3.0 DESCRIPTION OF THE SCOPING PROCESS

DOE has undertaken a scoping process consistent with the CEQ NEPA Implementing Regulations (40 CFR Part 1500 et seq.) and the DOE NEPA Regulations (10 CFR Part 1021). Its purpose is to identify the issues to be analyzed in depth in the FS/PP-EIS. The issues raised in the scoping process have been evaluated to determine which are to be incorporated in the FS/PP-EIS. The selection of issues is based on:

- Level of concern expressed in the public scoping process;
- The overall extent and intensity of the issue;
- The relevance of the issue to the proposed action; and
- Whether the issue is addressed in another NEPA program or document.

For this FS/PP-EIS, significant issues have been identified from: (1) the comments received during the scoping process; (2) issues listed in the Notice of Intent; and (3) issues submitted during a prior scoping process in 1986.

DOE began the scoping process to prepare an EIS to address renovation and waste cleanup at the FEMP, with the publication of a NOI on August 19, 1986 (51 Fed. Reg. 29583). The original NOI was amended on September 8, 1986, to extend the comment period and hold a second scoping meeting. After the decision was made for a permanent cessation of production activities at the FEMP, DOE canceled the site Renovation EIS on December 10, 1991 (56 Fed. Reg. 64504).

The NOI to prepare the FS/PP-EIS and hold public scoping meetings was published by the DOE on May 15, 1990 (55 Fed. Reg. 20183-20188), and was amended on June 28, 1990, to extend the comment period. During June 1990, two scoping meetings were held in the potentially affected communities located near the FEMP. The public, interested organizations, and Federal, state, and local agencies were invited to provide oral comments at the scoping meetings, and to submit written comments until the close of the EIS scoping period on June 29, 1990.

3.1 ISSUES IDENTIFIED DURING THE SCOPING PROCESS

DOE has identified a list of the issues that will be addressed in the FS/PP-EIS and those that will not be addressed. The issues were selected from those raised during the 1986 scoping period for the Renovation EIS, the issues listed in the NOI, and the issues raised during the public scoping process. The lists were based on NEPA Regulations and DOE's experience relative to other proposals of this nature.

The relationship of these issues to the content of the FS/PP-EIS are described below. Comments received by DOE during the scoping meetings or by correspondence are grouped below according to major issue categories. A computer system was used to record, identify, compile, and track each of the comments received.

A copy of scoping meeting transcripts and comment letters with identified issue bracketed are available in the separate Appendices B and C, in Volume II of this Plan. The manner in which these comments will be included in the FS/PP-EIS is addressed in Appendix A. A listing of the issue categories is provided in Table 3-1 along with the number of commenters on each issue.

The issues list developed by DOE is as follows:

Potential radiological and chemical issues, and health risks:

- Radiation doses to the general public;
- Related to human exposure, including exposure to workers and the public, individuals and the total population, children and adults, present and future generations;
- Along transportation routes and near other sites included in the alternatives;
- Chemical exposure effects to the general public;
- Associated with various pathways to individuals, including surface waters and groundwater, soils and sediments, flora and fauna (including crops and livestock), gases, dust, and particulates;
- Associated with both routine operations and accidents;
- Associated with human intrusion into the contaminated materials; and
- Due to natural forces such as erosion and flooding.

Potential socioeconomic impacts:

- Associated with land use;
- Related to local transportation systems;
- Related to economic activities near the site; and
- Socioeconomic impacts of expenditures/employment cultural resources, and transportation routes.

Potential institutional issues:

- Project-specific criteria for decontamination, effluent concentrations, and release of the property or portions thereof for unrestricted or restricted uses;
- Future institutional controls for monitoring and maintenance;
- Institutional issues related to the implementation of alternatives;
- Citing of any necessary treatment, storage or disposal facilities; and
- Environmental monitoring.

Potential engineering and technical issues:

- The most reasonable engineering options for each type of waste/residue;
- Probable duration of waste isolation or stabilization;
- Rates and magnitude of loss of containment; and
- Environmental mitigation.

Potential ecological issues:

- Related to terrestrial and aquatic habitats;
- Chemical exposure effects to the ecological resources;
- Related to chemical contamination, as well as radiological impacts;
- Source items and exposure pathways analyzed for surface water, groundwater, air, and soil;
- Environmental monitoring and mitigation;
- Related to wetlands;
- Effects on the regional aquifer;
- Related to site-specific hydrology;

- Cumulative impacts from remedial actions; and
- Irreversible and/or irretrievable commitments of resources

Issues related to the CERCLA criteria for selection of a remedial action:

- Compliance with applicable or relevant and appropriate requirements (ARARs);
- Protection of human health and the environment;
- Short-term effectiveness;
- Long-term effectiveness and performance;
- Reduction of toxicity, mobility, and volume;
- Implementability;
- Cost;
- Cumulative impacts;
- State acceptance; and
- Community acceptance.

Some of the issues raised at the scoping meetings were not within the scope of the FS/PP-EIS. The reasons for exclusion of these comments are addressed in Appendix A. The following is a list of comments considered to be beyond the scope of the FS/PP-EIS:

- The content and schedule of the Renovation EIS;
- The authority and responsibility of DOE at the FEMP;
- Procedures for audits and hazardous waste inventories at the FEMP;
- Impacts of continued uranium production;
- Analysis of FEMP releases using a mass balance approach, as being done by the Center for Disease Control;
- Provision of a public water supply for Crosby Township; and
- Provision of community service or assistance programs to benefit all residents.

3.2 RELATED SCOPING PROCESS FOR THE PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT

In January of 1990, the Secretary of Energy determined that DOE will prepare a Programmatic Environmental Impact Statement (PEIS) on a newly proposed integrated environmental restoration and waste management program. Historically, DOE environmental restoration and waste management operations have been conducted on a site-by-site basis. This practice has led to differing approaches to cleanup and waste management among DOE sites. The PEIS will assess broad programmatic issues and integrated approaches to DOE's environmental restoration and waste management activities. DOE intends, to the extent feasible, for the PEIS to provide the primary environmental basis for selecting waste management methods and technologies, and the locations at which they would be implemented.

Environmental restoration at the FEMP will generate large volumes of radioactive, hazardous, and mixed waste. The FEMP will be considered within the PEIS, because PEIS decisions are likely to affect the disposal alternatives, in particular the disposal site(s), for these FEMP wastes. The Draft ROD for OU 4 is scheduled to be submitted to EPA on June 10, 1994, prior to completion of the PEIS planned for late 1994. Decisions will be made prior to completion of the PEIS on other FEMP issues such as containment, stabilization, and treatment/storage/disposal of the wastes. These actions are appropriate interim actions because they are justified independently of the program, would be accompanied by an adequate environmental impact statement, and do not prejudice the ultimate decision on the program by determining subsequent development or limiting alternatives. Before issuing the ROD pursuant to the FS/PP-EIS for OU 4, DOE will further review these conditions to ensure that they are met at that time.

-5187

TABLE 3-1
FS/PP-EIS PROCESS PUBLIC SCOPING ISSUE CATEGORIES

Category	Number of Commenters
1.FEMP NEPA Process	
Renovation and Site Evaluation EIS	3
FEMP FS/PP-EIS	8
Public Participation	6
Notification	6
Extended Comment Period	2
Cooperating Agency	5
2. DOE Authority and Responsibility	7
3. FS/PP-EIS Proposed Action and Alternatives	
Cost	4
Monitoring	5
Wastes	5
Cleanup	3
Cleanup Methods	7
Cleanup Standard	3
Separation of Cleanup and Production	3
Alternatives	6
Disclosure of Alternatives	1
Evaluation of Alternatives	4
No Action	1
Testing, Sampling, and Analysis	1
4. Environmental Impact Issues	
General	5
Health and Safety	11
Impact to Nearby Residents	4
Protection of Groundwater	6

0032

-5187

TABLE 3-1 (Continued)

FS/PP-EIS PROCESS PUBLIC SCOPING ISSUE CATEGORIES

Category	Number of Commenters
4. Environmental Impact Issues (Continued)	
Public Water Supply	7
Surface Water Contamination	9
Transportation	2
Ecological Issues	4
Air Quality/Climate	4
Socioeconomic	2
Cumulative Impacts	3

0033

4.0 ENVIRONMENTAL IMPACT STATEMENT PREPARATION

The final product of this integration will be an integrated set of documents, namely, an RI report and an FS report that comprise the FS/PP-EIS. The NEPA/CERCLA process is a dynamic one and the contents of the document as listed below may change during preparation to meet the needs of the project. The Table of Contents for the RI (April 1993) and the outline for the FS can be found in Appendix D.

4.1 SCHEDULE

The following milestones have been completed for the OU 4 FS/PP-EIS:

NOI to prepare RI/FS-EIS published	May 15, 1990
Scoping Meetings Conducted	June 12, 13, 1990
RI/FS-EIS Scoping Period Closed	June 29, 1990
Initial Screening of Alternatives approved by EPA Region 5	October 1990
RI Report/Baseline Risk Assessment to EPA Region 5 for first CERCLA review	April 19, 1993
Scheduled future steps for OU 4 FS/PP-EIS include:	
FS Report/Comprehensive Response Action Risk Evaluation to EPA Region 5 for first CERCLA review	September 10, 1993
Proposed Plan to EPA Region 5 for CERCLA review	September 10, 1993
Draft FS/PP-EIS issued for 45-day public comment period	After EPA approval of FS/PP-EIS
Final FS/PP-EIS (i.e., Responsiveness Summary) issued for 30-day public review	May 1994
Proposed Draft ROD to EPA Region 5	June 10, 1994
Projected date for Final ROD (including Responsiveness Summary) to be signed by EPA	August 1994

All documents will be part of the Administrative Record and will be made available for public review. The public will be provided public notice of the availability of the draft FS/PP-EIS and will be allowed to comment on the document for a 45-day period. A public hearing on the issues in the document will be held. The public will be advised of the time and place of the meeting. The public notices will be published in the Federal Register, in the local newspaper(s) of general circulation, and in other local media; and will be mailed to owners and occupants of nearby or affected property, to those individuals who have requested such notice, and to national organizations reasonably expected to be interested in this project.

Integrated NEPA/CERCLA documents will be prepared for the remaining FEMP operable units, with the following schedule for DOE submittal of draft documents to EPA for initial CERCLA review:

RI/FS-NEPA Document for OU 4	September 10, 1993
RI/FS-NEPA Document for OU 2	April 29, 1994
RI/FS-NEPA Document for OU 1	March 7, 1994
RI/FS-NEPA Document for OU 5	November 16, 1994
RI/FS-NEPA Document for OU 3	August 7, 1996

Public review opportunities for these documents will be announced when scheduled, and all of these documents will be available in the Administrative Record.

4.2 DEVELOPMENT PROCEDURES

The Fernald Environmental Restoration Management Corporation (FERMCO) was selected to prepare the FS/PP-EIS and supporting documentation using sampling and environmental research data as well as information provided by DOE, other federal agencies, state agencies, and other DOE contractors.

DOE is responsible for the scope and content of the FS/PP-EIS and shall provide direction to FERMCO staff. The DOE Fernald Field Office and DOE Headquarters staff will review the draft FS/PP-EIS before its submittal to EPA.

4.3 DISCLOSURE STATEMENT

FERMCO is the prime contractor which has overall contractual responsibility for the remediation of the FEMP and the conduct of base activities under Prime Contract No. DE-AC05-92OR21972. As part of its responsibility under the prime contract FERMCO must perform remedial investigations and feasibility studies at the FEMP and prepare draft NEPA documents including the draft FS/PP-EIS. DOE is responsible for the scope and content of the FS/PP-EIS and provides direction to FERMCO under its prime contract. FERMCO's prime contract contains a ceiling on the maximum amount of fee that may be earned over the life of the contract. Although FERMCO may manage the remedial action work, the remedial alternative(s) (including no action of delayed action) which may be selected by DOE do not impact the amount of fee that may be earned under the prime contract. There is sufficient work available under the terms of the prime contract to allow FERMCO the opportunity to earn the maximum fee, regardless of how (or whether) the remedial action work is performed. Therefore, FERMCO has no financial or other interest in the outcome of the project within the meaning of 40 CFR 1506.5(c).

J. A. Rasile
Executive Vice President, FERMCO

4.4 AGENCY CONSULTATION

Consultation with Federal and state agencies is a necessary part of the NEPA process. Many Federal and state agencies have responsibility for certain geographic areas, natural resources, or regulation for environmental protection that will be addressed in the FS/PP-EIS. DOE will request consultation with those and other interested agencies. The list of review agencies will include, but is not limited to:

- U.S. Fish and Wildlife Service;
- U.S. Environmental Protection Agency;

- U.S. Army Corps of Engineers;
- U.S. Soil Conservation Service;
- U.S. Department of Interior;
- U.S. Department of Transportation;
- Ohio Historic Preservation Office;
- Ohio Department of Natural Resources;
- Ohio Environmental Protection Agency; and
- Ohio Department of Transportation.

APPENDIX A

FS/PP-EIS SCOPING ISSUES

TABLE OF CONTENTS

		Page
1.0	The FEMP NEPA Process	A-1-1
1.1	Renovation EIS	A-1-1
1.2	The FEMP FS/PP-EIS	A-1-2
1.3	Public Participation	A-1-4
1.4	Cooperating Agencies	A-1-6
2.0	DOE Authority and Responsibility	A-2-1
3.0	The Proposed Action and Alternatives	A-3-1
3.1	Cost	A-3-1
3.2	Monitoring	A-3-1
3.3	Wastes	A-3-3
3.4	Cleanup	A-3-4
3.5	Cleanup Methods	A-3-5
3.6	Cleanup Standards	A-3-6
3.7	Separation of Cleanup and Production	A-3-7
3.8	Evaluation of Alternatives	A-3-7
3.9	Testing, Sampling, and Analysis	A-3-9
4.0	Environmental Impact Issues	A-4-1
4.1	General Issues	A-4-1
4.2	Health and Safety	A-4-1
4.3	Impact to Nearby Residents	A-4-3
4.4	Protection of Groundwater	A-4-5
4.5	Public Water Supply	A-4-6
4.6	Surface Water Contamination	A-4-7
4.7	Transportation	A-4-8
4.8	Ecological Issues	A-4-9
4.9	Air Quality/Climate	A-4-10
4.10	Socioeconomics	A-4-11
4.11	Cumulative Impacts	A-4-12

1.0 THE FEMP NEPA PROCESS

1.1 RENOVATION EIS

Summary of Comments

The 1986 EIS was to cover renovation and cleanup of the FEMP, but within the past three and one-half years, the renovation part of the EIS had been dropped. The new EIS now focuses entirely on cleanup activities at an estimated cost of $1.0 million, and cleanup was supposed to be part of the 1986 EIS.

The 1986 draft EIS was to be public within one year and after four years, the 1986 EIS is still not published. DOE is asking for comments on a new EIS when the public has not seen the draft of the old one. A question was raised how DOE could consider a second EIS when the 1986 EIS was not complete.

Some on-property projects completed over the past three and one-half years could be labeled as renovation activities, done without the input of the EIS. This observation raises a question about the usefulness of an EIS. No more funds should be spent on rehabilitation when cleanup funding is in question.

FS/PP-EIS Issue Response

The 1986 scoping meetings did request public comments on site renovation and cleanup actions. These comments are recorded in the revised EIS Implementation Plan for the Renovation EIS, February, 1989. Because of the extensive actions required and the initiation of the RI/FS process, a separate EIS to address cleanup alternatives was announced.

The cleanup of waste at the FEMP is considered to be a major Federal action and separate from the renovation of the site. The 1986 public scoping comments related to cleanup have been incorporated in this Implementation Plan in Section 4.1.

The Renovation EIS was canceled because DOE decided to permanently cease production at the site; DOE withdrew its NOI to prepare an EIS for the renovation of the site on December 10, 1991 (56 Fed. Reg. 64504). All required maintenance projects at the FEMP will be undergo appropriate environmental review in compliance with NEPA.

1.2 The FEMP FS/PP-EIS

Summary of Comments

Reviewers noted that the FS/PP-EIS is an important first step to address Fernald's problems, and that the draft FS/PP-EIS should provide full disclosure and easy access to information on the FEMP.

There was concern regarding the relationship of the "new" FS/PP-EIS to the 1986 Renovation EIS; the legality of the proposed FS/PP-EIS; the efficiency of publishing a second document when the first one has not been completed. A reviewer questioned the necessity for a full RI/FS-EIS for all five OUs.

The FS/PP-EIS should consider the most recent scientific findings. Additionally, reviewers urged that the FS/PP-EIS cover the following considerations: groundwater quality, subsurface hydrology, surface water hydrology and water quality, air quality, meteorological conditions, biotic environment, existing contamination, health effects, scenic and historical resources, socioeconomic impacts, and legal and institutional issues.

One reviewer stated that the RI/FS-EIS contractor must assign qualified (Ph.D. level) personnel to analyze the biological and ecological impacts.

FS/PP-EIS Issue Response

All FS/PP-EIS data will be completely referenced and all references will be provided as part of the Administrative Record. The Administrative Record is available at the following locations:

Public Environmental Information Center
JAMTEK Building
10845 Hamilton-Cleves Highway
Harrison, OH 45030
Telephone: 513-738-0164

Mon and Thurs: 9 a.m.- 8 p.m.
Tues, Wed, Fri: 9 a.m.- 4:30 p.m.
Sat: 9 a.m.- 1 p.m.

U.S. EPA - Region 5, HR-12
230 S. Dearborn Street
Chicago, IL 60604
Telephone: 800-621-8431

Among the goals of the NEPA process are to clearly state and comprehensively analyze the environmental implications of a decision. These goals will be followed in the preparation of the FS/PP-EIS. Although an RI/FS-NEPA document will be prepared for each of the OUs, the level of NEPA review for the remaining four OUs--i.e., EIS or environmental assessment--has not been determined at this time.

The relationship between the Renovation EIS and the FS/PP-EIS is addressed under issue title - Renovation EIS.

Because the OU 4 FS/PP-EIS is the lead operable unit NEPA document for the FEMP, it will (among other things) describe to the extent relevant the regional and the FEMP study area and will consider the cumulative impacts of all five OU remedial actions.

Every effort is being made to incorporate recent scientific findings and remedial action experience at other sites. This is being accomplished through literature reviews, scientific conferences, information exchange with other sites, and the involvement of a multi-disciplinary staff, including a qualified Ph.D. biologist, to prepare the FS/PP-EIS. A list of the FS/PP-EIS preparers will be included in the document. The FS/PP-EIS will consider all the technical issues stated in the above comments.

1.3 PUBLIC PARTICIPATION

Summary of Comments

Reviewers noted they have not seen the results of their scoping comments for the Renovation EIS Implementation Plan and have repeatedly asked DOE over the past three years for progress information. A reviewer noted positive changes occurring, including community input and increased availability of information through public libraries.

An oversight board was suggested to monitor the cleanup and be comprised of local citizens as well as DOE personnel. Another reviewer questioned if the public's involvement would be limited to formal meetings. Reviewers stated that public participation in the review and planning process should be allowed as well as citizen inclusion in the monitoring of remediation. While oversight by EPA was supported, reviewers also called for an oversight team composed of independent experts, media, and local citizens; citizen involvement would improve the process credibility. DOE's adversarial relationship with the community must improve in order to provide the best solutions for cleanup.

Reviewers said DOE refused to notify people of potential contamination danger from the FEMP and did not inform the public of the change to include cleanup in the new EIS, especially those who participated in the scoping process for the Renovation/Site Evaluation EIS. A question was raised whether DOE is in compliance with NEPA regulations. There was concern that DOE's NOI was made available less than 30 days before the hearings. Reviewers asked about DOE's plan to issue interim progress reports to the public and how to keep the public informed about cleanup progress in

nontechnical, plain terms. A recommendation was made to broadcast the next series of public meetings on local radio stations and allow citizens to call in testimony. It was requested that the scoping comment period be extended by one week.

FS/PP-EIS Issue Response

The FS/PP-EIS Implementation Plan supersedes the Renovation EIS Implementation Plan, as renovation plans for the FEMP have been canceled. The Implementation Plan is a public document and will be available to the public and in the Administrative Record. The public will be notified of any change in scope of remedial actions.

In accordance with NEPA and CERCLA, Federal agencies provide opportunities for public participation in the planning and review process. EPA monitors the CERCLA program to insure that public involvement goals are being achieved. In addition, a FEMP Health and Environmental Advisory Committee was formed in 1986 of technical experts and local residents. The functions of the Advisory Committee and public review can be addressed through the RI/FS-EIS public participation program. The FS/PP-EIS will provide an additional opportunity for public comment on alternative cleanup methods at the draft stage of analysis. The monitoring of impacts during remediation will be an administrative measure to be considered in the FS/PP-EIS. Residual risks remaining after the remedial actions have been completed will be addressed in the Site-Wide Comprehensive Risk Evaluation.

Information concerning the FS/PP-EIS was provided in various forms: the quarterly community meetings, presentation at Fernald Residents for Environmental Safety and Health (FRESH) meeting, Federal Notice of Intent, and materials sent to the FEMP mailing list. There was confusion about the content of the Renovation EIS and the FS/PP-EIS. This did require further clarification. The NOI for the RI/FS-EIS was published in the Federal Register on May 15, 1990, 28 days prior to the June 12 and 13, 1990, scoping meetings. A minimum of 20 days notice is required. The comment period was extended one week as requested. The recommendation to broadcast the public hearing for the Draft FS/PP-EIS on local radio will be considered.

1.4 COOPERATING AGENCIES

Summary of Comments

One reviewer noted EPA thinks the FS/PP-EIS is unnecessary and redundant. Another reviewer wanted to know what steps DOE and EPA are taking to simplify and speed up the process.

The U.S. Department of Interior, Fish and Wildlife Service, stated a willingness to become a cooperating agency in the project if it would enhance project quality. Their input would be limited to review and comment on project documents.

FS/PP-EIS Issue Response

Under its policy of integrating NEPA values within the CERCLA procedural and documentation process, DOE has determined that an FS/PP-EIS will be undertaken for the OU 4 remedial action. This policy and the FEMP integration strategy is presented in Section 1.2 of this Plan.

Consultation with certain Federal and state agencies is a necessary part of the CERCLA and NEPA processes. The U.S. Department of Interior, Fish and Wildlife Service will be consulted on certain environmental regulations, such as wetlands and floodplains, and will be requested to review the Draft FS/PP-EIS. Other agencies that will be consulted are listed in Section 4.6 of this Plan.

2.0 DOE AUTHORITY AND RESPONSIBILITY

Summary of Comments

Concern was expressed that DOE should fund the FS/PP-EIS but not be the agency in charge of ensuring the FS/PP-EIS is consistent with NEPA. Another reviewer stated that DOE has a long history of neglect towards environmental health and safety problems from its nuclear weapons production activities and continues to place production goals ahead of environmental health and safety. Concern was expressed that DOE focuses too narrowly on compliance with the law, but not the spirit and intent of the law in the operation of its facilities. DOE was encouraged to develop and implement proactive strategies to avoid future problems. Also, reviewers noted there is an ethical and moral responsibility to the community to do the best with the cleanup. A reviewer stated that the cleanup controversy has created fear in the community that DOE will not do anything about the environmental hazards. An observation was made that the public has waited over five years for short-term removal actions at the FEMP.

Some reviewers accused DOE of giving misleading or inaccurate information; frequently changing proposed dates and figures; not answering questions or following up on promises to get answers to questions; and refusing to be accountable to the public.

FS/PP-EIS Issue Response

DOE is the agency responsible for implementing the proposed action, and therefore, the agency is funding and preparing the FS/PP-EIS. Compliance with other Federal and state laws and regulations will be determined by approximately six Federal agencies. The Amended Consent Agreement with EPA establishes cleanup study areas and decision dates.

Former DOE Secretary Watkins has stated in department orders, congressional hearings, and DOE Five-Year Environmental Restoration and Waste Management Plan, June 1990, that environmental health and safety is now the first priority at the former weapons production facilities.

DOE has heard and recorded the public's concern for accurate information and accelerated action. The RI/FS program itself has been placed on a "fast-track" to speed-up final actions. DOE and EPA are committed to a timely cleanup of the FEMP, in compliance with all Federal and state regulations. The cleanup effort is extraordinarily complex, and will require large commitments of resources over a long period of time. Careful investigation of the contamination problems, namely the RI used to support the consideration of the alternatives in the FS, is essential to ensure that the cleanup adequately addresses the problems and is efficient.

Several removal actions have already been implemented at the FEMP including the K-65 Silos, Waste Pit Area Stormwater Runoff Control, Exposed Materials at Pit 6, South Groundwater Contamination Plume, Pit 5 Experimental Treatment Facility, and Silo 3, among others.

Issues concerning the authority and credibility of DOE are not within the scope of the FS/PP-EIS, which is to focus on an analysis of the environmental impacts of the proposed remedial actions.

3.0 THE PROPOSED ACTION AND ALTERNATIVES

3.1 COST

Summary of Comments

It was noted that Congressional efforts to create a weapons plant cleanup trust fund is a positive step. A suggestion was made to have a congressionally mandated fund, based on a percentage of the weapons budget, for plant cleanup. The cleanup program alternatives should not be determined by the funds that DOE has available.

FS/PP-EIS Issue Response

Mechanisms for funding DOE waste cleanup effort are a national policy issue and can not be addressed in the FS/PP-EIS. However, it should be noted that the "cost of cleanup alternatives" is part of the EPA CERCLA criteria for evaluating alternatives. Cost information will be provided in the FS for each OU.

DOE's Environmental Restoration and Waste Management Five-Year Plan for Fiscal Years 1992-1996 was released in June, 1990. It identifies environmental restoration and waste management projects and funds at DOE facilities.

3.2 MONITORING

Summary of Comments

Comments regarding monitoring programs included that the number and placement of monitoring wells are inadequate to properly determine the impact to groundwater from specific disposal areas, which precludes effective and timely remedial action; consideration should be given to installing wells

between Paddys Run Road and Paddys Run Creek; and further study of the pit area is needed to determine if there is permeation of water from the bottom.

Reviewers stated that the current method of measuring radon emissions is misleading, since the measurements are taken from the areas of highest concentration of radon rather than in an area immediately outside the silos. If the radon emissions are measured outside the silos, the emissions should be examined in regard to compliance with the Clean Air Act. An installation of monitoring devices should be made to record the nature and extent of radon gas release due to dome failure or other catastrophe.

A request was made to consider the adequacy of the monitoring evaluation program. The monitoring techniques and modeling should fulfill the requirements of NEPA and protect the public and the environment. Consideration should also be given to the placement and maintenance of ambient air measuring devices.

Reviewers noted that periodic auditing of all cleanup activities, procedures for emergency preparedness, and an inventory system to monitor the amount and condition of storage containers for radioactive and hazardous waste is necessary.

FS/PP-EIS Approach

A sampling program has been developed to determine the extent of contamination on the FEMP property and the adjacent area. The Work Plan for the sampling program was approved by EPA in May, 1988. Specific information will be provided from this sampling work in the RI reports for each OU. In addition, yearly monitoring data will be included in the FS/PP-EIS reports. The FS/PP-EIS will summarize available groundwater data from the FEMP, including the waste pit area. The environmental and human health impacts of radon emissions from the silos will be discussed in the FS/PP-EIS. The completion of the K-65 Silos Removal Action, which placed at least one foot of bentonite slurry cover directly over the K-65 residues, resulted in a greater than 96 percent reduction of radon concentration in the silos.

The FS/PP-EIS will perform a baseline evaluation of the conditions at the FEMP to determine the necessary CERCLA actions to be undertaken, and will address their impacts to human health and the environmental. The need for potential mitigation measures, to monitor impacts, or provide emergency preparedness procedures related to specific alternatives, will be considered. However, procedures for audits, and hazardous waste inventories, detailed in various FEMP hazardous materials and waste management documents, are subjects that will not be part of the scope of the FS/PP-EIS.

3.3 WASTES

Summary of Comments

The Radioactive Waste Campaign has estimated large amounts of radioactivity being released into the air and water from the FEMP. Since 1952, chemical and radioactive wastes have been disposed of in six waste pits. As a result, there is concern for the presence of uranium in the soil. Comments were made on the types of radioactive material and the storage sites. There is concern regarding the leakage of the waste pits and the structural condition of the K-65 silos and drums containing thorium. Other concerns include radioactive contaminated scrap and mixed wastes, such as PCBs and asbestos contaminated by radioactive material.

Concerning the disposal of the waste, it was noted that diluting pollution by direct discharge to surface water is inadequate. One reviewer was opposed to dumping any more radioactive heavy metals either in the air or on the ground. The dangers of the mixed waste contents of the K-65 silos were commented on.

FS/PP-EIS Issue Response

Within the EPA CERCLA framework, RIs are being prepared to determine the nature and extent of any releases of hazardous or radioactive materials, pollutants, or contaminants, and to gather the necessary data to develop cleanup alternatives. These investigations will be reported in the OU's RI

reports and summarized in the FS/PP-EIS. All of the types of pollutants and areas of contamination commented on are being investigated. Each OU's characterization will include information regarding specific contaminants, estimated volumes, and ecological and human health risk assessments.

The management of waste onsite is an ongoing process. Waste management activities include the safe interim storage of waste, the appropriate packing of waste, and the shipment of waste for disposal. These processes are driven by several Removal Actions in the Amended Consent Agreement of 1991 and under requirements of the State of Ohio Environmental Protection Agency (OEPA) programs.

FEMP will discharge less than 1,700 pounds (compared to a baseline of 1,862 pounds) per year of uranium to the surface waters. This will be accomplished by the installation of a trailer mounted interim advanced wastewater treatment plant and, later, a permanent advanced wastewater treatment plant.

3.4 CLEANUP

Summary of Comments

Neighbors of the FEMP have the right to be informed of cleanup activities that are hazardous or potentially hazardous; the FS/PP-EIS must identify potential direct and indirect consequences of the five cleanup efforts; and, while DOE's preferred alternatives may comply with regulations, they do not represent optimal cleanup actions.

FS/PP-EIS Issue Response

The direct and indirect individual and cumulative impacts of the cleanup alternatives for the five OUs are part of the FS/PP-EIS scope and will be addressed. CERCLA evaluation criteria and the environmental impacts developed by the use of the NEPA process will be used to select the most appropriate alternatives. The selected remedial action, by CERCLA Regulations, will be protective of

the human health and the environment. The public will have opportunities to review the remedial action alternatives that will be placed in the Administrative Record, and to formally submit comments to the DOE.

3.5 CLEANUP METHODS

Summary of Comments

Several comments were provided concerning the selection of cleanup methods for the FEMP. Some concerns were expressed regarding the evaluation of removal and remedial actions which only redirect contamination, and the consideration of time-sensitive removal actions which are not permanent remedial action solutions.

Some reviewers suggested cleanup methods for possible use at the FEMP, including: effluent controls, waste minimization, monitoring of waste stabilization and isolation activities, construction of isolation buildings around the K-65 silos, and monitored storage of treated waste on-property. One reviewer expressed concern about the effect of excavated wastes on the surrounding environment and population.

FS/PP-EIS Issue Response

The cleanup methods being implemented at the FEMP include both the interim removal actions, and the final remedial actions being evaluated in the NEPA/CERCLA reports for each OU. Removal actions are short-term immediate actions taken to address releases of hazardous substances that require expedited response. In the event of a release or threatened release of a hazardous substance into the environment, a removal action is instituted to prevent or minimize the release of the hazardous substance, so it will not migrate nor cause substantial danger to the present or future public health and welfare, or the environment. The removal actions are consistent with the permanent remedy, and are not instead of, but in addition to, the remedial action. DOE does not consider removal actions to be a substitute for remedial actions. Cleanup methods being evaluated include those mentioned in the

above comments made by the public. The potential impact of implementing these cleanup methods will be evaluated in the FS/PP-EIS. The effectiveness of all cleanup alternatives is considered a part of the CERCLA evaluation process.

3.6 CLEANUP STANDARDS

Summary of Comments

It would be difficult to select a cleanup alternative because standards for uranium and radioactive substances have not been established. Another reviewer noted that remedial and removal actions should be in full compliance with applicable laws and statutes. One reviewer stated that the concentration limit around the South Plume was based entirely on an adult population concentration limit and recommended that children should be taken into account in calculating the concentration limit. There was also concern that exposures from current and future FEMP production will contribute to health risks. The radiation exposure standards should take into consideration the latest scientific findings on the health effects of exposures to low-level ionizing radiation, e.g., BEIR V, Martin I. Gardner study, and latest announcement from the International Committee for Radiation Protection.

FS/PP-EIS Issue Response

FEMP has no current nor will have any future production activities.
Applicable laws will be identified in the RI/FS-EIS process and appropriate cleanup standards will be developed with EPA's guidance and in consultation with the OEPA. The adult population concentration limit generally will be used; however, where appropriate, a child's concentration limit will be used. For example, the pathway for exposure to contaminated soils and sediments via ingestion uses a child's concentration limit, since children are more likely to ingest soil than are adults. This information will be summarized in the FS/PP-EIS.

3.7 SEPARATION OF CLEANUP AND PRODUCTION

Summary of Comments

Reviewers stressed that planning and strategy for the FEMP must not separate cleanup from uranium production activities. A suggestion was made that the best approach is to eliminate waste-generating activity not essential to processing or removal of on-property waste inventories. Another reviewer said there should be no repair or upgrading of production facilities and, where possible, production equipment and buildings should be dismantled.

FS/PP-EIS Approach

The cumulative impacts of cleanup alternatives will be addressed in the FS/PP-EIS. Production activities at the site ceased in July 1989 and the overall mission of the FEMP has been directed to environmental restoration and cleanup. Therefore, production activities will not be addressed in the FS/PP-EIS.

3.8 EVALUATION OF ALTERNATIVES

Summary of Comments

Reviewers asked DOE to identify clearly defined permanent solutions, and begin the cleanup process. A question was raised about why alternative new technologies for cleanup were not considered. A reviewer offered guiding principles for alternatives: (1) where feasible, the preferred alternative should be that which reduces or eliminates environmental contamination; and (2) a permanent risk containment is preferable over a time-sensitive alternative. Additionally, strategies and technologies that reduce existing waste and pollution, address the immediate danger to the public, and prevent future generation of waste, pollution, and contamination should be given top priority.

A second "no-action" alternative was proposed for parts of the facility that would be affected by resuming uranium production so that no further waste would be generated other than what is necessary to remove or process existing waste inventories. A recommendation was made that the FS/PP-EIS include activities to achieve compliance with other applicable laws. Specific comment regarding OU 5 and the EPA-DOE Consent Agreement suggested that the FS/PP-EIS include activities not specifically required by regulation, but that are

important to achieve public safety and protection. Also, the FS/PP-EIS should identify potential direct and indirect consequences of each of the five OU cleanup efforts.

Reviewers expressed concern regarding DOE's evaluation of alternatives in the FS/PP-EIS. Some viewpoints which were stated included support for no further production activities at the FEMP; endorsement of a removal action with permanent cleanup results; implementation of a remedial plan with the least possible delay involved; and preference for treatment of contaminated groundwater prior to disposal. Some reviewers stated a reluctance to ship waste to other states, as this would only spread the problem by knowingly contaminating other areas.

FS/PP-EIS Approach

The evaluation of alternatives in the FS/PP-EIS process will include the principles mentioned in the public comments. Pilot studies for new technologies are being considered for the FEMP, e.g., Minimum Additive Waste Stabilization Project for OU 1, Cryogenics Technology Demonstration Project. The FS/PP-EIS will evaluate direct and indirect impacts of cleanup actions. The CERCLA process requires an identification of applicable laws. The impacts of transporting waste to an off-property disposal location will be evaluated.

Uranium production is not part of the scope of the FS/PP-EIS as the FEMP has no current or future plans for production activities. The FS/PP-EIS solely addresses cleanup.

3.9 TESTING, SAMPLING, AND ANALYSIS

Summary of Comments

The comment was made that thorough testing and analysis is needed for geology and geochemistry features, as well as for existing contamination. A specific comment was made that soil and sediment sampling is inadequate and there is insufficient documentation to ensure reliable data were collected. Lack of sampling from the main channel of the Great Miami River, where plant effluent discharge occurs, was noted as an example of inadequate sampling procedures.

FS/PP-EIS Issue Response

A sampling program has been developed determine the extent of contamination at the FEMP. The Work Plan for this sampling program was approved by EPA in May 1988. As part of the Work Plan, a Quality Assurance Program Plan has been prepared to ensure that the samples collected are scientifically valid. Field and laboratory data is validated by an independent quality assurance staff. The geology and geochemistry of the FEMP will be described in the FS/PP-EIS, and available soil and sediment contamination data will be summarized and discussed.

Sediment sampling has been done in the main channel of the Great Miami River directly downstream from the effluent line.

4.0 ENVIRONMENTAL IMPACT ISSUES

4.1 GENERAL ISSUES

Summary of Comments

A reviewer requested that the FS/PP-EIS consider impacts to wildlife and plant life including impacts from increased radiological and chemical emission; loss of habitat, impact to scenic and historic resources, and impacts to the physical environment. One reviewer asked how environmental impacts could be determined from something not defined. Another reviewer cited several incidents occurring at the FEMP and stated they have had terrible impacts to the environment.

FS/PP-EIS Issues Approach

The extent of the contamination at the FEMP is part of the FS/PP-EIS studies. The FS/PP-EIS will address the potential impacts of the remedial alternatives to wildlife, plant life, historic resources, etc. (as reflected in the FS/PP-EIS outline). Both the extent of the contamination and the cleanup alternatives will be defined.

4.2 HEALTH AND SAFETY

Summary of Comments

Suggestions were made that the FS/PP-EIS discuss the existing health hazards as well as uranium's chemical toxicity to the plant workers and to the neighbors. The reviewers also wanted DOE to disclose records on health and safety problems, along with providing access to information on the FEMP in DOE's computer tracking system. This system should be a chronological description of environment, safety, and health problems and should summarize remedial actions.

A comment was made that the old policy of diluting pollution is invalid and that there is no longer scientific pretense that some level of radiation exposure is safe. One reviewer felt the community's health was hindered. Another concern was voiced over buckets full of water from the river used on the residents' gardens. In addition, medical monitoring of workers and of the community was suggested to be provided upon request, as well as a health study of the area.

It was pointed out that potential radiological and chemical exposures would impact the health of workers, visitors, and the surrounding population during the cleanup, and that health and safety is the highest priority. Several persons suggested medical monitoring be performed during the cleanup. Also, compliance with the Occupational Safety and Health Administration and additional applicable environmental laws should be required to achieve the greatest margin of public safety and protection.

There were concerns expressed that the transient worker may become overexposed when moving waste between plants within the FEMP. A suggestion was made that the FS/PP-EIS consider the adequacy of public health notification procedures for hazardous and radioactive emissions from operations or accidents, and that the document also consider the activities and resources acquired from other Federal, state, or local health and environmental agencies.

The structure of the K-65 silos was also a concern, since a collapse could cause additional health and safety problems. A reviewer suggested placing an airlock around the silos and a similar structure around the drummed waste to prevent accidental spills, which would create a worker health and safety hazard.

The FS/PP-EIS should describe FEMP site releases using the mass balance approach. The fate of these materials in the environment should be detailed. The specific activity of various media in contaminated areas should be presented along with the types of radiation emitted.

The risk assessment should consider not only human health but the risk to fish and wildlife species. Another reviewer stated the earliest possible removal of threats to health and the environment should be a priority of the FS/PP-EIS.

FS/PP-EIS Approach

Former Secretary of Energy Watkins has stated that cleanup and health and safety are the number one issues facing DOE at present. It is the policy of DOE to comply with all applicable laws. The FS/PP-EIS includes a site-wide risk assessment (RA), which will detail the hazards and evaluate the risks posed to workers and neighbors by the proposed remedial actions at the FEMP. The toxicity of relevant chemical and radioactive materials, including uranium, will be discussed. The issue of improved health and safety controls for workers will also be evaluated.

The issues regarding the priority removal of the most serious threats to the health and safety of workers and neighbors have been detailed in the various removal action documentation, i.e., the Engineering Evaluation and Cost Analysis (EE/CAs). One such removal action document, the K-65 Silos EE/CA, describes the structural stability of the silos and the alternatives for controlling the releases from the silos. Pertinent information from all the removal action documents available at the time the FS/PP-EIS is prepared will be summarized in the FS/PP-EIS. Safe handling and storage practices for the drums accumulated on-property will also be discussed.

The potential impacts of the FEMP effluent to the surface waters will be discussed in the FS/PP-EIS. The concern about uptake of radionuclides by vegetation will be detailed in the FS/PP-EIS. An environmental risk assessment will be developed for the FS/PP-EIS.

An analysis of the FEMP releases using a mass balance approach, prepared by the Centers for Disease Control, will be made part of the Administrative Record, but it is not part of the scope for the FS/PP-EIS.

4.3 IMPACT TO NEARBY RESIDENTS

Summary of Comments

The comment was made that large amounts of radioactivity have been released into the air and water

from the FEMP. It was further stated that it is not known how far this material has traveled or what impact it has had on the health of the nearby residents.

The FS/PP-EIS should consider how the exposures to radioactivity and toxic material at the FEMP have contributed to health risks of members of the community. The reviewer indicated a thorough dose reconstruction effort to assess the cumulative dose has not yet been completed.

Throughout the cleanup, it has been suggested that the process be extensively sampled, tested, and analyzed for radioactive and hazardous substances. The residents should also be informed. Comments were made to discuss the health effects to the neighbors including existing health hazards, uranium's chemical toxicity, yearly radiation dose limits, and all known and suspected health effects from FEMP operations. An emergency notification system with an emergency plan was suggested for the residents.

During the cleanup and possible emergencies, various concerns for the impacts to residents were enumerated. In addition to radiological and chemical exposures, there would be impacts on education, utility, industry, municipal, scenic, and recreational resources. Also, an impact would be felt on existing and proposed land uses, as well as on property values and on the tax base. It was stated that there would be transportation impacts due to increased road traffic and potential spills from vehicular accidents.

A reviewer stated that neighbors should be compensated for lost property values.

FS/PP-EIS Issue Response

The amounts and extent of radioactive and hazardous materials released to the environment, and the health hazards and related risks from the FEMP, will be detailed summarized in the FS/PP-EIS and in other project documents. Specific needs for monitoring remedial activities at the FEMP will be considered in the FS/PP-EIS. These methods will also be contained within the work plans for the remedial actions, as part of the engineering design process. As stated in Subsection 4.2 of this

appendix, the risk assessment will discuss the hazards, and evaluate the risks posed to workers and neighbors by the remedial actions and other activities at the FEMP, including specific chemical toxicities and annual exposure limits.

FEMP has an emergency response plan, complete with notification procedures and emergency notification system. Additional emergency response needs will be addressed, if required for remedial action alternatives.

The issue of a dose reconstruction study to evaluate the possible health effects to the neighbors is beyond the scope of the FS/PP-EIS. Dose reconstruction information is currently being reported separately by DOE. The calculation considerations used in this dose reconstruction will be reviewed and applied where appropriate in evaluating current and future health risk assessments.

Local property values and existing land use patterns will be included in the FS/PP-EIS. The impacts to local property values and proposed land uses associated with the remedial action alternatives will be addressed. The possible impacts to the local community and possible road degradation and noise associated with transportation of wastes off-property and construction materials on-property will be addressed. The FS/PP-EIS will also identify potential socioeconomic impacts to education, industry, public utilities, and community resources.

Compensation for possible decline in property values is not relevant to selecting a remedial alternative, and therefore is not within the scope of this FS/PP-EIS.

4.4 PROTECTION OF GROUNDWATER

Summary of Comments

A number of reviewers voiced concern that DOE take steps to clean up contaminated groundwater as well as to prevent further groundwater

contamination. At least one reviewer stated that cleanup and protection of the Great Miami Buried Valley Aquifer was a major priority.

In regard to DOE's evaluation of groundwater remediation alternatives, reviewers sought assurance that thorough subsurface hydrology and groundwater quality studies would be performed for the FS/PP-EIS. One reviewer stated that, through studies of this nature, sources of groundwater contamination could be more accurately determined.

Some reviewers expressed preference for further investigation of the waste pit area, in order to ascertain whether contaminated runoff is entering the Great Miami Valley Buried Aquifer through the waste pit.

FS/PP-EIS Approach

Thorough subsurface hydrology and groundwater quality studies are being conducted will be summarized and referenced in the FS/PP-EIS. These studies include investigations of all potential sources of contamination such as the waste pit area.

Cleanup of contaminated groundwater will be achieved through the removal action and remedial action process, and will be documented in the South Plume EE/CA and in the OU 5 RI/FS-NEPA reports. The FS/PP-EIS will summarize these investigations and will also address any potential impacts of remedial actions on groundwater.

4.5 PUBLIC WATER SUPPLY

Summary of Comments

Reviewers stated that the FS/PP-EIS should address the impacts to the public and private water supply from radioactive and hazardous material emissions. There was also concern that DOE has made no offers to relocate or provide alternative water sources.

Specifically, reviewers said DOE should pay for a public water supply for area residents and the Crosby Township community, and study the feasibility of a safe public water system for Crosby Township.

Specific comment was also directed to concern for the Great Miami River; Butler County relies on the Great Miami Buried Valley Aquifer for its total drinking water source; the Great Miami Buried Valley Aquifer has been designated as a sole source aquifer; and that the Great Miami River should be safe and usable for recreation and as a future potential drinking water source.

FS/PP-EIS Approach

The FS/PP-EIS will detail the impacts to local surface and groundwater associated with releases of hazardous and radioactive materials by the proposed remedial actions at the FEMP. If the risk assessment determines that an alternate water supply is recommended for specific areas, it will be considered in the FS/PP-EIS. An alternate supply of water is currently being provided to affected residences and is part of the South Plume removal action for businesses along Paddys Run Road.

The possible impacts to local and regional land uses, such as recreation on the Great Miami River, and the use of the Great Miami Buried Valley Aquifer as a source of industrial and drinking water, will be detailed in the FS/PP-EIS, including the status of the aquifer as a "sole source" of drinking water.

DOE provision of a alternative public water supply for Crosby Township, currently under negotiation, is near completion, but is not within the scope of the FS/PP-EIS.

4.6 SURFACE WATER CONTAMINATION

Summary of Comments

Reviewers made a variety of recommendations regarding surface water, most commonly requesting

additional study of areas such as Paddys Run and the Great Miami River. Several persons noted that pumping and disposing of contaminated groundwater into the Great Miami River was unacceptable as a cleanup alternative. Other reviewers felt the storm water runoff through Paddys Run, possibly ending up in the Great Miami Buried Valley Aquifer, should be stopped.

Concern was also expressed that there was a lack of information available regarding the migration of contaminants as well as its potential impact on local ecology and human health. Related to this issue was a comment that additional local water supplies could become contaminated via contaminants' migration from the South Plume.

FS/PP-EIS Approach

Surface water contamination in Paddys Run and the Great Miami River is being investigated. Control of storm water runoff is being addressed by the Waste Pit Area Storm Water Runoff Control Removal Action and the Uncontrolled Production Area Stormwater Runoff Collection Removal Action. The investigations and removal actions, and the associated potential impacts on surface water quality, including any discharge of treated effluent and surface water runoff to the Great Miami River will be summarized and discussed in the FS/PP-EIS. The FS/PP-EIS will address migration of contaminants from the FEMP and potential impacts on local ecology and human health. Impacts of the South Plume are being addressed in the South Plume EE/CA and will be summarized in the FS/PP-EIS.

4.7 TRANSPORTATION

Summary of Comments

Comments regarding transportation included that the FS/PP-EIS should consider an emergency plan approved by the Federal Emergency Management Agency (FEMA), which contains transportation and roadway improvement plans to accommodate emergency evacuations and impacts from accident spills. The FS/PP-EIS should also include the potential dangers associated with the remedial actions as

related to transport plans. It was also stated that DOE could not be trusted to the transport of waste across the country, considering the past leakage during transport from the hopper. A reviewer noted that problems with transport would only be magnified given the quantity involved.

FS/PP-EIS Issue Response

An evacuation plan is not within the scope of the FS/PP-EIS. FEMP has in place an approved Contingency Plan, coordinated with area fire and disaster response agencies, and EPA. There is also an emergency response plan complete with notification procedures and an emergency notification system.

The FS/PP-EIS will reference U.S. Department of Transportation (DOT) reports on potential transportation accidents while moving construction materials on-property and wastes off-property during implementation of remedial action alternatives. The volume of materials and wastes involved will be considered in the statistical analysis of accident potential. All transportation actions will be done in compliance with the DOT and the Nuclear Regulatory Commission requirements.

4.8 ECOLOGICAL ISSUES

Summary of Comments

Comment was made that indices of environmental quality should include regular testing of birds, small mammals, dairy cows, and milk. Also, consideration should be given to loss of habitat and biotic environment. Another reviewer stated that DOE's past management failures raise questions about DOE's claim that the FEMP has had only negligible effects on the local ecology. Comment was also made that local flora and fauna should not be destroyed, unless they pose an extreme danger to the local environment or health of residents, or pose further serious contamination to the ecosystem. One reviewer also requested that the cleanup alternative return the area to a near natural environmental state.

The FS/PP-EIS should describe and map the vegetation onsite and in surrounding areas subject to site releases. Site and vicinity fish and wildlife, vegetation and soils should be sampled and appropriate tissues examined for radionuclides. The movement of radionuclides released from the site in aquatic and terrestrial ecosystems, should be modeled and points of concentration noted.

FS/PP-EIS Issue Response

The FS/PP-EIS will describe and map aquatic and terrestrial communities at the FEMP and will describe the regional biotic environment. FS/PP-EIS data and Environmental Monitoring Reports, describing contaminant levels in aquatic and terrestrial organisms, vegetation, and soils, will be summarized, as will data on the general effects of the FEMP on the local ecology within the FS/PP-EIS. The potential impacts of remedial actions on individual organisms and local habitats, including recommendations for mitigation of impacts and monitoring to be conducted during remediation will be discussed in the FS/PP-EIS. Movement of radionuclides from the FEMP into aquatic and terrestrial ecosystems, is being modelled as part of health and ecological risk assessments and will be summarized in the FS/PP-EIS. Criteria for selection of remedial actions include minimal impact on the environment, consistent with protection of human health and the local ecology.

4.9 AIR QUALITY/CLIMATE

Summary of Comments

Comment was made that there are approximately 430 emission sources throughout the FEMP and the major sources originate from uranium production operations. A request was made that the FS/PP-EIS consider the following air quality factors: temperature variations, wind data, precipitation data, identification of air quality standards and noncompliance with these standards, impacts to air quality from radioactive and hazardous material emissions during cleanup, and excavation activities and other remedial actions.

A reviewer noted that the current method for storing hazardous waste could not withstand natural

occurrences, such as tornadoes, and that storage containers should be constructed to withstand tornadoes, so that the waste will not come into contact with the weather elements.

FS/PP-EIS Issue Response

The air quality analysis for the FS/PP-EIS will provide a description of the existing air quality environment, including meteorological factors such as wind data, precipitation data, temperature variations, and severe storm data. This information will be used to evaluate the current compliance or noncompliance status at the FEMP with respect to ambient standards for priority pollutants, radionuclides, and air toxins. Additional air quality analyses will include the evaluation of unmonitored emission sources, cleanup activities, fugitive dust emissions, and the entrainment of hazardous materials during remedial actions. Severe storm data from the National Climatic Data Center will be used to determine the potential for severe thunderstorm and tornado impacts.

4.10 SOCIOECONOMICS

Summary of Comments

Reviewers stated that the EIS should include the following socioeconomic factors: demography, business profiles, government structure and finances, local land use patterns, transportation networks and increased road traffic, municipal and utility services, local industry impact, impacts to schools, impacts to Miami-Whitewater Forest and the Great Miami River, impacts to local hunting and fishing areas, impacts to local parks and recreation areas, and impacts to land conservation. Reviewers also asked that impact to property values, compensation for lost property values, impact to tax base and transportation impacts from accidents be included in the EIS.

FS/PP-EIS Approach

The FS/PP-EIS will address a number of socioeconomic factors such as demographics and related impacts to schools and local employment. Local and regional economies will be examined with

respect to potential impacts to business and industry resulting from remedial activities at the FEMP. The socioeconomic analysis will also review land use patterns, including recreational areas, and land conservation efforts with particular attention paid to special area resources such as the Miami-Whitewater Forest. Potential impacts to the existing transportation network and public utilities will be discussed. A depiction of local government structures, the tax base, and property values will also be included. The impacts to local property values and proposed land uses associated with the remedial action alternatives will be addressed. However, compensation for possible decline in property values is not within the scope of selecting a remedial alternative and therefore will not be addressed in the FS/PP-EIS.

4.11 CUMULATIVE IMPACTS

Summary of Comments

Cumulative impacts from a range of factors are being requested for consideration in the document, including: the extent of pollution around the FEMP, DOE's claim of negligible effects on the local ecology, the need for responsible and informed decision making, and consideration of past faults with the FEMP monitoring program. Additionally, health and safety issues, socioeconomic impacts, institutional issues, engineering and technical issues, and ecological issues should be addressed for all five OUs. An assessment of the cumulative effects of the various projects should be considered as well as impacts on education, scenic and recreational resources, socioeconomics, transportation, and impact of waste on other locations, if waste is disposed off-site.

FS/PP-EIS Issue Response

The FS/PP-EIS will evaluate the cumulative impacts of CERCLA remedial actions at five OUs, other Resource Conservation and Recovery Act corrective actions, and other plant activities that would enhance the potential for cumulative impacts. The potential impacts mentioned by the reviewers will be analyzed in the FS/PP-EIS.

APPENDIX D

Table of Contents for the FS/EIS (OU 4)

DOCUMENT CONTENTS

VOLUME I

Executive Summary

Chapter 1 Introduction

Chapter 2 Identification and Screening of Technologies and Process Options

Chapter 3 Development and Screening of Preliminary Alternatives

Chapter 4 Detailed Analysis of Feasible Alternatives

Chapter 5 Comparative Analysis of Alternatives

Chapter 6 References

VOLUME II

Appendix A Summary of Operable Unit 4 Data

Appendix B Detailed Description of Technologies and Process Options

Appendix C Summary of Vitrification, Cement Stabilization, and Chemical Extraction Treatability Studies

Appendix D Public Health and Occupational Risk Considerations for the Operable Unit 4 Feasibility Study at the FEMP

Appendix E Detailed Cost Estimates

VOLUME III

Appendix F Analysis of Potential ARARs for Operable Unit 4

Appendix G Summary of Comparative Analysis

Appendix H Optional Phase Treatability Study Report

Appendix I Site-wide Environmental Impact Statement

Appendix J Comprehensive Response Action Risk Evaluation

-5187

TABLE OF CONTENTS

CONTENTS VOLUME I

	Page
Document Contents	xix
List of Tables	xxi
List of Figures	xxiii
English/Metric and Metric/English Equivalents	xxv
Acronym List	xxvii
Executive Summary	ES-1
1.0 Introduction	1-1
1.1 Purpose and Need for Decision	1-5
1.2 Purpose and Organization of Report	1-6
1.3 Overview of FEMP Site Environmental Restoration Process	1-7
1.3.1 RI/FS Process	1-7
1.3.2 Removal Actions	1-12
1.4 Background Information	1-13
1.4.1 Description of the FEMP Site	1-13
1.4.1.1 Air Quality	1-13
1.4.1.2 Meteorology	1-15
1.4.1.3 Topography and Surface Water	1-16
1.4.1.4 Soils and Seismology	1-18
1.4.1.5 Geology and Groundwater	1-18
1.4.1.5.1 Physiography	1-18
1.4.1.5.2 Geologic History	1-18
1.4.1.5.3 Site-Wide Hydrogeology	1-19
1.4.1.5.4 Hydrogeology of the Glacial Overburden	1-19
1.4.1.5.5 Hydrogeology of the Great Miami Aquifer	1-21
1.4.1.6 Population and Land Use	1-22
1.4.1.7 Ecology	1-24
1.4.1.7.1 Regional Ecology	1-24
1.4.1.7.2 Ecological Community on the FEMP	1-24
1.4.1.7.3 Floodplains and Wetlands	1-25
1.4.1.7.4 Threatened and Endangered Species	1-28
1.4.2 Description of Operable Unit 4	1-29
1.4.2.1 Silos 1, 2, 3, 4 and the Decant Sump	1-29

0070

TABLE OF CONTENTS
(continued)

	Page
1.4.2.2 Radon Treatment System	1-30
1.4.2.3 Concrete Pipe Trench and Miscellaneous Structures	1-31
1.4.2.4 K-65 Silo Berms	1-31
1.4.3 Site History	1-32
1.4.4 Operable Unit 4 History	1-34
1.4.4.1 History of Silo 1	1-34
1.4.4.2 History of Silo 2	1-35
1.4.4.3 History of Silos 3 and 4	1-36
1.4.4.4 History of the Radon Treatment System	1-37
1.5 Nature and Extent of Contamination	1-37
1.5.1 Site-Wide Summary	1-38
1.5.1.1 Air Quality	1-38
1.5.1.2 Surface Water and Sediment	1-42
1.5.1.3 Groundwater	1-42
1.5.1.4 Surface Soils	1-43
1.5.1.5 Subsurface Soils	1-44
1.5.1.6 Ecological Assessments	1-44
1.5.2 Operable Unit 4 Summary	1-45
1.5.2.1 Contaminant Source Data	1-46
1.5.2.1.1 Silos 1 and 2	1-46
1.5.2.1.2 Decant Sump Tank	1-46
1.5.2.1.3 Radon Treatment System	1-49
1.5.2.1.4 Silo 3	1-49
1.5.2.1.5 Silo 4	1-52
1.5.2.2 Nature and Extent of Contamination of Environmental Media	1-52
1.5.2.2.1 Surface Soil	1-52
1.5.2.2.2 Berm Soil	1-53
1.5.2.2.3 Subsurface Soil	1-53
1.5.2.2.4 Perched Groundwater	1-54
1.5.2.2.5 Great Miami Aquifer Groundwater	1-54
1.5.2.2.6 Air	1-54

0071

TABLE OF CONTENTS
(continued)

Page

1.5.2.2.7 Direct Radiation 1-55

1.6 Summary of Site Risks 1-56

1.6.1 Preliminary Site-Wide Baseline Risk Assessment 1-56

1.6.2 Site-Wide Ecological Assessment 1-58

1.6.3 Operable Unit 4 Baseline Risk Assessment 1-60

2.0 Identification and Screening of Technologies and Process Options 2-1

2.1 Introduction 2-1

2.2 Remedial Action Objectives 2-3

2.2.1 Constituents of Concern 2-4

2.2.2 Preliminary Remediation Goals 2-4

2.2.2.1 Regulatory Guidance 2-10

2.2.2.2 Target Risk 2-13

2.2.2.3 Land Use Scenarios 2-14

2.2.2.4 As Low As Reasonably Achievable 2-15

2.2.2.5 Soil Preliminary Remediation Goals 2-16

2.2.2.5.1 Applicable or Relevant and Appropriate Requirements for Radiological Constituents 2-16

2.2.2.5.2 Applicable or Relevant and Appropriate Requirements for Chemical Constituents 2-21

2.2.2.6 Groundwater Preliminary Remediation Goals 2-21

2.2.2.6.1 Applicable or Relevant and Appropriate Requirements for Radiological Constituents 2-28

2.2.2.6.2 Applicable or Relevant and Appropriate Requirements for Chemical Constituents 2-29

2.2.3 Development of Remedial Action Objectives 2-30

2.2.3.1 Waste Material 2-35

2.2.3.2 Structural Material and Equipment 2-35

2.2.3.3 Soil 2-35

2.2.3.4 Residual Water 2-36

2.3 Subunit Designations 2-36

2.4 General Response Actions 2-37

2.4.1 No-Action General Response Action 2-37

0072

TABLE OF CONTENTS
(continued)

	Page
2.4.2 Institutional Action General Response Action	2-37
2.4.3 Long-Term Containment General Response Action	2-37
2.4.4 In Situ Treatment/Long-Term Containment General Response Action	2-38
2.4.5 Removal/Treatment/Disposal General Response Action	2-38
2.5 Identification and Screening of Technologies and Process Options	2-38
2.5.1 Criteria for Identifying and Screening Technologies	2-39
2.5.2 No-Action General Response Action	2-39
2.5.3 Institutional Action General Response Action	2-44
2.5.3.1 Monitoring Technologies	2-44
2.5.3.1.1 Groundwater Monitoring	2-44
2.5.3.1.2 Leachate Monitoring	2-44
2.5.3.1.3 Radon Monitoring	2-44
2.5.3.1.4 Surface Water/Sediment Monitoring	2-44
2.5.3.2 Access Control Technologies	2-45
2.5.3.2.1 Physical Barriers	2-45
2.5.3.2.2 Administrative Controls	2-45
2.5.4 Long-Term Containment General Response Action	2-45
2.5.4.1 Subsurface Flow Control Technologies	2-45
2.5.4.1.1 Subsurface Drains	2-45
2.5.4.1.2 Slurry Walls	2-46
2.5.4.1.3 Pumping Wells	2-46
2.5.4.1.4 Sheet Pilings	2-46
2.5.4.1.5 Grout Curtains	2-46
2.5.4.2 Capping Technologies	2-46
2.5.4.2.1 Concrete-Based Cap	2-47
2.5.4.2.2 Asphalt-Based Cap	2-47
2.5.4.2.3 Soil-/Clay-Based Cap	2-47
2.5.4.2.4 Chemical Sealant Cap	2-47
2.5.4.2.5 Multimedia Cap	2-47
2.5.4.2.6 Void Space Grout	2-47
2.5.4.3 Run-on/Runoff Control Technologies	2-48
2.5.4.3.1 Sedimentation Basin/Sediment Trap	2-48

TABLE OF CONTENTS
(continued)

-5187

	Page
2.5.4.3.2 Diversion/Collection	2-48
2.5.4.3.3 Grading	2-48
2.5.4.3.4 Revegetation	2-48
2.5.4.4 Silo Renovation	2-49
2.5.5 In Situ Treatment/Long-Term Containment General Response Action	2-49
2.5.5.1 In Situ Treatment Technologies	2-49
2.5.5.1.1 Shallow Soil Mixing	2-49
2.5.5.1.2 In Situ Vitrification	2-49
2.5.5.1.3 Surcharging	2-50
2.5.5.1.4 Soil Aeration	2-50
2.5.5.1.5 Steam Stripping	2-50
2.5.5.2 Long-Term Containment Technologies	2-50
2.5.6 Removal/Treatment/Disposal General Response Action	2-50
2.5.6.1 Removal Technologies	2-50
2.5.6.1.1 Mechanical Removal Technologies	2-51
2.5.6.1.2 Hydraulic Removal Technology	2-51
2.5.6.1.3 Pneumatic Removal Technologies	2-52
2.5.6.2 Waste Treatment Technologies	2-52
2.5.6.2.1 Waste Stabilization Technologies	2-52
2.5.6.2.2 Physical Treatment Technologies	2-53
2.5.6.2.3 Chemical Treatment Technologies	2-55
2.5.6.2.4 Thermal Treatment Technologies	2-56
2.5.6.2.5 Biological Treatment Technologies	2-57
2.5.6.2.6 Decontamination and Decommissioning Technologies	2-58
2.5.6.2.7 Silo Demolition Technology	2-59
2.5.6.3 Disposal Technologies	2-62
2.5.6.3.1 Waste Transportation	2-62
2.5.6.3.2 On-Property Disposal Technology	2-63
2.5.6.3.3 Off-Site Disposal Technology	2-66
2.6 Evaluation of Technologies and Process Options	2-68
2.6.1 Criteria for Evaluating Technologies and Process Options	2-69

0074

TABLE OF CONTENTS
(continued)

	Page
2.6.1.1 Effectiveness Evaluation	2-69
2.6.1.2 Implementability Evaluation	2-69
2.6.1.3 Cost Evaluation	2-70
2.6.2 No-Action General Response Action	2-70
2.6.3 Institutional Action General Response Action	2-70
2.6.3.1 Monitoring Technology	2-72
2.6.3.1.1 Groundwater Monitoring	2-72
2.6.3.1.2 Leachate Collection/Monitoring	2-72
2.6.3.1.3 Radon Monitoring	2-73
2.6.3.1.4 Surface Water/Sediment Monitoring	2-73
2.6.3.2 Access Control Technology	2-73
2.6.3.2.1 Physical Barriers	2-74
2.6.3.2.2 Administrative Controls	2-74
2.6.4 Long-Term Containment General Response Action	2-74
2.6.4.1 Subsurface Flow Control Technology	2-75
2.6.4.1.1 Slurry Walls	2-75
2.6.4.1.2 Pumping Wells	2-75
2.6.4.1.3 Sheet Pilings	2-79
2.6.4.1.4 Grout Curtains	2-79
2.6.4.2 Capping Process Options	2-80
2.6.4.2.1 Concrete-Based Cap	2-80
2.6.4.2.2 Asphalt-Based Cap	2-80
2.6.4.2.3 Soil-/Clay-Based Cap	2-81
2.6.4.2.4 Chemical Sealant Cap	2-82
2.6.4.2.5 Multimedia Cap	2-82
2.6.4.2.6 Void Space Grout	2-83
2.6.4.3 Run-On/Runoff Control Technology	2-83
2.6.4.3.1 Sedimentation Basin/Sediment Trap	2-83
2.6.4.3.2 Diversion/Collection	2-84
2.6.4.3.3 Grading	2-84
2.6.4.3.4 Revegetation	2-85
2.6.4.4 Silo Renovation Technology	2-85

TABLE OF CONTENTS
(continued)

		Page
2.6.5	In Situ Treatment/Long-Term Containment General Response Action	2-86
2.6.5.1	In Situ Treatment Process Options	2-86
2.6.5.1.1	Shallow Soil Mixing	2-86
2.6.5.1.2	In Situ Vitrification	2-90
2.6.5.2	Long-Term Containment Technology	2-90
2.6.6	Removal/Treatment/Disposal General Response Action	2-90
2.6.6.1	Mechanical Removal Technology	2-91
2.6.6.1.1	Loader/Dozer	2-91
2.6.6.1.2	Crane With Clamshell System	2-91
2.6.6.1.3	Conveyor System	2-98
2.6.6.1.4	Backhoe	2-98
2.6.6.1.5	Dragline System	2-99
2.6.6.2	Hydraulic Removal Technology	2-99
2.6.6.3	Pneumatic Removal Technology	2-100
2.6.6.4	Waste Stabilization Technology	2-100
2.6.6.4.1	Asphalt-Based Stabilization	2-100
2.6.6.4.2	Cement-Based Stabilization	2-101
2.6.6.4.3	Thermoplastic Encapsulation	2-101
2.6.6.4.4	Vitrification	2-102
2.6.6.4.5	Lime/Flyash Stabilization	2-103
2.6.6.5	Physical Treatment Technology	2-103
2.6.6.5.1	Solid/Liquid Separation	2-103
2.6.6.5.2	FEMP Advanced Wastewater Treatment System	2-104
2.6.6.6	Chemical Treatment Technology	2-105
2.6.6.7	Thermal Treatment Technology	2-105
2.6.6.8	Decontamination and Decommissioning Technology	2-106
2.6.6.8.1	Vacuum Scabbling	2-106
2.6.6.8.2	Pressure Washing	2-107
2.6.6.8.3	Vacuum Grit Blasting	2-107
2.6.6.8.4	Acid Washing with Oxidizing Agents	2-108
2.6.6.8.5	Strippable Coatings	2-108
2.6.6.9	Silo Demolition Technology	2-108

Page

2.6.6.9.1 Controlled Blasting 2-109
2.6.6.9.2 Impact Hammer 2-109
2.6.6.9.3 Flame Cutting 2-110
2.6.6.9.4 Thermite Reaction Lance 2-110
2.6.6.9.5 Gas Torch 2-110
2.6.6.9.6 Hydraulic Splitter 2-111
2.6.6.9.7 Nonexplosive Demolition Agents 2-111
2.6.6.9.8 Circular Diamond or Carbide Saws 2-112
2.6.6.9.9 Diamond Rope Saw 2-112
2.6.6.9.10 Diamond Chain Saw 2-113
2.6.6.9.11 Abrasive Water Jet 2-113
2.6.6.9.12 Core-Stitch Drilling 2-114
2.6.6.9.13 Wrecking Ball 2-114
2.6.6.10 Waste Transportation Technology 2-114
2.6.6.10.1 Rail Transport 2-114
2.6.6.10.2 Truck Transport 2-115
2.6.6.11 On-Property Disposal Technology 2-115
2.6.6.11.1 Engineered Disposal Facility 2-116
2.6.6.11.2 Above-Grade Disposal Vault 2-116
2.6.6.12 Off-Site Disposal Technology 2-117
2.6.6.12.1 Interim Storage Facility 2-117
2.6.6.12.2 Nevada Test Site 2-118
2.6.6.12.3 Envirocare 2-118
2.6.6.12.4 New Facility Adjacent to the FEMP Site 2-118
2.6.6.12.5 New Facility Within 483 Kilometers (300 Miles) of FEMP 2-119
3.0 Development and Screening of Alternatives 3-1
3.1 Introduction 3-1
3.2 Development of Preliminary Alternatives 3-3
3.2.1 Criteria for Developing Preliminary Alternatives 3-3
3.2.2 Factors Common to All Subunits 3-3
3.2.2.1 Perched Water 3-4
3.2.2.2 Groundwater Monitoring 3-5

TABLE OF CONTENTS
(continued)

		Page
3.2.2.3	Disposal Facilities	3-6
3.2.2.4	Packaging/Transportation	3-6
3.2.2.5	Decontamination and Decommissioning of Remedial Facilities	3-7
3.2.2.6	Institutional Action	3-7
3.2.3	Summary of Preliminary Alternatives	3-7
3.2.3.1	Subunit A	3-8
3.2.3.2	Subunit B	3-9
3.2.3.3	Subunit C	3-9
3.2.3.4	Subunit D	3-10
3.2.4	Subunit A Preliminary Alternatives	3-11
3.2.4.1	Alternative 0A - No Action	3-11
3.2.4.2	Alternative 1A - In Situ Containment	3-11
3.2.4.3	Alternative 2A - Removal, Stabilization, and On-Property Disposal	3-18
3.2.4.4	Alternative 3A - Removal, Stabilization, and Off-Site Disposal	3-22
3.2.4.5	Alternative 4A - Removal, Stabilization, Interim On-Property Storage, and Off-Site Disposal	3-24
3.2.4.6	Alternative 5A - Removal, Chemical Extraction, Stabilization, and On-Property Disposal	3-26
3.2.4.7	Alternative 6A - Removal, Chemical Extraction, Stabilization, and Off-Property Disposal	3-30
3.2.4.8	Alternative 7A - Removal, Chemical Extraction, Stabilization, Interim On-Property Storage, and Off-Site Disposal	3-32
3.2.5	Subunit B Preliminary Alternatives	3-35
3.2.5.1	Alternative 0B - No Action	3-35
3.2.5.2	Alternative 1B - In Situ Containment	3-35
3.2.5.3	Alternative 2B - Removal, Stabilization, and On-Property Disposal	3-41
3.2.5.4	Alternative 3B - Removal, Stabilization, and Off-Site Disposal	3-45
3.2.5.5	Alternative 4B - Removal, Stabilization, Interim On-Property Storage, and Off-Site Disposal	3-47
3.2.6	Subunit C Preliminary Alternatives	3-50
3.2.6.1	Alternative 0C - No Action	3-50
3.2.6.2	Alternative 1C - Demolition and Containment	3-50
3.2.6.3	Alternative 2C - Demolition and Containment, Removal, and	

Page

On-Property Disposal 3-57

3.2.6.4 Alternative 3C - Demolition, Removal, and Off-Site Disposal 3-60

3.2.6.5 Alternative 4C - Demolition, Removal, Interim On-Property Storage and Off-Site Disposal 3-63

3.2.7 Subunit D Preliminary Alternatives 3-64

3.2.7.1 Alternative 0D - No Action 3-64

3.2.7.2 Alternative 1D - Water/Sediment Removal and Site Renovation 3-68

3.2.7.3 Alternative 2D - Water/Sediment Removal, Silo Demolition, and Off-Site Disposal 3-70

3.3 Screening of Alternatives 3-73

3.3.1 Subunit A 3-76

3.3.1.1 Alternative 0A - No Action 3-76

3.3.1.2 Alternative 1A - In Situ Containment 3-77

3.3.1.3 Alternative 2A - Removal, Stabilization, and On-Property Disposal 3-77

3.3.1.4 Alternative 3A.1 - Removal, Stabilization, and Off-Site Disposal at NTS 3-78

3.3.1.5 Alternative 3A.2 - Removal, Stabilization, and Off-Site Disposal at a Newly Constructed Facility Within 483 Kilometers (300 Miles) of the FEMP Site 3-79

3.3.1.6 Alternative 4A.1 - Removal, Stabilization, Interim On-Property Storage, and Off-Site Disposal at NTS 3-79

3.3.1.7 Alternative 4A.2 - Removal, Stabilization, Interim On-Property Storage, and Off-Site Disposal at a Newly Constructed Facility Within 483 Kilometers (300 Miles) of the FEMP Site 3-80

3.3.1.8 Alternative 5A - Removal, Chemical Extraction, Stabilization, and On-Property Disposal 3-80

3.3.1.9 Alternative 6A.1 - Removal, Chemical Extraction, Stabilization, and Off-Site Disposal at NTS 3-81

3.3.1.10 Alternative 6A.2 - Removal, Chemical Extraction, Stabilization, and Off-Site Disposal at a Newly Constructed Facility Within 483 Kilometers (300 Miles) of the FEMP Site 3-82

3.3.1.11 Alternative 7A.1 - Removal, Chemical Extraction, Stabilization, Interim On-Property Storage, and Off-Site Disposal at NTS 3-83

3.3.1.12 Alternative 7A.2 - Removal, Chemical Extraction, Stabilization, Interim On-Property Storage, and Off-Site Disposal at a Newly Constructed Facility Within 484 Kilometers (300 Miles) of the FEMP Site 3-83

0079

			Page
3.3.2	Subunit B		3-84
	3.3.2.1	Alternative OB - No Action	3-84
	3.3.2.2	Alternative 1B - In Situ Containment	3-84
	3.3.2.3	Alternative 2B - Removal, Stabilization, and On-Property Disposal	3-85
	3.3.2.4	Alternative 3B.1 - Removal, Stabilization, and Off-Site Disposal at NTS	3-86
	3.3.2.5	Alternative 3B.2 - Removal, Stabilization, and Off-Site Disposal at a Newly Constructed Facility Within 483 Kilometers (300 Miles) of the FEMP Site	3-86
	3.3.2.6	Alternative 4B.1 - Removal, Stabilization, Interim On-Property Storage, and Off-Site Disposal at the NTS	3-87
	3.3.2.7	Alternative 4B.2 - Removal, Stabilization, Interim On-Property Storage, and Off-Site Disposal at a Newly Constructed Facility Within 483 Kilometers (300 Miles) of the FEMP Site	3-88
3.3.3	Subunit C		3-88
	3.3.3.1	Alternative 0C - No Action	3-88
	3.3.3.2	Alternative 1C - Demolition and Containment	3-89
	3.3.3.3	Alternative 2C - Demolition, Removal, and On-Property Disposal	3-89
	3.3.3.4	Alternative 3C.1 - Demolition, Removal, and Off-Site Disposal at NTS	3-90
	3.3.3.5	Alternative 3C.2 - Demolition, Removal, and Off-Site Disposal at Envirocare	3-90
	3.3.3.6	Alternative 3C.3 - Demolition, Removal, and Off-Site Disposal at a Newly Constructed Facility Within 483 Kilometers (300 Miles) of the FEMP Site	3-91
	3.3.3.7	Alternative 4C.1 - Demolition, Removal, Interim On-Property Storage, and Off-Site Disposal at NTS	3-92
	3.3.3.8	Alternative 4C.2 - Demolition, Removal, Interim On-Property Storage, and Off-Site Disposal at Envirocare	3-92
	3.3.3.9	Alternative 4C.3 - Demolition, Removal, Interim On-Property Storage, and Off-Site Disposal at a Newly Constructed Facility Within 483 Kilometers (300 Miles) of the FEMP Site	3-93
3.3.4	Subunit D		3-93
	3.3.4.1	Alternative 0D - No Action	3-93
	3.3.4.2	Alternative 1D - Water/Sediment Removal and Renovation	3-94
	3.3.4.3	Alternative 2D.1 - Water/Sediment Removal, Silo Demolition, and Off-Site Disposal at NTS	3-94

Page

3.3.4.4 Alternative 2D.2 - Water/Sediment Removal, Silo Demolition, and Off-Site Disposal at Envirocare 3-95

3.4 Alternative Screening Summary 3-95

3.4.1 Subunit A 3-96

3.4.2 Subunit B 3-97

3.4.3 Subunit C 3-98

3.4.4 Subunit D 3-99

4.0 Detailed Analysis of Feasible Alternatives 4-1

4.1 Introduction 4-1

4.2 Subunit A 4-3

4.2.1 Alternative 0A - No Action 4-3

4.2.1.1 Detailed Description 4-3

4.2.1.2 Detailed Analysis 4-3

4.2.1.2.1 Overall Protection of Human Health and the Environment 4-3

4.2.1.2.2 Compliance with ARARs 4-6

4.2.1.2.3 Long-Term Effectiveness and Permanence 4-6

4.2.1.2.4 Reduction of Toxicity, Mobility, or Volume 4-9

4.2.1.2.5 Short-Term Effectiveness 4-9

4.2.1.2.6 Implementability 4-11

4.2.1.2.7 Cost 4-11

4.2.2 Alternative 1A - In Situ Containment 4-11

4.2.2.1 Detailed Description 4-11

4.2.2.1.1 Radon Treatment System 4-11

4.2.2.1.2 Structural Grout Injection 4-11

4.2.2.1.3 Site Preparation 4-13

4.2.2.1.4 Partial Relocation of Paddys Run 4-13

4.2.2.1.5 Installation of Multimedia Cap 4-14

4.2.2.2 Detailed Analysis 4-15

4.2.2.2.1 Overall Protection of Human Health and the Environment 4-15

4.2.2.2.2 Compliance with ARARs 4-15

4.2.2.2.3 Long-Term Effectiveness and Permanence 4-18

-5187

TABLE OF CONTENTS
(continued)

		Page
4.2.2.2.4	Reduction of Toxicity, Mobility, or Volume	4-21
4.2.2.2.5	Short-Term Effectiveness	4-22
4.2.2.2.6	Implementability	4-26
4.2.2.2.7	Cost	4-26
4.2.3	Alternative 2A/Vit - Removal, Vitrification, and On-Property Disposal	4-28
4.2.3.1	Detailed Description	4-28
4.2.3.1.1	Site Preparation/Construction	4-28
4.2.3.1.2	Removal	4-30
4.2.3.1.3	Material Processing	4-33
4.2.3.1.4	Decontamination and Decommissioning	4-33
4.2.3.1.5	On-Property Disposal	4-33
4.2.3.2	Detailed Analysis	4-40
4.2.3.2.1	Overall Protection of Human Health and the Environment	4-40
4.2.3.2.2	Compliance with ARARs	4-41
4.2.3.2.3	Long-Term Effectiveness	4-41
4.2.3.2.4	Reduction of Toxicity, Mobility, or Volume	4-44
4.2.3.2.5	Short-Term Effectiveness	4-45
4.2.3.2.6	Implementability	4-49
4.2.3.2.7	Cost	4-51
4.2.4	Alternative 2A/Cem - Removal, Cement Stabilization, and On-Property Disposal	4-51
4.2.4.1	Detailed Description	4-51
4.2.4.2	Detailed Analysis	4-51
4.2.4.2.1	Overall Protection of Human Health and the Environment	4-51
4.2.4.2.2	Compliance with ARARs	4-54
4.2.4.2.3	Long-Term Effectiveness and Permanence	4-54
4.2.4.2.4	Reduction of Toxicity, Mobility, or Volume	4-55
4.2.4.2.5	Short-Term Effectiveness	4-56
4.2.4.2.6	Implementability	4-57
4.2.4.2.7	Cost	4-59
4.2.5	Alternative 3A.1/Vit - Removal, Vitrification, and Off-Site Disposal at NTS	4-59

TABLE OF CONTENTS
(continued)

		Page
4.2.5.1	Detailed Description	4-59
4.2.5.2	Detailed Analysis	4-59
4.2.5.2.1	Overall Protection of Human Health and the Environment	4-59
4.2.5.2.2	Compliance with ARARs	4-61
4.2.5.2.3	Long-Term Effectiveness and Permanence	4-61
4.2.5.2.4	Reduction of Toxicity, Mobility, or Volume	4-65
4.2.5.2.5	Short-Term Effectiveness	4-65
4.2.5.2.6	Implementability	4-70
4.2.5.2.7	Cost	4-70
4.2.6	Alternative 3A.1/Cem - Removal, Cement Stabilization, and Off-Site Disposal at NTS	4-70
4.2.6.1	Detailed Description	4-70
4.2.6.2	Detailed Analysis	4-72
4.2.6.2.1	Overall Protection of Human Health and the Environment	4-72
4.2.6.2.2	Compliance with ARARs	4-72
4.2.6.2.3	Long-Term Effectiveness and Permanence	4-72
4.2.6.2.4	Reduction of Toxicity, Mobility, or Volume	4-73
4.2.6.2.5	Short-Term Effectiveness	4-73
4.2.6.2.6	Implementability	4-74
4.2.6.2.7	Cost	4-75
4.2.7	Alternative 5A/Vit - Removal, Chemical Extraction, Vitrification, and On-Property Disposal	4-75
4.2.7.1	Detailed Description	4-73
4.2.7.2	Detailed Analysis	4-82
4.2.7.2.1	Overall Protection of Human Health and the Environment	4-82
4.2.7.2.2	Compliance with ARARs	4-82
4.2.7.2.3	Long-Term Effectiveness and Permanence	4-83
4.2.7.2.4	Reduction of Toxicity, Mobility, or Volume	4-86
4.2.7.2.5	Short-Term Effectiveness	4-87
4.2.7.2.6	Implementability	4-90
4.2.7.2.7	Cost	4-91

TABLE OF CONTENTS
(continued)

		Page
4.2.8	Alternative 5A/Cem - Removal, Chemical Extraction, Cement Stabilization, and On-Property Disposal	4-93
4.2.8.1	Detailed Description	4-93
4.2.8.2	Detailed Analysis	4-93
4.2.8.2.1	Overall Protection of Human Health and the Environment	4-93
4.2.8.2.2	Compliance with ARARs	4-93
4.2.8.2.3	Long-Term Effectiveness and Permanence	4-95
4.2.8.2.4	Reduction of Toxicity, Mobility, or Volume	4-96
4.2.8.2.5	Short-Term Effectiveness	4-96
4.2.8.2.6	Implementability	4-98
4.2.8.2.7	Cost	4-99
4.2.9	Alternative 6A.1/Vit - Removal, Chemical Extraction, Vitrification, and Off-Site Disposal - NTS	4-99
4.2.9.1	Detailed Description	4-99
4.2.9.2	Detailed Analysis	4-99
4.2.9.2.1	Overall Protection of Human Health and the Environment	4-99
4.2.9.2.2	Compliance with ARARs	4-99
4.2.9.2.3	Long-Term Effectiveness and Permanence	4-101
4.2.9.2.4	Reduction of Toxicity, Mobility, or Volume	4-103
4.2.9.2.5	Short-Term Effectiveness	4-103
4.2.9.2.6	Implementability	4-106
4.2.9.2.7	Cost	4-107
4.2.10	Alternative 6A.1/Cem - Removal, Chemical Extraction, Cement Stabilization, and Off-Site Disposal - NTS	4-107
4.2.10.1	Detailed Description	4-107
4.2.10.2	Detailed Analysis	4-109
4.2.10.2.1	Overall Protection of Human Health and the Environment	4-109
4.2.10.2.2	Compliance with ARARs	4-109
4.2.10.2.3	Long-Term Effectiveness and Permanence	4-109
4.2.10.2.4	Reduction of Toxicity, Mobility, or Volume	4-110
4.2.10.2.5	Short-Term Effectiveness	4-110

TABLE OF CONTENTS
(continued)

	Page
4.2.10.2.6 Implementability	4-111
4.2.10.2.7 Cost	4-113
4.3 Subunit B	4-113
4.3.1 Alternative 0B - No Action	4-113
4.3.1.1 Detailed Description	4-113
4.3.1.2 Detailed Analysis	4-113
4.3.1.2.1 Overall Protection of Human Health and the Environment	4-113
4.3.1.2.2 Compliance with ARARs	4-116
4.3.1.2.3 Long-Term Effectiveness and Permanence	4-116
4.3.1.2.4 Reduction of Toxicity, Mobility, or Volume	4-116
4.3.1.2.5 Short-Term Effectiveness	4-117
4.3.1.2.6 Implementability	4-117
4.3.1.2.7 Cost	4-117
4.3.2 Alternative 1B - In Situ Containment	4-117
4.3.2.1 Detailed Description	4-117
4.3.2.1.1 Grout Injection	4-117
4.3.2.1.2 Site Preparation	4-118
4.3.2.1.3 Partial Relocation of Paddys Run	4-118
4.3.2.1.4 Installation of Multimedia Cap	4-118
4.3.2.2 Detailed Analysis	4-121
4.3.2.2.1 Overall Protection of Human Health and the Environment	4-121
4.3.2.2.2 Compliance with ARARs	4-121
4.3.2.2.3 Long-Term Effectiveness and Permanence	4-123
4.3.2.2.4 Reduction of Toxicity, Mobility, or Volume	4-126
4.3.2.2.5 Short-Term Effectiveness	4-126
4.3.2.2.6 Implementability	4-129
4.3.2.2.7 Cost	4-129
4.3.3 Alternative 2B/Vit - Removal, Vitrification, and On-Property Disposal	4-131
4.3.3.1 Detailed Description	4-131
4.3.3.1.1 Site Preparation/Construction	4-131
4.3.3.1.2 Removal	4-131

TABLE OF CONTENTS
(continued)

			Page
		4.3.3.1.3 Material Processing	4-132
		4.3.3.1.4 On-Property Disposal	4-132
	4.3.3.2	Detailed Analysis	4-135
		4.3.3.2.1 Overall Protection of Human Health and the Environment	4-135
		4.3.3.2.2 Compliance with ARARs	4-135
		4.3.3.2.3 Long-Term Effectiveness and Permanence	4-135
		4.3.3.2.4 Reduction of Toxicity, Mobility, or Volume	4-138
		4.3.3.2.5 Short-Term Effectiveness	4-139
		4.3.3.2.6 Implementability	4-142
		4.3.3.2.7 Cost	4-144
4.3.4	Alternative 2B/Cem - Removal, Cement Stabilization, and On-Property Disposal		4-144
	4.3.4.1	Detailed Description	4-144
	4.3.4.2	Detailed Analysis	4-144
		4.3.4.2.1 Overall Protection of Human Health and the Environment	4-144
		4.3.4.2.2 Compliance with ARARs	4-147
		4.3.4.2.3 Long-Term Effectiveness and Permanence	4-147
		4.3.4.2.4 Reduction of Toxicity, Mobility, or Volume	4-148
		4.3.4.2.5 Short-Term Effectiveness	4-149
		4.3.4.2.6 Implementability	4-150
		4.3.4.2.7 Cost	4-151
4.3.5	Alternative 3B.1/Vit - Removal, Vitrification, and Off-Site Disposal at NTS		4-153
	4.3.5.1	Detailed Description	4-153
	4.3.5.2	Detailed Analysis	4-153
		4.3.5.2.1 Overall Protection of Human Health and the Environment	4-153
		4.3.5.2.2 Compliance with ARARs	4-153
		4.3.5.2.3 Long-Term Effectiveness and Permanence	4-154
		4.3.5.2.4 Reduction of Toxicity, Mobility, or Volume	4-156
		4.3.5.2.5 Short-Term Effectiveness	4-157
		4.3.5.2.6 Implementability	4-160
		4.3.5.2.7 Cost	4-162

0086

Page

4.3.6 Alternative 3B.1/Cem - Removal, Cement Stabilization, and Off-Site Disposal at NTS 4-162

4.3.6.1 Detailed Description 4-162

4.3.6.2 Detailed Analysis 4-162

4.3.6.2.1 Overall Protection of Human Health and the Environment 4-162

4.3.6.2.2 Compliance with ARARs 4-162

4.3.6.2.3 Long-Term Effectiveness 4-164

4.3.6.2.4 Reduction of Toxicity, Mobility, or Volume 4-164

4.3.6.2.5 Short-Term Effectiveness 4-165

4.3.6.2.6 Implementability 4-166

4.3.6.2.7 Cost 4-167

4.4 Subunit C 4-169

4.4.1 Alternative 0C - No Action 4-169

4.4.1.1 Detailed Description 4-169

4.4.1.2 Detailed Analysis 4-169

4.4.1.2.1 Overall Protection of Human Health and the Environment 4-169

4.4.1.2.2 Compliance with ARARs 4-169

4.4.1.2.3 Long-Term Effectiveness and Permanence 4-171

4.4.1.2.4 Reduction of Toxicity, Mobility, or Volume 4-171

4.4.1.2.5 Short-Term Effectiveness 4-171

4.4.1.2.6 Implementability 4-172

4.4.1.2.7 Cost 4-172

4.4.2 Alternative 1C - Demolition and Containment 4-172

4.4.2.1 Detailed Description 4-172

4.4.2.1.1 Site Preparation 4-173

4.4.2.1.2 Silo Decontamination 4-173

4.4.2.1.3 Silo 1, 2, and 3 Demolition 4-173

4.4.2.1.4 Vacuum Scabbling 4-175

4.4.2.1.5 Decant Sump Tank 4-176

4.4.2.1.6 Contaminated Surface Soil 4-176

4.4.2.1.7 Partial Relocation of Paddys Run 4-176

-5187

TABLE OF CONTENTS
(continued)

		Page
4.4.2.1.8	Installation of Multimedia Cap	4-176
4.4.2.2	Detailed Analysis	4-178
4.4.2.2.1	Overall Protection of Human Health and the Environment	4-178
4.4.2.2.2	Compliance with ARARs	4-178
4.4.2.2.3	Long-Term Effectiveness and Permanence	4-179
4.4.2.2.4	Reduction of Toxicity, Mobility,or Volume	4-181
4.4.2.2.5	Short-Term Effectiveness	4-181
4.4.2.2.6	Implementability	4-184
4.4.2.2.7	Cost	4-185
4.4.3	Alternative 2C - Demolition, Removal, and On-Property Disposal	4-185
4.4.3.1	Detailed Description	4-185
4.4.3.1.1	Site Preparation	4-185
4.4.3.1.2	Decontamination and Demolition of Silos 1, 2, and 3	4-185
4.4.3.1.3	Vacuum Scabbling	4-185
4.4.3.1.4	Decant Sump Tank, Process Piping, and Trenches	4-188
4.4.3.1.5	Contaminated Surface Soil and Subsoil	4-188
4.4.3.1.6	Above-Grade Disposal Vault	4-189
4.4.3.2	Detailed Analysis	4-190
4.4.3.2.1	Overall Protection of Human Health and the Environment	4-190
4.4.3.2.2	Compliance with ARARs	4-191
4.4.3.2.3	Long-Term Effectiveness and Permanence	4-191
4.4.3.2.4	Reduction of Toxicity, Mobility, or Volume	4-193
4.4.3.2.5	Short-Term Effectiveness	4-193
4.4.3.2.6	Implementability	4-196
4.4.3.2.7	Cost	4-197
4.4.4	Alternative 3C.2 - Demolition, Removal, and Off-Site Disposal at Envirocare of Utah, Inc.	4-197
4.4.4.1	Detailed Description	4-197
4.4.4.2	Detailed Analysis	4-199
4.4.4.2.1	Overall Protection of Human Health and the Environment	4-199
4.4.4.2.2	Compliance with ARARs	4-199

0088

Page

4.4.4.2.3 Long-Term Effectiveness and Permanence 4-199
4.4.4.2.4 Reduction of Toxicity, Mobility, or Volume 4-202
4.4.4.2.5 Short-Term Effectiveness 4-202
4.4.4.2.6 Implementability 4-205
4.4.4.2.7 Cost 4-205
4.5 Subunit D 4-207
4.5.1 Alternative 0D - No Action 4-207
4.5.1.1 Detailed Description 4-207
4.5.1.2 Detailed Analysis 4-207
4.5.1.2.1 Overall Protection of Human Health and the Environment 4-207
4.5.1.2.2 Compliance with ARARs 4-207
4.5.1.2.3 Long-Term Effectiveness and Permanence 4-207
4.5.1.2.4 Reduction of Toxicity, Mobility, or Volume 4-209
4.5.1.2.5 Short-Term Effectiveness 4-209
4.5.1.2.6 Implementability 4-210
4.5.1.2.7 Cost 4-210
4.5.2 Alternative 2D.2 - Water Removal, Silo Demolition, and Off-Site Disposal at Envirocare 4-210
4.5.2.1 Detailed Description 4-210
4.5.2.1.1 Site Preparation 4-210
4.5.2.1.2 Silo Decontamination and Demolition 4-210
4.5.2.1.3 Vacuum Scabbling 4-212
4.5.2.1.4 Off-Site Disposal 4-212
4.5.2.2 Detailed Analysis 4-213
4.5.2.2.1 Overall Protection of Human Health and the Environment 4-213
4.5.2.2.2 Compliance with ARARs 4-213
4.5.2.2.3 Long-Term Effectiveness and Permanence 4-214
4.5.2.2.4 Reduction of Toxicity, Mobility, or Volume 4-215
4.5.2.2.5 Short-Term Effectiveness 4-216
4.5.2.2.6 Implementability 4-219
4.5.2.2.7 Cost 4-219

TABLE OF CONTENTS
(continued)

	Page
4.6 Detailed Analysis Summary	4-219
4.7 Monitoring and Mitigative Measures	4-229
4.8 Unavoidable Adverse Impacts	4-234
4.9 Irreversible and Irretrievable Commitment of Resources	4-234
4.10 Impacts of Potential Loss of Institutional Actions	4-237
4.11 Short-Term Uses and Long-Term Productivity	4-238
5.0 Comparative Analysis	5-1
5.1 Introduction	5-1
5.2 Subunit A	5-2
5.2.1 Alternatives	5-2
5.2.1.1 Threshold Criteria	5-2
5.2.1.1.1 Overall Protection of Human Health and the Environment	5-2
5.2.1.2 Compliance with ARARs	5-10
5.2.1.2 Primary Balancing Criteria	5-11
5.2.1.2.1 Long-Term Effectiveness and Permanence	5-11
5.2.1.2.2 Reduction of Toxicity, Mobility, or Volume	5-12
5.2.1.2.3 Short-Term Effectiveness	5-12
5.2.1.2.4 Implementability	5-13
5.2.1.2.5 Cost	5-14
5.3 Subunit B	5-16
5.3.1 Alternatives	5-16
5.3.1.1 Threshold Criteria	5-16
5.3.1.1.1 Overall Protection of Human Health and the Environment	5-16
5.3.1.1.2 Compliance with ARARs	5-16
5.3.1.2 Primary Balancing Criteria	5-17
5.3.1.2.1 Long-Term Effectiveness and Permanence	5-17
5.3.1.2.2 Reduction of Toxicity, Mobility, or Volume	5-18
5.3.1.2.3 Short-Term Effectiveness	5-19
5.3.1.2.4 Implementability	5-19
5.3.1.2.5 Cost	5-20
5.4 Subunit C	5-22

TABLE OF CONTENTS
(continued)

	Page
5.4.1 Alternatives	
5.4.1.1 Threshold Criteria	5-22
5.4.1.1.1 Overall Protection of Human Health and the Environment	5-22
5.4.1.1.2 Compliance with ARARs	5-22
5.4.1.2 Primary Balancing Criteria	5-23
5.4.1.2.1 Long-Term Effectiveness and Permanence	5-23
5.4.1.2.2 Reduction of Toxicity, Mobility, or Volume	5-23
5.4.1.2.3 Short-Term Effectiveness	5-24
5.4.1.2.4 Implementability	5-24
5.4.1.2.5 Cost	5-25
5.5 Subunit D	5-25
5.5.1 Alternatives	5-25
5.5.1.1 Threshold Criteria	5-25
5.5.1.1.1 Overall Protection of Human Health and the Environment	5-25
5.5.1.1.2 Compliance with ARARs	5-27
5.5.1.2 Primary Balancing Criteria	5-27
5.5.1.2.1 Long-Term Effectiveness and Permanence	5-27
5.5.1.2.2 Reduction of Toxicity, Mobility, or Volume	5-27
5.5.1.2.3 Short-Term Effectiveness	5-27
5.5.1.2.4 Implementability	5-28
5.5.1.2.5 Cost	5-28
5.6 Identification of Preferred Remedial Action Alternative	5-28
5.6.1 Identification of the Preferred Remedial Action Alternative for Each Subunit	5-28
5.6.2 Identification of the Preferred Comprehensive Remedial Action Alternative	5-30
5.7 Cumulative Impacts	5-32
5.7.1 Human Health Impacts	5-32
5.7.1.1 Long-Term Risks	5-32
5.7.1.2 Short-Term Risks	5-33
5.7.2 Environmental Protection	5-34

0091

-5187

TABLE OF CONTENTS
(continued)

		Page
5.7.2.1	Soil and Geology	5-34
5.7.2.2	Air Quality	5-34
5.7.2.3	Water Quality and Hydrology	5-35
5.7.2.4	Biotic Resources	5-35
5.7.2.5	Wetlands and Floodplains	5-35
5.7.2.6	Socioeconomics and Land Use	5-36
5.7.2.7	Cultural Resources	5-37
6.0 References		6-1

0092