4528

# INTEGRATED ENVIRONMENTAL MONITORING PLAN

## FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
## FERNALD, OHIO

OCTOBER 2002

U.S. DEPARTMENT OF ENERGY

2505-WP-0022
REV. 3A
000001 DRAFT FINAL

4528

# INTEGRATED ENVIRONMENTAL MONITORING PLAN

## FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
## FERNALD, OHIO

**OCTOBER 2002**

**U.S. DEPARTMENT OF ENERGY**

**DRAFT FINAL**

000002

# TABLE OF CONTENTS


| | Page |
|---|---|
| List of Figures | vi |
| List of Tables | vii |
| List of Acronyms | viii |
| Section | |
| 1.0 Introduction | 1-1 |
| 1.1 Background | 1-1 |
| 1.2 Program Objectives and Scope | 1-2 |
| 1.3 Relationship to Project-Specific Remedial Programs | 1-4 |
| 1.4 Plan Organization | 1-6 |
| 1.5 Role of the IEMP in Remedial Action Decision Making | 1-8 |
| 1.5.1 What are the Management Decisions that the IEMP Will Support? | 1-8 |
| 1.5.2 Who is Responsible for Making the Decisions? | 1-9 |
| 1.5.3 What are the General Criteria for the Decisions? | 1-10 |
| 1.5.4 How Will IEMP Decisions be Communicated? | 1-11 |
| 1.6 Program Modifications and Revisions | 1-12 |
| 2.0 Summary of FEMP Remedial Strategy | 2-1 |
| 2.1 FEMP Remediation Strategy | 2-1 |
| 2.2 General Remediation Activities | 2-9 |
| 2.3 Two-Year Projection of Remediation Field Activities | 2-10 |
| 3.0 Groundwater Monitoring Program | 3-1 |
| 3.1 Integration Objectives for Groundwater | 3-1 |
| 3.2 Summary of Regulatory Drivers, DOE Policies, and Other FEMP-Specific Agreements | 3-3 |
| 3.2.1 Approach | 3-3 |
| 3.2.2 Results | 3-4 |
| 3.3 Programmatic Boundary for the Groundwater Monitoring Program | 3-8 |
| 3.3.1 Responsibility Boundary between Great Miami Aquifer and Soil/Perched Groundwater Remediation Efforts | 3-9 |
| 3.3.2 Administrative Boundary between the IEMP and Paddys Run Road Site Contaminant Plumes | 3-9 |
| 3.3.3 Responsibility Boundary between the Soil & Disposal Facility Project and the Aquifer Restoration Project for Performance Monitoring at the On-Site Disposal Facility | 3-9 |
| 3.3.4 Responsibility Boundary between the Aquifer Restoration Project and the Operable Unit 1 Waste Pit Remediation Efforts | 3-10 |
| 3.4 Program Expectations and Design Considerations | 3-10 |
| 3.4.1 Program Expectations | 3-10 |
| 3.4.2 Design Considerations | 3-11 |
| 3.4.2.1 Background | 3-11 |
| 3.4.2.2 The Modular Approach to Aquifer Restoration | 3-13 |
| 3.4.2.3 Well Selection Criteria | 3-18 |
| 3.4.2.4 Constituent Selection Criteria | 3-20 |

# TABLE OF CONTENTS
## (Continued)


| | | | | Page |
|---|---|---|---|---|
| 3.5 | Design of the IEMP Groundwater Monitoring Program | | | 3-25 |
| 3.6 | Media-Specific Plan for Groundwater Monitoring | | | 3-27 |
| | 3.6.1 | Project Organization | | 3-27 |
| | 3.6.2 | Sampling Program | | 3-33 |
| | | 3.6.2.1 | Total Uranium Monitoring | 3-33 |
| | | 3.6.2.2 | South Field Monitoring | 3-36 |
| | | 3.6.2.3 | Waste Storage Area Monitoring | 3-40 |
| | | 3.6.2.4 | Property/Plume Boundary Monitoring | 3-40 |
| | | 3.5.2.5 | Monitor Non-Uranium Groundwater FRL constituents without IEMP FRL Exceedances | 3-43 |
| | | 3.6.2.6 | Routine Water-Monitoring | 3-43 |
| | | 3.6.2.7 | Sampling Procedures | 3-45 |
| | | 3.6.2.8 | Quality Control Sampling Requirements | 3-48 |
| | | 3.6.2.9 | Decontamination | 3-49 |
| | | 3.6.2.10 | Waste Disposition | 3-49 |
| | | 3.6.2.11 | Monitoring Well Maintenance | 3-49 |
| | 3.6.3 | Change Control | | 3-52 |
| | 3.6.4 | Health and Safety Considerations | | 3-52 |
| | 3.6.5 | Data Management | | 3-52 |
| | 3.6.6 | Quality Assurance | | 3-53 |
| 3.7 | IEMP Groundwater Monitoring Data Evaluation and Reporting | | | 3-54 |
| | 3.7.1 | Data Evaluation | | 3-54 |
| | 3.7.2 | Reporting | | 3-63 |
| 4.0 | Surface Water and Treated Effluent Monitoring Program | | | 4-1 |
| 4.1 | Integration Objectives for Surface Water and Treated Effluent | | | 4-1 |
| 4.2 | Analysis of Regulatory Drivers, DOE Orders, and Other FEMP-Specific Agreements | | | 4-2 |
| | 4.2.1 | Approach | | 4-2 |
| | 4.2.2 | Results | | 4-3 |
| 4.3 | Programmatic Boundary for the Surface Water and Treated Effluent Monitoring Program | | | 4-5 |
| 4.4 | Program Expectations and Design Considerations | | | 4-8 |
| | 4.4.1 | Program Expectations | | 4-8 |
| | 4.4.2 | Design Considerations | | 4-9 |
| | | 4.4.2.1 | Constituents of Concern | 4-9 |
| | | 4.4.2.2 | Surface Water Cross-Media Impact | 4-9 |
| | | 4.4.2.3 | Sporadic Exceedances of FRLs and BTVs | 4-14 |
| | | 4.4.2.4 | Impacts to Surface Water due to Uncontrolled Storm Water Runoff and Remediation Activities | 4-19 |
| | | 4.4.2.5 | Ongoing Background Evaluation | 4-23 |

**TABLE OF CONTENTS**
**(Continued)**


| | Page |
|---|---|
| 4.4.2.6 Continue to Fulfill National Pollutant Discharge Elimination System Requirements | 4-25 |
| 4.4.2.7 Continue to Fulfill Federal Facilities Compliance Agreement and Operable Unit 5 Record of Decision Requirements | 4-25 |
| 4.4.2.8 Continue to Fulfill DOE Order 5400.1 Requirements | 4-27 |
| 4.4.2.9 Continue to Address Concerns of the Community | 4-27 |
| 4.4.3 Program Design | 4-27 |
| 4.5 Media-Specific Plan for Surface Water and Treated Effluent Sampling | 4-28 |
| 4.5.1 Project Organization | 4-28 |
| 4.5.2 Sampling Program | 4-29 |
| 4.5.2.1 Sampling Procedures | 4-34 |
| 4.5.2.2 IEMP Quality Control Sampling Requirements | 4-35 |
| 4.5.2.3 Decontamination | 4-35 |
| 4.5.2.4 Waste Dispositioning | 4-36 |
| 4.5.3 Change Control | 4-36 |
| 4.5.4 Health and Safety Considerations | 4-36 |
| 4.5.5 Data Management | 4-37 |
| 4.5.6 Quality Assurance | 4-38 |
| 4.6 IEMP Surface Water and Treated Effluent Monitoring Data Evaluation and Reporting | 4-38 |
| 4.6.1 Data Evaluation | 4-38 |
| 4.6.2 Reporting | 4-42 |
| 5.0 Sediment Monitoring Program | 5-1 |
| 5.1 Integration Objectives for the Sediment Monitoring Program | 5-1 |
| 5.2 Analysis of Regulatory Drivers, DOE Policies, and Other FEMP-Specific Agreements | 5-2 |
| 5.2.1 Approach | 5-2 |
| 5.2.2 Results | 5-3 |
| 5.3 Programmatic Boundary for the Sediment Monitoring Program | 5-4 |
| 5.4 Program Expectations and Design Considerations | 5-5 |
| 5.4.1 Program Expectations | 5-5 |
| 5.4.2 Sediment Program Design Considerations | 5-6 |
| 5.4.3 Sediment Program Design | 5-8 |
| 5.5 Media-Specific Plan for Sediment Monitoring | 5-10 |
| 5.5.1 Project Organization | 5-10 |
| 5.5.2 Sampling Program | 5-11 |
| 5.5.2.1 Sampling Procedures | 5-14 |
| 5.5.2.2 Quality Control Sampling Requirements | 5-14 |
| 5.5.2.3 Decontamination | 5-15 |
| 5.5.2.4 Waste Dispositioning | 5-15 |
| 5.5.3 Change Control | 5-15 |
| 5.5.4 Health and Safety Considerations | 5-16 |
| 5.5.5 Data Management | 5-16 |
| 5.5.6 Quality Assurance | 5-17 |

# TABLE OF CONTENTS
## (Continued)


| | Page |
|---|---|
| 5.6 IEMP Sediment Monitoring Data Evaluation and Reporting | 5-18 |
| 5.6.1 Data Evaluation | 5-18 |
| 5.6.2 Reporting | 5-20 |
| 6.0 Air Monitoring Program | 6-1 |
| 6.1 Integration Objectives for Air | 6-1 |
| 6.2 Analysis of Regulatory Drivers, DOE Orders, and other FEMP-Specific Agreements | 6-2 |
| 6.2.1 Approach | 6-3 |
| 6.2.2 Results | 6-3 |
| 6.3 Boundary Definition | 6-6 |
| 6.4 Program Expectations and Design Considerations | 6-10 |
| 6.4.1 Program Expectations | 6-10 |
| 6.4.2 Program Design | 6-11 |
| 6.4.2.1 Radiological Air Particulate Monitoring Design Summary | 6-11 |
| 6.4.2.2 Radon Monitoring Design Summary | 6-17 |
| 6.4.2.3 Direct-Radiation Monitoring Design Summary | 6-20 |
| 6.4.2.4 Meteorological Monitoring Program Design Summary | 6-23 |
| 6.5 Media-Specific Plan for Sitewide Environmental Air Monitoring | 6-23 |
| 6.5.1 Project Organization | 6-24 |
| 6.5.2 Sampling Program – Radiological Air Particulates | 6-25 |
| 6.5.2.1 Sampling Procedures – Radiological Air Particulates | 6-26 |
| 6.5.2.2 Quality Control Sampling Requirements – Radiological Air Particulates | 6-27 |
| 6.5.2.3 Decontamination | 6-27 |
| 6.5.2.4 Waste Dispositioning | 6-27 |
| 6.5.3 Sampling Program – Radon Monitoring | 6-28 |
| 6.5.3.1 Sampling Procedures – Radon Monitoring | 6-28 |
| 6.5.3.2 Quality Control Sampling Requirements – Radon Monitoring | 6-29 |
| 6.5.4 Sampling Program – Direct Radiation (TLDs) | 6-28 |
| 6.5.4.1 Sampling Procedures – Direct Radiation (TLDs) | 6-29 |
| 6.5.4.2 Quality Control Sampling Requirements – Direct Radiation (TLDs) | 6-30 |
| 6.5.4.3 Decontamination | 6-31 |
| 6.5.4.4 Waste Dispositioning | 6-31 |
| 6.5.5 Change Control | 6-31 |
| 6.5.6 Health and Safety Considerations | 6-32 |
| 6.5.7 Data Management | 6-32 |
| 6.5.8 Quality Assurance | 6-33 |
| 6.6 IEMP Air Monitoring Data Evaluation and Reporting | 6-34 |
| 6.6.1 Data Evaluation | 6-34 |
| 6.6.1.1 Radiological Air Particulate Data Evaluation | 6-34 |
| 6.6.1.2 Radon Data Evaluation | 6-37 |
| 6.6.1.3 Direct Radiation Monitoring Data Evaluation | 6-39 |
| 6.6.2 Reporting | 6-41 |

# TABLE OF CONTENTS
(Continued)


| | Page |
|---|---|
| 7.0 Biota Monitoring Program | 7-1 |
| 7.1 Integration Objectives for the Biota Monitoring Program | 7-1 |
| 7.2 Analysis of Regulatory Drivers, DOE Orders, and Other FEMP-Specific Agreements | 7-1 |
| 7.2.1 Approach | 7-1 |
| 7.2.2 Results | 7-2 |
| 7.3 Programmatic Boundary for the Biota Monitoring Program | 7-3 |
| 7.4 Program Expectations and Design Considerations | 7-3 |
| 7.4.1 Biota Monitoring Program Expectations | 7-3 |
| 7.4.2 Biota Monitoring Program Design Considerations | 7-4 |
| 7.4.3 Biota Monitoring Program Design | 7-5 |
| 7.5 Media-Specific Plan for Produce Sampling | 7-5 |
| 7.5.1 Project Organization | 7-6 |
| 7.5.2 Sampling Program | 7-6 |
| 7.5.2.1 Sampling Procedures | 7-8 |
| 7.5.2.2 Quality Control Sampling Requirements | 7-9 |
| 7.5.2.3 Decontamination | 7-9 |
| 7.5.2.4 Waste Dispositioning | 7-10 |
| 7.5.3 Change Control | 7-10 |
| 7.5.4 Health and Safety Considerations | 7-10 |
| 7.5.5 Data Management | 7-11 |
| 7.5.6 Quality Assurance | 7-11 |
| 7.6 IEMP Biota Monitoring Data Evaluation and Reporting | 7-12 |
| 7.6.1 Data Evaluation | 7-12 |
| 7.6.2 Reporting | 7-13 |
| 8.0 Program Summary and Reporting | 8-1 |
| 8.1 Introduction | 8-1 |
| 8.2 Program Design | 8-1 |
| 8.2.1 Programmatic Boundaries | 8-1 |
| 8.2.2 IEMP Monitoring Summary for 2003 and 2004 | 8-2 |
| 8.2.3 Program Review and Revision | 8-3 |
| 8.3 Reporting | 8-4 |
| 8.3.1 Regulatory Drivers for Reporting Monitoring Data | 8-4 |
| 8.3.2 Reporting Responsibilities | 8-5 |
| 8.3.3 IEMP Reporting | 8-6 |
| References | R-1 |

Appendices

A Detailed Explanation of Constituent Selection for Groundwater Monitoring
B Surface Water FRL and BTV Exceedances
C Dose Assessment
D Natural Resource Monitoring Plan


000007

# LIST OF FIGURES


| | | Page |
|---|---|---|
| Figure 2-1 | Fernald Schedule for Site Closure in 2006 | 2-2 |
| Figure 2-2 | Planned FEMP Remediation Activities for 2003 and 2004 | 2-13 |
| Figure 3-1 | Location of Aquifer Restoration Modules | 3-2 |
| Figure 3-2 | Total Uranium Plume Map, Modified from Fourth Quarter 2001 to Include South Field Phase-II Design Findings | 3-12 |
| Figure 3-3 | Extraction and Re-Injection Well Locations | 3-15 |
| Figure 3-4 | Groundwater Aquifer Zones and Aquifer Restoration Footprint | 3-19 |
| Figure 3-5 | Locations for Semi-Annual Total Uranium Monitoring Only | 3-35 |
| Figure 3-6 | Locations for Semi-Annual Uranium and Non-Uranium Monitoring Property/Plume Boundary, South Field, and Waste Storage Area | 3-37 |
| Figure 3-7 | Re-Injection Module Monitoring Wells and Direct Push Sampling Locations | 3-39 |
| Figure 3-8 | Groundwater Elevation Monitoring Wells | 3-44 |
| Figure 3-9 | General Groundwater Monitoring Decision-Making Process for 2003 and 2004 | 3-58 |
| Figure 3-10 | Aquifer Restoration Decision-Making Process | 3-62 |
| Figure 4-1 | Sitewide Remediation Areas | 4-6 |
| Figure 4-2 | Anticipated Controlled Runoff Areas and Uncontrolled Flow Directions as of January 1, 2003 | 4-7 |
| Figure 4-3 | Area where Glacial Overburden has been Removed by Erosion | 4-13 |
| Figure 4-4 | IEMP Surface Water and Treated Effluent Sample Locations | 4-20 |
| Figure 4-5 | Comparison of Average Total Uranium Concentrations in Paddys Run at Willey Road Sample Location SWP-03 | 4-22 |
| Figure 4-6 | IEMP Background Surface Water Sample Locations | 4-24 |
| Figure 4-7 | NPDES Permit Sample Locations | 4-26 |
| Figure 4-8 | IEMP Surface Water Data Evaluation and Associated Actions | 4-40 |
| Figure 5-1 | Sitewide Remediation Areas | 5-7 |
| Figure 5-2 | Sediment Sample Locations | 5-9 |
| Figure 5-3 | IEMP Sediment Data Evaluation and Associated Actions | 5-19 |
| Figure 6-1 | IEMP Air Monitoring Locations | 6-12 |
| Figure 6-2 | Average FEMP Wind Rose Data, 1997-2001 | 6-13 |
| Figure 6-3 | Radon Monitoring – Continuous Alpha Scintillation Locations | 6-18 |
| Figure 6-4 | Direct Radiation (Thermoluminescent Dosimeter) Monitoring Locations | 6-22 |
| Figure 6-5 | IEMP Air Particulate Data Evaluation and Associated Actions | 6-36 |
| Figure 6-6 | IEMP Radon Data Evaluation and Associated Actions | 6-38 |
| Figure 6-7 | IEMP TLD Data Evaluation and Associated Actions | 6-40 |
| Figure 7-1 | Produce Monitoring Locations | 7-7 |
| Figure 8-1 | IEMP Reporting Schedule for 2003 and 2004 | 8-8 |

# LIST OF TABLES


| | | Page |
|---|---|---|
| Table 2-1 | FEMP Operable Unit Remedies and Associated Project Responsibilities | 2-3 |
| Table 2-2 | FEMP Integrated Remediation Field Activities for 2003 and 2004 | 2-11 |
| Table 3-1 | FEMP Groundwater Monitoring Program Regulatory Drivers and Actions | 3-6 |
| Table 3-2 | Groundwater FRL Exceedances Based on Samples and Locations since IEMP Inception (from August 1997 thru 2001) | 3-22 |
| Table 3-3 | IEMP Constituents with FRL Exceedances, Location of Exceedances, and Revised Monitoring Program | 3-26 |
| Table 3-4 | Listing of IEMP Groundwater Wells | 3-28 |
| Table 3-5 | Monitoring Requirements | 3-32 |
| Table 3-6 | Listing of Groundwater Monitoring Wells to be Sampled for Total-Uranium Only | 3-34 |
| Table 3-6 | Analytical Requirements for the Groundwater Monitoring Program | 3-47 |
| Table 4-1 | FEMP Surface Water and Treated Effluent Monitoring Regulatory Drivers and Responsibilities | 4-4 |
| Table 4-2 | Surface Water Selection Criteria Summary | 4-10 |
| Table 4-3 | Summary of Surface Water and Treated Effluent Sampling Requirements by Location | 4-15 |
| Table 4-4 | Surface Water Analytical Requirements for Constituents at Sample Locations SWD-01, SWD-02, SWD-03, SWP-01, SWP-02, SWP-03 and SWR-01 | 4-30 |
| Table 4-5 | Surface Water and Effluent Analytical Requirements for Constituents at Sample Locations PF 4001, STP 4601, STRM 4003, STRM 4004, STRM 4005, STRM 4006, SWRB 4002O, SWRB 4002B, SWR-4801, and SWR-4902 | 4-32 |
| Table 5-1 | FEMP Sediment Monitoring Program Regulatory Drivers and Responsibilities | 5-5 |
| Table 5-2 | Annual Sediment Sampling Program Design | 5-12 |
| Table 5-3 | Sediment Sample Analytical Requirements | 5-13 |
| Table 6-1 | FEMP Monitoring Program Regulatory Drivers and Responsibilities | 6-7 |
| Table 6-2 | Sampling and Analytical Summary for Radiological Air Particulate Samples | 6-17 |
| Table 6-3 | Sampling Analytical Summary for Continuous Radon Detectors | 6-20 |
| Table 6-4 | Analytical Summary for Direct Radiation (TLD) | 6-21 |
| Table 6-5 | Technical Specifications for Radiological Air Particulate Monitoring | 6-26 |
| Table 7-1 | FEMP Biota Monitoring Program Regulatory Drivers and Responsibilities | 7-3 |
| Table 7-2 | Annual Produce Sample Analytical Requirements | 7-8 |

# LIST OF ACRONYMS

| | |
|---|---|
| AMS | air monitoring station |
| ANSI | American National Standards Institute |
| ARAR | applicable or relevant and appropriate requirement |
| ARPA | Archaeological Resources Protection Act |
| ARP | Aquifer Restoration Project |
| ASL | analytical support level |
| AWWT | advanced wastewater treatment facility |
| BAT | Best Available Technology |
| BTVs | benchmark toxicity values |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| CPRD | continuous passive radon detector |
| CWA | Clean Water Act |
| D&D | decontamination and dismantling |
| DCF | dose conversion factors |
| DOE | U.S. Department of Energy |
| EMP | Fernald Site Environmental Monitoring Plan |
| EPA | U.S. Environmental Protection Agency |
| FEMP | Fernald Environmental Management Project |
| FFA | Federal Facility Agreement |
| FFCA | Federal Facility Compliance Agreement |
| FRL | final remediation level |
| GPMPP | Groundwater Protection Management Program Plan |
| HAMDC | Highest Allowable Minimum Detection Concentration |
| IEMP | Integrated Environmental Monitoring Plan |
| MCL | maximum contaminant level |
| MDC | minimum detectable concentration |
| NAGPRA | Native American Graves Protection and Repatriation Act |
| NEPA | National Environmental Policy Act |
| NESHAP | National Emissions Standards Hazardous Air Pollutant |
| NHPA | National Historic Preservation Act |
| NPDES | National Pollutant Discharge Elimination System |
| NRMP | National Resource Monitoring Plan |
| NRRP | Natural Resource Restoration Plan |
| NTU | Nephelometric Turbidity Units |
| O&M | operations and maintenance |
| OAC | Ohio Administrative Code |
| OEPA | Ohio Environmental Protection Agency |

## LIST OF ACRONYMS
## (Continued)

| | |
|---|---|
| ORC | Ohio Revised Code |
| OSDF | on-site disposal facility |
| OU | Operable Unit |
| PRG | preliminary remediation goal |
| PRRS | Paddys Run Road Site |
| PSP | project specific plan |
| RI/FS | remedial investigation/feasibility study |
| RCRA | Resource Conservation and Recovery Act |
| SCQ | FEMP Sitewide CERCLA Quality Assurance Project Plan |
| SWIFT | Sandia Waste Isolation Flow and Transport |
| TLD | thermoluminescent dosimeter |
| WPRAP | Waste Pits Remedial Action Project |
| cm | centimeter |
| $m^3$ | cubic meter |
| Ci/g | Curies per gram |
| m/min | meters per minute |
| μg/g | micrograms per gram |
| μg/L | micrograms per liter |
| μm | micron |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| mrem | millirem |
| pCi/g | picoCuries per gram |
| pCi/kg | picoCuries per kilogram |
| pCi/L | picoCuries per liter |
| $pCi/m^2/sec$ | picoCuries per square meter per second |

Section 1.0

# 1.0 INTRODUCTION

## 1.1 BACKGROUND

The U.S. Department of Energy's (DOE's) Fernald Environmental Management Project (FEMP) has completed its remedial investigation/feasibility study obligations, and final records of decision for all five FEMP operable units are now in place. Since 1997, the project's focus has been on the safe and efficient execution of site remediation including facility decontamination and dismantling, the design and construction of waste processing and disposal facilities, waste excavation and shipping, and continuation of groundwater remediation. In recognition of this increased focus on remedy implementation, DOE developed an integrated environmental monitoring strategy tailored to the near-term cleanup actions planned for the FEMP. The monitoring strategy was initially documented in the first issue of the Integrated Environmental Monitoring Plan (IEMP) in 1997 followed by updated monitoring programs included in subsequent revisions in 1999 and 2001 based on the planned two-year revision cycle. The biennial revision cycle continues to be essential to adjust the IEMP monitoring programs as cleanup progresses, particularly under the current 2006 site closure schedule.

Since the last revision of the IEMP (effective January 2001), DOE has put a performance-based contract structure in place in which the closure contractor is incentivized to achieve closure of the Fernald site by 2006. The definition of site closure is included in the Fernald closure contract and summarized in the Fernald Closure Project Performance Management Plan (DOE 2002b). With the exception of the Silos 1 & 2 and Silo 3 projects, which are in the design phase, all remediation projects are mature and being successfully implemented. Accordingly, the environmental effects of these ongoing remediation activities on the various environmental pathways are better understood. Three or more years of environmental data have now been collected and assessed while several remedial actions have been concurrently implemented.

As with past IEMP revisions, this current IEMP revision directs environmental monitoring program elements toward sitewide remediation activities and incorporates any new regulatory requirements for sitewide monitoring, reporting, and remedy performance tracking activated by the formal applicable or relevant and appropriate requirements (ARARs) identified in the FEMP's remedy selection documents. The current IEMP emphasis is on tailoring the sitewide monitoring needs to the active remediation projects in 2003 and 2004 with respect to their potential to emit or discharge contaminants. The IEMP also serves as the reporting link for selected project-specific emission control monitoring activities that will accompany remediation and decontamination and demolition projects during the FEMP cleanup.

The basis for the current understanding of environmental conditions at the FEMP is the extensive site environmental data that have been collected. The data were collected over a 10-year period through the remedial investigation process required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, combined with five years of subsequent routine environmental monitoring data collected through the IEMP. The remedial investigation data culminated in the selection of a final remedy for the FEMP's environmental media, with the issuance of the Final Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996b) in January of 1996. Operable Unit 5 includes all environmental media, contaminant transport pathways, and environmental receptors (soil, groundwater, surface water, sediment, air, and biota) at and around the FEMP that have been affected by past uranium production operations. The remedy for Operable Unit 5 defines final sitewide cleanup levels and establishes the general areal extent of on- and off-property actions necessary to mitigate environmental impacts caused by site production activities.

The IEMP is a formal remedial design deliverable required to fulfill Task 9 of the Remedial Design Work Plan for Remedial Actions at Operable Unit 5 (DOE 1996c). This revision to the IEMP (Revision 3) provides an update to the original IEMP (approved in August of 1997) as required by the Remedial Design Work Plan and DOE Order 5400.1.

## 1.2 PROGRAM OBJECTIVES AND SCOPE

As the mature remediation projects continue to execute cleanup actions, or prepare to initiate their remedy as is the case with the silos projects, the need for accurate, accessible, and manageable environmental monitoring information will continues to be essential. The IEMP has been formulated to meet this need and will serve several comprehensive functions for the site over the life of the FEMP's accelerated remediation program:

- Maintain the FEMP's commitment to a remediation-focused environmental surveillance monitoring program that is consistent with DOE Orders 5400.1 and 5400.5 and continues to address stakeholder concerns. Both orders are listed as "to be considered-based" criteria in all FEMP records of decision, and therefore are key drivers for the scope of the monitoring program.

- Fulfill additional sitewide monitoring and reporting requirements activated by the CERCLA ARARs for each FEMP record of decision

- Provide the mechanism for assessing the performance of the Great Miami Aquifer groundwater remedy, including determining when restoration activities are complete

- Provide a reporting mechanism for many environmental regulatory compliance monitoring activities (i.e., on-site disposal facility groundwater monitoring; Federal Facility Compliance Agreement (FFCA) and elements of the National Pollutant Discharge Elimination System

discharge reporting; and the air-pathway-specific dose estimates required under National Emissions Standards for Hazardous Air Pollutants [NESHAP] Subpart H) with the environmental reporting for DOE Order 5400.1

- Provide a reporting interface for various project-specific emission control monitoring activities that, because of ARAR requirements, will be implemented at project locations under approved project-specific remedial design plans.

Under the IEMP, data showing the baseline environmental conditions at the FEMP are collected and maintained, and contaminant releases attributable to remedial activities at the FEMP are evaluated and compared against established thresholds. DOE fulfills its obligation to document most environmental monitoring information under the umbrella of the IEMP reports. The monitoring program is designed to appraise and report upon the effectiveness of the administrative and engineering emission controls accompanying the individual remediation projects.

Several remediation-based environmental activities fall outside the scope of the IEMP. These activities include:

- Some project-specific emission-control monitoring activities, which because of ARARs, are being implemented under project-specific design plans outside of the IEMP. These projects and accompanying remedial design plans are identified and their reporting interfaces with the IEMP are described in subsequent sections of this document.

- The soil remediation pre-certification and certification sampling program which is being conducted as part of the work scope of the Soil & Disposal Facility Project

- The ambient air sampling and direct radiation measurements conducted for worker health and safety purposes as part of the FEMP's occupational monitoring program

- The FEMP's spill and chemical release reporting required under Superfund Amendment and Reauthorization Act Title III.

Each of these efforts will continue to be conducted outside the formal scope of the IEMP, although the results of the efforts will be factored, as necessary, into the sitewide interpretations provided in IEMP reports.

In addition to the environmental activities specifically excluded from the scope of the IEMP, boundary conditions throughout the IEMP further define the IEMP scope. These boundary conditions are:

- The administrative boundary lies between remedial actions for groundwater south of the FEMP and those potential remedial actions associated with the Paddys Run Road Site plume. This boundary is shown in the Feasibility Study Report for Operable Unit 5 (DOE 1995b) and Proposed Plan for Operable Unit 5 (DOE 1995c).
- The programmatic boundary refers to the differentiation between the scope and responsibility associated with the design, implementation, and documentation of environmental monitoring activities. Monitoring activities are designated as project-specific (associated with emission controls at the project) or IEMP (associated with monitoring the collective impact on a particular environmental medium resulting from all remediation activities). The designation is based on an evaluation of the pertinent regulatory drivers and DOE policies that have monitoring implications.
- The geographic boundary refers to the physical boundary of a project or activity.

Sitewide environmental monitoring, which generally refers to the IEMP monitoring programs, measures the collective environmental impacts resulting from all remediation activities.

## 1.3 RELATIONSHIP TO PROJECT-SPECIFIC REMEDIAL PROGRAMS

To define the interface between the IEMP and the individual remediation projects, the monitoring-related ARARs in the FEMP's records of decision were evaluated. During the ARARs analysis, monitoring requirements were evaluated to determine if they had sitewide implications, and therefore, fell under the scope of the IEMP, or pertained to project-specific monitoring as part of the emission controls implemented by individual remediation projects. The results of these evaluations are presented for each environmental medium in Sections 3.0 through 7.0.

The programmatic boundary established through the IEMP designates which monitoring activities will be the responsibilities of the remediation projects. Establishing this boundary ensures:

- The roles and responsibilities for designing, implementing, and reporting upon monitoring activities are explicitly understood by the FEMP project organizations, their regulatory counterparts, and FEMP stakeholders
- That all regulatory obligations for conducting and documenting the results of monitoring activities are identified and met
- That monitoring and reporting activities are integrated to promote efficiency of execution and support consistency in technical approach and data interpretations.

To fully delineate this programmatic boundary, it is necessary to clearly define the scope of monitoring activities that will be executed by individual remediation projects and their relationship to the IEMP. Project-specific monitoring activities are divided into compliance monitoring and process control monitoring categories.

Project-specific compliance monitoring will be implemented by remediation projects to meet the requirements of monitoring-related ARARs designated as project-specific through the ARARs analysis presented in each media-specific section of the IEMP. The results of the ARARs analysis provides the basis for determining when project-specific compliance monitoring programs will be developed. If there is no project-specific responsibility for monitoring identified through the ARARs analysis, then no project-specific compliance-monitoring program will be developed. For those ARARs designated as project-specific, the affected remediation project is responsible for designing, implementing, and documenting the monitoring program in compliance with the requirement and for identifying any programmatic interface with the IEMP. This responsibility includes meeting all reporting obligations for demonstrating compliance with the given requirement.

Project-specific process control monitoring is designed and implemented by the individual remediation project to provide timely feedback on the performance of a remediation treatment process or operation relative to a design specification. This information is used to adjust the process or operation to ensure that conditions remain within specified operating parameters. In general, process control schemes rely on real-time or near real-time measurements or quick turnaround analytical methods that provide prompt feedback on system performance. Due to the need for a quick response, process control measurements primarily occur within a treatment process or operation. However, under certain circumstances, monitoring of environmental media at or near a project boundary may be appropriate within the process control scheme of a specific project operation. The following criteria provide the basis for determining when project-specific process control monitoring within environmental media will be considered by the affected projects.

- Projects processing and/or treating waste materials (such as process residues) which pose a significant risk to human health and/or the environment. These projects are associated with remediation activities for Operable Units 1 and 4.
- When, due to the location of the remediation activity on the FEMP property, it is likely that emissions from the project will not be assessed through the sitewide monitoring programs defined under the IEMP.

While the criteria listed above provide a basis for determining when additional project-specific environmental monitoring (beyond that required to meet ARAR obligations) may be implemented, it is not

intended to limit the range or scope of potential monitoring activities that may be implemented to successfully complete site remediation. Additional process control monitoring may be proposed in response to changes in the remedial design or discovery of unanticipated field conditions.

The IEMP provides a reporting link for project-specific compliance and process control results, as necessary, to fulfill its responsibility for providing a comprehensive evaluation of sitewide environmental conditions. Each remediation project will continue to be responsible for the design and execution of its own monitoring activities required to demonstrate compliance with its respective project-specific monitoring ARARs and to obtain the necessary immediate feedback required for effective process control. The information collected through both project-specific and IEMP monitoring programs will be used to support a remedial action decision-making process during active site remediation. The role of each monitoring program and the range of decisions encompassed within this process are discussed in detail in Section 1.5.

## 1.4 PLAN ORGANIZATION

The IEMP is comprised of eight sections and four appendices. The remaining sections and their contents are as follows:

Section 2.0 Summary of the FEMP Remedial Strategy: provides a description of the individual remediation projects for each of the FEMP's five operable units, a status summary of the project-specific monitoring that is planned for each project, and a two-year ( 2003 and 2004) forecast of the remediation activities planned for each major project

Section 3.0 Groundwater Monitoring Program: provides a description of the monitoring activities necessary to track the progress of the restoration of the Great Miami Aquifer and discusses the groundwater monitoring activities necessary to maintain compliance with Resource Conservation and Recovery Act (RCRA) requirements as specified in the Ohio Environmental Protection Agency (OEPA) Director's Findings and Orders dated September 2000; and integration with the groundwater monitoring program for the on-site disposal facility

Section 4.0 Surface Water and Treated Effluent Monitoring Program: provides a description of the routine sitewide surface water monitoring to be performed during active remediation of the FEMP and to maintain compliance with treated-effluent surface water discharge requirements

Section 5.0 Sediment Monitoring Program: provides a description of the routine sitewide sediment monitoring activities to independently verify the overall effectiveness of the sediment controls accompanying the FEMP's remedial construction and excavation activities

Section 6.0 Air Monitoring Program: provides a description of the sitewide air monitoring to be conducted during active remediation of the FEMP and includes a description of the plan for particulate, radon, and direct radiation measurements and the continuation of the FEMP's meteorological monitoring program

Section 7.0 Biota Monitoring Program: identifies the scope of monitoring activities that will be maintained during remediation to verify the continued protection of local produce grown in proximity to the FEMP

Section 8.0 Program Summary and Reporting: summarizes the program design, scope of each media monitoring program, and provides a detailed accounting of the reporting elements included within the IEMP reporting framework

Appendix A Revised Groundwater Monitoring Approach

Appendix B Surface Water Final Remediation Level (FRL) and Benchmark Toxicity Value (BTV) Exceedances

Appendix C Dose Assessment: summarizes the IEMP's responsibility for preparing the FEMP's annual radiological dose assessment related to remediation activities to comply with NESHAP Subpart H requirements and the intention of DOE Order 5400.5

Appendix D Natural Resource Monitoring Plan (NRMP): provides the regulatory requirements and strategy for the monitoring of ecological impacts to wetlands, threatened and endangered species, and terrestrial and aquatic habitats. The NRMP also outlines additional provisions for reporting these monitoring results to FEMP Natural Resource Trustees. Additionally, the NRMP identifies the relationship of this monitoring effort with other relevant documents, such as the Sloan's Crayfish Management Plan.

As this format indicates, the IEMP is organized according to the principal environmental media and contaminant migration pathways routinely examined under the program. For each of the media comprising the program, evaluations of the regulatory drivers and pertinent DOE policies that govern environmental monitoring for that media were conducted. Findings were made regarding those drivers that have sitewide implications and those that are project-specific in scope (and therefore fall outside the domain of the IEMP). This evaluation was used to define, for each media, the ARAR-driven administrative boundaries that separate the project-specific emission control monitoring activities from those sitewide environmental monitoring activities that are the responsibility of the IEMP. The results of these responsibility- and boundary-definition evaluations are presented in detail for each respective media in Sections 3.0 through 7.0.

The baseline schedule (as of September 2002), regulatory drivers and expectations of stakeholders were evaluated to define the 2003 and 2004 IEMP scope for each environmental media. A Media-Specific Plan was prepared for each media to define detailed program implementation requirements. The details and results of this evaluation are individually presented for each media in the Media-Specific Plan sections (Sections 3.0 through 7.0).

## 1.5 ROLE OF THE IEMP IN REMEDIAL ACTION DECISION MAKING

As indicated in Section 1.2, one of the primary responsibilities of the IEMP is to document that the FEMP's cumulative environmental emissions resulting from the implementation of multiple, concurrent, remedial action projects at the site do not exceed the FEMP's regulatory-based limits or result in unacceptable off-site conditions. Fundamental to this role is the recognition that each individual remedial action project at the FEMP is expected to be implemented and operated in full compliance with its project-specific emission control requirements for the respective environmental pathways of concern. It is thus the responsibility of the individual remedial design documents (required by the CERCLA Remedial Design Work Plans for each of the FEMP's five operable units) to convey the project-specific measures for satisfying worker's health and safety, process control, and environmental protection requirements accompanying each remedial action project. Under this fundamental expectation, the IEMP can then serve to provide independent oversight assurance that there are no undesirable compounding environmental effects resulting from the concurrent implementation and operation of otherwise fully compliant individual projects.

In light of this oversight responsibility, the data generated through the IEMP are expected to support a number of management decisions regarding the progressive implementation strategy, sequence, and overall management control of the FEMP's individual remedial action projects. This subsection highlights: 1) the key management decisions that will be supported by the IEMP; 2) the organizational responsibilities for making the decisions; 3) the framework and criteria needed to facilitate the decisions; and 4) the communication process for internally conveying the results of the decisions to the respective project organizations and externally to the FEMP's stakeholders. Each of the individual environmental media sections of this plan (Sections 3.0 through 7.0) provide detailed discussions of the specific IEMP data-use and decision-making criteria that are relevant to that particular media.

### 1.5.1 What are the Management Decisions that the IEMP Will Support?

In its role of compiling the information necessary to assess cumulative sitewide impacts, the IEMP will be expected to support the following key management decisions:

- From a sitewide perspective, is the FEMP maintaining compliance with its various regulatory requirements for emission control and environmental monitoring?
- Are there any trends in the sitewide environmental monitoring data that indicate the potential for an unacceptable future condition?
- In the event of a regulatory non-compliance situation or potentially unacceptable cumulative trend, what activities or projects are the principal contributors to the situation?

- What specific response actions must be taken to address the situation, and which projects are affected?
- What communications are necessary with regulatory agencies or other concerned stakeholders as a result of the situation and/or decisions made?

The response action decisions necessary to address potentially undesirable cumulative effects could involve:

- Upgrading project-specific emissions controls (beyond those that are regulatory based) for one or more projects to reduce cumulative emissions further
- Slowing the pace of activities within one or more remedial projects for a specified period of time
- Altering the number or variety of active projects underway at a particular time
- Continued monitoring of cumulative data trends.

As discussed in the next subsection, FEMP decision-makers will be conducting ongoing evaluations of the data generated by both the projects and the IEMP to ensure satisfactory operating conditions are maintained during remedy implementation.

### 1.5.2 Who is Responsible for Making the Decisions?

The FEMP's sitewide environmental data is used by FEMP management personnel to closely monitor the acceptability of the various remedial projects underway at any particular time. Thus, the bulk of the day-to-day planning and routine operating decisions will be internal to the FEMP, with process adjustments implemented as necessary on a situation-specific, as-needed basis.

It is anticipated that in the vast majority of cases, the data evaluation will conclude that all regulatory requirements are being met and that no unacceptable cumulative trends in the monitoring data are present. The FEMP's evaluation and conclusions will be documented for regulatory agency concurrence through the normal reporting mechanisms described in this plan.

The FEMP will notify the U.S. Environmental Protection Agency (EPA) and the OEPA immediately (prior to taking an action internally) for three important, albeit unlikely, situations:

- The FEMP's evaluation indicates that a regulatory schedule milestone is in jeopardy of attainment because of the mitigative actions necessary to address an adverse cumulative situation

- For the air pathway, the FEMP's data evaluation indicates that an actual current condition has resulted in an exceedance of a NESHAP regulatory compliance limit (as opposed to an undesirable data trend indicating the potential for an unacceptable hypothetical future condition)
- For the air pathway, a projected exceedance of a NESHAP regulatory compliance level is believed to be imminent.

For these three special cases, the FEMP will: 1) identify the root cause of the unacceptable situation; 2) determine the options for addressing the problem; and 3) communicate with EPA and OEPA to arrive at a mutually acceptable decision concerning the follow-up actions to be taken. For all remaining situations (i.e., those involving the FEMP's responses to undesirable data trends for any of the environmental media), the FEMP will identify and implement appropriate actions internally and will document the decisions and resultant response actions in weekly teleconferences, in the IEMP mid-year reports and in the annual site environmental reports (Section 1.5.4).

The environmental media personnel are responsible for the ongoing review of media–specific monitoring data and the identification of any related environmental compliance issues. Similarly, the remediation projects are responsible for identifying any noncompliant situation within their project-specific monitoring program (e.g., stack emissions). The Closure Project Regulatory Management organization serves to independently review the compliance-related project-specific monitoring data and also facilitates reporting of this data. If the potential for an unacceptable future situation is identified, then the Closure Project Regulatory Management organization will facilitate the process of identifying alternatives for addressing the problem. The Closure Project Regulatory Management organization will also work closely with DOE to finalize the alternative decisions, assess their implications, and communicate the results of the evaluations as necessary to the FEMP's stakeholders and to EPA and OEPA.

### 1.5.3 What are the General Criteria for the Decisions?

The IEMP establishes, on a media-specific basis, the types of data and thresholds or regulatory limits required to support the management decisions described above. Each set of media-specific criteria are handled uniquely because of the varying media-specific locations where the regulatory criteria are applied. For example, the FEMP's most restrictive air monitoring criterion (the 10 millirem NESHAP requirements discussed in Section 6.0) is applied at locations at the site's fenceline, near where actual receptors are located. Other media-specific criteria, such as the FEMP's sediment control performance criteria, apply at the geographic boundaries of the individual projects themselves.

The media-specific sections of this plan review which monitoring requirements are to be met at the project boundaries (and thus fall under the domain of the individual projects) and which requirements fall outside the project boundaries and, because of their cumulative nature, fall under the domain of the IEMP. This responsibility distinction is facilitated by an in-depth ARAR review for each environmental media to identify applicable compliance locations and the resultant responsibilities for meeting them. Additionally, the media-specific sections define the criteria to be used to identify trends in the data that could indicate an imminent, unacceptable situation. Each of the media-specific sections specifies the frequency of the data evaluations to satisfy the FEMP's overall remediation planning and decision-making requirements. DOE will evaluate the FEMP's remediation data accordingly, and will report the results according to the approach summarized below.

### 1.5.4 How Will IEMP Decisions Be Communicated?

Each media section of this IEMP (Sections 3.0 through 7.0) present media-specific reporting components and Section 8.0 summarizes the overall reporting strategy for the IEMP. The data will be made available to the regulatory agencies on an ongoing basis in the form of electronic data files through the IEMP Data Information Site. Both IEMP mid-year data summaries and annual site environmental reports will be issued as part of the IEMP program. The reports will provide a reporting mechanism for both IEMP data and the project-specific environmental data gathered to meet project-specific regulatory compliance requirements pertinent to sitewide interpretation.

As indicated above, the majority of the management decisions made from IEMP data evaluations will be internally executed by the FEMP, as part of the FEMP's internal remediation planning and operations control practices. These internal decisions fall into two categories:

- Routine "process adjustment" decisions, which will be made by the FEMP's lead project organizations to react and respond to project-specific operating conditions and process-control objectives
- Major "project control" decisions, which may have more impact on the remediation project's continuing operations as discussed in Section 1.5.2, are the responsibility of the FEMP's Closure Project Regulatory Management organization (in collaboration with the affected project organizations) to respond to a pending adverse cumulative situation that may be developing.

The routine process adjustment decisions will not necessarily be reported as part of the IEMP mid-year or annual reporting cycles. These types of routine decisions will be maintained as part of the project organizations' daily operations logs and are considered to be a normal course of day-to-day practice to achieve project-specific operating objectives. The major project-control decisions that are the ultimate

responsibility of the Closure Project Regulatory Management organization will be summarized in IEMP mid-year data summaries and in annual site environmental reports. The decision-reporting format will include: 1) a description of the pending adverse conditions; 2) the actions taken to respond to the situation; and 3) the mitigative results obtained. All such internal decisions will be made consistent with the FEMP's enforceable work plans and ARAR compliance requirements.

Three special circumstances were identified in Section 1.5.2 that require EPA and OEPA input before response actions are taken by FEMP management. For these three circumstances, EPA and OEPA concurrence will be sought before the actions are taken. Once a mutually agreeable decision is reached, the actions will be implemented. The decision process, actions taken, and results obtained will be summarized in the next available IEMP mid-year data summary report and/or in the annual site environmental report.

The IEMP mid-year data summaries and annual site environmental reports will be furnished to EPA and OEPA in accordance with the provisions summarized in Section 8.0. The IEMP annual site environmental reports will also be available for review by the FEMP's stakeholders at the Public Environmental Information Center and to selected stakeholders via mail.

If it becomes necessary to adjust the acceptable mix of projects underway at a particular time or curtail a planned activity in response to a pending unacceptable cumulative situation, then the Closure Project Regulatory Management organization will prioritize project activities and suspend non-priority activities as necessary to avoid a noncompliance. The Closure Project Regulatory Management organization's decision will be communicated to all affected parties, including EPA and OEPA.

## 1.6 PROGRAM MODIFICATIONS AND REVISIONS

The IEMP will remain in place throughout the duration of the FEMP's remediation activities. Accordingly, the IEMP will function as a "living document" with periodic revisions as necessary to accommodate the initiation of new projects and the completion of others. As part of this living document concept, the IEMP, Revision 3, primarily focuses on the remediation activities forecasted for 2003 and 2004. The IEMP will be reviewed annually for necessary changes and revised every two years. Yearly reviews will focus on appropriateness of IEMP scope. The two-year revision cycle will provide for any change in program emphasis or allow for the scale back of monitoring activities deemed no longer appropriate based on project needs, accumulated results, or stakeholder concerns. If necessary, immediate, specific modifications to the IEMP will be made as data are reviewed. The two-year revision cycle for the IEMP will also fulfill the formal commitment for revision of the FEMP's sitewide environmental monitoring program at least every three years as intended by DOE Order 5400.1.

Section 2.0

# 2.0 SUMMARY OF FEMP REMEDIAL STRATEGY

4528

This section presents a summary of the Fernald Environmental Management Project (FEMP) remedial strategy, including descriptions of the FEMP's five operable units, the remediation projects, and associated large-scale remediation activities; and a two-year (2003 and 2004) forecast of the remediation activities planned for each major project.

## 2.1 FEMP REMEDIATION STRATEGY

The FEMP's remedial strategy reflects the culmination of all CERCLA activities at the site. This includes extensive site characterization activities to determine the nature and extent of contamination, baseline risk assessments, and detailed evaluation and screening of remedial alternatives leading to a final remedy selection as documented in the record of decision for each operable unit.

The FEMP is executing an integrated remediation strategy focusing on accelerated remedial design and action to achieve site closure in 2006 as defined in the Fernald closure contract and the Fernald Performance Management Plan (DOE 2002b). At the heart of this strategy is integrated project planning that consolidates cleanup activities and schedules across the projects. Successful implementation is dependent upon the close coordination and sequencing of remediation activities, such as on-site disposal facility preparation, facilities decontamination and dismantlement, and final soil and groundwater remediation, among all project organizations throughout the remedial design/remedial action process. The FEMP's accelerated remediation strategy is reflected in the site master schedule, which is summarized in Figure 2-1. Section 2.2 describes activities that are underway or completed.

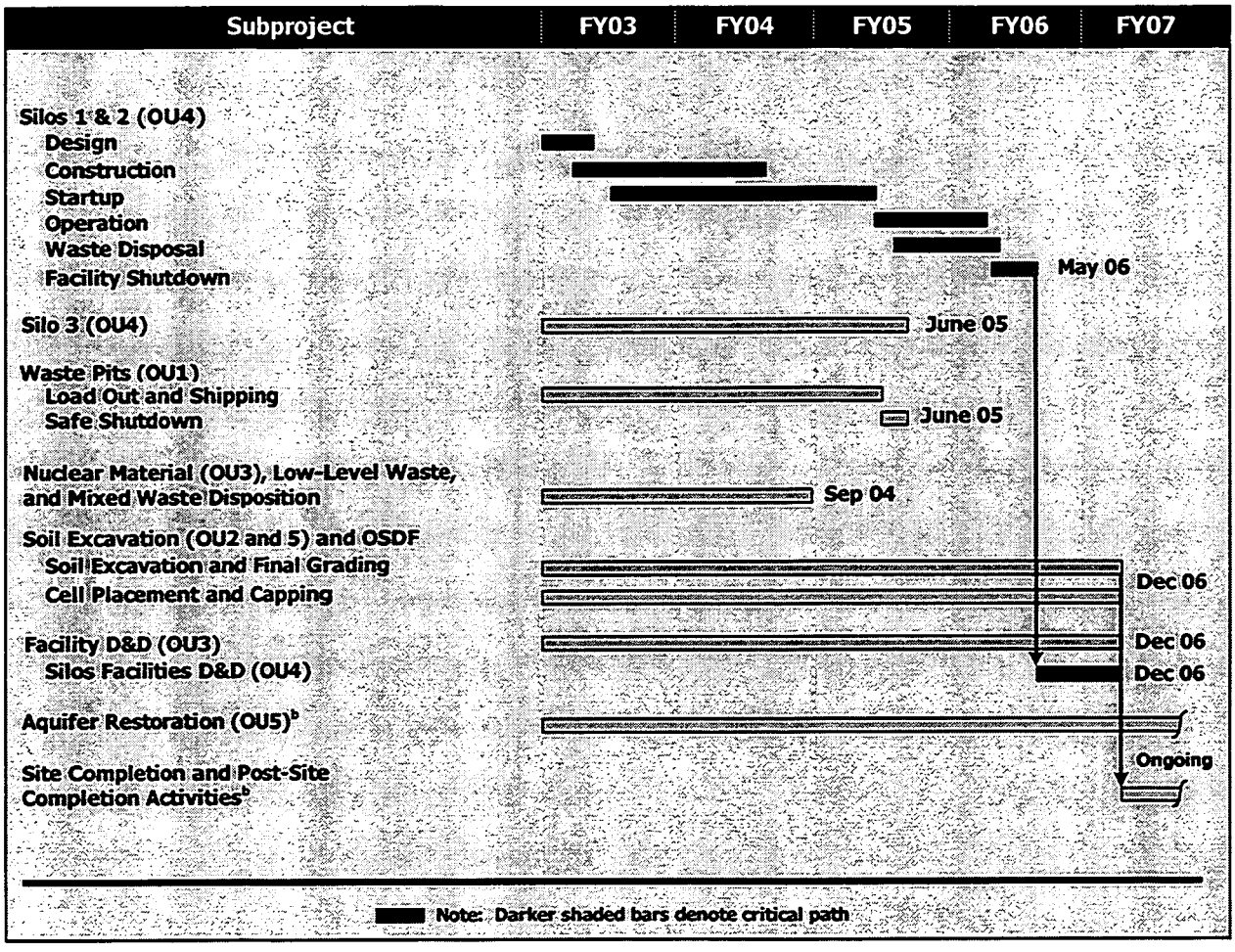
The FEMP began a projectized remedial action approach in 1997 that integrated activities among the operable units to ensure that the final adopted sitewide remedy is well reasoned, cost effective, and ensures long-term protection of human health and the environment. The project organizations, initially created in 1997, reflect the actual work processes and operations to be performed during remediation, and does not alter the requirements of the records of decision for each of the FEMP's operable units. Table 2-1 provides the crosswalk between each operable unit remedy and the FEMP's project organizations' responsibilities for implementing each remedy.

000024

4528

## FIGURE 2-1

## FERNALD SCHEDULE FOR SITE CLOSURE IN 2006[a]




[a] Based on site master schedule, July 2002. Note that schedule layout is based on fiscal year (FY) of October through September.
[b] Following the target site closure date of December 2006, groundwater pumping and treatment and limited activities will be performed in the Site Completion Phase as defined in the closure contract. Post-Site Completion includes long-term stewardship and continued operations of groundwater remediation facilities.

000025

4528

## TABLE 2-1

## FEMP OPERABLE UNIT REMEDIES AND ASSOCIATED PROJECT RESPONSIBILITIES

| Operable Unit | Description | Remedy Overview[a] | Project Organization/Responsibilities |
|---|---|---|---|
| 1 | • Waste Pits 1 – 6<br>• Clearwell<br>• Burn pit<br>• Berms, liners, caps, and soil within the boundary | Record of Decision Approved: March 1995<br><br>Excavation of materials with constituents of concern above FRLs, waste processing and treatment by thermal drying (as necessary), off-site disposal at a permitted facility, and FEMP remediation | Waste Pits Remedial Action Project is responsible for rail upgrades, excavation of Operable Unit 1 waste units, waste processing and drying, loading, rail transport, and off-site disposal of contaminated soil and debris that exceed the waste acceptance criteria for the on-site disposal facility. (Note: Some of the activities within this project are being performed by Shaw Environmental.)<br><br>Soil and Disposal Facility Project is responsible for excavation and certification of contaminated soil beneath the waste pits, as well as at- and below-grade remediation facilities.<br><br>Aquifer Restoration Project is responsible for final treatment of contaminated runoff, perched water collected during waste pit excavation, and processing wastewater discharges. Each project is responsible for transporting remediation wastewater to the head works of the advanced wastewater treatment facility for treatment.<br><br>Decontamination and Demolition Project is responsible for decontamination and dismantling of Operable Unit 1 remediation facilities. |
| 2 | • Solid waste landfill<br>• Inactive flyash pile<br>• Active flyash pile (now inactive)<br>• North and south lime sludge ponds<br>• Other South Field disposal areas<br>• Berms, liners, and soil within the operable unit boundary | Record of Decision Approved: May 1995<br><br>Excavation of all materials with constituents of concern above FRLs, treatment for size reduction and moisture control as required, on-site disposal in the on-site disposal facility, off-site disposal of a small fraction of excavated material that exceeds the waste acceptance criteria for the on-site disposal facility and lead-contaminated soil from the South Field firing range, and FEMP remediation | Soil and Disposal Facility Project is responsible for excavating and disposing of waste from all Operable Unit 2 subunits and certifying the footprints. This project is also responsible for the ongoing design, construction and maintenance, and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes; Operable Unit 5 soil and debris, and Operable Unit 3 debris.<br><br>Waste Acceptance Operations is responsible for field oversight of soil excavations, for reviewing and signing manifests for impacted material delivered to the on-site disposal facility for placement, and for rejecting any unacceptable shipments.<br><br>Aquifer Restoration Project is responsible for treating contaminated runoff and perched water collected during excavation of Operable Unit 2 subunit wastes. This project is also responsible for leachate and leak detection monitoring at the on-site disposal facility and for treating leachate from the on-site disposal facility. Each project is responsible for transporting remediation wastewater to the head works of the advanced wastewater treatment facility for treatment. |

4528

**TABLE 2-1**
**(Continued)**

| Operable Unit | Description | Remedy Overview[a] | Project Organization/Responsibilities |
|---|---|---|---|
| 3 | Former production area, associated facilities, and equipment (includes all above- and below-grade improvements) including, but not limited to:<br><br>• All structures, equipment, utilities, effluent lines, and K-65 transfer line<br>• Wastewater treatment facilities<br>• Fire training facilities<br>• Scrap metals piles<br>• Drums, tanks, solid waste, waste product, feedstocks, and thorium | Record of Decision Approved: September 1996<br><br>Adoption of Operable Unit 3 Interim Record of Decision; alternatives to disposal through the unrestricted or restricted release of materials, as economically feasible for recycling, reuse, or disposal; treatment of material for on- or off-site disposal; required off-site disposal for process residues, product materials, process-related metals, acid brick, concrete from specific locations, and any other material exceeding the on-site disposal facility waste acceptance criteria; and on-site disposal for material that meets the on-site disposal facility waste acceptance criteria | Decontamination and Demolition Project is responsible for decontamination and dismantling of all above-grade portions of buildings and facilities at the FEMP.<br><br>Soil and Disposal Facility Project is responsible for excavation and certification of soil beneath facilities and for removal of at- and below-grade structures. This project is also responsible for design, construction and maintenance, and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes, Operable Unit 5 soil, and Operable Unit 3 debris.<br><br>Waste Acceptance Operations is responsible for reviewing facility decontamination and dismantling planning documents. This organization is also responsible for field oversight of debris sizing, segregation of on-site disposal facility material categories, and prohibited items; completing field tracking logs; completing manifests for material bound for the on-site disposal facility; and compiling final records of decontamination and dismantling debris placed in the on-site disposal facility.<br><br>Aquifer Restoration Project is responsible for treating decontamination and other wastewaters during decontamination and dismantling activities and processing wastewater discharges; each decontamination and dismantling project is responsible for transporting remediation wastewater to the head works of the advanced wastewater treatment facility for treatment. |

**TABLE 2-1**
**(Continued)**

| Operable Unit | Description | Remedy Overview[a] | Project Organization/Responsibilities |
|---|---|---|---|
| 4 | • Silos 1 and 2 (containing K-65 residues)<br>• Silo 3 (containing cold metal oxides)<br>• Silo 4 (empty and never used)<br>• Decant tank system<br>• Berms and soil within the operable unit boundary | Record of Decision Approved: December 1994<br><br>Record of Decision Amendment for Silos 1 and 2 Approved: July 2000<br><br>Silo 3: Explanation of Significant Differences Approved: March 1998<br><br>Removal of Silo 3 materials for off-site disposal (elimination of on-site treatment requirement is pending an amendment to the Record of Decision requiring regulatory approval). Removal of Silos 1 and 2 residues and decant sump tank sludges with on-site stabilization of materials, residues, and sludges followed by off-site disposal; demolition and decontamination, to the extent possible, of silos and remediation facilities. An amendment to the Record of Decision is planned for regulatory review and approval to permit disposal of Silos 1 and 2 materials as 11e.(2) waste at Envirocare in Utah. Excavation of silos area contaminated soil above the FRLs with on-site disposal for contaminated soils and debris that meet the on-site disposal facility waste acceptance criteria; and site restoration. Concrete from Silos 1 and 2, and contaminated soil and debris that exceed the on-site disposal facility waste acceptance criteria will be disposed of off site. | Silos 1 and 2 Project is responsible for transfer of Silos 1 and 2 residues to temporary transfer tanks, treatment, and transport off site. Infrastructure and support systems such as roads and utilities will be completed to support the final remediation of the silos.<br><br>Silo 3 Project is responsible for Silo 3 content removal, and transport off site.<br><br>Soil and Disposal Facility Project is responsible for certification, excavation, and disposition of contaminated soil beneath the silos and for removal of subsurface structures (i.e., sub-grade silo decant system). The project is also responsible for design, construction, maintenance and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes, Operable Unit 5 soil, and Operable Unit 3 debris.<br><br>Aquifer Restoration and Wastewater Project is responsible for treating decontamination and other wastewaters during decontamination and demolition activities; each project is responsible for capturing and transporting remediation wastewater to the head works of the advanced wastewater treatment facility for treatment.<br><br>Decontamination and Demolition Project is responsible for decontamination and dismantling of all Operable Unit 4 remediation facilities and associated above ground pipings. |

4528

**TABLE 2-1**
**(Continued)**

| Operable Unit | Description | Remedy Overview[a] | Project Organization/Responsibilities |
|---|---|---|---|
| 5 | • Groundwater<br>• Surface water and sediments<br>• Soil not included in the definitions of Operable Units 1 through 4<br>• Flora and fauna | Record of Decision Approved: January 1996<br><br>An Explanation of Significant Differences document was approved on November 30, 2001 formally adopting EPA's Safe Drinking Water Act Maximum Contaminant Level for uranium of 30 µg/L as both the FRL for groundwater remediation and the uranium effluent discharge limit to the Great Miami River.<br><br>Extraction of contaminated groundwater from the Great Miami Aquifer to meet FRLs at all affected areas of the aquifer. Treatment of contaminated groundwater, storm water, and wastewater to attain concentration and mass-based discharge limits and FRLs in the Great Miami River. Excavation of contaminated soil and sediment to meet FRLs. Excavation of contaminated soil containing perched water that presents an unacceptable threat, through contaminant migration, to the underlying aquifer. On-site disposal of contaminated soil and sediment that meet the on-site disposal facility waste acceptance criteria. Soil and sediment that exceed the waste acceptance criteria for the on-site disposal facility will be treated, when possible, to meet the on-site disposal facility waste acceptance criteria or will be disposed of at an off-site facility. Also includes site restoration, institutional controls, and post-remediation maintenance | Aquifer Restoration Project is responsible for designing, installing, and operating the extraction/re-injection systems for Great Miami Aquifer groundwater restoration This project is responsible for groundwater monitoring in the Great Miami Aquifer; reporting on the progress of aquifer restoration; designing, constructing, and operating all treated effluent discharge systems, and treating and discharging contaminated groundwater, storm water, and remediation wastewaters at the FEMP. This project is also responsible for operation, maintenance, and monitoring of the on-site disposal facility leachate collection system and leak detection system.<br><br>Soil and Disposal Facility Project is responsible for certification of sitewide soil; excavation and disposition of contaminated soil, sediment, perched groundwater and at- and below-grade structures; and final site restoration. The project is also responsible for design, construction, maintenance and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes, Operable Unit 5 soil, and Operable Unit 3 debris.<br><br>Waste Acceptance Operations is responsible for reviewing Soils and Disposal Facility Project planning documents. This project is also responsible for oversight of field excavations, segregation on-site disposal facility material categories, and segregating prohibited items; completing field tracking logs; completing manifests for material bound for the on-site disposal facility; and compiling final records of soil and at- and below-grade debris placed in the on-site disposal facility.<br><br>Decontamination and Demolition Project is responsible for decontamination and dismantling of Operable Unit 5 remediation facilities necessary through the site completion phase following the completion of aquifer remediation. |

[a]Source of information is each operable unit's record of decision, remedial design documents, and the Fernald Closure Contract Performance Management Plan (DOE 2002).

The project organizations with primary responsibilities for CERCLA remediation, their current status (as of July 2002), and their key acceleration initiatives under the Fernald 2006 closure plan are summarized as follows:

- Waste Pits Remedial Action Project – This work scope includes the completion of remedial actions for the excavation, drying (as required), loading, and rail transport of contents of waste pits 1-6, the burn pit, and the clearwell to an off site disposal facility (Envirocare of Utah), and responsibility for the off-site disposal of contaminated soil and debris that exceed the waste acceptance criteria for the on-site disposal facility.

  Status: Project is 48 percent complete with 376,800 tons of waste pit material shipped via 60 unit trains since pit excavation began in 1999.

  Acceleration Initiatives: In May 2002, the project adopted a 24-hour per day, 7-day per week schedule for dryer operation. Contingent upon regulatory approvals, the on-site disposal facility will be utilized for disposal of selected subsurface and waste pits cover material that is below the waste acceptance criteria instead of disposal off-site.

- Soil and Disposal Facility Project – This project is responsible for the completion of remedial actions to address contaminated soil at the FEMP and miscellaneous waste units including the South Field, flyash piles, lime sludge ponds, and the solid waste landfill; also excavation/removal of building foundations, roadways, underground utilities and piping systems, and sitewide restoration activities and management of perched water encountered during remediation. This project is also responsible for the design, installation, maintenance and closure of the on-site disposal facility. Oversight of waste acceptance criteria compliance is provided by the Waste Acceptance Operations organization.

  Status: Project is 30 percent complete with 724,400 cubic yards of soil and debris placed into three cells of the on-site disposal facility. Approximately 1.8 million cubic yards of material remain to be placed in the facility. Fifty-two percent of the Fernald site is certified as clean.

  Acceleration Initiatives: Gain regulatory approval to maintain three cells open simultaneously and to reduce the intervening layer thickness. Accelerate start of Cell 4 and Cell 5 liner construction in FY02; significantly increase annual on-site disposal facility placement rates.

- Decontamination and Demolition Project – This work scope includes facility shutdown and decontamination and dismantling of the above-grade portion of the former uranium processing facilities and all treatment facilities used to support remedial actions of other operable units; also responsible for disposal of all generated debris, either on site or off site based on associated waste acceptance criteria.

  Status: Facility decontamination and demolition is 47 percent complete with 105 of 223 structures removed.

  Acceleration Initiatives: The decontamination and demolition subcontract was renegotiated and additional work crews and equipment will be mobilized.

- Silos Project – This project oversees the design and completion of remedial actions for the contents of Silos 1-3, including the retrieval, stabilization as necessary, and transport of the inventoried residues for off-site disposal.

  Status: Silos 1 and 2 – The overall design and construction is 7 percent complete with the Accelerated Waste Retrieval facility construction underway and the radon treatment system completed. The remedial design process is 21 percent complete.

  Silo 3 – The overall Silo 3 project is 10 percent complete and the final design work is nearing completion.

  Acceleration Initiatives: Silos 1 and 2 – The Silos 1 and 2 project will pursue approval to dispose of treated Silos 1 and 2 material at Envirocare of Utah. Bulk transportation by rail is planned, which is safer and more cost-effective than truck shipments. The design, procurement, and construction of the treatment facility will include earlier vendor involvement and early release of design packages for procurement of non-treatment-related facilities.

  Silo 3 – The Silo 3 project will pursue an amendment to the Record of Decision to eliminate treatment of the waste to immobilize metals because the material is 11e (2) "by-product" material. The project is also requesting approval to dispose of Silo 3 material at a permitted off-site commercial disposal facility which offers significant cost savings with waste transport and disposal. The bulk transport of the material is planned via railcar versus the former plan to truck transport the material.

- Aquifer Restoration Project – This project is responsible for the completion of activities necessary to restore the water quality in the affected portions of the Great Miami Aquifer including the pumping, treating, re-injecting, and discharging of extracted groundwater. This project is responsible for groundwater modeling, monitoring, and reporting. This project is responsible for the design, construction, maintenance and operation of all conveyance, treatment, and discharge systems for groundwater, wastewater, and storm water at the FEMP. The aquifer restoration project is also responsible for the on-site disposal facility leak detection monitoring program and for monitoring leachate (quantity and quality) generated in the on-site disposal facility. Note that wastewater from individual projects may require project-specific pre-treatment and transportation to one of the aquifer restoration project treatment head works. This will be determined in conjunction with aquifer restoration project, on a project by project basis.

  Status: The Aquifer Restoration project is 62 percent complete (based on actual pounds of uranium removed from the aquifer versus the 1997 estimated total amount to be removed).

  Acceleration Initiatives: Although the project does not have any key actions or responsibilities necessary for acceleration to support the Fernald site closure in 2006 (as defined in the closure contract), two groundwater restoration modules are ahead of schedule. The Waste Storage Area Phase I module and the South Field Extraction System Phase II module are ahead of schedule compared to the Operable Unit 5 Remedial Action Work Plan.

## 2.2 GENERAL REMEDIATION ACTIVITIES

Several of the FEMP's remediation projects involve similar large-scale field activities, some of which are underway or completed, that will occur throughout the Fernald cleanup, particularly during the 2003 and 2004 time frame. These activities include site preparation; excavation/retrieval; construction; remediation facility operation; wastewater management and treatment; transportation of waste materials; on-site disposal facility development, waste placement, and capping; decontamination and dismantling, and safe shutdown; and site restoration. Each field activity has associated monitoring implications, primarily resulting from the potential impact of fugitive dust generation and stormwater runoff, as described below:

- Site Preparation: Site preparation activities, such as excavation of stormwater basins, preparations for development of laydown areas and soil stockpile areas, and construction of remedial facilities that will result in the generation of dust to some degree as well as stormwater runoff.

- Waste Excavation/Retrieval and Soil Excavation: The excavation and movement of waste and soil will create dust throughout the remediation, which must be controlled. The following areas remain to be excavated: in Operable Unit 1, all or portions of six waste pits, the clear well, and the burn pit; in Operable Unit 2, the solid waste landfill or portions thereof, and in Operable Unit 5, all contaminated soil above FRLs (including affected soils beneath demolished structures in Operable Units 3 and 4) on the FEMP property. In addition, the contents of Silos 1, 2, and 3 will be retrieved for storage, treatment (Silos 1 and 2) and shipment, although all processes will be conducted within closed or sealed systems.

- Construction of Remediation Facilities: Construction involves large-scale movement of materials, including generation of dust, and development of project-specific controls such as collection of storm water runoff. Additional remediation facilities remain to be constructed for Silos 1, 2, and 3, including retrieval and stabilization facilities.

- Operation of Remediation Facilities: During the operation of remediation facilities administrative and engineered controls limit the fugitive point source air emissions and surface water discharges. An extensive amount of environmental control data is being and will be generated and reviewed against control limits during the operation of these facilities, including the waste pits remedial action project and silos project.

- Wastewater Management: Wastewater generated during remediation must be collected, monitored, discharged, and if necessary, transported for treatment at one of the designated wastewater treatment facilities. Wastewaters include pumped groundwater, decontamination water, storm water, and other potentially contaminated water requiring treatment.

- Transportation of Treated and Untreated Waste to On- and Off-site Disposal Facilities: All materials and soils with constituents of concern above FRLs on the FEMP property will be transported following excavation, treatment, or both, to on- or off-site disposal facilities. This activity will generate dust throughout the life of the remediation even though the best available control technology is employed to limit emissions.

- Decontamination and Dismantling: Along with all facilities in the former production area, all facilities constructed to implement remedies will eventually undergo decontamination and dismantling. Decontamination and dismantling, which is already well underway within the former production area, will continue throughout the life of the remediation.

- Site Restoration: As the last facilities undergo dismantling and disposal and soil excavation is completed, restoration activities will begin. This activity will involve movement and final grading of soil, planting/seeding native vegetation, and related activities.

## 2.3 TWO-YEAR PROJECTION OF REMEDIATION FIELD ACTIVITIES

The two-year IEMP revision schedule limits the uncertainties associated with long-range project planning and provides flexibility to customize monitoring programs to align with the current mix of remediation activities and actively incorporate stakeholder input. In addition, the annual IEMP review will enable DOE to update the plan each year if the need arises. Table 2-2 and Figure 2-2 identify remediation field activities for this two-year period (excluded are document submittals, design submittals, restoration, and certification activities).

This two-year focus on remediation activities provides the basis to estimate monitoring needs, both on a project-specific and sitewide basis. The scope of the activities detailed above was a fundamental consideration in developing the IEMP monitoring approach and media-specific sampling programs.

## TABLE 2-2

## FEMP INTEGRATED REMEDIATION FIELD ACTIVITIES FOR 2003 AND 2004[a]

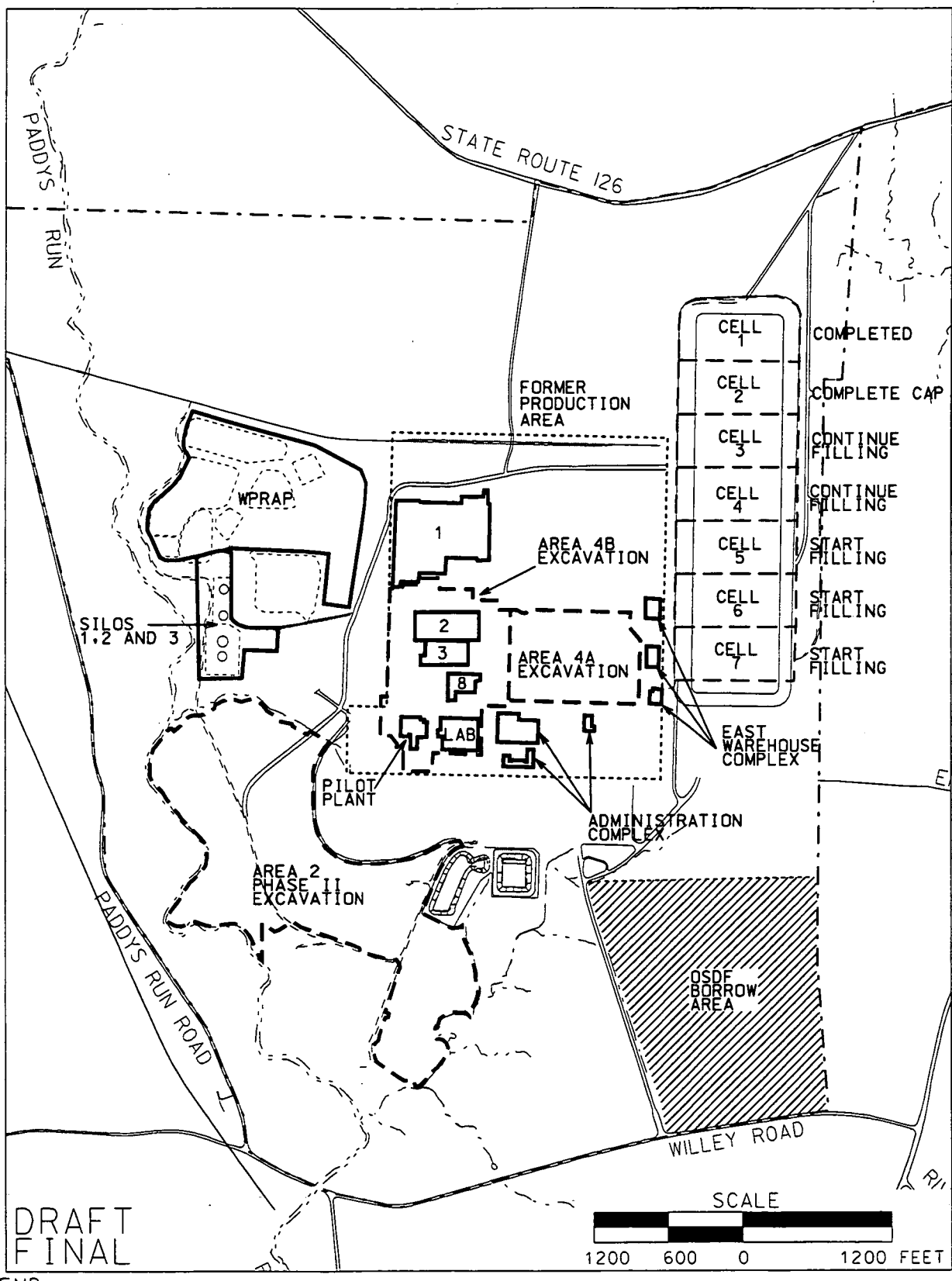
| Remediation Project | 2003 | 2004 |
|---|---|---|
| Waste Pits Remedial Action Project | Continue waste excavation, treatment, shipment, and off-site disposal by rail | Continue waste excavation, treatment, shipment, and off-site disposal by rail |
| Soil and Disposal Facility Project | Continue excavation and screening of clay from Borrow Area | Continue excavation and screening of clay from Borrow Area |
| | Begin and complete Cell 2 cap construction | Begin and complete Cell 7 liner construction and begin impacted material placement |
| | Continue Cell 3 impacted material placement | Continue Cell 3 impacted material placement |
| | Continue Cell 4 impacted material placement | Continue Cell 4 impacted material placement |
| | Begin Cell 5 impacted material placement | Continue Cell 5 impacted material placement |
| | Begin and complete Cell 6 liner construction and begin impacted material placement | Continue Cell 6 impacted material placement |
| | Continue Area 6 excavation (Solid Waste Landfill and Fire Training Facility) | Begin Area 4B excavation |
| | Begin and complete Area 4A excavation | Begin Area 5 excavation |
| | Complete Area 2/Phase 2 excavation | Begin Area 6 excavation (Waste Pit 1, 2 and 3 liners) |
| | | Begin and complete Stream Corridors excavation |
| Aquifer Restoration Project | Sitewide groundwater monitoring | Sitewide groundwater monitoring |
| | Continue operation of water treatment facilities | Continue operation of water treatment facilities |
| | Continue South Plume Module extraction well operations and Phase 2 Optimization Construction (if necessary) | Continue South Plume Module extraction well operations and Phase 2 Optimization Startup |
| | Continue Re-Injection Module well operations | Continue Re-Injection Module well operations |
| | Continue South Field Phase I Module extraction well operations and continue construction and Startup Phase II | Continue South Field Module extraction well operations |
| | Installation and maintenance of supplemental extraction/re-injection wells (as necessary) | Installation and maintenance of supplemental extraction/re-injection wells (as necessary) |
| | Continued collection and treatment of storm water and wastewater | Continued collection and treatment of storm water and wastewater |
| | Continued on-site disposal facility leak detection and leachate monitoring | Continued on-site disposal facility leak detection and leachate monitoring |
| | Continue Waste Storage Area Phase I Module extraction well operations | Continue Waste Storage Area Phase I Module extraction well operations |

**TABLE 2-2**
**(Continued)**

| Remediation Project | 2003 | 2004 |
|---|---|---|
| Decontamination and Demolition Project | Begin Plant 1 Phase 2 Complex<br><br>Complete Plant 2 Complex<br><br>Complete Plant 3 Complex<br><br>Complete Plant 8 Complex<br><br>Begin & complete Pilot Plant Warehouse<br><br>Begin Administration Complex (6 buildings/structures)<br><br>Begin Laboratory Complex<br><br>Continue miscellaneous structures<br><br>Continue Pilot Plant Complex<br><br>Complete Liquid Storage Complex<br><br>Complete General Sump complex | Complete Plant 1 Phase 2 Complex<br><br>Complete Administration Complex (6 buildings/structures)<br><br>Complete Laboratory Complex<br><br>Begin East Warehouse Complex<br><br>Continue miscellaneous structures<br><br>Complete Pilot Plant Complex |
| Silos Project | Silo 3 Construction and Startup<br><br>Begin Silo 3 operations and shipping<br><br>Radon Control System Operation (intermittent; this is a component of Silo 1 and 2 Accelerated Waste Retrieval)<br><br>Continue Silo 1 and 2 Accelerated Waste Retrieval construction | Complete Silo 3 operations and shipping<br><br>Begin Radon Control System Phase 2 Operations (a component of Silo 1 and 2 Accelerated Waste Retrieval)<br><br>Begin Silo 1 and 2 Accelerated Waste Retrieval Operations (Silo 1 and 2 material transfer) |

[a]All schedule information is based on the site master schedule, July 2002 status.

000035




LEGEND:

— · — · — FEMP BOUNDARY

WPRAP EXCAVATION, TREATMENT AND OFF-SITE DISPOSAL OF WASTE PIT MATERIALS

SILOS 1,2,3 CONSTRUCTION AND OPERATIONS

NOTE:

DECONTAMINATION AND DISMANTLING OF COMPLEXES (IDENTIFIED BY PLANT NUMBERS)

FIGURE 2-2. PLANNED FEMP REMEDIATION ACTIVITIES FOR 2003 AND 2004



v:#5fgp1#dgn#02revision#02rv003.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002

Section 3.0

# 3.0 GROUNDWATER MONITORING PROGRAM

Section 3.0 presents the monitoring strategy for tracking the progress of the restoration of the Great Miami Aquifer and satisfying the Fernald Environmental Management Project's (FEMP's) site-specific commitments related to groundwater monitoring. A Media-Specific Plan for conducting all groundwater monitoring activities is provided. Program expectations for 2003 and 2004 are outlined in Section 3.4, and the program design for 2003 and 2004 is presented in Section 3.5.

## 3.1 INTEGRATION OBJECTIVES FOR GROUNDWATER

The groundwater sampling specified in the Integrated Environmental Monitoring Plan (IEMP) tracks the performance of the Great Miami Aquifer groundwater restoration remedy being implemented under Operable Unit 5. The strategy and technical approach will adapt to changes made to the aquifer remedy over the life of the remedy. Aquifer restoration modules include:

- The South Plume Module
- The Re-Injection Module (formerly called the Re-Injection Demonstration Module)
- The South Field Extraction (Phase I and II) Modules
- The Waste Storage Area (Phase I and II) Modules.

An overview of each of the modules listed above is provided in Section 3.4 and Figure 3-1 identifies the location of these aquifer restoration modules.

The current focus of the monitoring program is to address remedy performance tracking responsibilities for 2003 and 2004. The design of the groundwater monitoring program for 2003 and 2004 was developed (i.e., well monitoring coverage) in recognition of:

- Operation of the South Field Extraction (Phase I and Phase II) Modules
- Operation of the South Plume Module
- Operation of the Re-Injection Module
- Operation of the Waste Storage Area Phase I Module
- Soils Excavation in the Former Production Area
- Waste excavation activities associated with Operable Unit 1
- Silos project activities

Ultimately, the IEMP will be used to document the approach for determining when the various modules can be removed from service, once remedial action objectives for the Great Miami Aquifer provided in the Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996b) are achieved. The IEMP will later serve as the vehicle for verifying the completion of the aquifer restoration. The sampling strategy that will be used to verify completion will be described in future revisions to the IEMP.

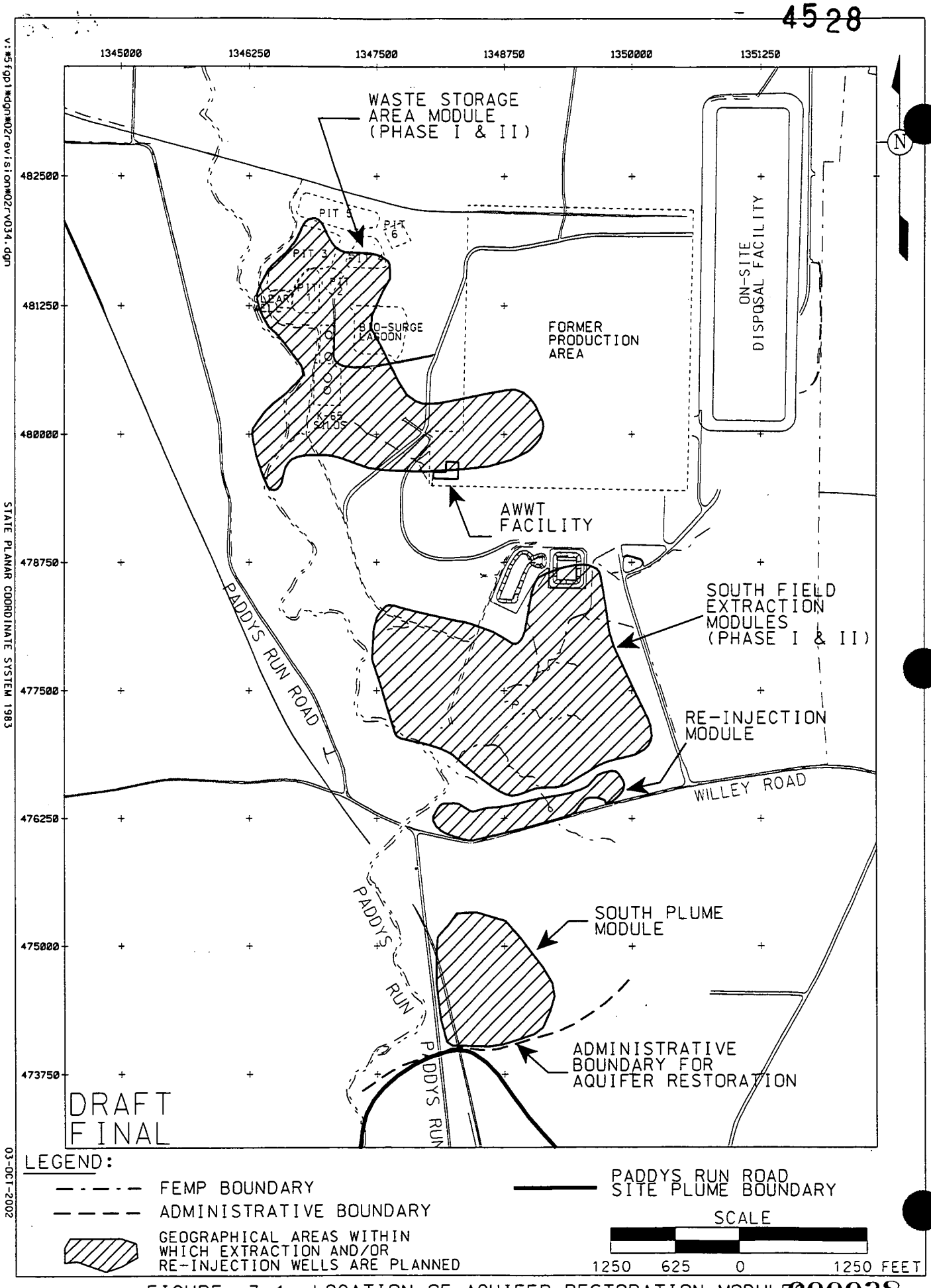



FIGURE 3-1. LOCATION OF AQUIFER RESTORATION MODULES

Along with this performance-based responsibility, the IEMP also serves to integrate several former compliance-based groundwater monitoring or protection programs:

- Ohio Environmental Protection Agency (OEPA) Director's Findings and Orders for property boundary groundwater monitoring to satisfy Resource Conservation and Recovery Act (RCRA) facility groundwater monitoring requirements
- Private well sampling
- Groundwater Protection Management Program Plan.

As discussed in Section 3.7, these multiple activities were brought together under a single reporting structure to facilitate regulatory agency review of the progress of the Operable Unit 5 groundwater remedy.

## 3.2 SUMMARY OF REGULATORY DRIVERS, DOE POLICIES, AND OTHER FEMP-SPECIFIC AGREEMENTS

This section presents a summary evaluation of the regulatory-based requirements and policies governing monitoring of the Great Miami Aquifer. The intent of the section is to identify the pertinent regulatory drivers, including applicable or relevant and appropriate requirements (ARARs) and to be considered-based requirements, for the scope and design of the Great Miami Aquifer groundwater monitoring system. These requirements are used to confirm that the program design satisfies the regulatory obligations for monitoring that have been activated by the Operable Unit 5 Record of Decision and to achieve the intentions of other pertinent criteria, such as U.S. Department of Energy (DOE) Orders and the FEMP's existing agreements, as appropriate that have a bearing on the scope of groundwater monitoring.

The results of the analysis are also used to define, as appropriate for this media, the administrative boundaries between the IEMP and the project-specific source control monitoring conducted by other FEMP organizations.

### 3.2.1 Approach

The analysis of the regulatory drivers and policies for groundwater monitoring was conducted by examining the suite of ARARs and to be considered-based requirements in the FEMP's five approved Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) operable unit records of decision to identify the subset with specific groundwater monitoring requirements. The FEMP's existing compliance agreements issued outside the CERCLA process, such as the September 10, 1993, OEPA Director's Findings and Orders (OEPA 1993), were also reviewed.

3.2.2 Results

The following regulatory drivers, compliance agreements, and DOE policies were found to govern the monitoring scope and reporting requirements for remedy performance monitoring and general surveillance of the protectiveness of the Great Miami Aquifer groundwater remedy:

- The CERCLA Record of Decision for Remedial Actions at Operable Unit 5 requires the extraction and treatment of Great Miami Aquifer groundwater above final remediation levels (FRLs) until the full beneficial use potential of the aquifer is achieved, including use as a drinking water source. The FRLs are established by considering chemical-specific ARARs, hazard indices, background, and detection limits for each contaminant. Many Great Miami Aquifer FRLs are based on established or proposed Safe Drinking Water Act maximum contaminant levels (MCLs), which are ARARs for groundwater remediation. For those FEMP-related contaminants that do not have an established MCL under the Safe Drinking Water Act, a concentration equivalent to an incremental lifetime cancer risk of $10^{-5}$ for carcinogens or a hazard quotient of one for noncarcinogens was used as the FRL, unless background concentrations or detection limits are such that health-based limits could not be attained (in these cases the background or detection limit became the FRL). The FRLs will be tracked throughout all affected areas of the aquifer and will be the basis for determining when the Great Miami Aquifer restoration objectives have been met. By definition, the Operable Unit 5 Record of Decision incorporates the requirements of the FEMP's existing CERCLA South Plume Removal Action (which was the regulatory driver for the FEMP's former Design Monitoring and Evaluation Program Plan Groundwater Monitoring and Reporting Program).

- The September 10, 1993, OEPA Director's Findings and Orders, which required groundwater monitoring at the FEMP's property boundary to satisfy RCRA facility groundwater monitoring requirements have been superceded by Directors Final Findings and Orders, issued September 7, 2000. The September 7, 2000 Directors Final Findings and Orders specify that the site's groundwater monitoring activities will be implemented in accordance with the IEMP. The revised language allows modification of the groundwater monitoring program as necessary, via the IEMP revision process, without issuance of a new order.

- DOE Order 5400.1, General Environmental Protection Program, which establishes the requirement for a Groundwater Protection Management Program Plan (GPMPP) for DOE facilities. The required informational elements of a GPMPP are fulfilled by the Remedial Investigation and Feasibility Study Reports for Operable Unit 5 (DOE 1995d and 1995b, respectively). The groundwater monitoring program requirement is being fulfilled by the IEMP. This also satisfies DOE M 435.1 which refers to DOE Order 5400.1

- DOE Order 5400.5, Radiation Protection of the Public and Environment, which establishes radiological dose limits and guidelines for the protection of the public and environment. Demonstration of compliance with these limits and guidelines for radiological dose are generally based on calculations that make use of information obtained from the FEMP's monitoring and surveillance program. This program is based on guidance in the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE 1991). The FEMP's private well sampling program for the Great Miami Aquifer (that previously was in the Fernald Site Environmental Monitoring Plan [FERMCO 1995]) is conducted to satisfy the intention of this DOE Order with respect to groundwater. While most private well water users in the affected area are now provided with a public water supply, a limited private well sampling activity will be maintained to supplement the groundwater monitoring network provided by monitoring wells. A dose assessment is no longer required due to the availability of a public water supply.

- The 1986 Federal Facilities Compliance Agreement, which requires that the FEMP maintain a sampling program for daily flow and uranium concentration of discharges to the Great Miami River and report the results quarterly to the U.S. Environmental Protection Agency (EPA), OEPA, and Ohio Department of Health. The sampling program conducted to address this requirement has been modified over the years and is currently governed by an agreement reached with EPA and OEPA in early 1996 with modifications documented and approved through biennial IEMP revisions. For groundwater, this agreement is specifically related to the South Plume wellfield to quantify the amount of uranium removed and total volume of groundwater extracted.

The groundwater monitoring plan provided in this IEMP has been developed in full consideration of the above regulatory drivers. Each of these drivers and the associated monitoring conducted to comply with these drivers is listed in Table 3-1. Table 3-1 also lists each regulatory requirement for the on-site disposal facility groundwater monitoring program and the associated project-specific plan. Sections 3.7 and 8.0 outline the FEMP's current and long-range plan for complying with the reporting requirements contained within the IEMP drivers.

Project-specific groundwater monitoring is required only for one project -- the on-site disposal facility. The IEMP will not be utilized as the mechanism for conducting on-site disposal facility performance monitoring within the glacial overburden and the Great Miami Aquifer. A leak detection monitoring program plan, which includes both leachate and groundwater monitoring as part of a leak detection program, was submitted separately from the IEMP and approved by EPA and OEPA in 1997. The on-site disposal facility monitoring requirements include the regulatory drivers and the ARARs and to be considered-based criteria that have a bearing on the design and execution of a groundwater monitoring program for the on-site disposal facility and are listed below:

- Ohio Solid Waste Disposal Facility Groundwater Monitoring Rules, Ohio Administrative Code (OAC) 3745-27-10, which specify groundwater monitoring program requirements for sanitary landfills. These regulations describe a three-tiered program for detection, assessment, and corrective measures.

- RCRA/Ohio Hazardous Waste Groundwater Monitoring Requirements for Regulated Units, 40 Code of Federal Regulations (CFR) 264.90 through .99 (OAC 3745-54-90 through 99) and 40 CFR 265.90 through .94 (OAC 3745-65-90 through 94), which specify groundwater monitoring program requirements for surface impoundments, landfills, and land treatment units that manage hazardous wastes. Because the Ohio regulations are at least as stringent, and in some cases more stringent, they are the controlling regulations.

- Uranium Mill Tailings Reclamation and Control Act Regulations, 40 CFR 192.32(A)(2), which specify standards for uranium byproduct materials in piles or impoundments. This regulation requires conformance with the RCRA groundwater monitoring performance standard in 40 CFR 264.92. Compliance with RCRA/Ohio Hazardous Waste rules for groundwater monitoring will fulfill the substantive requirements for groundwater monitoring in the Uranium Mill Tailings Reclamation and Control Act regulations.

**TABLE 3-1**

**FEMP GROUNDWATER MONITORING PROGRAM REGULATORY DRIVERS AND ACTIONS**

| | DRIVER | ACTION |
|---|---|---|
| IEMP | CERCLA Record of Decision for Operable Unit 5 | The IEMP describes routine monitoring to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer. The IEMP will be modified toward completion of the remedial action to include a sampling plan to certify achievement of the FRLs. |
| | OEPA Director's Final Findings and Orders; RCRA/Hazardous Waste Facility Groundwater Monitoring | The IEMP describes routine monitoring at wells located at the property boundary to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer. |
| | DOE Order 5400.1, Groundwater Protection Management Plan. Also satisfies DOE M 435.1 which refers to DOE Order 5400.1 | The IEMP describes routine monitoring to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer. |
| | DOE Order 5400.5, Radiation Protection of Public and Environment | No longer required. |
| | Federal Facilities Compliance Agreement Radiological Monitoring | The IEMP describes the routine sampling and reporting of the South Plume wellfield in terms of the total volume extracted and the amount of uranium removed. |

**TABLE 3-1**
**(Continued)**

| | DRIVER | ACTION | PROJECT PLAN |
|---|---|---|---|
| PROJECT | OAC 3745-27-10, Ohio Solid Waste Disposal Facility Groundwater Monitoring | A leak detection monitoring program in the glacial overburden and the Great Miami Aquifer is being conducted for the on-site disposal facility. | Groundwater, leak detection, and leachate monitoring plan for the on-site disposal facility |
| | 40 CFR 264.90-.99 (OAC 3745-54-90 through 99); 40 CFR 265.90-.94 (OAC 3745-65-90 through 94), RCRA/Ohio Hazardous Waste Disposal Facility Groundwater Monitoring | A leak detection monitoring program in the glacial overburden and the Great Miami Aquifer is being conducted for the on-site disposal facility. | Groundwater, leak detection, and leachate monitoring plan for the on-site disposal facility |
| | Uranium Mill Tailings Reclamation and Control Act Regulations Groundwater Monitoring for Disposal Facilities | A leak detection monitoring program in the Great Miami Aquifer is being conducted for the on-site disposal facility. | Groundwater, leak detection, and leachate monitoring plan for the on-site disposal facility |
| | OAC 3745-27-19(M)(4) and (5), Ohio Solid Waste Disposal Facility Leachate Detection and Collection Systems | Monitoring of on-site disposal facility leachate detection and collection systems is included in the on-site disposal facility leak detection monitoring program. | Groundwater, leak detection, and leachate monitoring plan for the on-site disposal facility |

- Ohio Solid Waste Disposal Facility Rules, OAC 3745-27-19(M)(4) and (5), which requires submittal of an annual operational report, including a summary of the quantity of leachate collected for treatment and disposal, location of leachate treatment, verification that the leachate management system is operating properly, and the results of analytical testing of an annual grab sample of leachate for groundwater monitoring constituents listed in Appendix I of OAC 3745-27-10.

## 3.3 PROGRAMMATIC BOUNDARY FOR THE GROUNDWATER MONITORING PROGRAM

This section identifies the programmatic boundary(s) that have been established between the IEMP and the project-specific activities to be conducted by others. The intent behind the boundary definition is to clearly delineate the scope and geographic extent of the IEMP's monitoring responsibility and establish a recognized interface between the sitewide focus of the IEMP and the predominant emission control focus of project-specific monitoring.

The programmatic boundary for each of the FEMP's environmental media will be unique, and for certain media, time-dependent. One or more of the following defines the media-specific boundary:

- Regulatory monitoring requirements for the media
- Physical boundaries (i.e., geologic, hydrogeologic, or surface boundaries imposed by the remediation projects)
- Media-specific monitoring requirements specifically assigned to the IEMP by administrative decisions.

Because of these unique considerations, the boundary definitions are provided for each media to clearly convey the line of responsibility for that media under the IEMP. For groundwater, five programmatic boundaries require definition for the IEMP:

- The responsibility boundary between the Great Miami Aquifer and the soil/perched groundwater remediation efforts
- The administrative boundary between the FEMP and the Paddys Run Road Site contaminant plumes (Figure 3-1)
- The responsibility boundary for performance monitoring of the on-site disposal facility between the Soil & Disposal Facility Project and the Aquifer Restoration Project
- The responsibility boundary between the Aquifer Restoration Project and the Operable Unit 1 waste pit remediation efforts.

### 3.3.1 Responsibility Boundary between Great Miami Aquifer and Soil/Perched Groundwater Remediation Efforts

For the FEMP's Great Miami Aquifer plume, all the geographic areas that are to be restored under the Operable Unit 5 Record of Decision (or routinely monitored beyond the restoration area) reside within the scope of the Aquifer Restoration Project. For the soil and perched groundwater remediation, all remedial responsibilities reside within the Soil & Disposal Facility Project. The pre-certification and certification sampling activities that will accompany the excavation of affected soil and perched groundwater zones (to demonstrate the attainment of cross-media based soil FRLs) will be performed by the Soil & Disposal Facility Project.

### 3.3.2 Administrative Boundary between the IEMP and Paddys Run Road Site Contaminant Plumes

As described in the Remedial Investigation Report for Operable Unit 5 (Section 4.8.2), the Paddys Run Road Site consists of two facilities, PCS Purified Phosphates, (formerly Albright & Wilson Americas, Inc.) and Ruetgers-Nease Chemical Company, Inc. PCS Purified Phosphates occupies the northern portion of the site and manufactures phosphate compounds. The Paddys Run Road Site Remedial Investigation Report released in September 1992 documented releases to the Great Miami Aquifer of inorganics, volatile organic compounds, and semi-volatile organic compounds. The Proposed Plan for Operable Unit 5 (DOE 1995c), acknowledged that DOE's role and involvement in OEPA's ongoing assessment and/or cleanup of the Paddys Run Road Site plume, if any, would be separately defined as part of the Paddys Run Road Site response obligations and in accordance with the Paddys Run Road Site project schedule. Groundwater monitoring will continue south of the administrative boundary until such time as the need for action is established and implemented. This monitoring will assess the nature of the 30 micrograms per liter (µg/L) total uranium plume south of the administrative boundary and the impact that pumping of the South Plume extraction wells has on the Paddys Run Road Site plume.

### 3.3.3 Responsibility Boundary between the Soil & Disposal Facility Project and the Aquifer Restoration Project for Performance Monitoring at the On-Site Disposal Facility

The Soil & Disposal Facility Project is responsible for construction, filling, capping and maintenance of each cell of the On-Site Disposal Facility. The Aquifer Restoration Project is responsible for leak detection monitoring for the On-Site Disposal Facility and for leachate monitoring, conveyance and treatment. The monitoring results will initially be evaluated by the Aquifer Restoration Project then shared and discussed with the Soil & Disposal Facility Project.

On-site disposal facility monitoring results will be reported on the IEMP Extranet Site, in the IEMP mid-year data summaries, and annual site environmental reports. Evaluation of baseline conditions will be provided through technical memoranda.

### 3.3.4 Responsibility Boundary Between the Aquifer Restoration Project and the Operable Unit 1 Waste Pit Remediation Efforts

Responsibility for remediation of the FEMP's Great Miami Aquifer plume specified to be restored under the Operable Unit 5 Record of Decision resides within the scope of the Aquifer Restoration Project. This includes the geographic area that is required to be restored as a result of contaminant migration (past and that occurring during remediation) from the Operable Unit 1 area. For the remediation of the waste pit contents (including pit leachate, surface water falling on the pit area, and perched water draining into the active excavation) remedial responsibilities reside within the Waste Pit Remedial Action Project. The pre-certification and certification sampling activities that will accompany the excavation of affected perched groundwater zones adjacent to the pits and affected subsoils below the pits (to demonstrate the attainment of cross-media-based soil FRLs) will be performed by the Soil & Disposal Facility Project.

## 3.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

### 3.4.1 Program Expectations

The IEMP groundwater monitoring program for 2003 and 2004 is designed to provide a comprehensive monitoring network that will track remedial wellfield operations and assess aquifer conditions. The expectations of the monitoring program are to:

- Provide groundwater data to assess the capture and restoration of the 30 μg/L total uranium plume
- Provide groundwater data to assess the capture and restoration of non-uranium FRL constituents
- Provide groundwater data to assess groundwater quality at the downgradient FEMP property boundary and offsite at the leading edge of the 30 μg/L total uranium plume
- Provide groundwater data that are sufficient to assess model predictions
- Provide groundwater data to assess the impact that the aquifer restoration is having on the Paddys Run Road Site plume
- Continue to fulfill DOE Order 5400.1 requirements to maintain an environmental monitoring plan for groundwater
- Continue to address concerns of the community regarding the progress of the aquifer restoration.

Following active remediation, monitoring will be conducted to check for rebound and to certify cleanup. Design considerations for rebound and certification groundwater monitoring will be incorporated, where necessary, into later revisions to the IEMP. The following section provides the design considerations required to monitor remedy performance in 2003 and 2004.

### 3.4.2 Design Considerations

#### 3.4.2.1 Background

The Great Miami Aquifer is contaminated with uranium and other constituents from the FEMP. An extensive evaluation of the nature and extent of contamination in the Great Miami Aquifer can be found in the Remedial Investigation Report for Operable Unit 5. Uranium is the principal constituent of concern.

Figure 3-2 shows the maximum total uranium plume map (30 μg/L uranium or higher) as of the fourth quarter of 2001. The plume depicted in Figure 3-2 is modified to include findings from the South Field Phase II Design which was completed in 2002. The map represents a compilation of several different monitoring depths within the aquifer, and illustrates the maximum lateral extent of the plume at all depths. Over the majority of the plume, the top of the plume is situated at the water table. In some regions of the aquifer though, the top of the plume is situated below the water table. More detailed presentations of the geometry of the uranium plume can be found in Appendix G of the Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) (DOE 1997a), the Conceptual Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas (DOE 2000a), and the Design for Remediation of the Great Miami Aquifer South Field Phase II Module (DOE 2002a).

The primary sources of contamination at the FEMP that contributed to the present geometry of the uranium plume include: 1) the waste pits in the waste storage area; 2) the inactive fly ash pile in the South Field area; 3) former production activities, deep soil and perched water contamination in the vicinity of Plant 6; and 4) the previously uncontrolled surface water runoff from the former production area that had direct access to the aquifer through the Pilot Plant Drainage Ditch, Storm Sewer Outfall Ditch, and Paddys Run.

A groundwater remediation strategy which relies on pump-and-treat and re-injection technology is being used to conduct a concentration-based clean up of the Great Miami Aquifer. The restoration strategy focuses primarily on the removal of uranium, but also has been designed to limit the further expansion of the plume, achieve removal of all targeted contaminants to concentrations below designated FRLs, and prevent undesirable draw down impacts beyond the FEMP property.

Pumping prior to the start of the actual remediation began in August of 1993 with the start up of five extraction wells in the South Plume. The wells were installed and operated as part of a Removal Action to prevent the further southern migration of the uranium plume while the Remedial Investigation of the plume was being completed and a remediation system was being designed.

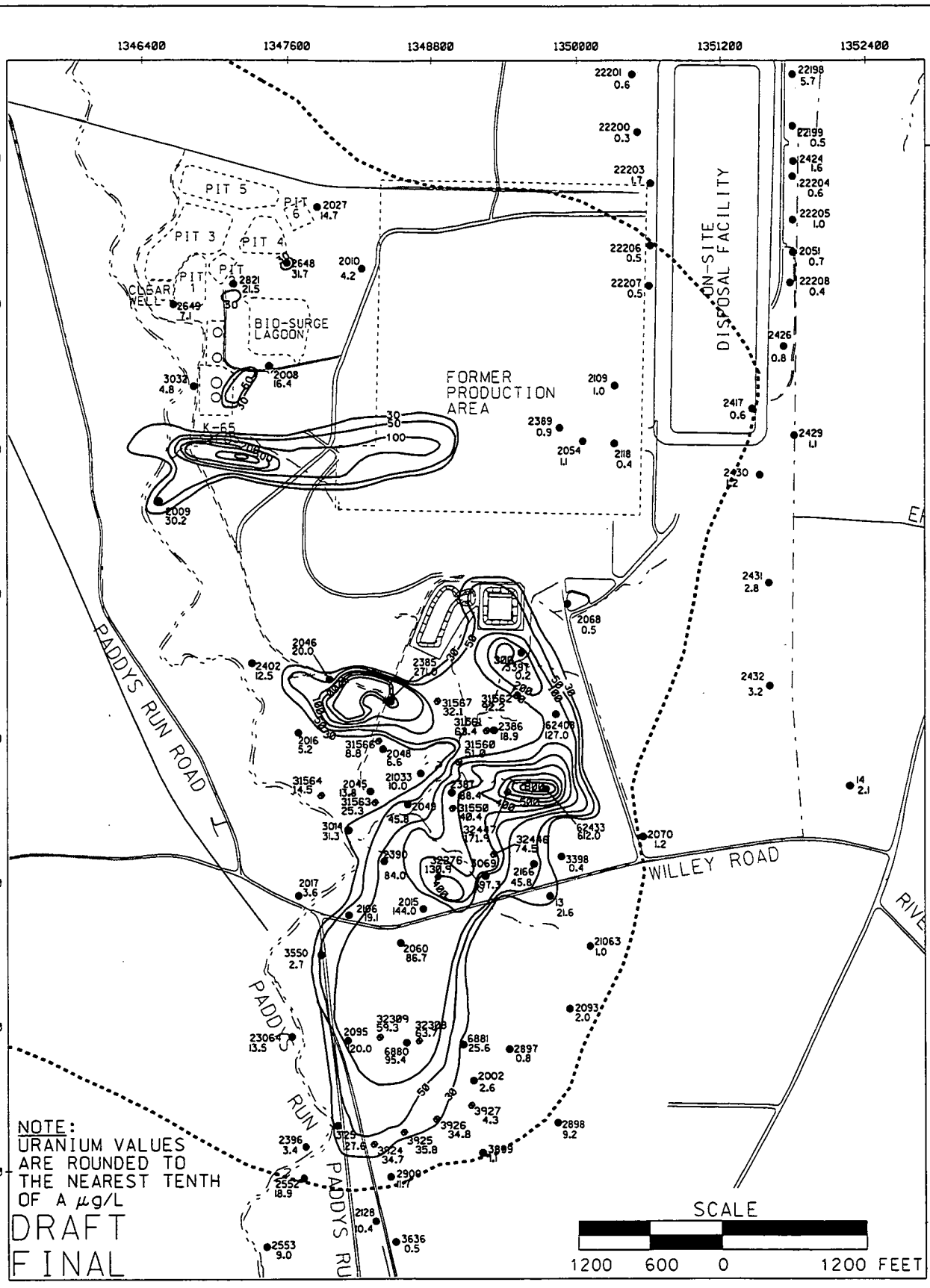



FIGURE 3-2. TOTAL URANIUM PLUME MAP, MODIFIED FROM FOURTH QUARTER 2001 TO INCLUDE SOUTH FIELD PHASE-II DESIGN FINDINGS

The first aquifer remediation design was presented in the Operable Unit 5 Feasibility Study (DOE 1995b). The design consisted of 28 extraction wells pumping for 27 years. It is this design that is contained in the Operable Unit 5 Record of Decision (DOE 1996b). A commitment was also made in the Operable Unit 5 Record of Decision to pursue technological advances that might decrease the remediation time. A technology that was pursued was treated groundwater re-injection. Groundwater modeling was conducted to determine if adding re-injection wells to the remediation would facilitate a quicker cleanup. The groundwater modeling showed that a faster cleanup could be realized by using re-injection if several other actions were also realized. These other actions included:

- Other operable units completing their accelerated clean-up objectives so that surface access is available for aquifer remediation wells
- The accelerated removal of sources which will allow extraction wells to be located closer to the center of uranium plumes
- Modeled geochemical and hydraulic parameters being consistent with aquifer conditions.

An aquifer remediation design, which included re-injection was presented in the Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (DOE 1997). This design called for 37 pumping wells and 10-re-injection wells. The predicted cleanup time was modeled at 10 years.

Although groundwater modeling showed that re-injection expedited the cleanup, the technology was unproven at the FEMP. Of concern was the cost that it would take to keep the wells operating in light of industry experience that they tend to plug. A demonstration was needed to prove that the re-injection wells could be operated efficiently at the FEMP. The decision was made to tie the demonstration into the remedy design presented in the Baseline Remedial Strategy Report. If successful the impact to the remedy would be immediate.

In the summer of 1998, the first wells for the aquifer remediation became operational and marked implementation of the aquifer remedy design presented in the Baseline Remedial Strategy Report. Implementation of the Baseline Remedial Strategy Report design included a groundwater re-injection demonstration that was conducted from September 2, 1998, to September 2, 1999. The evaluation of re-injection technology at the FEMP was sponsored by the DOE's Office of Science and Technology Subsurface Contaminants Focus Area, at the request of the FEMP. The re-injection demonstration was successful. Re-injection is currently being used in the aquifer remedy. Up until 2002, the system design presented in the Baseline Remedial Strategy Report was essentially being implemented, but as presented below, changes were implemented in 2002, and the remedy design continues to evolve.

3.4.2.2 The Modular Approach to Aquifer Restoration

Restoration of the Great Miami Aquifer is being accomplished by using a series of area-specific groundwater restoration modules and a centralized water treatment facility (Figure 3-1). The current design of the aquifer restoration system is modified from the design presented in the Baseline Remedial Strategy Report. Area-specific groundwater restoration modules in the current design include:

- The South Plume Module
- The Re-Injection Module
- The South Field Extraction (Phase I and II) Modules
- The Waste Storage Area (Phase I and II) Modules.

Area-specific modules are being brought on line as scheduled during the life of the remedy. In 2003 and 2004 the South Field Extraction (Phase I and II) Modules, South Plume Module, Waste Storage Area (Phase I) Module and the Re-Injection Module will all be operational. Figure 3-3 shows the location of the extraction and re-injection wells that comprise these modules.

The current aquifer remediation system evolved from the 10-year aquifer remedy design presented in the Baseline Remedial Strategy Report. Changes to the aquifer remedy design in the Waste Storage and Plant 6 Areas were based on findings and groundwater modeling results presented in the Conceptual Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas (DOE 2000a). Characterization efforts conducted in support of the design showed that the uranium plume in the Plant 6 area had dissipated. Therefore, an aquifer restoration module is no longer planned for the Plant 6 area, however, groundwater monitoring in the Plant 6 area will continue under the IEMP. Characterization efforts conducted in support of the design also showed that the uranium plume in the Waste Storage Area was smaller than what was characterized during the remedial investigation/feasibility study. Characterization efforts also showed that the Waste Storage Area uranium plume in the vicinity of the confluence of Paddys Run and the Pilot Plant Drainage Ditch needed to be redefined and extended to the east. In light of these findings, a new remedial system for the waste storage area was modeled. The number of wells needed in the design to remediate the Waste Storage Area went from 10 (Baseline Remedial Strategy Report design) down to 5 (modified design). Three of these began pumping in 2002. The details concerning this design are presented in the document Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas (DOE 2001a).

Based on findings presented in the Design for Remediation of the Great Miami Aquifer, South Field Phase (II) Module (DOE 2002a), the design of the South Field (Phase II) Module was also modified from what was presented in the Baseline Remedial Strategy Report. Characterization efforts conducted to support the design showed that uranium concentrations beneath western portions of the Southern Waste Units were much lower than in previous years. The lower concentrations were attributed to; source removal, natural flow of clean groundwater from the west into the area, the continued flushing of clean recharge water through Paddys Run to the underlying aquifer, increased flushing of clean recharge water

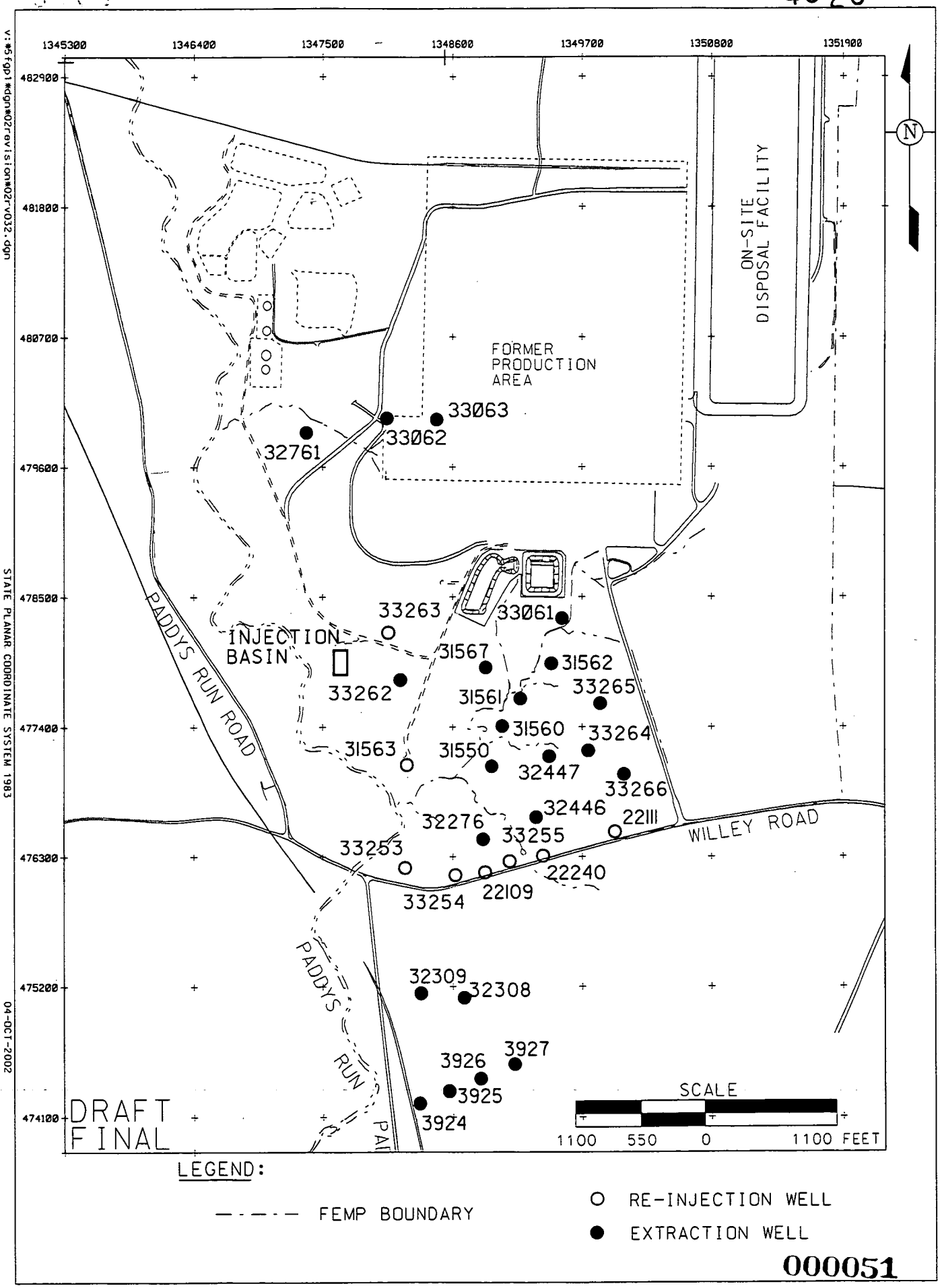





FIGURE 3-3. EXTRACTION AND RE-INJECTION WELL LOCATIONS

through deep surface excavations in the Inactive Flyash Pile, and remedial pumping of the extraction wells to the east of this area. The modified design for Phase II of the South Field went from nine new extraction wells and five new re-injection wells (Baseline Remedial Strategy Report design) down to four new extraction wells, one new re-injection well, conversion of an existing extraction well into an injection well, and an injection basin (DOE 2002a).

Groundwater modeling predicts that aquifer remedy pumping will create a hydraulic capture zone that is larger than the actual dimension of the 30 µg/L total uranium plume. In previous plans the extent of this capture zone was called the 10-year, uranium-based restoration footprint. The 10-year time reference originated from the modeling done for the Baseline Remedial Strategy Report that predicted a 10-year cleanup time. As explained above, the current design is modified from the Baseline Remedial Strategy Report design, therefore the 10-year aquifer restoration footprint originating from the Baseline Remedial Strategy Report is no longer applicable to the remedy. Plans are underway for an addendum to the Baseline Remedial Strategy Report that incorporates the changes made to the Baseline Remedial Strategy Report design. The addendum will include a new remediation footprint, but the new footprint is not available at this time for inclusion in this revision of the IEMP.

For this revision to the IEMP, the 10-year Baseline Remedial Strategy Report footprint will continue to be used. It is felt that the new footprint will be similar in extent to the Baseline Remedial Strategy Report footprint. If it turns out that the new footprint is not similar, the need (if any) to revise the monitoring program will be evaluated and communicated to the EPAs.

The South Plume Module consists of six extraction wells (3924, 3925, 3926, 3927, 32308, and 32309). It is planned that all six wells will be operational in 2003 and 2004. Extraction Wells 3924, 3925, 3926, and 3927, which were originally called the South Plume Module, have been in operation since 1993 as part of a removal action. Located at the southern edge of the total uranium plume, the initial South Plume Module, as reported in The Work Plan for the South Contaminated Plume Removal Action (DOE 1992), was installed to create a hydraulic barrier and to prevent the further southern migration of the uranium plume. In 1998 two additional extraction wells (32308 and 32309) became operational just north of the four original South Plume Module wells. These two wells were installed under a project known as the South Plume Optimization Module. The South Plume Module will be used to refer to those original extraction wells installed under the South Plume Module and those installed under the South Plume Optimization Module.

The South Field Extraction Module (Phases I and II) consists of 13 extraction wells (33262, 31567, 31550, 31560, 31561, 31562, 32276, 32247, 32446, 33061, 33264, 33265, and 33266), one new re-injection well (33263), conversion of an existing extraction well (31563) to a re-injection well, and an injection basin. At the current time 10 of the extraction wells are operating, however, 13 extraction wells (31563 currently operating as an extraction well will be shut down shortly and converted to re-injection), 2 re-injection wells, and the injection basin are scheduled to be operational beginning in 2003.

The aquifer in this area is contaminated with a total uranium plume which resulted from infiltration of contamination through the South Field inactive flyash pile, Paddys Run, and the Storm Sewer Outfall Ditch. The sources of contamination in this area have been remediated by the Soil & Disposal Facility Project.

Restoration of the aquifer in the South Field area began in 1998, when 10 extraction wells (31550, 31560, 31561, 31562, 31563, 31564, 31565, 31566, 31567, and 32276) began pumping around the excavation area near the Storm Sewer Outfall Ditch (South Field Extraction [Phase I] Module). Extraction Wells 31566, 31564, and 31565 are no longer operating. Well 31566 was shut down to minimize the potential for pulling contamination into a region of the aquifer with finer grain sediment. Extraction Wells 31564 and 31565 were shut down in 2001 so that additional soil remediation could be conducted in the area. The module was expanded in 1999 and 2002. In 1999, Extraction Wells 32446 and 32447 were added, which began operating in 2000. Extraction well 33061 was subsequently added and became operational in 2002. Figure 3-3 shows the location of the extraction wells. The 4 new additional extraction wells, one new re-injection well, conversion of Extraction Well 31563 into a re-injection well, and injection pond will begin operation in 2003 in accordance to a South Field Phase II Design published in 2002.

The Re-Injection Module consists of Re-Injection Wells 33253, 33254, 33255, 22109, 22111, and 22240. Operation of the re-injection wells began in September 1998 as part of a one-year technology demonstration. Following completion of the re-injection demonstration in September of 1999, it was decided to incorporate re-injection technology into the aquifer remedy.

Injection Wells 33253 and 33254 were installed in 2002 to replace Re-Injection Wells 22107 and 22108. A new re-injection well (33255) was also installed in 2002. All three new re-injection wells should commence operations in late 2002.

The Waste Storage Area Phase I Module consists of three extraction wells (32761, 33062, and 33063). The wells became operational in May of 2002.

The groundwater-monitoring program is designed around the remediation modules presented above. For monitoring purposes, the aquifer is divided into five zones referred to as aquifer zones (Figure 3-4). These aquifer zones are used to evaluate the predicted performance (both individually and collectively) at the aquifer restoration modules. Four of the five aquifer zones (Aquifer Zones 1 through 4) contain aquifer remediation modules. Aquifer Zone 0 (the 5th zone) is the area outside the other four aquifer zones. The location of the extraction or re-injection wells comprising the restoration modules is as follows:

- The South Plume Module is located in Aquifer Zone 4.
- The South Field Extraction (Phase I and II) Modules and the Re-Injection Module are located in Aquifer Zone 2.
- The Waste Storage Area Module is located in Aquifer Zone 1.

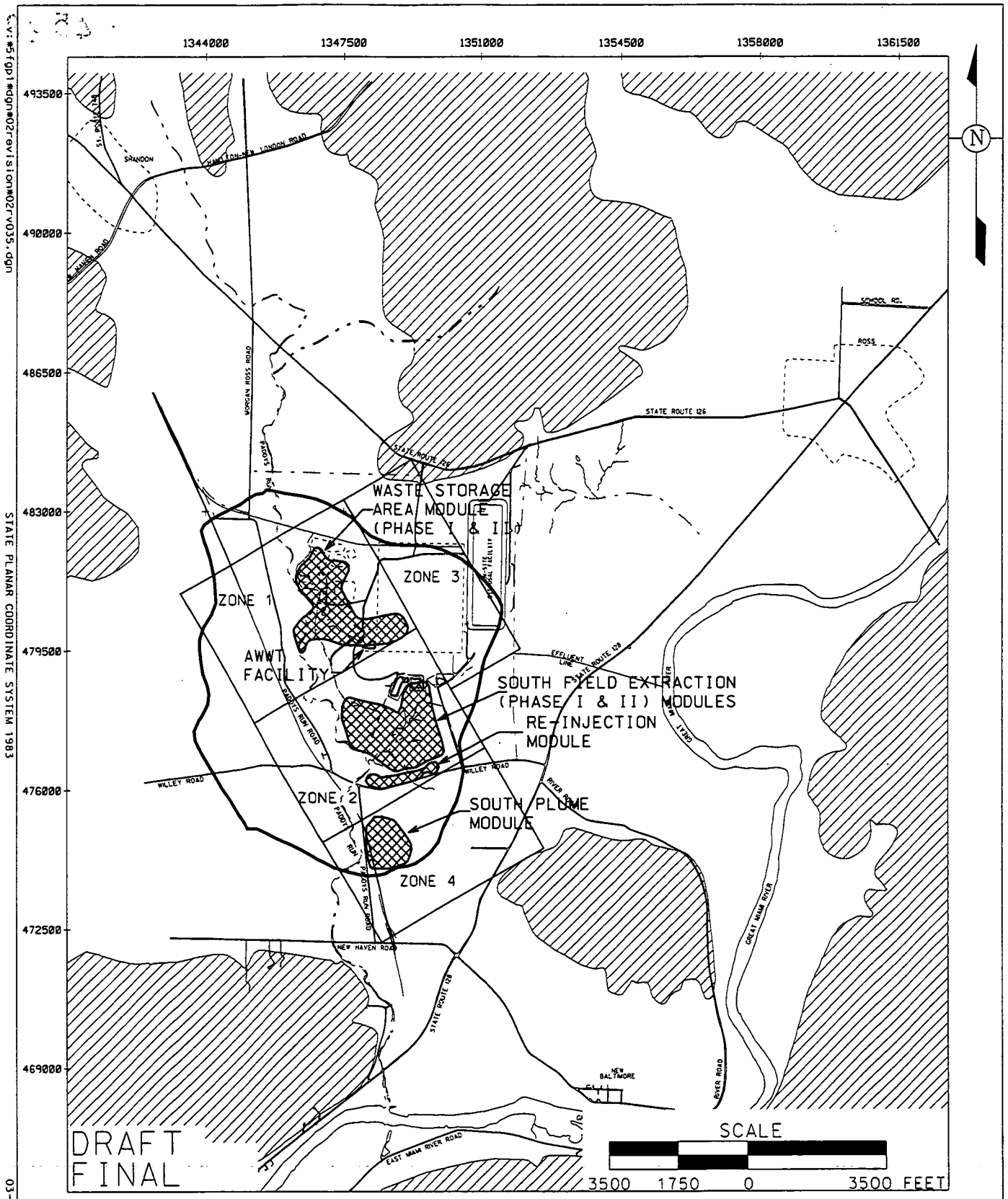
The 10-year, uranium-based restoration footprint is shown in Figure 3-4 so that its relationship to the aquifer zones can be seen.

3.4.2.3 Well Selection Criteria

Geologic and hydrogeologic properties, predicted and actual groundwater flow, and contaminant distribution within the Great Miami Aquifer (before and during remediation), serve as input to the design and modification of the IEMP groundwater monitoring network. Field measurements and computer simulations were conducted to support initial design efforts. Continued monitoring, and modeling (to support module design and changes) are used to assess the adequacy of the monitoring network. All available information is reviewed to select appropriate monitoring well locations. In general, the monitoring well locations for the IEMP are selected according to the following criteria:

- Monitor within the projected capture zone of the groundwater restoration operation unless an operational concern (i.e., the close proximity of the South Plume extraction wells to the Paddys Run Road Site plume) requires a monitoring location to be outside of the capture zone.

  Note: By 2003 most of the extraction wells and re-injection wells planned for the aquifer remedy will be operational. A few additional wells are planned for the Waste Storage Area. Additional wells may be installed if conditions indicate that they are needed. Also, pumping rates may change to optimize the operation through time. To be conservative, the monitoring well network will cover the capture zone predicted for all planned pumping wells, not just for the wells in service at the time that monitoring is taking place. This capture zone is not static, but may change over time to reflect new pumping and injection operations. Modeling is currently underway to determine a new capture zone, following the finalization of a new module design for the Waste Storage Area and South Field Phase II Area, and further evaluation of the off-property South Plume area. The modeling work (and new capture zone) will be reported in an addendum to the OU5 Baseline Remedial Strategy Report. Based on results of this work, the network design presented for 2003 and 2004 may need to be slightly modified, but no changes are anticipated at this time.




LEGEND:

- FEMP BOUNDARY
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS
- GEOGRAPHIC AREAS WITHIN WHICH EXTRACTION AND/OR RE-INJECTION WELLS ARE PLANNED

ZONE 0 CONSISTS OF ALL AREAS OUTSIDE ZONES 1, 2, 3, AND 4.

FIGURE 3-4. GROUNDWATER AQUIFER ZONES AND AQUIFER RESTORATION FOOTPRINT



c:\v:\#51fgp1#dgn#02revision#02rv035.dgn
STATE PLANAR COORDINATE SYSTEM 1983
03-OCT-2002

- Use existing monitoring wells and avoid installing new monitoring wells until determined necessary based on operational knowledge, which will be used to help select new locations.

  Note: In 2001, nine new monitoring wells were installed in the Waste Storage area module to provide better monitoring coverage of the extraction wells near the Pilot Plant Drainage Ditch. In 2002, 26 new monitoring wells were installed in the South Field area to provide better monitoring coverage of the extraction and re-injection wells in the South Field. The Project Specific Plan covering the new wells in the South Field was titled, Project Specific Plan for the Installation of the South Field Phase II Module Extraction/Re-Injection Wells and Additional South Field Monitoring Wells" (DOE 2002). The strategy is to have a network that provides coverage on each side (surrounding) of an extraction/re-injection well.

- Provide adequate areal coverage across each remediation module area

- Include monitoring wells which are needed to meet site-specific monitoring commitments

- Avoid selecting monitoring well locations, which would interfere with surface remediation activities such as soil excavations.

  Note: This criterion is becoming less of a concern because most of the planned monitoring wells are already in place. At issue though, is the loss of monitoring wells should excavation activities expand into areas that contain existing monitoring wells. It is anticipated that some monitoring wells in the current network will need to be plugged and abandoned to make way for surface operations, but all efforts will be made to keep existing wells if possible. If wells are lost due to surface operations, replacement wells will be installed, if deemed appropriate at the time.

- Select monitoring well locations that will provide data needed to determine if groundwater model predictions are being achieved.

- Select monitoring well locations in consideration of landowner concerns. In the off-property portion of the South Plume, landowner access concerns have and will continue to have a bearing on the location and number of monitoring wells in that area. Generally, location of monitoring wells is limited to peripheral areas along the edges of the farm fields. This monitoring well limitation is being addressed through supplemental use of direct push sampling that can be conducted during the times of the year when the fields are not being used for crops.

During 2003 and 2004, 148 wells at the FEMP will be monitored as identified in subsequent subsections.

#### 3.4.2.4 Constituent Selection Criteria

The groundwater sampling constituent selection criteria are based on evaluation of the nearly five years of groundwater data that have been collected since inception of the IEMP. Rationale and justification for the revision are provided in Appendix A. The following is a brief overview.

Restoration of the aquifer will be verified against FRLs. FRLs for the aquifer have been established in the Operable Unit 5 Record of Decision for 50 constituents of concern. Groundwater monitoring has and will continue to focus on these 50 FRL constituents to assess the progress of the aquifer remedy.

During the past five years the remedy has been tracked using a logical "short list" of constituents, with the understanding that verification of the completion of the remedy would be made using the full suite of 50 FRL constituents. The original "short list" of FRL groundwater constituents was based on mobility and persistence characteristics and whether or not the constituents had ever been detected in the aquifer for the monitoring area of concern. As presented in Appendix A, new area specific short lists have been determined based on whether the constituent had an FRL exceedance in the aquifer since inception of the IEMP. Constituents on these revised short lists will be monitored semiannually. Those not on the short lists will be monitored every five years. The next scheduled five year sampling event will be in 2006.

Table 3-2 summarizes groundwater sampling results since the inception of IEMP program and contains the following information:

- Column 1 lists the 50 constituents for which FRLs were established in the Operable Unit 5 Record of Decision
- Column 2 lists the respective FRL concentration for each of the constituents
- Column 3 identifies the basis for each FRL constituent (i.e., Risk, ARAR, Background, or Detection limit) as defined in the Operable Unit 5 Feasibility Study Report
- Column 4 documents the number of samples that have been analyzed for each constituent since the start of IEMP sampling
- Column 5 notes the number of samples that have had a concentration greater than the FRL for each constituent
- Column 6 notes the percent of the samples for each constituent that have had a concentration greater than the FRL
- Column 7 identifies the zones where FRL exceedances have been observed and the number of wells in each zone that had exceedances
- Column 8 shows the above FRL concentration range for each constituent that had FRL exceedances.

# TABLE 3-2

## GROUNDWATER FRL EXCEEDANCES BASED ON SAMPLES AND LOCATIONS SINCE IEMP INCEPTION (FROM AUGUST 1997 THROUGH 2001)

| (1) Constituents | (2) Groundwater FRL[a] | (3) Basis for FRL[b] | (4) No. of Samples[c] | (5) No. of Samples > FRL[c,d] | (6) Percent of Samples > FRL | (7) Zones with FRL Exceedances (No. of Wells with exceedances in each Aquifer Zone)[c,d,e] | (8) Range above FRL[c,d,e] |
|---|---|---|---|---|---|---|---|
| Uranium, Total | 30 µgL | A | 2473 | 632 | 25.56% | 1(9) 2(35) 3(2) 4(16) | 30.13 J/844.991 - |
| Zinc | 0.021 mg/L | B | 854 | 70 | 8.20% | 0(10) 1(5) 2(14) 3(5) 4(2) | 0.0216 -/13.6 - |
| Manganese | 0.90 mg/L | B | 1025 | 62 | 6.05% | 0(5) 1(6) 2(8) 3(5) 4(3) | 0.916 -/105 J |
| Nickel | 0.10 mg/L | A | 853 | 19 | 2.23% | 0(1) 2(7) 3(1) | 0.101 -/1.54 - |
| Lead | 0.015 mg/L | A | 853 | 12 | 1.41% | 0(2) 1(2) 2(4) 3(1) | 0.0157 -/0.201 - |
| Technetium-99 | 94 pCi/L | R* | 1089 | 15 | 1.38% | 1(3) | 101.08 -/1352.266 J |
| Nitrate[f] | 11 mg/L | B | 1625 | 19 | 1.17% | 1(5) 2(1)[g] | 11.4 -/331 NV |
| Arsenic | 0.050 mg/L | A | 1046 | 12 | 1.15% | 0(1) 1(1) 2(1) 4(4) | 0.0547 -/0.125 - |
| Boron | 0.33 mg/L | R | 1516 | 14 | 0.92% | 2(2) | 0.331 -/1.16 - |
| Molybdenum | 0.10 mg/L | A | 674 | 5 | 0.74% | 1(1) | 0.207 -/0.69 - |
| Carbon disulfide | 0.0055 mg/L | A | 854 | 5 | 0.59% | 0(1)[h] 1(3) 2(1)[h] | 0.006 -/0.014 - |
| Trichloroethene | 0.0050 mg/L | A | 983 | 5 | 0.51% | 1(2) | 0.0207 -/0.120 - |
| Antimony | 0.0060 mg/L | A | 854 | 4 | 0.47% | 0(1) 1(1) 2(2) | 0.0073 J/0.0196 J |
| Fluoride | 4 mg/L | A | 1045 | 4 | 0.38% | 0(2) 1(1) 3(1) | 5.3 -/12.3 - |
| Vanadium | 0.038 mg/L | R | 810 | 1 | 0.12% | 0(1) | 0.0664 J[i] |
| 1,1-Dichloroethane | 0.28 mg/L | A | 86 | 0 | 0% | NA | NA |
| 1,1-Dichloroethene | 0.0070 mg/L | A | 323 | 0 | 0% | NA | NA |
| 1,2-Dichloroethane | 0.0050 mg/L | A | 602 | 0 | 0% | NA | NA |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 0.000010 mg/L | D | 19 | 0 | 0% | NA | NA |
| 4-Methylphenol | 0.029 mg/L | R | 86 | 0 | 0% | NA | NA |
| 4-Nitrophenol | 0.32 mg/L | R | 86 | 0 | 0% | NA | NA |
| alpha-Chlordane | 0.0020 mg/L | A | 490 | 0 | 0% | NA | NA |
| Aroclor-1254 | 0.00020 mg/L | D | 86 | 0 | 0% | NA | NA |
| Barium | 2.0 mg/L | A | 176 | 0 | 0% | NA | NA |
| Benzene | 0.0050 mg/L | A | 764 | 0 | 0% | NA | NA |
| Beryllium | 0.0040 mg/L | A | 762 | 0 | 0% | NA | NA |
| bis(2-Chloroisopropyl) ether | 0.0050 mg/L | D | 238 | 0 | 0% | NA | NA |
| bis(2-Ethylhexyl)phthalate | 0.0060 mg/L | A | 86 | 0[j] | 0% | NA[j] | NA |
| Bromodichloromethane | 0.10 mg/L | A | 489 | 0 | 0% | NA | NA |
| Bromomethane | 0.0021 mg/L | R | 86 | 0 | 0% | NA | NA |
| Cadmium | 0.014 mg/L | B | 853 | 0 | 0% | NA | NA |

# TABLE 3-2
## (Continued)

| (1) Constituents | (2) Groundwater FRL[a] | (3) Basis for FRL[b] | (4) No. of Samples[c] | (5) No. of Samples > FRL[c,d] | (6) Percent of Samples > FRL | (7) Zones with FRL Exceedances (No. of Wells with exceedances in each Aquifer Zone)[c,d,e] | (8) Range above FRL[c,d,e] |
|---|---|---|---|---|---|---|---|
| Carbazole | 0.011 mg/L | R | 238 | 0 | 0% | NA | NA |
| Chloroethane | 0.0010 mg/L | D | 86 | 0 | 0% | NA | NA |
| Chloroform | 0.10 mg/L | A | 86 | 0 | 0% | NA | NA |
| Chromium VI | 0.022 mg/L | R | 12 | 0 | 0% | NA | NA |
| Cobalt | 0.17 mg/L | R | 762 | 0 | 0% | NA | NA |
| Copper | 1.3 mg/L | A | 101 | 0 | 0% | NA | NA |
| Mercury | 0.0020 mg/L | A | 1640 | 0 | 0% | NA | NA |
| Methylene chloride | 0.0050 mg/L | A | 86 | 0 | 0% | NA | NA |
| Neptunium-237 | 1.0 pCi/L | R* | 1396 | 0 | 0% | NA | NA |
| Octachlorodibenzo-p-dioxin | 1.0E-7 mg/L | D | 19 | 0 | 0% | NA | NA |
| Radium-226 | 20 pCi/L | A | 174 | 0 | 0% | NA | NA |
| Radium-228 | 20 pCi/L | A | 86 | 0 | 0% | NA | NA |
| Selenium | 0.050 mg/L | A | 853 | 0 | 0% | NA | NA |
| Silver | 0.050 mg/L | A | 746 | 0 | 0% | NA | NA |
| Strontium-90 | 8.0 pCi/L | A | 1204 | 0 | 0% | NA | NA |
| Thorium-228 | 4.0 pCi/L | R* | 850 | 0 | 0% | NA | NA |
| Thorium-230 | 15 pCi/L | R* | 86 | 0 | 0% | NA | NA |
| Thorium-232 | 1.2 pCi/L | R* | 775 | 0 | 0% | NA | NA |
| Vinyl chloride | 0.0020 mg/L | A | 489 | 0 | 0% | NA | NA |

[a]From Operable Unit 5 Record of Decision, Table 9-4
[b]From Operable Unit 5 Feasibility Study, Table 2-16:
A - ARAR based
B - Based on 95th percentile background concentrations
D - Based on lowest achievable detection limit
R - Risk based Preliminary Remediation Goal (PRG)
R*- Risk based Preliminary Remediation Level includes the radionuclide risk-based PRG plus its 95th percentile background concentration.
[c]Based on filtered and unfiltered samples from the August 1997 through 2001 IEMP groundwater data
[d]Sample results having a -, J, or NV qualifier were used:
- = result is confident as reported
J = result is quantitatively estimated
NV = result is not validated
[e]NA = not applicable
[f]Nitrate/nitrite results are evaluated with respect to the nitrate FRL.
[g]Since the IEMP inception, there has been only one nitrate/nitrite exceedance at Well 2017 in 1998, which has not occurred in later years (refer to Figure A-11).
[h]Since the IEMP inception, there has been one isolated exceedance for carbon disulfide at two locations (refer to Figure A-5)
[i]Since the IEMP inception, there has been only one vanadium exceedance at Well 2426 in 1998, which has not occurred in later years (refer to Figure A-15).
[j]Of the 86 samples analyzed for bis(2-Ethylhexyl)phthalate, a common laboratory containment, five had results above the FRL. The above FRL results are all considered suspect due to laboratory analysis issues, laboratory blank and field blank contamination, or field duplicate results being non-detected. The five results exceeding the FRL are as follows: 0.014J mg/L, Well 2398 and 0.010J mg/L, Well 3390 in Aquifer Zone 2; 0.016J mg/L, Well 2109 in Aquifer Zone 3; 0.008J mg/L, Well 2125 and 0.13J mg/L, Well 3095 in Aquifer Zone 4.

As can be seen in Table 3-2, thirty-five of the 50-groundwater FRL constituents did not have an FRL exceedance. Excluding uranium, the groundwater FRL constituents that did have recorded exceedances were from a limited number of wells. The spatial distribution of these wells indicates that many of the non-uranium FRL exceedances are not associated with a plume.

The revised groundwater-monitoring program will focus on this new short-list of 15 groundwater FRL constituents. The following monitoring will be conducted:

1. Uranium, which is the primary constituent of concern and has the greatest number of wells with exceedances, will be monitored semiannually.

2. Constituents that have FRL exceedances in multiple zones (i.e., antimony, arsenic, fluoride, lead, manganese, nickel, and zinc) will be monitored semiannually as follows:

   - At a minimum, all constituents will be monitored at downgradient wells including existing property boundary/on-site disposal facility wells along the eastern perimeter of the site and additionally those wells along the eastern/southern boundary of the South Plume. Figure A-18 (Area C) shows the configuration of this monitoring network, which lies in Zones 0, 2, 3, and 4 and for the most part outside of the restoration footprint. Monitoring at these locations will document that above FRL contaminants are not migrating beyond the expected capture zone.

     Note: Carbon disulfide and nitrate/nitrite are considered to have legitimate exceedances in only one zone (i.e., Zone 1) and are discussed below (item #3).

   - In addition to being monitored in Zones 0, 2, 3, and 4, constituents that have exceedances in multiple zones were evaluated with respect to Zone 1 to determine if monitoring should be conducted to address consistent/recent exceedances in this area. Monitoring will be addressed in this zone, in addition to the monitoring at the Property/Plume Boundary, to ensure that the constituents exhibiting consistent/recent exceedances are being monitored near potential sources. From review of Table A-2, only manganese in Zone 1 appears to have recent and consistent exceedances. Therefore, it will be monitored in this zone at wells that have exceedances. Refer to Figure A-18 (Area A) for the locations to be monitored in Zone 1.

3. Constituents that have FRL exceedances in only one zone will be monitored semiannually solely in that zone. The monitoring will consist of the following: carbon disulfide, molybdenum, nitrate/nitrite, technetium-99, and trichloroethene in Zone 1 (Waste Storage Area) and boron in Zone 2 (South Field). Specific monitoring locations will be based on the wells that have exceedances.

   Note: Carbon disulfide primarily has exceedances in Zone 1. The two wells that have exceedances outside Zone 1 were property boundary wells 2432 and 3069. These wells were sampled quarterly and exceedances were minimally above the FRL (6 μg/L with respect to the 5.5 μg/L FRL). For well 2432, there have been no additional exceedances since the occurrence during first quarter 1999. In regard to the one exceedance for well 3069 that occurred during fourth quarter 2001, a duplicate result during the sampling event was below the FRL (Refer to Figure A-5). Results in 2002 will be used to evaluate persistence for well 3069.

   Nitrate/nitrite primarily has exceedances in Zone 1. One well, 2017, which is located in Zone 2, had a one-time exceedance in 1998.

4. Vanadium has a one-time exceedance in 1998 during IEMP quarterly sampling at one well, 2426. This constituent will be monitored on a less than semi-annual frequency due to the lack of exceedances. Monitoring for this constituent is addressed in Section A.3.2 (Monitoring for FRL constituents without exceedances).

Delegating vanadium to the 5-year constituent-sampling list, because it only had one exceedance, leaves 13 non-uranium groundwater FRL constituents on the short-list. The 13 constituents are listed in Table 3-3, along with the aquifer zones in which their FRL exceedances occurred and the monitoring activity they are assigned to. These short-listed constituents will be monitored semi-annually. The 37 constituents will be monitored once every five years. Additional rationale and information concerning constituent selection is presented in Appendix A.

## 3.5 DESIGN OF THE IEMP GROUNDWATER MONITORING PROGRAM

A revised groundwater remedy performance monitoring approach will be implemented in 2003 and 2004. This revised approach is based on the evaluation of nearly five years of groundwater data that have been collected since beginning the groundwater remedy performance monitoring specified in previous versions of the IEMP. The revised monitoring approach focuses on monitoring groundwater FRL constituents with recorded IEMP period exceedances on a semi-annual basis and monitoring groundwater FRL constituents without recorded IEMP period exceedances every five years. A listing of IEMP Groundwater Monitoring

## TABLE 3-3

## IEMP CONSTITUENTS WITH FRL EXCEEDANCES, LOCATION OF EXCEEDANCES, AND REVISED MONITORING PROGRAM

| Parameter | Aquifer Zones with Exceedances | Monitoring Program |
|---|---|---|
| Antimony | Multiple Zones | Property/Plume Boundary |
| Arsenic | Multiple Zones | Property/Plume Boundary |
| Boron | Aquifer Zone 2 (South Field) | South Field |
| Carbon Disulfide | Aquifer Zone 1 (Waste Storage Area) | Waste Storage Area |
| Fluoride | Multiple Zones | Property/Plume Boundary |
| Lead | Multiple Zones | Property/Plume Boundary |
| Manganese | Multiple Zones[a] | Property/Plume Boundary, Waste Storage Area |
| Molybdenum | Aquifer Zone 1 (Waste Storage Area) | Waste Storage Area |
| Nickel | Multiple Zones | Property/Plume Boundary |
| Nitrate/Nitrite | Aquifer Zone 1 (Waste Storage Area) | Waste Storage Area |
| Technetium-99 | Aquifer Zone 1 (Waste Storage Area) | Waste Storage Area |
| Trichloroethene | Aquifer Zone 1 (Waste Storage Area) | Waste Storage Area |
| Zinc | Multiple Zones | Property/Plume Boundary |

[a]There are consistent/recent exceedances of manganese in Zone 1; therefore, this constituent will be monitored in the Waste Storage Area, and also along the Property/Plume Boundary.

Wells is provided in Table 3-4. Table 3-5 provides a listing of the monitoring requirements. Justification for the monitoring approach is provided in Appendix A.

The monitoring strategy and technical approach will be revised as necessary in subsequent revisions to the IEMP to encompass operational changes over the life of the remedy. A start-up monitoring project-specific plan will be developed to supplement the IEMP each time a new module begins operations.

## 3.6 MEDIA-SPECIFIC PLAN FOR GROUNDWATER MONITORING

This section serves as the Media-Specific Plan for implementation of the sampling, analysis, and data management activities associated with the sitewide groundwater remedy performance monitoring program. The program expectations and design presented in Section 3.4 were used as the framework for developing the monitoring approach presented in this section. The activities described in this Media-Specific Plan have been designed to provide groundwater data of sufficient quality to meet the program expectations as defined in Section 3.4.1. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 2002b).

Subsequent sections of this Media-Specific Plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance.

### 3.6.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this Media-Specific Plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this Media-Specific Plan in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all Media-Specific Plan activities defined herein with other project organizations is also a key responsibility. All changes to media activities must be approved by the team leader or designee.

# TABLE 3-4

## LISTING OF IEMP GROUNDWATER MONITORING WELLS[a]

| | | Property/Plume Boundary Monitoring | | | | |
|---|---|---|---|---|---|---|
| Number | Total Uranium Monitoring | Monitor FRL Exceedances | Monitor OSDF Constituents[b] | Monitor PRRS Constituents[c] | Waste Storage Area Monitoring - FRL Exceedances | South Field Monitoring - FRL Exceedances |
| 1 | 13 | | | | | |
| 2 | 14 | | | | | |
| 3 | 2002 | | | | | |
| 4 | 2008 | | | | | |
| 5 | 2009 | | | | | |
| 6 | 2010 | | | | 2010 | |
| 7 | 2014 | | | | | |
| 8 | 2016 | | | | | |
| 9 | 2015 | | | | | |
| 10 | 2017 | | | | | |
| 11 | 2032 | | | | | |
| 12 | 2037 | | | | 2037 | |
| 13 | 2045 | | | | | 2045 |
| 14 | 2046 | | | | | |
| 15 | 2048 | | | | | |
| 16 | 2049 | | | | | 2049 |
| 17 | 2054 | | | | | |
| 18 | 2060 (12) | | | | | |
| 19 | 2068 | | | | | |
| 20 | 2070 | 2070 | | | | |
| 21 | 2093 | 2093 | | | | |
| 22 | 2095 | | | | | |
| 23 | 2106 | | | | | |
| 24 | 2109 | | | | | |
| 25 | 2118 | | | | | |
| 26 | 2125 | | | | | |
| 27 | 2128 | 2128 | | 2128 | | |
| 28 | 2166 | | | | | |
| 29 | 2385 | | | | | |
| 30 | 2386 | | | | | |
| 31 | 2387 | | | | | |
| 32 | 2389 | | | | | |
| 33 | 2390 | | | | | |
| 34 | 2396 | | | | | |
| 35 | 2397 | | | | | |
| 36 | 2398 | 2398 | | | | |
| 37 | 2402 | | | | | |
| 38 | 2426 | 2426 | | | | |
| 39 | 2429 | 2429 | | | | |
| 40 | 2430 | 2430 | | | | |
| 41 | 2431 | 2431 | | | | |

000064

**TABLE 3-4**
**(Continued)**

| Number | Total Uranium Monitoring | Property/Plume Boundary Monitoring: Monitor FRL Exceedances | Monitor OSDF Constituents[b] | Monitor PRRS Constituents[c] | Waste Storage Area Monitoring - FRL Exceedances | South Field Monitoring - FRL Exceedances |
|---|---|---|---|---|---|---|
| 42 | 2432 | 2432 | | | | |
| 43 | 2550 | | | | | |
| 44 | 2552 | | | | | |
| 45 | 2553 | | | | | |
| 46 | 2625 | 2625 | | 2625 | | |
| 47 | 2636 | 2636 | | 2636 | | |
| 48 | 2648 | | | | 2648 | |
| 49 | 2649 | | | | 2649 | |
| 50 | 2733 | 2733 | | | | |
| 51 | 2821 | | | | 2821 | |
| 52 | 2880 | | | | | |
| 53 | 2897 | | | | | |
| 54 | 2898 | 2898 | | 2898 | | |
| 55 | 2899 | 2899 | | 2899 | | |
| 56 | 2900 | 2900 | | 2900 | | |
| 57 | 3009 | | | | 3009 | |
| 58 | 3014 | | | | | |
| 59 | 3015 | | | | | |
| 60 | 3032 | | | | | |
| 61 | 3045 | | | | | |
| 62 | 3046 | | | | | |
| 63 | 3049 | | | | | |
| 64 | 3054 | | | | | |
| 65 | 3067 | 3067 | | | | |
| 66 | 3069 | | | | | |
| 67 | 3070 | 3070 | | | | |
| 68 | 3093 | 3093 | | | | |
| 69 | 3095 | | | | | |
| 70 | 3106 | | | | | |
| 71 | 3125 | | | | | |
| 72 | 3128 | 3128 | | 3128 | | |
| 73 | 3385 | | | | | |
| 74 | 3387 | | | | | |
| 75 | 3390 | | | | | |
| 76 | 3396 | | | | | |
| 77 | 3397 | | | | | |
| 78 | 3398 | 3398 | | | | |
| 79 | 3402 | | | | | |
| 80 | 3424 | 3424 | | | | |
| 81 | 3426 | 3426 | | | | |
| 82 | 3429 | 3429 | | | | |
| 83 | 3431 | 3431 | | | | |
| 84 | 3432 | 3432 | | | | |
| 85 | 3550 | | | | | |

**TABLE 3-4**
**(Continued)**

| Number | Total Uranium Monitoring | Property/Plume Boundary Monitoring | | | Waste Storage Area Monitoring - FRL Exceedances | South Field Monitoring - FRL Exceedances |
|---|---|---|---|---|---|---|
| | | Monitor FRL Exceedances | Monitor OSDF Constituents[b] | Monitor PRRS Constituents[c] | | |
| 86 | 3552 | | | | | |
| 87 | 3636 | 3636 | | 3636 | | |
| 88 | 3733 | 3733 | | | | |
| 89 | 3821 | | | | 3821 | |
| 90 | 3880 | | | | | |
| 91 | 3897 | | | | | |
| 92 | 3898 | 3898 | | 3898 | | |
| 93 | 3899 | 3899 | | 3899 | | |
| 94 | 3900 | 3900 | | 3900 | | |
| 95 | 4125 | | | | | |
| 96 | 4398 | 4398 | | | | |
| 97 | 6880 | | | | | |
| 98 | 6881 | | | | | |
| 99 | 21033 | | | | | |
| 100 | 21063 | 21063 | | | | |
| 101 | 21192 | | | | | |
| 102 | 22204 | 22204 | 22204 | | | |
| 103 | 22205 | 22205 | 22205 | | | |
| 104 | 22208 | 22208 | 22208 | | | |
| 105 | 22198 | 22198 | 22198 | | | |
| 106 | 22199 | 22199 | 22199 | | | |
| 107 | 23064 | | | | | |
| 108 | 23118 | | | | | |
| 109 | 23271 | | | | | |
| 110 | 23272 | | | | | |
| 111 | 23273 | | | | | |
| 112 | 23274 | | | | | |
| 113 | 23275 | | | | | |
| 114 | 23276 | | | | | |
| 115 | 23277 | | | | | |
| 116 | 23278 | | | | | |
| 117 | 23279 | | | | | |
| 118 | 23280 | | | | | |
| 119 | 23281 | | | | | |
| 120 | 23282 | | | | | |
| 121 | 31217 | 31217 | | | | |
| 122 | 32766 | | | | | |
| 123 | 32768 | | | | | |
| 124 | 62408 | | | | | |
| 125 | 62433 | | | | | |
| 126 | 63116 | | | | | |
| 127 | 63119 | | | | | |
| 128 | 63121 | | | | | |
| 129 | 63122 | | | | | |

**TABLE 3-4**
**(Continued)**

| Number | Total Uranium Monitoring | Property/Plume Boundary Monitoring | | | Waste Storage Area Monitoring - FRL Exceedances | South Field Monitoring - FRL Exceedances |
|---|---|---|---|---|---|---|
| | | Monitor FRL Exceedances | Monitor OSDF Constituents[b] | Monitor PRRS Constituents[c] | | |
| 130 | 63283 | | | | | |
| 131 | 63284 | | | | | |
| 132 | 63285 | | | | | |
| 133 | 63286 | | | | | |
| 134 | 63287 | | | | | |
| 135 | 63288 | | | | | |
| 146 | 63289 | | | | | |
| 137 | 63290 | | | | | |
| 138 | 63291 | | | | | |
| 139 | 63292 | | | | | |
| 140 | 82433 | | | | | |
| 141 | 83117 | | | | | |
| 142 | 83120 | | | | | |
| 143 | 83123 | | | | | |
| 144 | 83124 | | | | | |
| 145 | 83293 | | | | | |
| 146 | 83294 | | | | | |
| 147 | 83295 | | | | | |
| 148 | 83296 | | | | | |

[a]The Column 1 number is used to identify the number of wells in the overall program. The individual monitoring well identification numbers are provided in Columns 2-7 as appropriate.
[b]Listing of total uranium monitoring wells and Property/Plume Boundary monitoring wells that overlap with OSDF monitoring wells.
[c]Listing of total uranium monitoring wells and Property/Plume Boundary monitoring wells that overlap with PRRS monitoring wells.

# TABLE 3-5

## MONITORING REQUIREMENTS[a]

**1. TOTAL URANIUM** *(148 wells – 47 wells are from the activities below)*

**2. WASTE STORAGE AREA** *(7 wells)*

| General Chemistry | Inorganic | Radionuclide | Organic |
|---|---|---|---|
| Nitrate/Nitrite | Manganese | Technetium-99 | Carbon Disulfide |
| | Molybdenum | Total Uranium[b] | Trichloroethene |

**3. SOUTH FIELD** *(2 wells)*

| General Chemistry | Inorganic | Radionuclide | Organic |
|---|---|---|---|
| NA | Boron | Total Uranium[b] | NA |

**4. PROPERTY/PLUME BOUNDARY FOR FRL EXCEEDANCES** *(38 wells)*

| General Chemistry | Inorganic | Radionuclide | Organic |
|---|---|---|---|
| Fluoride | Antimony | Total Uranium[b] | NA |
| | Arsenic | | |
| | Lead | | |
| | Manganese | | |
| | Nickel | | |
| | Zinc | | |

**5. PROPERTY/PLUME BOUNDARY FOR PRRS** *(11 wells are a subset of the 38 Property/Plume Boundary)*

| General Chemistry | Inorganic | Radionuclide | Organic |
|---|---|---|---|
| Phosphorous | Arsenic[c] | NA | Benzene |
| | Potassium | | Ethyl benzene |
| | Sodium | | Isopropyl benzene |
| | | | Toluene |
| | | | Total xylene |

[a]Monitoring will be conducted semi-annually.
[b]Total uranium is monitored as part of the site-wide uranium monitoring.
[c]Arsenic is also monitored with respect to FRL exceedances as part of the Property/Plume Boundary.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support and assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standards and assist in evaluating and resolving all quality related concerns.

### 3.6.2 Sampling Program

The information derived from the groundwater monitoring program should produce a clear understanding of groundwater quality in the Great Miami Aquifer. The groundwater sampling process will be controlled so that collected samples are representative of groundwater quality. All procedures for monitoring well development, sample collection, and shipment will be performed in accordance with directives established in the SCQ.

#### 3.6.2.1 Total Uranium Monitoring

148 monitoring wells will be sampled semi-annually for total uranium. Forty-seven of these wells will be sampled for additional constituents as described in Section 3.6.2.2 to 3.6.2.4. A listing of the 101 wells to be sampled for total uranium only is provided in Table 3-6 and shown in Figure 3-5.

The wells extend across all aquifer zones, and provide monitoring coverage in all restoration module areas. Figure 3-5 shows the locations of the monitoring wells.

This semi-annual total uranium sampling activity will address the following remediation-sampling needs:

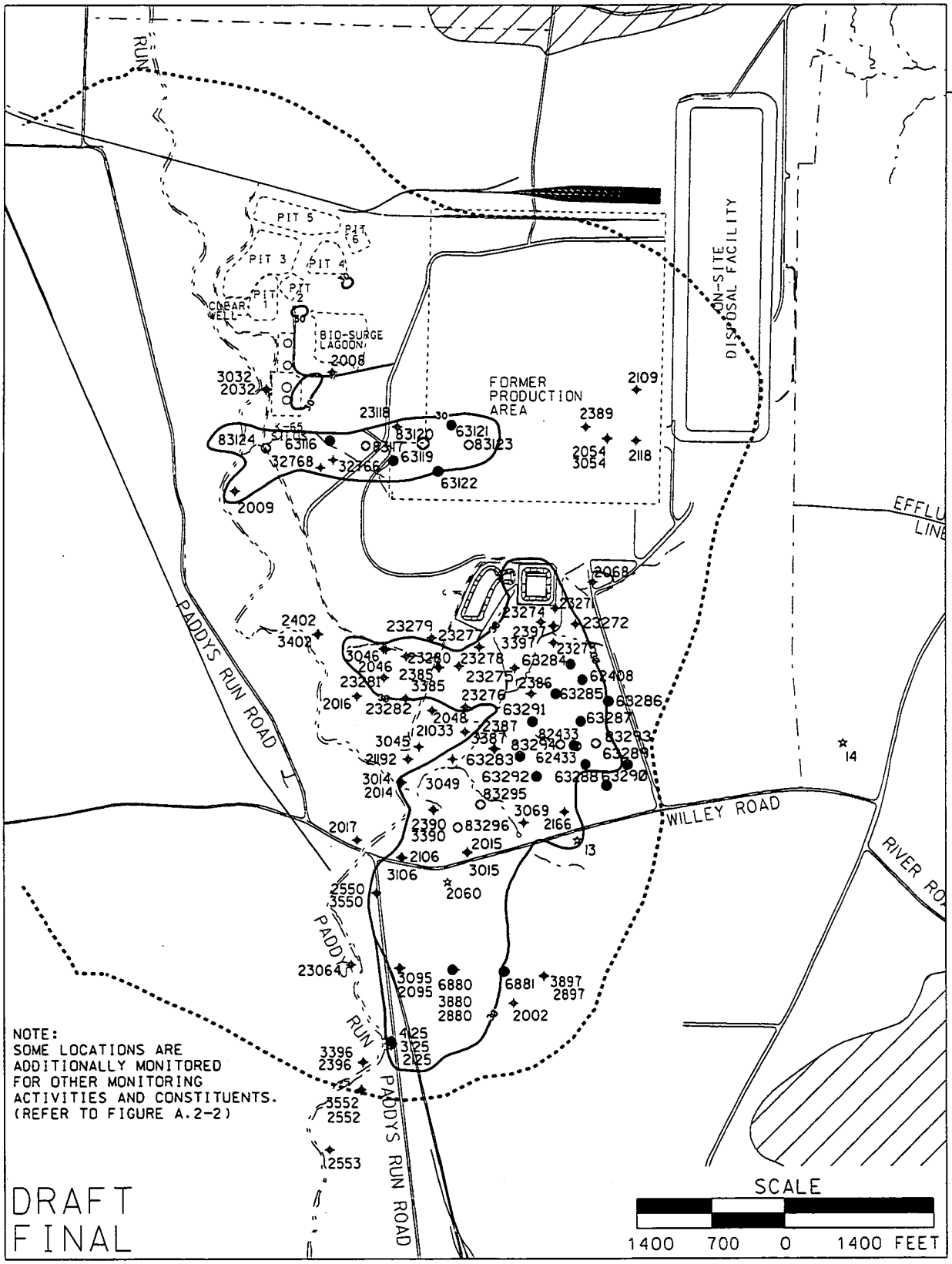
- The need to interpret changes to the total uranium plume over time due to remediation activities
- The need to interpret the extent of capture in relation to the total uranium plume
- The need to interpret the effectiveness of the aquifer remedy in maintaining a hydraulic barrier that limits the further southern migration of the total uranium plume and to document the area of uranium contamination (above 30 μg/L) south of the administrative boundary.
- Continued tracking of uranium concentrations at three off-property private monitoring wells

## TABLE 3-6

## LISTING OF GROUNDWATER WELLS TO BE SAMPLED FOR TOTAL URANIUM ONLY

| | | | | |
|---|---|---|---|---|
| 13 | 14 | 2002 | 2008 | 2009 |
| 2014 | 2015 | 2016 | 2017 | 2032 |
| 2046 | 2048 | 2054 | 2060 (12) | 2068 |
| 2095 | 2106 | 2109 | 2118 | 2125 |
| 2166 | 2385 | 2386 | 2387 | 2389 |
| 2390 | 2396 | 2397 | 2402 | 2550 |
| 2552 | 2553 | 2880 | 2897 | 3014 |
| 3015 | 3032 | 3045 | 3046 | 3049 |
| 3054 | 3069 | 3095 | 3106 | 3125 |
| 3385 | 3387 | 3390 | 3396 | 3397 |
| 3402 | 3550 | 3552 | 3880 | 3897 |
| 4125 | 6880 | 6881 | 21033 | 21192 |
| 23064 | 23118 | 23271 | 23272 | 23273 |
| 23274 | 23275 | 23276 | 23277 | 23278 |
| 23279 | 23280 | 23281 | 23282 | 32766 |
| 32768 | 62408 | 62433 | 63116 | 63119 |
| 63121 | 63122 | 63283 | 63284 | 63285 |
| 63286 | 63287 | 63288 | 63289 | 63290 |
| 63291 | 63292 | 82433 | 83117 | 83120 |
| 83123 | 83124 | 83293 | 83294 | 83295 |
| 83296 | | | | |

Note: Six of the seven available channels in a CMT well are available for water quality sampling. The seventh channel is used only for water level measurements. The channel completed in the plume interval with the highest measured uranium concentration will be sampled every 6-months. The other five channels will only be sampled once a year, to document any changes in the plume concentration profile.




LEGEND:

- FEMP BOUNDARY
- MONITORING WELL
- CMT WELL
- BEDROCK HIGHS
- 30 — TOTAL URANIUM CONTOUR (30 µg/L)
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT (BRSR 1997)

FIGURE 3-5. LOCATIONS FOR SEMI-ANNUAL TOTAL URANIUM MONITORING ONLY





v:\5fop1\dgn\02revision\02rv031.dgn
STATE PLANAR COORDINATE SYSTEM 1983
03-OCT-2002

In addition to monitoring these 101 monitoring wells for uranium semi-annually, up to 27 locations will be sampled each year for total uranium using a direct-push sampling tool. Direct-push sampling will provide vertical profile concentration data. The vertical profile data will be used to supplement the fixed monitoring well data to produce more robust plume interpretations. Exact locations for the direct-push sampling will be selected each year based on monitoring well data, modeling needs, and data interpretation needs.

In 2003 and 2004 three private wells (12, 13, and 14) will continue to be sampled for total uranium. Figure 3-5 shows the location of these three wells. Private well number 12 is also identified as Monitoring Well 2060. Continuing to add to the historical database at these three private well locations is beneficial for facilitating discussions with area stakeholders on the progress of the aquifer restoration. The three locations are situated immediately downgradient of the FEMP property boundary.

3.6.2.2 South Field Monitoring

The South Field is located in Aquifer Zone 2 (Figure 3-4). Thirteen extraction, two re-injection wells, and an injection pond (South Field Phase I and II Modules) are scheduled to be operating in the South Field in 2003–2004.

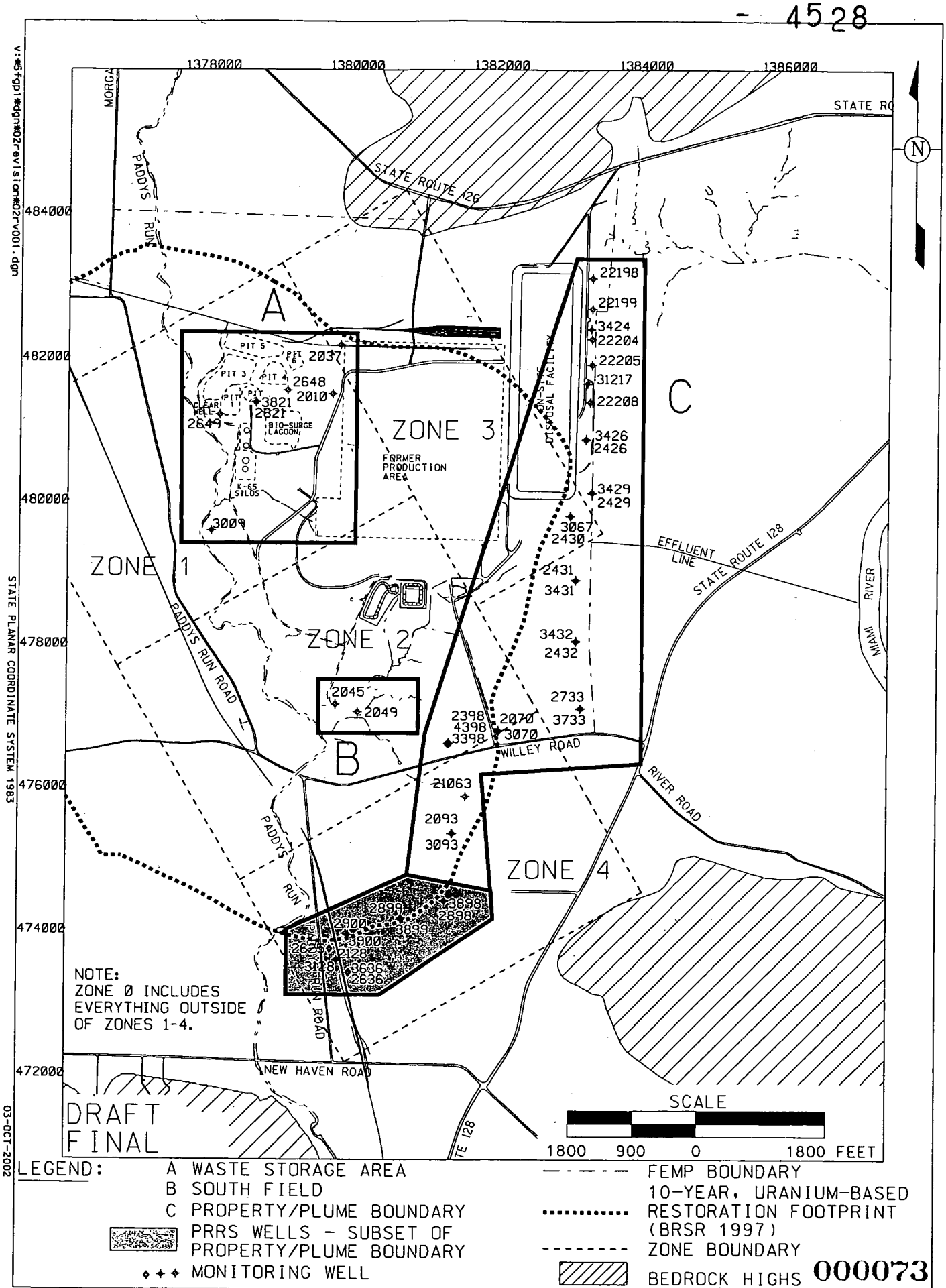
In addition to the monitoring wells being sampled in the South Field for total uranium only (Section 3.6.2.1), two monitoring wells (Wells 2045 and 2049) will also be sampled semi-annually for boron and total uranium. The rational for the selection of these wells and this constituent is presented in Section 3.4 and Appendix A. Figure 3-6 shows the locations of these two wells. The sampling table is provided below.

**SOUTH FIELD MONITORING TABLE**
**SEMI-ANNUAL SAMPLING FREQUENCY**

| General Chemistry | Inorganic | Radionuclide | Organic |
|---|---|---|---|
| NA | Boron | Total Uranium | NA |

Re-Injection Monitoring in the South Field Area

Six re-injection wells are located along the southern FEMP property boundary, just north of Willey Road in the South Field. On September 2, 1999, DOE completed one year of active groundwater re-injection as part of a field-scale demonstration. A report detailing the demonstration was issued to EPA and OEPA on May 30, 2000 (DOE 2000b). Based on the results of the demonstration, re-injection has continued at the FEMP.




000073

FIGURE 3-6. LOCATIONS FOR SEMI-ANNUAL URANIUM AND NON-URANIUM MONITORING PROPERTY/PLUME BOUNDARY, SOUTH FIELD, AND WASTE STORAGE AREA

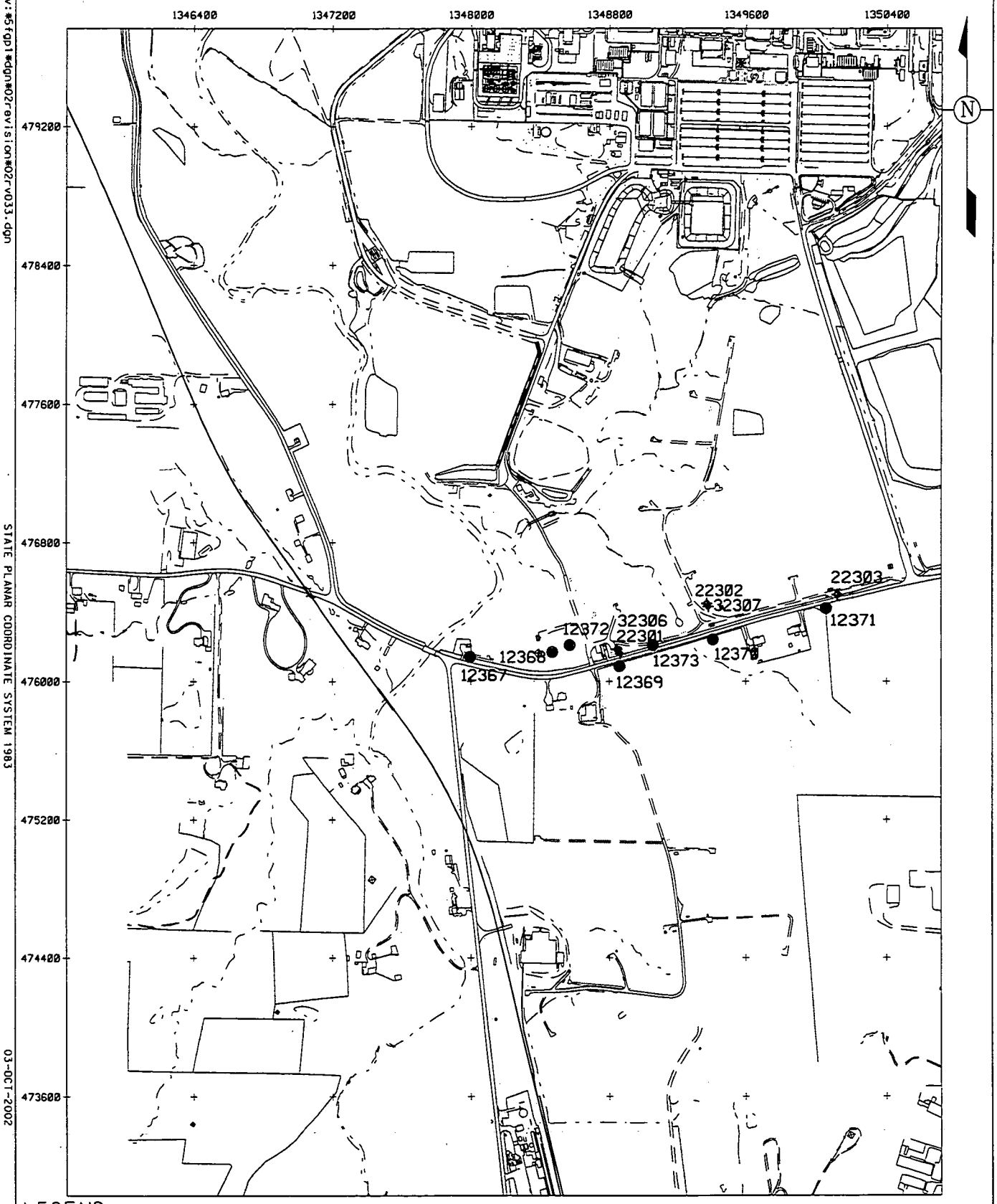
Monitoring during 2003 and 2004 will be conducted to:

- Assess operation of the re-injection wells by documenting re-injection rates, gallons of water re-injected and total uranium re-injected
- Assess aquifer conditions by measuring specific conductivity, pH, Eh, and dissolved oxygen using downhole water quality probes, and by direct push sampling for uranium in the re-injection area.

As recommended in the Re-Injection Demonstration Test Report for the Aquifer Restoration and Wastewater Project (DOE 2000b) the monthly in-situ monitoring of Eh and pH conditions in the aquifer which was conducted during the demonstration will continue on a quarterly basis. Hydrolab™ downhole water quality probes and data loggers will be used to monitor specific conductivity, temperature, pH, Eh, and dissolved oxygen in the aquifer in the area where re-injection is occurring. Twenty-four hours worth of hourly readings will be collected each quarter at Monitoring Wells 22301, 22302, 22303, 32306, and 32307. Figure 3-7 depicts the locations of these monitoring wells. In 2002 replacement wells were installed for Re-Injection Wells 8 and 9, therefore Monitoring Wells 22299, 22300, 32304, and 32305 will no longer be monitored. These four wells monitored around IW-8 and IW-9.

As also recommended in the Re-Injection Demonstration Test Report, annual direct push sampling for total uranium will be conducted along and south of Willey Road to track progress of the re-injection over time. At each direct push location, a groundwater sample will be collected 1-foot below the water table and at 10-foot intervals beneath the water table until it can be verified that the entire vertical thickness of the 30 μg/L total uranium plume has been sampled. Sampling will take place at the same seven locations that were sampled during the demonstration. Figure 3-7 shows these locations.

In the 1998 Integrated Site Environmental Report (1999b), it was presented that chromium VI was not present in the aquifer at the FEMP and that Eh-pH conditions measured in the aquifer were not oxidizing enough to support the presence of chromium VI. These conclusions were based on sampling that took place at eight well locations where measured total chromium concentrations had recently exceeded the FRL for chromium VI. Eh-pH data presented in the Re-Injection Demonstration Test Report indicate that at least on a transient basis, some Eh-pH measurements (recorded around the re-injection wells during the demonstration) were favorable for supporting hexavalent chromium. This is based on the assumption that oxidation kinetics are instantaneous. Additional chromium VI data will be collected to document that no chromium VI is present in the aquifer due to chemistry changes caused by re-injection. Therefore, monitoring for chromium VI will be conducted once every five years in Monitoring Wells 22301, 22302, and 22303. These wells are located within 25 feet of the active re-injection wells. The next sampling is scheduled for the year 2006.




LEGEND:

FEMP BOUNDARY

TYPE 2 MONITORING WELL

TYPE 3 MONITORING WELL

DIRECT PUSH GEOPROBE LOCATION

SCALE

800 400 0 800 FEET

DRAFT FINAL

v:\5fgp1\dgn\02revision\02rv033.dgn

STATE PLANAR COORDINATE SYSTEM 1983

03-OCT-2002

FIGURE 3-7. RE-INJECTION MODULE MONITORING WELLS AND DIRECT PUSH SAMPLING LOCATIONS

000075

The screens in these observation wells are located at approximately the same elevation depth that re-injection will be occurring at in 2003 and 2004. This activity coupled with the continued collection of Eh-pH data (discussed above) should be sufficient to document whether or not chromium VI is present in the aquifer as a result of re-injection.

3.6.2.3 Waste Storage Area Monitoring

The Waste Storage Area is located in Aquifer Zone 1 (Figure 3-4) and contains three total uranium plumes that have been targeted for restoration (Figure 3-2). Three extraction wells (32761, 33062, and 33063) will be operating in the Waste Storage Area in 2003 and 2004. Figure 3-3 shows the locations of these three wells.

In addition to the monitoring wells being sampled in the Waste Storage Area for total uranium only (See Section 3.6.2.1), the seven wells listed below will also be sampled semi-annually. Figure 3-6 shows the locations of these seven wells.

List of Seven Monitoring Wells to be monitored semiannually
In the Waste Storage Area for Constituents listed below

| | | | | |
|---|---|---|---|---|
| 2010 | 2037 | 2648 | 2649 | 2821 |
| 3009 | 3821 | | | |

The seven wells listed above will be sampled for the constituents listed in the table below. The rational for the selection of these wells and these constituents is presented in Section 3.4 and Appendix A.

**WASTE STORAGE AREA MONITORING TABLE**
**SEMI-ANNUAL SAMPLING FREQUENCY**

| General Chemistry | Inorganic | Radionuclide | Organic |
|---|---|---|---|
| Nitrate/Nitrite | Manganese | Technetium-99 | Carbon Disulfide |
| | Molybdenum | Total Uranium | Trichloroethene |

3.6.2.4 Property/Plume Boundary Monitoring

The focus of the Property/Plume Boundary Groundwater Monitoring activity is to detect and assess potential changes in groundwater conditions along the eastern FEMP property boundary and downgradient of the leading edge of the 30 µg/L total uranium plume south of the FEMP Property.

In 2003 and 2004, monitoring will be conducted along the property boundary and downgradient uranium plume boundary for FRL exceedances, and the influence, or lack thereof, that pumping is having on the Paddys Run Road Site Plume will be documented. Monitoring in 2003 and 2004 will also reduce redundancy with On-Site Disposal Facility monitoring.

Property/Plume Boundary Monitoring for FRL Exceedances1

Twenty-seven monitoring wells along the eastern property boundary, and the leading edge of the off-site total uranium plume (see table below) will be sampled semi-annually. Figure 3-6 is a map showing the locations of the wells.

**PROPERTY/PLUME BOUNDARY MONITORING WELLS TO BE MONITORED FOR FRL EXCEEDANCES ONLY**

| | | | | |
|---|---|---|---|---|
| 2070 | 2093 | 2398 | 2426 | 2429 |
| 2430 | 2431 | 2432 | 2733 | 3067 |
| 3070 | 3093 | 3398 | 3424 | 3426 |
| 3429 | 3431 | 3432 | 3733 | 4398 |
| 21063 | 31217 | 22204 | 22205 | 22208 |
| 22198 | 22199 | | | |

The twenty-seven monitoring wells will be sampled semi-annually for the constituents listed below. These constituents have all had FRL exceedances. The rational for the selection of these constituents and the monitoring schedule are presented in Section 3.4 and Appendix A. Once every five years, the following type-4 monitoring wells (4067, 4424, 4426, 4432, and 41217) will also be sampled for the constituents listed below. The next sampling is scheduled for 2006.

Five of the 27 monitoring wells (22204, 22205, 22208, 22198, and 22199) will be sampled for On-Site Disposal Facility constituents at the same time they are being sampled for Property/Plume boundary constituents. The data collected will then be used to satisfy both needs. The On-Site Disposal Facility monitoring wells will continue to be sampled quarterly as specified in the On-Site Disposal Facility Groundwater/Leak Detection and Leak Monitoring Plan (DOE 1997c).

**PROPERTY PLUME BOUNDARY MONITORING TABLE FOR FRL EXCEEDANCES SEMI-ANNUAL SAMPLING FREQUENCY**

| General Chemistry | Inorganic | Radionuclide | Organic |
|---|---|---|---|
| Fluoride | Antimony | Total Uranium | NA |
| | Arsenic | | |
| | Lead | | |
| | Manganese | | |
| | Nickel | | |
| | Zinc | | |

Property/Plume Boundary Monitoring for Paddys Run Road Site Constituents

Groundwater is being pumped from the aquifer immediately north of the Paddys Run Road Site (Extraction Wells 3924, 3925, 3926, and 3927); it remains important to document the influence, or lack thereof, that the pumping is having on the Paddys Run Road Site plume. In 2003 and 2004 groundwater samples will be collected semi-annually from 11 monitoring wells. The eleven wells are tabulated below.

| | | | | |
|---|---|---|---|---|
| 2128 | 2625 | 2636 | 2898 | 2899 |
| 2900 | 3128 | 3636 | 3898 | 3899 |
| 3900 | | | | |

These 11 wells will be analyzed for Paddys Run Road Site constituents as well as for IEMP FRL exceedance constituents. The Paddys Run Road Site constituent list used in 2001 and 2002 will be carried over into 2003 and 2004. The constituent list presented below represents the constituents to be monitored.

**PROPERTY PLUME BOUNDARY MONITORING TABLE FOR FRL EXCEEDANCES AND PRRS CONSTITUENTS SEMI-ANNUAL SAMPLING FREQUENCY**

| General Chemistry | Inorganic | Radionuclide | Organic |
|---|---|---|---|
| Fluoride | Antimony | Total Uranium | Benzene |
| Phosphorous | Arsenic | | Ethyl benzene |
| | Lead | | Isopropyl benzene |
| | Manganese | | Toluene |
| | Nickel | | Total Xylene |
| | Potassium | | |
| | Sodium | | |
| | Zinc | | |

If pumping rates of wells in the South Plume Module are increased above rates established in 1998, then arsenic sampling will be conducted weekly in Monitoring Wells 2128, 2625, 2636, 2900, and in Extraction Wells 3924, and 3925. The arsenic sampling will be used to determine if the increased pumping rates have adversely impacted the Paddys Run Road Site plume. The weekly sampling will be done for a minimum of three weeks after a pumping rate increase and if no changes in arsenic concentration trends are observed, the increased arsenic sampling will be discontinued. Figure 3-6 identifies the locations of these monitoring wells.

3.6.2.5 Monitor Non-Uranium Groundwater FRL constituents without IEMP FRL Exceedances

Once every five years, all wells being monitored semi-annually for total uranium will be monitored for the non-uranium groundwater FRL constituents that have not had a recorded FRL exceedance since the inception of the IEMP. The next round of sampling is scheduled for 2006.

3.6.2.6 Routine Water-Level Monitoring

The water table in the Great Miami Aquifer and its response to seasonal fluctuations has been well characterized in the Remedial Investigation Report for Operable Unit 5. Water-level data have been routinely collected at the FEMP since 1988. Water-level data are used to evaluate seasonal variations and interpret groundwater flow directions. This is accomplished by preparing hydrographs and maps of the water table in the Great Miami Aquifer. During the remediation phase of the CERCLA process, water levels will be monitored across the site to assess the effects of extraction and re-injection operations on the water table and flow conditions within the Great Miami Aquifer.

The Great Miami Aquifer is an unconfined aquifer and responds rapidly to recharge events. Data collected at the FEMP and reported in the Operable Unit 5 Remedial Investigation Report document that no strong vertical gradients exist in the area of the FEMP. Water level monitoring will rely mostly on data from Type 2 wells, which will be supplemented as necessary with data from Type 3, Type 6, and Type 8 wells. Type 8 wells will have water level measurements taken in Channels 1 and 2.

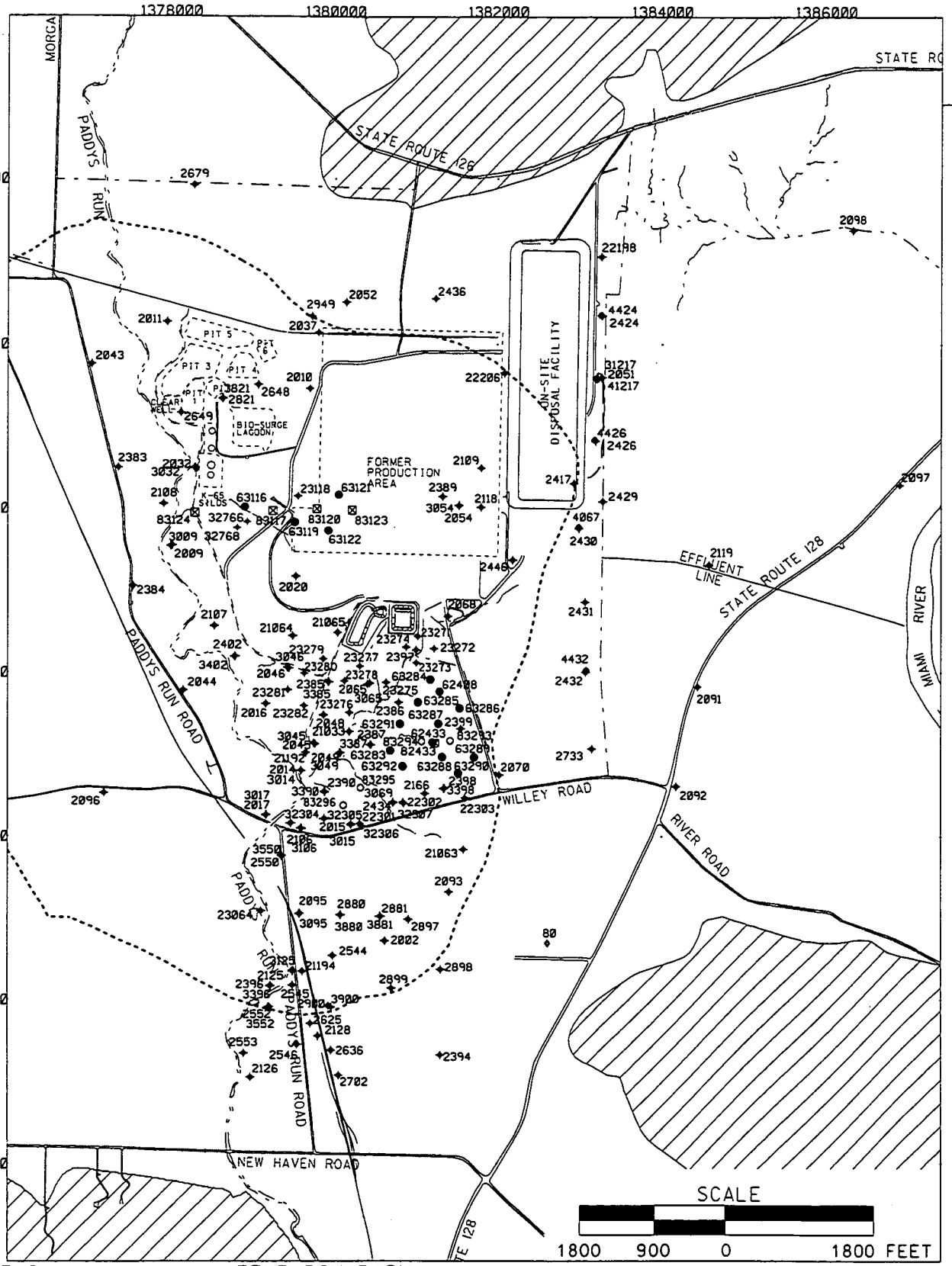
The 175 monitoring wells, which were selected for water level monitoring in 2003 and 2004, are shown in Figure 3-8 and listed below. This represents a net increase of 38 wells from the last version of the IEMP. These 38 wells are the new monitoring wells added to the South Field and Waste Storage Area to improve monitoring coverage around the extraction wells.

Groundwater elevation monitoring locations were selected to provide areal coverage across all areas of the FEMP with an increasing density of wells in areas surrounding active aquifer restoration wells. Groundwater elevations will be measured quarterly in these wells to provide data for construction of water table elevation maps. These maps will be used to interpret the location of flow divides, capture zones, and

V:/5FGP1/DGN/02REVISION/02RV002.DGN

STATE PLANAR COORDINATE SYSTEM 1983

03-OCT-2002




LEGEND:

- FEMP BOUNDARY
- 2046 TYPE 2 MONITORING WELL
- 3046 TYPE 3 MONITORING WELL
- 4046 TYPE 4 MONITORING WELL
- 6046 TYPE 6 MONITORING WELL
- 80 PRIVATE WELL
- 82433 MULTI-LEVEL MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

DRAFT FINAL

FIGURE 3-8. GROUNDWATER ELEVATION MONITORING WELLS

000080

stagnation zones created by the operation of remediation wells. Additional monitoring wells and more frequent measurement intervals may be used near aquifer remediation modules as they become operational and as sensitive capture zones or stagnation zones are identified, or if unpredicted fluctuations in contaminant concentrations are observed.

**LIST OF GROUNDWATER ELEVATION MONITORING WELLS**

| | | | | | | |
|---|---|---|---|---|---|---|
| 80 | 2092 | 2397 | 2702 | 23271 | 3125 | 62408 |
| 2002 | 2093 | 2398 | 2733 | 23272 | 3385 | 62433 |
| 2009 | 2095 | 2399 | 2821 | 23273 | 3387 | 63116 |
| 2010 | 2096 | 2402 | 2880 | 23274 | 3390 | 63119 |
| 2011 | 2097 | 2417 | 2881 | 23275 | 3396 | 63121 |
| 2014 | 2098 | 2424 | 2897 | 23276 | 3398 | 63122 |
| 2015 | 2106 | 2426 | 2898 | 23277 | 3402 | 63283 |
| 2016 | 2107 | 2429 | 2899 | 23278 | 3550 | 63284 |
| 2017 | 2108 | 2430 | 2900 | 23279 | 3552 | 63285 |
| 2020 | 2109 | 2431 | 2949 | 23280 | 3821 | 63286 |
| 2032 | 2118 | 2432 | 21033 | 23281 | 3880 | 63287 |
| 2037 | 2119 | 2434 | 21063 | 23282 | 3881 | 63288 |
| 2043 | 2125 | 2436 | 21064 | 3009 | 3900 | 63289 |
| 2044 | 2126 | 2446 | 21065 | 3014 | 31217 | 63290 |
| 2045 | 2128 | 2544 | 21192 | 3015 | 32304 | 63291 |
| 2046 | 2166 | 2545 | 21194 | 3017 | 32305 | 63292 |
| 2048 | 2383 | 2546 | 22198 | 3032 | 32306 | 82433 |
| 2049 | 2384 | 2550 | 22206 | 3045 | 32307 | 83117 |
| 2051 | 2385 | 2552 | 22299 | 3046 | 32766 | 83120 |
| 2052 | 2386 | 2553 | 22300 | 3049 | 32768 | 83123 |
| 2054 | 2387 | 2625 | 22301 | 3054 | 4067 | 83124 |
| 2065 | 2389 | 2636 | 23064 | 3065 | 4424 | 83293 |
| 2068 | 2390 | 2648 | 22302 | 3069 | 4426 | 83294 |
| 2070 | 2394 | 2649 | 22303 | 3095 | 4432 | 83295 |
| 2091 | 2396 | 2679 | 23118 | 3106 | 41217 | 83296 |

3.6.2.7 Sampling Procedures

Sample analysis will be performed at the on-site FEMP laboratory or a contract laboratory dependent on specific analyses required, laboratory capacity, turn-around time, and performance of the laboratory. The laboratories utilized for analytical testing must be approved by the FEMP in accordance with the criteria specified in Section 3.1.5, 12.4, and Appendix E of the SCQ. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits and an internal quality assurance program. A list of FEMP-approved laboratories and current status of each is maintained by the FEMP quality assurance organization.

All monitoring wells will be purged and sampled using the guidelines specified in Section 6.2 and K.4.2 of the SCQ which have been incorporated into the standard operating procedures utilized for conducting groundwater sampling. The applicable SCQ sections and operating procedures pertaining to groundwater sampling are as follows:

Standard Operating Procedures

| | |
|---|---|
| SMPL-02 | Liquid Sampling for Water Monitoring Technicians |
| SMPL-05 | Groundwater Level/Total Depth Measurements |
| SMPL-21 | Collection of Field Quality Control Samples |
| ADM-02 | Field Project Prerequisites |
| ADM-03 | Water Sample Shipment |
| EQT-02 | Horiba Water Quality Meter |
| EQT-04 | Photoionization Detector |
| EQT-10 | Gasoline Powered Engines |
| EQT-28 | Hydrolab Multiparameter Water Quality Monitoring Instrument |
| EW-0002 | Chain of Custody/Request for Analysis Record for Sample Control |

Sitewide CERCLA Quality (SCQ) Assurance Project Plan

| | |
|---|---|
| Section 4 | Quality Assurance Objectives |
| Section 5 | Field Activities |
| Section 6 | Sampling Requirements |
| Section 7 | Sample Custody |
| Section 8 | Calibration Procedures and Frequency |
| Appendix I | Field Calibration Requirements |
| Appendix J | Field Activity Methods |
| Appendix K | Sampling Methods |

Table 3-7 summarizes the field sampling information by analytical constituent groups and includes the analytical support level (ASL), holding time, preservative, container requirement, and analytical method. The volume of purge water to be removed from monitoring and extraction wells is specified in procedure SMPL-02, Liquid Sampling for Water Monitoring Technicians.

An objective of the IEMP groundwater-monitoring program is to collect and analyze representative groundwater samples. The sample analysis for metals and radionuclides should quantify species that are dissolved, occur as mobile precipitates, or are adsorbed onto mobile particles. If immobile particles to which metals are bound are allowed to remain in field-acidified samples, then the laboratory analysis will overstate the true concentration of mobile species present in the sample because acidification dissolves precipitates or causes adsorbed metals to desorb. Turbidity readings and the use of filtration to obtain a representative sample are therefore important field concerns for collection of groundwater samples.

# TABLE 3-7

## ANALYTICAL REQUIREMENTS FOR THE GROUNDWATER MONITORING PROGRAM

| Constituent | Method | Sample Type | ASL[a] | Holding Time[b] | Preservative[b] | Container[b,c] |
|---|---|---|---|---|---|---|
| **General Chemistry:** | | | | | | |
| Fluoride | 300.0[d], 340.2[d], or 4500C[e] | Grab | B | 28 days | None | Plastic |
| Nitrate/Nitrite | 353.1[d], 353.2[d], 4500D[e], or 4500E[e] | Grab | B | 28 days | Cool to 4°C, $H_2SO_4$ to pH < 2 | Plastic or glass |
| Phosphorus | 365.(all)[d] or 4500E[e] | Grab | B | 28 days | Cool to 4°C, $H_2SO_4$ to pH < 2 | Plastic or glass |
| **Inorganics:** | | | | | | |
| Metals | 6020[f], 7000A[f], 6010B[f] or | Grab | B | 6 months | $HNO_3$ to pH < 2 | Plastic or glass |
| **Radionuclides: (All Radiological)** | SCQ[g] | Grab | B | Six months or 5x half-life, whichever is less | $HNO_3$ to pH < 2 | Plastic or glass |
| **Volatile Organics:** | 8260B[f] | Grab | B | 7 days | Cool to 4°C | Glass vial with Teflon lined septum cap |
| | | Grab | B | 14 days | Cool to 4°C $H_2SO_4$, HCl, or solid $NaHSO_4$ to pH < 2 | Glass vial with Teflon lined septum cap |
| **Field Parameters[h]:** | SCQ[i] | Grab | A | NA[j] | NA[j] | NA[j] |

[a]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[b]Appropriate preservative, holding time, and container will be used for the corresponding method.
[c]Container size is left to the discretion of the individual laboratory.
[d]Methods for Chemical analysis of Water and Wastes, EPA 600/4-79-020
[e]Standard Methods for the Analysis of Water and Wastewater, 17th edition
[f]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846
[g]Radionuclide analyses do not have standard methods; however, the analytical specifications for these constituents are provided in Appendix G of the SCQ.
[h]Field parameters include dissolved oxygen, pH, specific conductance, temperature, and turbidity.
[i]Appendix K of the SCQ provides field analytical methods.
[j]NA = not applicable

Consistent with OEPA guidelines, 5 nephelometric turbidity units (NTU) will serve as the cut off for a representative groundwater sample and for determining when filtration of the sample to be analyzed for metals/radionuclides is required. Routine filtration will be avoided at the FEMP whenever possible. Proper well construction and maintenance will be practiced in order to help keep the turbidity of unfiltered groundwater samples at or below 5 NTU. If after properly purging a monitoring well, the sample turbidity is greater than 5 NTU, then the sample will be filtered through a 5-micron filter. If the turbidity of the 5-micron filtered sample is still above 5 NTU, then the 5-micron filtered sample will be additionally filtered through a 0.45-micron filter. Both the unfiltered and final filtered uranium sample will be analyzed. The final filtered sample will be analyzed for metals and radionuclides only.

3.6.2.8 Quality Control Sampling Requirements

Field quality control samples will be collected to assess the accuracy and precision of field and laboratory methods as outlined in Section 4.1.1 of the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as decontamination, sampling technique, or analytical method may be responsible for introducing bias in the analytical results. The following types of quality control samples will be collected: sampling equipment rinsates, trip blanks, field blanks, and duplicate samples, as outlined in Section 4 and Appendix A of the SCQ. Each quality control sample is preserved using the same method for groundwater samples. The quality control sample frequencies will be tracked to ensure the proper frequency requirements are met as follows:

- Trip blanks will be prepared for each sampling team on each day of sampling when organic compounds are included in the respective analytical program.
- Equipment rinsates will be collected for every 20 groundwater samples that are collected using reusable sampling equipment. If a specific sampling activity consists of less than 20 groundwater samples, then a rinsate sample will still be required. Rinsates are not required when dedicated well equipment or disposable sampling equipment is utilized.
- Field blanks will be collected for each day of groundwater sampling when organic compounds are included in the respective analytical program.
- Field duplicates will be collected for every 20 groundwater samples or fraction thereof if the specific sampling program consists of less than 20 samples.

The groundwater samples associated with each quality control sample also will be tracked to ensure traceability in the event that contaminants are detected in the quality control samples.

3.6.2.9 Decontamination

In general, decontamination of equipment is minimized due to limited use of reusable equipment during sample collection. However, if decontamination is required, then equipment will be cleaned between sample locations. The decontamination shall be Level II as referenced in Section K.11 of the SCQ. The specific details are outlined in procedure SMPL-02, Liquid Sampling for Water Monitoring.

3.6.2.10 Waste Disposition

The following wastes will be generated during sampling activities:

- Purge water and decontamination solutions
- Contact wastes.

The following subsections provide the proposed disposition methodology for each type of waste generated.

Purge Water and Decontamination Solutions

Groundwater purged from the wells and solutions used to decontaminate equipment used during sampling will be containerized for proper disposal. For each batch of wastewater, a Wastewater Discharge Request Form is submitted to the FEMP compliance organization for direction and approval for disposition. This wastewater is routinely disposed of at the Storm Water Retention Basin or the Advanced Wastewater Treatment Plant dependent on the point of origin.

Contact Wastes

Contact wastes such as personal protective equipment, paper towels, and other solid, investigation-derived waste will be placed in plastic bags and placed in dumpsters. Contact wastes generated inside a radiologically controlled or contamination area will be dispositioned to a controlled waste container in the respective area.

3.6.2.11 Monitoring Well Maintenance

During the restoration of the FEMP, surface cleanup activities will create adverse conditions around several groundwater monitoring wells. Extra effort will be taken on the part of FEMP personnel to safeguard and inspect groundwater monitoring wells during FEMP restoration. Monitoring well maintenance will center around two questions:

1) Is the monitoring well protective of the subsurface environment in its current condition?
2) Does the monitoring well yield a representative groundwater sample?

Well Maintenance Inspections

Routine inspections of Great Miami Aquifer groundwater monitoring wells will be conducted during sampling or collection of water levels (at a minimum of once a year if the well is not being routinely sampled) to determine if the well is protective of the environment based on the inspection criteria below. Wells may be inspected more frequently if they are located in an area of active surface restoration. All assessment and maintenance activities will be recorded on applicable field data forms. The inspections include, but are not limited to, the following:

- Ensure that the well identification number is painted or welded on the top of the lid
- Inspect the ground surrounding the well for depressions and channels that allow surface water to collect and flow towards the wellhead, and for debris and foreign material that could leach contaminants into the subsurface or otherwise interfere with well sampling
- Ensure visibility and accessibility to the well
- Inspect locking lids and padlocks to check for rust and ease of operation
- Inspect the exposed (protective) well casing to ensure that it is free of cracks and signs of corrosion; it is reasonably plumb with the ground surface; it is painted bright orange; the drain hole is clear; it is free of debris; and the well casing has no sharp edges
- Remove and inspect the well cap to ensure that it is free of debris; fits securely and the vent hole is clear; and, if equipped with a ground-flush cap, ensure that it is water-tight to prevent surface water from entering the well
- Inspect concrete surface seals for settling and cracking
- If exterior guards are used to protect the well, then periodically inspect the guards for visibility and damage and repaint, if necessary.

Well Evaluation

If the turbidity and amount of sediment measured in the well and/or the visual inspection indicate a potential problem with the well, then the following work may be performed to evaluate the cause of the sedimentation or other problems:

- Review existing well installation documentation
- Review well history and historical water quality data to identify whether it produces consistently clear or turbid samples
- Review groundwater sampling field records
- Conduct a downhole camera survey to inspect the integrity of the screen and casing.

At least once a year, an assessment will be made of wells that are sampled as to whether or not the well is yielding a representative sample. This assessment includes, but is not limited to, the following:

- Determine how much sediment has entered the well screen and accumulated in the well and review historical depth records. This will be done by measuring the well depths for those wells that do not have dedicated packers.
- Determine if any foreign material is present in the well (e.g., bentonite grout)
- Determine if the groundwater color has changed over time (e.g., due to iron bacteria)
- Evaluate turbidity within the sample.

Well Maintenance Corrective Actions

Corrective actions to address problems identified in the well maintenance inspections will be conducted as soon as feasible. Corrective maintenance to address excessive turbidity will include removal of sediment from the well through redevelopment of the well.

The possibility exists that minerals can precipitate on well screens. If it is determined that minerals have precipitated in the well or on the well screen, and they are affecting the representativeness of the groundwater sample, then the limited use of chemicals (e.g., chlorine, hydrochloric acid, etc.) to remove the mineral build-up may be considered. It is understood that chemicals have a very limited application in the rehabilitation of monitoring wells because the chemicals can cause changes such that the well will no longer yield a representative sample (Aller et al 1989). Changes resulting from the use of chemicals could last for a short time or could be permanent. Therefore, if chemical rehabilitation is attempted, it will only be attempted as a last resort. Water quality parameters, such as Eh (redox potential), pH, temperature, and conductivity, will be measured prior to the application of the chemicals and following the use of the chemicals. These measurements will serve as values for comparison of water quality before and after well maintenance.

If a groundwater monitoring well has been damaged in such a way that it is no longer protective of the subsurface environment and it cannot be repaired, then the well will be plugged and abandoned. If it is determined that the well is not yielding a representative groundwater sample and rehabilitation efforts are not effective in correcting the condition, then the well will be considered for plugging and abandonment. If the well is still protective of the subsurface environment, then it might be used for the collection of water level data even though it does not yield representative groundwater samples.

3.6.3 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the Media-Specific Plan must have written approval by the project team leader or designee, quality assurance representative, and the Field Manager prior to implementation. In accordance with Section 15.3 of the SCQ, the Variance/Field Change Notice form must be completed and approved within one week of the initial written approval. The Variance/Field Change Notice form shall be issued as controlled distribution to team members, included in the field data package and become part of the project record. During biennial revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the Media-Specific Plan.

3.6.4 Health and Safety Considerations

The FEMP Health and Safety organization is responsible for the development and implementation of health and safety requirements for this Media-Specific Plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed during team briefings.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this Media-Specific Plan. Safety meetings will be conducted prior to beginning field work to address specific health and safety issues. All Fluor Fernald employees and subcontractor personnel who will be performing field work required by this Media-Specific Plan are required to have completed applicable training.

For areas which are subject to more restrictive radiological controls where the potential for exposure is greater, radiation work permits are necessary and will be obtained prior to the field work being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring a radiation work permit.

3.6.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, conform with appropriate sections and appendices of the SCQ, and comply with specific FEMP procedures, such as the Data Validation Procedure, EW-0010.

Data documentation and validation requirements for data collected in 2003 and 2004 for the IEMP generally fall into two categories depending upon whether the data are field- or laboratory-generated. Field

data validation will consist of verifying Media-Specific Plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with Media-Specific Plan specified ASLs. Specific requirements for field data documentation and validation, and laboratory data documentation and validation in accordance with SCQ and FEMP procedures.

There are five analytical levels (ASL A through ASL E) defined for the FEMP in Section 2 of the SCQ. For groundwater in 2003 and 2004, field data documentation will be at ASL A and laboratory data documentation, in general, will be at ASL B. A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives. In general, ASL B is appropriate for laboratory generated data collected in 2003 and 2004, because the data are being used for surveillance during site restoration. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality assurance/quality control checks.

At a minimum, 10 percent of the IEMP field and analytical data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or verification method to ensure accuracy. The hard copy data will be managed in the project file in accordance with FEMP record keeping procedures and DOE Orders.

### 3.6.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, SCQ and FEMP Quality Assurance Program (RM-0012) requirements.

Recommended quarterly quality assurance assessments or surveillances shall be performed on tasks specified in the Media-Specific Plan. These assessments may be in the form of independent assessments or self-assessments, with at least one independent assessment conducted annually. Independent assessments are the responsibility of designated project quality assurance personnel. Self-assessments are performed by project personnel to self-evaluate the overall quality of work performance. The project team

leader and quality assurance will coordinate assessment activities and comply with Section 12 of the SCQ. The project personnel or quality assurance representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

Only laboratories on the approved laboratory list will be used for FEMP sample analyses in accordance with Section 12 and Appendix E of the SCQ.

## 3.7 IEMP GROUNDWATER MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated by the IEMP groundwater sampling program in 2003 and 2004. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated groundwater data, including specific information to be reported in IEMP mid-year data summaries and in annual site environmental reports, is also provided.

### 3.7.1 Data Evaluation

Data resulting from the IEMP groundwater program will be evaluated to meet the program expectations identified in Section 3.4.1. Data evaluation will look at both the operational efficiency and the operational effectiveness of the groundwater remediation system (EPA 1992). Operational Efficiency refers to conducting the most efficient remedy possible. The objectives are to minimize downtimes, conduct stable operations, meet planned performance goals, and operate a cost effective system. Operational efficiency will be assessed by tracking:

- Pumping/re-injection rates for individual wells and modules
- Gallons of water pumped/re-injected
- Extraction and re-injection total well hours of operation during the year
- The volume of treated water.

Operational effectiveness refers to the evaluation of the degree of contamination cleanup achieved. Operational effectiveness will be assessed by tracking:

- Pounds of total uranium removed/re-injected
- Pounds of uranium removed per million gallons of water pumped (Uranium removal Index)
- Total uranium concentration data collected from extraction wells
- Total uranium concentration data collected from monitoring wells.
- Water level data collected from monitoring wells
- Interpretations of capture zones.

Most of the data will either be tabulated, presented in graphs, or presented in maps. Groundwater monitoring program data will be evaluated to:

- Assess progress in capturing and restoring the area containing the > 30 μg/L total uranium plume
- Assess progress in capturing and restoring the areas affected by non-uranium FRL exceedances
- Assess water quality at the downgradient FEMP property boundary
- Assess model predictions
- Assess the impact that the aquifer restoration is having on the Paddys Run Road Site plume
- Meet other monitoring commitments
- Address community concerns.

The aquifer restoration system is being designed to reduce the concentration of uranium and non-uranium FRL constituents in the aquifer to concentrations that are at or below their FRL. Because uranium is the principal constituent of concern, the aquifer restoration system has been designed to capture the 30 μg/L total uranium plume, with the understanding that the system may need to be modified in the future to capture and remediate non-uranium FRL constituents.

Extraction and re-injection wells have been positioned within each restoration module with this first objective in mind. Operational decisions and pumping/re-injection changes will focus on this first objective in 2003 and 2004. Operational changes to meet non-uranium FRL concentrations are considered to be a secondary objective. However, evaluation of the need for an operational change to address non-uranium FRL constituents will be an ongoing process throughout the course of the aquifer remediation and is expected to gain in importance as the achievement of the uranium objective approaches.

Following is a discussion of how each of the groundwater program expectations are intended to be met through evaluation of IEMP groundwater data.

<u>Capturing and Restoring the Area Containing the Greater than 30 μg/L Total Uranium Plume</u>

Capture and restoration of the area containing the > 30 μg/L total uranium plume will be evaluated using groundwater elevation data and the most current total uranium plume interpretation. Groundwater elevation maps with capture zone and flow divide interpretations will be prepared to evaluate the extent of capture.

Remediation of the 30 μg/L total uranium plume will be assessed by monitoring total uranium concentrations over time. The 30 μg/L total uranium plume will be mapped and compared to previous maps to determine how the plume has changed in response to remediation. Direct-push sampling data will be utilized throughout the remedy to supplement fixed monitoring well location data by providing vertical

profile concentration data. Plume maps will also be compared against modeling predictions of plume size and concentration to evaluate how close the modeling predictions are.

If a new total uranium FRL exceedance is detected in the aquifer, then an attempt will be made to determine the cause of the exceedance. Considerations will include:

- Movement of known total uranium contamination in response to pumping, re-injection, or natural migration
- New contamination reaching the aquifer as a result of FEMP restoration activity
- Previously undetected uranium contamination that has now moved into a monitoring zone as a result of pumping, re-injection, or natural migration.

When a restoration module begins operating, water levels will be collected more frequently until conditions have stabilized. Once conditions have stabilized, monitoring will fall back to the regular IEMP monitoring schedule. Individual module start-up plans will provide specifics on the frequency of water level and water quality data collection during the start-up time period.

Capturing and Restoring the Areas Affected by Non-Uranium FRL Exceedances

The Operable Unit 5 Record of Decision identifies 49 FRL constituents, other than total uranium, that also need to be tracked as part of the aquifer restoration. These 49 constituents are collectively referred to as the non-uranium FRL constituents. During the aquifer restoration, groundwater monitoring will take place for the non-uranium FRL constituents. Constituents that have been detected in the aquifer above their respective FRL will be monitored more frequently than those that have not been detected above their respective FRL.

Non-uranium FRL concentration trends in the Great Miami Aquifer will be assessed through trend analysis when sufficient data have been obtained. The Mann-Kendall statistical test for trend will be utilized to facilitate the trending interpretation. Concentrations versus time plots may be used to illustrate how the concentrations are trending.

If a new non-uranium FRL exceedance is detected in the aquifer, then an attempt will be made to determine the cause of the exceedance. Considerations will include:

- Movement of known contamination in response to pumping, re-injection, or natural migration
- New contamination reaching the aquifer as a result of FEMP restoration activity

- Previously undetected contamination that has now moved into a monitoring zone as a result of pumping, re-injection, or natural migration.

Any FRL exceedance detected at a property boundary/plume boundary well location will be evaluated utilizing the same data evaluation protocol which was approved for the Restoration Area Verification Sampling Program, Project Specific Plan (DOE 1997e) in order to determine if additional action is required. The constituent concentration data over time will be graphed. If two or more sampling events following a FRL exceedance indicate that the concentrations are below the FRL, then the location will not be considered for remediation or further monitoring above and beyond what is already prescribed by the IEMP. If sampling following the initial FRL exceedance indicates that the exceedance was not just a one-time occurrence, and the exceedance is judged to be the result of FEMP activities (either historical or current), then action will be taken to address the exceedance.

Meeting Other Monitoring Commitments

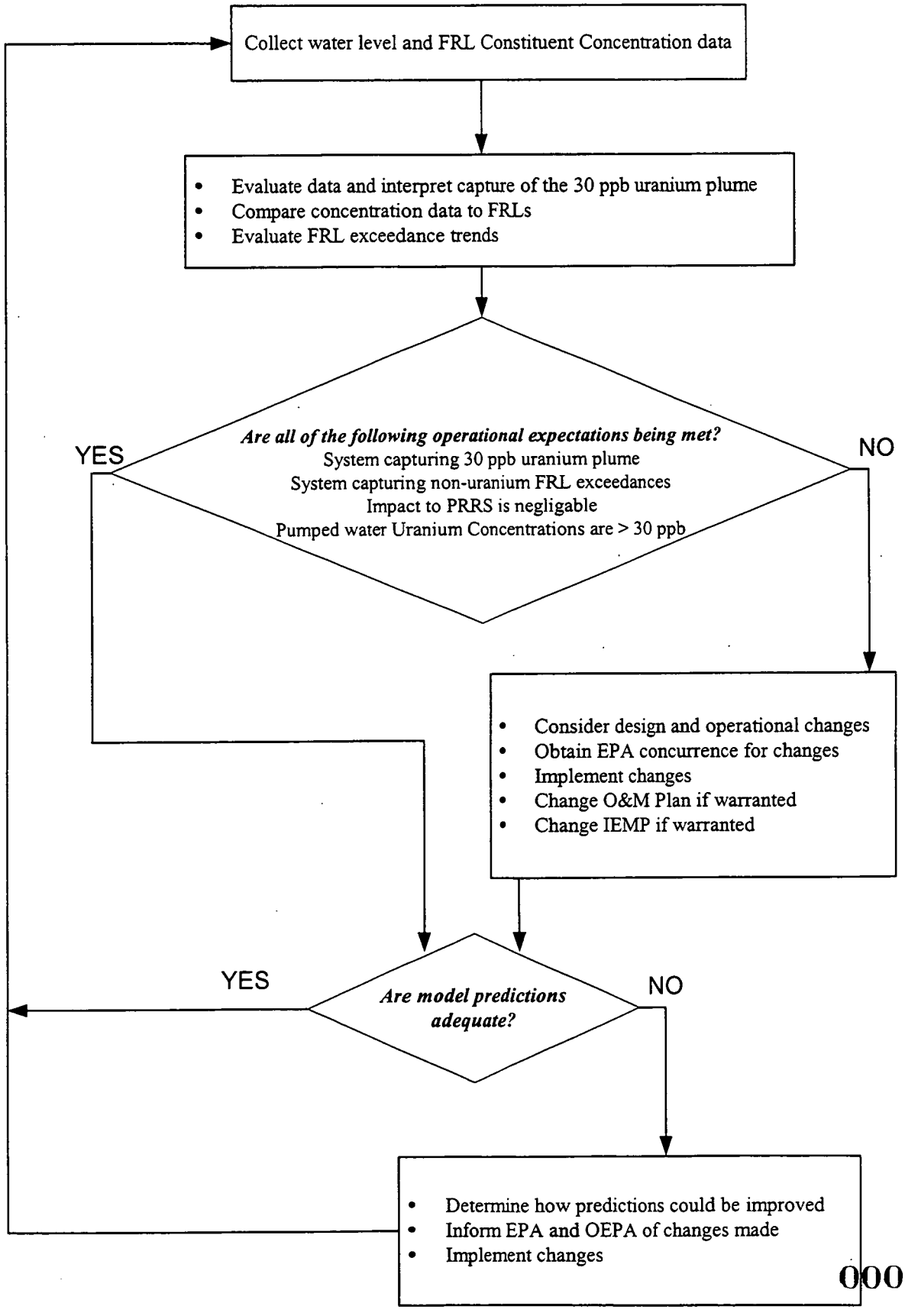
Other groundwater monitoring commitments that need to be addressed are: 1) private well sampling; 2) property boundary monitoring; and 3) fulfillment of DOE Order 5400.1 requirement to maintain an environmental monitoring program for groundwater.

Total uranium data collected at private wells will be graphed to illustrate changes and will be utilized in the preparation of total uranium contour maps. Data collected from the FEMP property/plume boundary monitoring system will be compared to FRLs. This will facilitate the detection and monitoring of FRL exceedances and will determine if interim actions are warranted, in addition to implementing the sitewide aquifer restoration. Lastly, this groundwater monitoring program presented in the IEMP, along with the groundwater data reporting in IEMP annual integrated site environmental reports, fulfills DOE Order 5400.1 requirements.

Assessing Model Predictions

Groundwater uranium concentration data and water-level data obtained through the life of the remedy will be compared against model predicted concentrations and water levels to evaluate how close the predictions come. (Figure 3-9). If the predictions are too far off, then changes to the model may need to be made.

**Figure 3-9**
**General Groundwater Monitoring Decision-Making Process**
**For 2003 and 2004**




000094

Since modeling was conducted for the remedial investigation/feasibility study and Baseline Remedial Strategy Report, the model has undergone several changes in order to improve its capability for making water level and uranium concentration predictions. The groundwater model was re-calibrated for flow to address transient water level conditions prior to it being used to support the design of the Waste Storage Area Module and South Field Phase II Module in 2002. The current model now uses three sets of boundary conditions (wet, dry, and nominal). It is understood that the groundwater model may need to be re-calibrated in the future for flow if measured water levels and model predictions are not adequate for managing the remedy. Should future flow model calibration efforts be performed, they will be conducted to the same standard used to calibrate the Sandia Waste Isolation Flow and Transport (SWIFT) model. However, the basic strategy for assessing flow predictions will be as follows:

- Model predicted water level values will be compared to actual field measured values. The decision to re-calibrate the groundwater model will be based on how close the model predictions are to field measured values.

- The difference between the maximum and minimum measured groundwater elevation over time will be used to define a water level elevation range for a particular well. The water level range is the result of seasonal variations and long term water level trends within the aquifer. A range of water levels over time has been established for each water level monitoring well identified in the IEMP.

- If the difference between measured elevations and modeled predictions is greater than five feet for more than one-third of the monitoring wells within the capture zone of the extraction system, or for a significant local area of the model domain, then the need to implement model recalibration for the affected area of the model will be evaluated. All relevant groundwater data acquired since the previous flow model calibration will be considered in future flow model calibrations. Comparisons will recognize that modeled predictions represent average conditions within a model block and monitoring wells are not usually located at the center of a model block. One solution might be to compare the surrounding eight model blocks to the actual measured elevation.

The current groundwater model has been adjusted from previous models to provide better point concentration predictions, but at the time of this writing, the predictions that have been made lack sufficient field measurements to determine if the model improvements were successful. In the past, point concentration predictions made using the SWIFT Model for the remedial investigation/feasibility study and Baseline Remedial Strategy Report modeling designs have not matched actual field measured concentrations as well as was hoped. For instance, measured concentrations in the South Plume during 2001 are higher than what were predicted in the Baseline Remedial Strategy Report. This could indicate that the model is not capable of making realistic predictions, or as the sensitivity analysis reported in Appendix A of the Baseline Remedial Strategy Report indicates, longer pumping times are required.

Several adjustments have been made to the model under the assumption that the model is not making realistic point concentration predictions. Initial conditions were reloaded. Earlier model runs assigned the maximum uranium concentration to a model layer, now the average concentration is assigned instead. The number of layers in the model has been increased from 6 to 14 in order to provide better resolution. Six layers were used in the SWIFT Model to support design of the Feasibility Study and Baseline Remedial Strategy Report Aquifer Remediation Systems. The VAM-3D model replaced the SWIFT model for design of the Waste Storage Area Module. The VAM-3D model had 12 layers. The ZOOM model replaced the VAM-3D model for design of the South Field Phase II Module. The ZOOM model has 14 layers.

Waste Storage Area wells have only been in operation since May of 2002. The South Field Phase II wells are not scheduled to be operational until 2003. Therefore no data is available to compare to the point concentration predictions modeled by the VAM-3D or ZOOM Models. In addition to adjusting the model as described above, a study to determine how uranium is sorbed and partitioned on Great Miami Aquifer Sediments is underway. It is hoped that information from this study can be applied to improve model predictions of point concentrations. Model-predicted contaminant concentration profiles over time will be compared to field measured concentrations. Concentration data collected in the field will be trended to determine if FRL concentrations will be achieved within the time frame predicted by the model. Differences between model predicted concentrations and measured concentrations may be the result of inaccurate transport parameter values and/or operational conditions (i.e., pumping and re-injection rates) not being the same as used in the model.

The mass of uranium removed from the aquifer will be compared to what was predicted by the groundwater model to determine how close the predictions were. Field data will be used to determine when pumping adjustments need to be evaluated. The future effect of pumping adjustments will be evaluated using the groundwater model.

Assess the Impact that the Aquifer Restoration is Having on the Paddys Run Road Site Plume

As was done from 1997 to 2002, concentration data collected in 2003 and 2004 for key Paddys Run Road Site constituents will be evaluated using trend analysis. Water level maps will be produced to determine where capture is occurring due to pumping in the South Plume Module.

Adequately Address Community Concerns

The IEMP fulfills the informational needs of the Fernald community by preparing groundwater environmental results in annual site environmental reports. DOE makes these reports available to the

public at the Public Environmental Information Center. Comments received over the life of the IEMP program regarding the IEMP groundwater program will be considered in future revisions to the IEMP.

Overall Aquifer Restoration Decision-Making Process

Figure 3-10 illustrates the overall framework for the decision-making process for 2003 and 2004. Groundwater monitoring will be conducted during aquifer remediation. If it is determined that program expectations for 2003 and 2004 are not being met, then the design and operation of the aquifer restoration system will be evaluated to determine if a change needs to be implemented. A change to the operation of the aquifer restoration system would be implemented through the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project (DOE 1997d). A groundwater monitoring change, if found to be necessary, would be implemented through the IEMP. If additional characterization data are needed above and beyond the current scope of the IEMP, (e.g., to determine the nature of a newly detected FRL exceedance, or to support the design of a new extraction or re-injection well), then a separate sampling plan will be prepared. Additional sampling activities may utilize other sampling techniques, such as a direct-push sampling tool, which has been successfully used at the FEMP to obtain groundwater samples without the use of a permanent monitoring well.

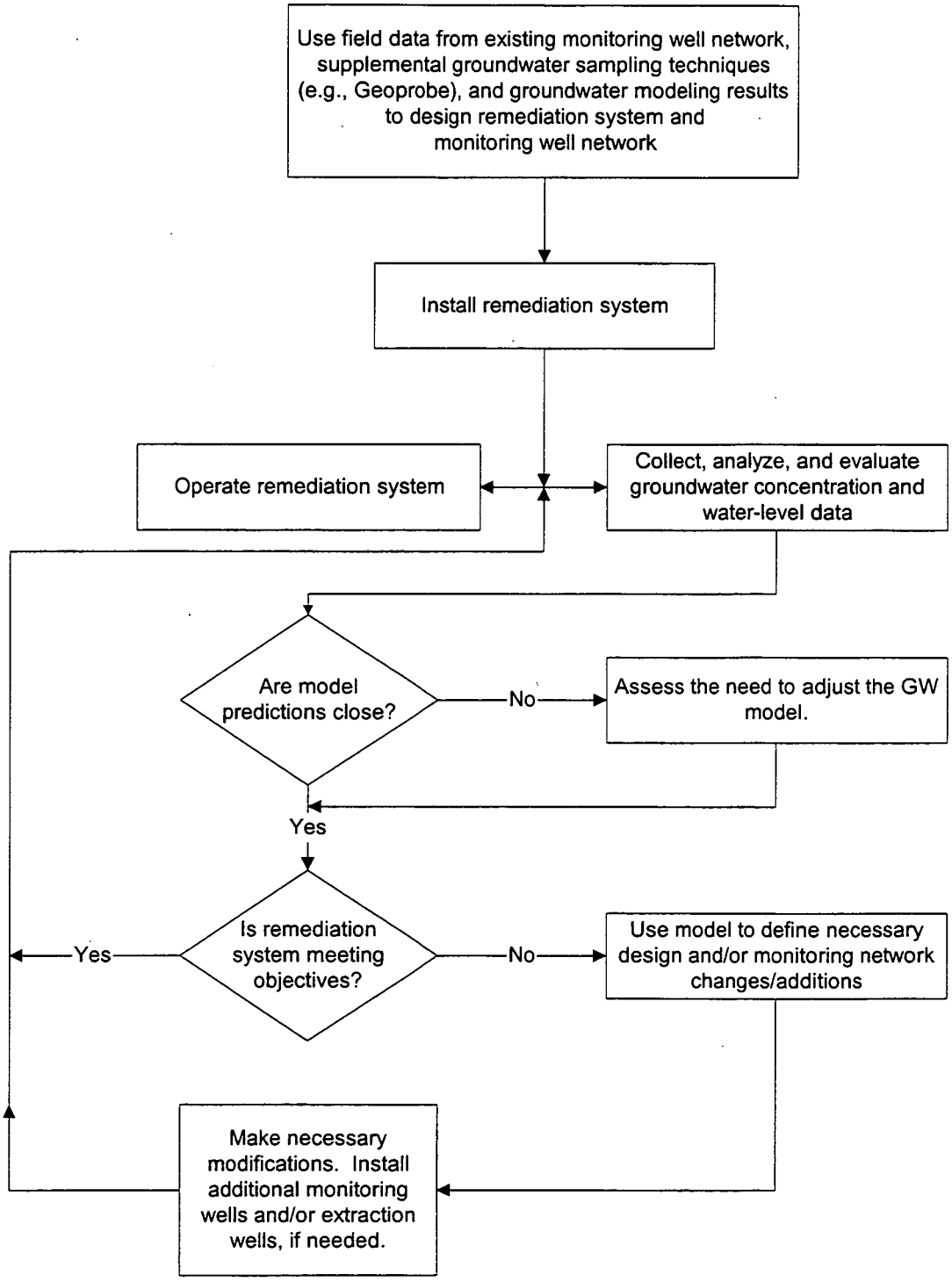
In the past, groundwater data have been presented and evaluated in the following manner:

- Concentration versus time plots for specific constituents
- Tables identifying wells with constituents above FRL concentrations
- Mann-Kendall trend analyses for specific constituents
- Concentration contour maps.

Through the lifetime of the aquifer restoration, large quantities of data will be collected and evaluated. In order to evaluate the results of the sampling, the data collected for the IEMP will be presented and evaluated using the above formats. The findings of data evaluations will be shared with project personnel. The EPA and OEPA have identified that this is a successful method of evaluating and presenting the data.

Ultimately, the IEMP will be used to document the approach for determining when various modules can be removed from service, once remedial action objectives for the Great Miami Aquifer (provided in the Operable Unit 5 Record of Decision) are achieved. It is too early to begin the process of removing modules from the aquifer restoration system during 2003 and 2004. Therefore, methods for verifying remedy completion are not included in this revision of the IEMP. However, the IEMP will later serve as the vehicle for verifying the completion of the aquifer restoration. The sampling and data evaluation methods which will be used to verify restoration will be presented in future revisions of the IEMP.

# FIGURE 3-10
# AQUIFER RESTORATION DECISION-MAKING PROCESS



3.7.2 Reporting

The IEMP groundwater program data will be reported on the IEMP Data Information Site. Mid-year data summary reports and annual site environmental reports will be produced. In addition, groundwater data that support the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring plan (DOE 1997c) will also be provided in the same manner. Additional information on IEMP data reporting is provided in Section 8.3.3.

Data pertaining to the groundwater program will be provided on the IEMP Data Information Site. The data will be in the format of searchable data sets and/or downloadable data files. This site will be updated every two to four weeks, as data become available.

The IEMP mid-year data summary will supplement the IEMP Data Information Site by providing a brief summary of the data added to the site during the reporting period and identifying notable results and/or events related to that data. The IEMP mid-year data summaries will be submitted in November of each year.

The IEMP annual site environmental reports will be issued each June for the previous year. The comprehensive report will discuss a year of IEMP data previously reported on the IEMP Data Information Site and in the mid-year data summary. The IEMP annual site environmental reports will include the following:

Operational Assessment

- The "set point" pumping rate(s) for each extraction well during the year
- The "set point" re-injection rate(s) for each re-injection well and module during the year
- The uranium removal rate of individual wells
- Extraction and re-injection well total hours of operation during the year
- The volume of treated groundwater
- Extraction or re-injection well operating time expressed as a percentage of total available operating time
- The volume of water pumped from each extraction well during the year
- The volume of water re-injected into each re-injection well during the year
- The net water balance, based on the amount of water pumped and the amount of water re-injected during the last quarter

- Total pounds of uranium removed during the year
- Total pounds of uranium removed from the aquifer since the start of remediation
- The maximum, minimum, and average uranium concentration sent to treatment during the last year
- The monthly average uranium concentration in water discharged to the Great Miami River during the year
- Pumping rate figures for each extraction and re-injection well.

Aquifer Conditions

- The area of capture during the year
- A description of the geometry of the total uranium plume during the year
- The effect that restoration had (i.e., pumping) on the Paddys Run Road Site plume during the year
- The status of non-uranium FRL exceedances, including any newly detected FRL exceedances
- Identification of any new areas of FRL exceedances
- A comparison of groundwater restoration performance with respect to model predictions established in the Baseline Remedial Strategy Report
- Any changes that may have been made to the operation or design of the system to maintain the restoration on schedule as predicted in the Baseline Remedial Strategy Report.

Data that Support the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan

- Status information pertaining to the on-site disposal facility wells along with baseline data summaries
- Leachate volumes and concentrations from the leachate collection system and from the leak detection system for the on-site disposal facility
- Results of quarterly groundwater sampling initiated after waste is placed in a cell of the on-site disposal facility.

In addition, the IEMP annual site environmental report will include trend analysis of the data collected from the on-site disposal facility.

Because the IEMP is a "living document", annual reviews and two-year revisions have been instituted. The annual review cycle provides the mechanism for identifying and initiating any groundwater program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

Section 4.0

# 4.0 SURFACE WATER AND TREATED EFFLUENT MONITORING PROGRAM

Section 4.0 provides a description of the routine sitewide surface water and treated effluent monitoring to be performed during active remediation of the Fernald Environmental Management Project (FEMP), which includes the FEMP's numerous compliance-based monitoring and reporting obligations for surface water and treated effluent, and a media-specific plan for conducting all surface water and treated effluent monitoring activities.

## 4.1 INTEGRATION OBJECTIVES FOR SURFACE WATER AND TREATED EFFLUENT

Unlike groundwater and sediment, no direct restoration of the FEMP's surface water resources (i.e., Paddys Run and the Great Miami River) is required to achieve the surface water final remediation levels (FRLs) specified in the Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996b). However, because surface water represents both a contaminant transport pathway and a route of exposure for human and ecological receptors, routine monitoring of surface water is necessary to confirm that the FEMP's point and non-point discharges from other remedial operations to receiving waters fall within established thresholds. The monitoring activities for surface water will thus serve both a surveillance and a compliance function over the life of remediation at the FEMP. These measures will help document that the FEMP's remedial operations are protective of both groundwater (via the surface water cross-media pathway) and intended surface water uses in the vicinity of the FEMP.

The Integrated Environmental Monitoring Plan (IEMP) is the designated vehicle for conducting the FEMP's sitewide surface water surveillance and compliance monitoring downstream from project-specific controls. The IEMP's focus is to accommodate remedial construction and operation activities taking place in 2003 and 2004. Ultimately, the IEMP will be used to verify and document that the conclusion of the FEMP's sitewide remedial actions result in a condition that no longer poses any long-term threat to human health and/or the environment through the surface water pathway. In this comprehensive role, the IEMP serves to integrate several compliance-based monitoring and reporting programs currently in existence for the FEMP:

- The discharge monitoring and reporting program related to the site's National Pollutant Discharge Elimination System (NPDES) Permit
- The radiological monitoring of and reporting for the treated effluent mandated by the Federal Facilities Compliance Agreement (FFCA) and Operable Unit 5 Record of Decision

- The IEMP Characterization Program which combines portions of the former Environmental Monitoring Program (EMP) that has been ongoing at the FEMP since the 1950s and was updated in the IEMP, Revision 0 (DOE 1997b), to accommodate surface water monitoring needs during remediation.

As discussed in Section 4.6, these multiple programs have been brought together under a single reporting structure to facilitate review of the performance of the FEMP's surface water protection actions and measures.

## 4.2 ANALYSIS OF REGULATORY DRIVERS, DOE ORDERS, AND OTHER FEMP-SPECIFIC AGREEMENTS

This section presents a summary evaluation of the regulatory drivers governing the monitoring of the FEMP's point and non-point discharges to Paddys Run and the Great Miami River. The intent of this section is to identify the pertinent regulatory requirements, including applicable or relevant and appropriate requirements (ARARs) and to be considered-based requirements, for the scope and design of the surface water monitoring program. These requirements will be used to confirm that the program satisfies the regulatory obligations for monitoring that have been activated by the FEMP's record of decisions and will achieve the intentions of other pertinent criteria, such as U.S. Department of Energy (DOE) Orders and the FEMP's existing agreements and permits, as appropriate that have a bearing on the scope of surface water and treated effluent monitoring.

The results of the analysis will also be used to define, as appropriate for this medium, the administrative boundaries between the IEMP and the project-specific emission control and uncontrolled runoff monitoring conducted by other FEMP organizations.

### 4.2.1 Approach

The analysis of the regulatory drivers and policies for surface water and treated effluent was conducted by examining the suite of ARARs and to be considered-based requirements in the Operable Unit 5 Record of Decision to identify the subset with specific environmental monitoring requirements. The FEMP's existing compliance agreements issued outside the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process (such as the NPDES Permit requirements and the FFCA) were also reviewed.

4.2.2 Results

The following summary of regulatory drivers, compliance agreements, and DOE Orders were found to govern the monitoring scope and reporting requirements for surface water and treated effluent:

- CERCLA Record of Decision for Remedial Actions at Operable Unit 5, which requires remediation of the site such that the surface water pathway is protective of the underlying Great Miami Aquifer and various surface water environmental receptors. The surface water FRLs provided in the Operable Unit 5 Record of Decision considered and incorporated all chemical-specific ARARs and to be considered-based requirements for the protection of human health via the surface water pathway. In addition, treatment performance based limits were established restricting total uranium mass discharged to the Great Miami River to 600 lbs./year and a uranium concentration based limit of 30 µg/L as a monthly average. (The concentration limit of 30 µg/L established in the Operable Unit 5 Explanation of Significant Differences Document.)

- The CERCLA Feasibility Study Report for Operable Unit 5 (DOE 1995b), which stated that if the concentrations of constituents remain above benchmark toxicity values (BTVs) after completion of the remedial action, then further investigation and remediation may be warranted. The surface water BTVs listed in this report were identified as contaminant concentrations that are protective of ecological receptors. The list of constituents was further refined based on the ecological risk screening process presented in the Sitewide Excavation Plan (DOE 1998); this information is summarized in Section 4.4.2.1.

- The current NPDES Permit for the FEMP, which triggers a variety of site-specific surface water and treated effluent sampling, analysis, and reporting requirements (as specified in Ohio Administrative Code 3745-33) for non-radiological discharges.

- The 1986 FFCA, which requires that the FEMP maintain a continuous sample collection program for radiological constituents at the FEMP's treated effluent discharge points and report the results quarterly to the U.S. Environmental Protection Agency (EPA), Ohio Environmental Protection Agency (OEPA), and the Ohio Department of Health. The sampling program to address this requirement has been modified over the years and is currently governed by an agreement reached with EPA and OEPA in early 1996 as described in the letter "Phase VII Removal Actions and Reporting Requirements Under the Fernald Environmental Management Project Legal Agreements" from DOE to EPA (DOE 1996a). This agreement became effective May 1, 1996 and has since been modified, documented and approved through biennial revisions of the IEMP. This agreement requires sampling at the Parshall Flume (PF 4001), the Storm Water Retention Basin spillway (SWRB 4002O), and the Storm Water Retention bypasses (SWRB 4002B) for radiological constituents. With approval of the IEMP, Revision 0, in 1997, the sampling program was modified to better assess the impact of the site on the surface water pathway. These details are provided in Section 4.4.2.7.

- DOE Order 5400.1, General Environmental Protection Program Requirements, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine treated effluent monitoring and environmental surveillance activities of the facility. The IEMP strategy is responsive to the changing site mission and associated remedial needs and complies with DOE Orders.

- DOE Order 5400.5, Radiation Protection of the Public and the Environment, which obligates the FEMP to perform surveillance monitoring of surface water to ensure that radiological dose limits to the public in the DOE Order are not exceeded. Under these requirements, the exposure to members of the public associated with activities at DOE facilities from all pathways must not exceed, in one year, an effective dose equivalent greater than 100 millirem. Studies in support of the Operable Unit 5 Feasibility Study demonstrated for all media that combined exposure to FEMP radiological constituents of concern at their respective FRLs fall well below the DOE dose requirement. Therefore, monitoring designed to track and document the CERCLA FRL-based remediation of the site meets the intent of DOE Order 5400.5.

The surface water and treated effluent monitoring program described in this IEMP has been developed with full consideration of these regulatory drivers. Any necessary project-specific monitoring is determined during preparation and review of the individual remedial design packages. Table 4-1 lists each of these IEMP and project-specific drivers and the associated monitoring conducted to comply with them. Sections 4.6 and 8.0 provide the FEMP's current and long-range plan for complying with the reporting requirements invoked by these drivers.

**TABLE 4-1**

**FEMP SURFACE WATER AND TREATED EFFLUENT MONITORING REGULATORY DRIVERS AND RESPONSIBILITIES**

| | DRIVER | ACTION |
|---|---|---|
| IEMP | DOE Order 5400.1, Environmental Monitoring Plan for all media | The IEMP describes treated effluent and surveillance monitoring as required by DOE Order 5400.1. |
| | DOE Order 5400.5, Radiation Protection of Public and Environment | The IEMP includes a description for routine sampling of Paddys Run and on-site drainage ditches for radionuclides. |
| | Operable Unit 5 Record of Decision | The IEMP will be modified toward completion of the remedial action to include sampling to certify FRL achievement. IEMP includes monitoring for performance based uranium discharge limits. |
| | Operable Unit 5 Feasibility Study | The IEMP will be modified toward completion of the remedial action to include verification sampling for BTV constituents. The IEMP has modified its BTV constituent sampling list to account for potential impacts to surface water during excavation and remediation as assessed and revised in the Sitewide Excavation Plan. |
| | NPDES Permit | The IEMP describes routine sampling of permit-designated effluent discharges and storm water drainage points for NPDES Permit constituents. |
| | Federal Facilities Compliance Agreement Radiological Monitoring | The IEMP describes the routine sampling at the Parshall Flume (PF 4001), Storm Water Retention Basin spillway (SWRB 4002O), and Storm Water Retention Basin bypass (SWRB 4002B) for radiological constituents. |
| | DOE Order 5400.1, Environmental Monitoring Plan for all media | The IEMP describes treated effluent and surveillance monitoring as required by DOE Order 5400.1. |

## 4.3 PROGRAMMATIC BOUNDARY FOR THE SURFACE WATER AND TREATED EFFLUENT MONITORING PROGRAM

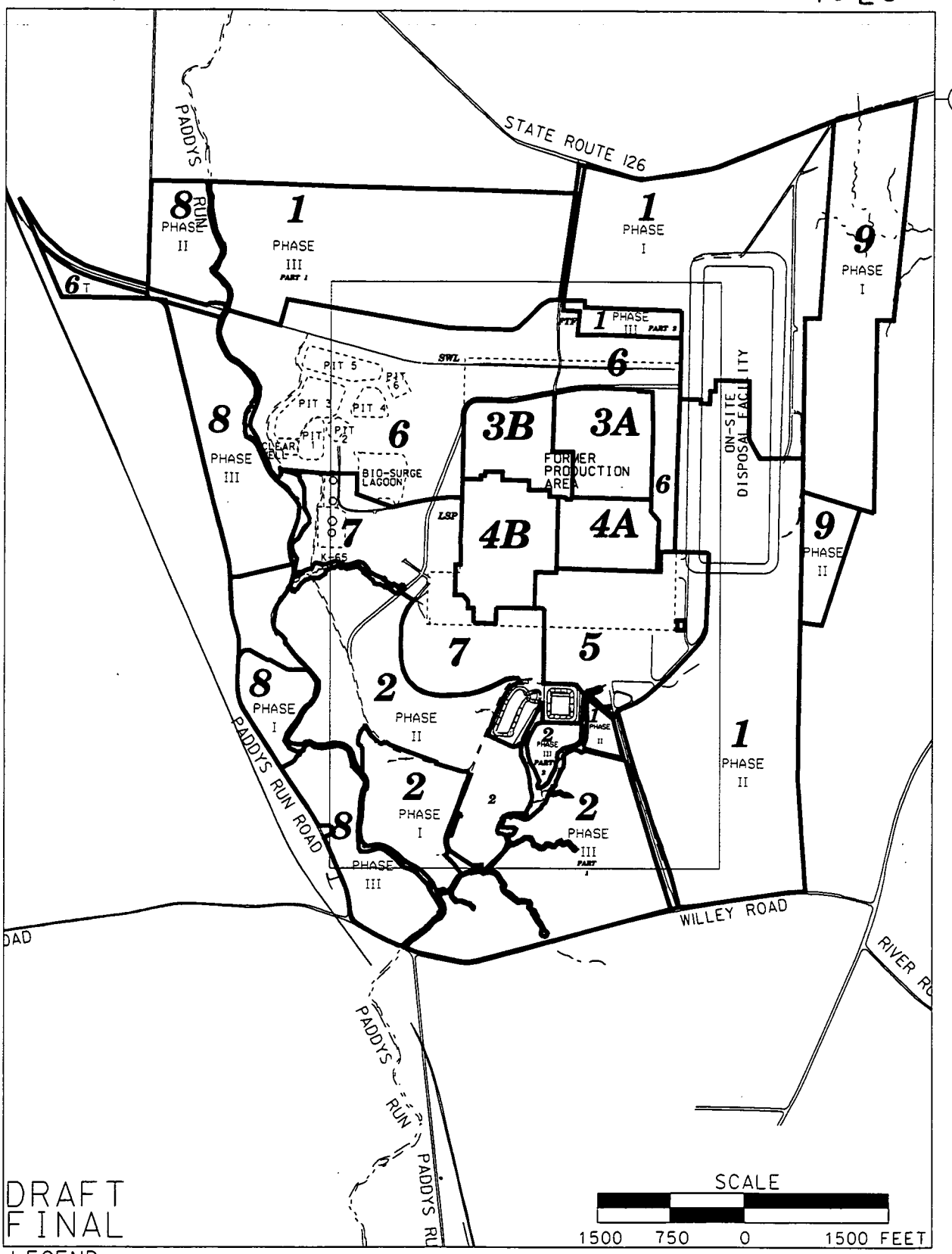
This section identifies the programmatic boundaries established between the IEMP and the project-specific activities to be conducted by others. The intent behind the boundary definition is to: 1) clearly delineate the scope and geographic extent of the IEMP's monitoring responsibility; and 2) establish a recognized interface between the sitewide focus of the IEMP and the predominant emission-control focus of project-specific monitoring.

It is important to emphasize that the IEMP program boundary for each of the FEMP's environmental media is unique and, for portions of the surface water and treated effluent program, time dependent. The boundary is the combined result of:

- Regulatory monitoring requirements
- The physical configuration of the site, planned remediation areas (which will change over time) for soil excavation and certification occurring in various areas of the site shown in Figure 4-1, and the associated project specific controls/monitoring of uncontrolled runoff
- The treated effluent monitoring responsibilities assigned to the IEMP.

For surface water, the programmatic boundary requiring definition for purposes of the IEMP is the line of demarcation between the areas where surface water remains uncontrolled and where surface water is currently controlled (former production area, waste storage areas, cells of the on-site disposal facility in which active waste placement is occurring, as shown in Figure 4-2), or will be controlled as a result of soil remediation activities. As noted above, these boundaries will be transient during remediation as the soil remediation progresses across the site and as additional cells of the on-site disposal facility are developed. In essence, the IEMP will provide surveillance monitoring downstream from the areas where project-specific controls are in place. IEMP surface water and treated effluent monitoring also includes all FFCA and NPDES surface water and treated effluent sampling requirements.

To assist in interpretation of IEMP surface water and treated effluent data collected downstream from the project-specific controls, the IEMP reports will: 1) present contaminant releases attributable to remediation; 2) state whether such releases remain within the established limits; and 3) notify the associated project personnel that such releases have occurred. Section 4.6 discusses this further.




DRAFT
FINAL

LEGEND:

1 REMEDIATION AREA

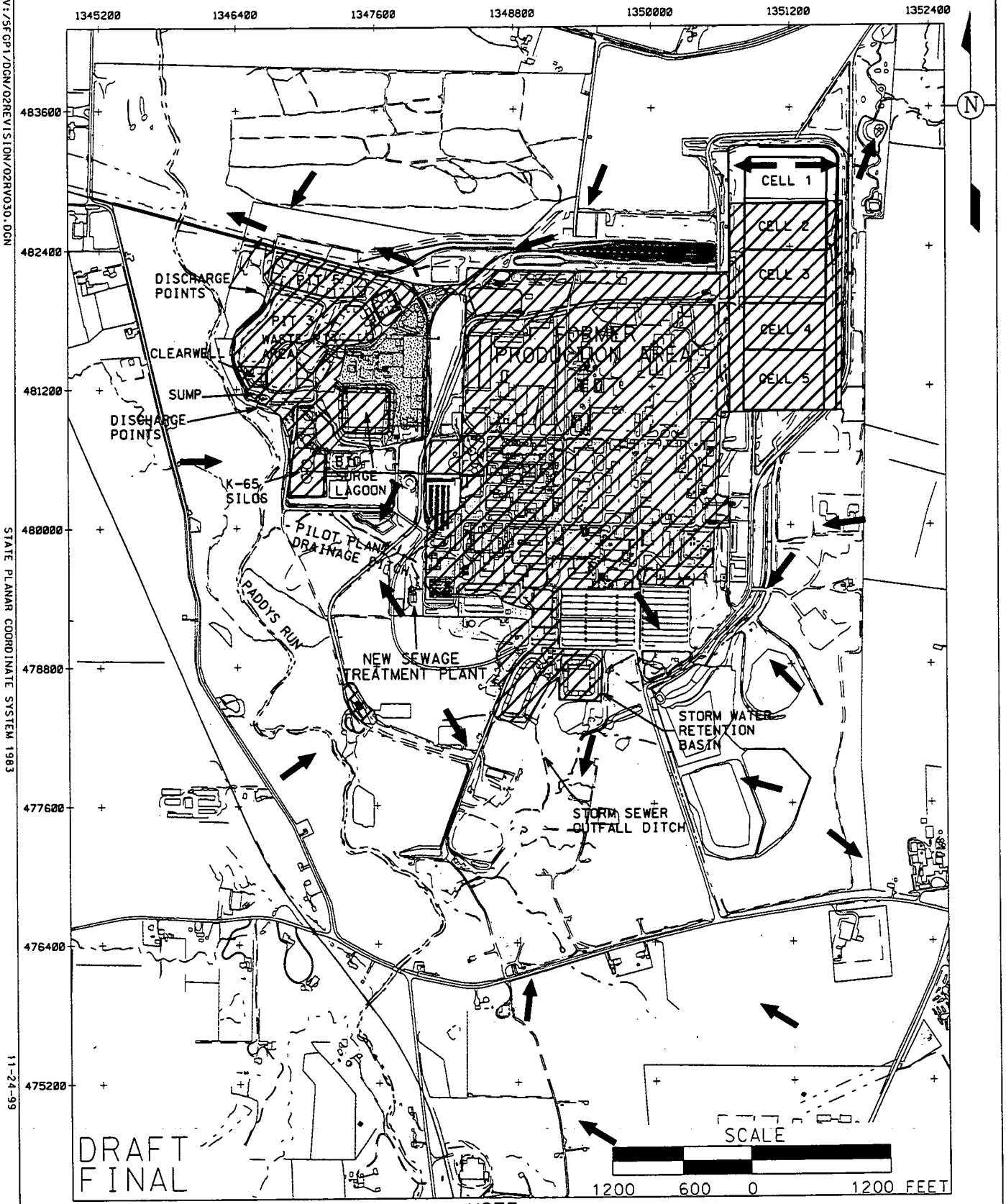
REMEDIATION AREA BOUNDARIES

000106

FIGURE 4-1. SITEWIDE REMEDIATION AREAS



v:\5fgp1\dgn\02revision\02rv024.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




V:/SFGP1/DGN/02REVISION/02RV030.DGN

STATE PLANAR COORDINATE SYSTEM 1983

11-24-99

LEGEND:

CONTROLLED AREA

UNCONTROLLED RUNOFF FLOW DIRECTION

NOTE:

CONTROLLED MEANS WATER IS COLLECTED AND SENT FOR TREATMENT AT THE AWWT.

WATER TREATED IF TOTAL URANIUM RESULT IS >30 μg/L

FIGURE 4-2. ANTICIPATED CONTROLLED RUNOFF AREAS AND UNCONTROLLED FLOW DIRECTIONS AS OF JANUARY 1, 2003

000107

## 4.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

### 4.4.1 Program Expectations

The IEMP surface water and treated effluent monitoring program is being designed to collect data sufficient to meet the following expectations for 2003 and 2004:

- Provide an ongoing assessment of the potential for cross-media impacts from surface water to the underlying Great Miami Aquifer at locations near the point where the protective glacial overburden has been breached by site drainages
- Document whether the sporadic exceedances of FRLs and BTVs in various site drainages (noted in IEMP reports) continue to occur at key on-property locations, at the property boundary on Paddys Run, and in the Great Miami River outside the mixing zone
- Provide an assessment of impacts to surface water due to uncontrolled runoff and implementation of FEMP remediation activities
- Provide additional data at background locations on Paddys Run and the Great Miami River to refine the FEMP's ability to distinguish site impacts from background as remediation progresses
- Continue to fulfill monitoring and reporting requirements associated with the site NPDES Permit
- Continue to fulfill monitoring and reporting requirements associated with the FFCA and Operable Unit 5 Record of Decision
- Continue to fulfill DOE Order 5400.1 requirements to maintain an environmental monitoring plan for surface water
- Continue to address the concerns of the community regarding the magnitude of the FEMP's discharges to surface water (i.e., to Paddys Run and the Great Miami River).

The following section provides the design considerations required to fulfill each of these expectations.

4.4.2 Design Considerations

4.4.2.1 Constituents of Concern

A comprehensive listing of constituents of concern has been developed and provides the suite of parameters that have been evaluated for monitoring. Table 4-2 presents this information. The following is a description of each of the columns in Table 4-2.

- Column 1, Constituent: This column represents the suite of constituents considered for monitoring in the surface water pathway as a result of the remedial investigation/feasibility study process at the FEMP. It represents the constituents for which a FRL was established in the Operable Unit 5 Record of Decision.

- Column 2, Final Remediation Levels: This column represents the human-health-protective remediation levels for surface water that were established in the Operable Unit 5 Record of Decision. BTVs are identified in the footnote (e) of the Table 4-2.

- Column 3, FRL Basis: This column is the basis for establishment of the FRL as defined in the Operable Unit 5 Feasibility Study.

- Column 4, 95th Percentile Background Level in Surface Water: This column represents the 95th percentile background level in surface water as presented in the Remedial Investigation Report for Operable Unit 5 (DOE 1995d) for Paddys Run and the Great Miami River. The IEMP provides this information for purposes of comparison.

4.4.2.2 Surface Water Cross-Media Impact

To assess the cross-media impact that contaminated surface water has on the underlying Great Miami Aquifer, the following design considerations are necessary:

- Samples should be collected at those points near where the glacial overburden has been breached by site drainages. As described in the Operable Unit 5 Remedial Investigation, the majority of the FEMP is underlain by clay-rich glacial overburden. Where present, this glacial overburden provides a measure of protection to the underlying sand-and-gravel aquifer. However, the glacial overburden (Figure 4-3) has been eroded by site drainages primarily in the lower reaches of Paddys Run and in the Storm Sewer Outfall Ditch. Additionally, pre-design groundwater characterization activities in the waste storage and Plant 6 areas confirmed that an area in the Pilot Plant Drainage Ditch adjacent to Paddys Run should be considered as a primary source of infiltration. At these locations, a direct pathway exists for surface water and associated contaminants to reach the underlying sand-and-gravel Great Miami Aquifer.

- Constituents analyzed should represent those area-specific constituents of concern identified in the Operable Unit 5 Feasibility Study and subsequent fate-and-transport modeling as having the potential for cross-media impact to groundwater via the surface water pathway.

- Sampling frequency should be such that seasonal fluctuations in contaminant concentrations (as well as fluctuations due to varying flow conditions) can be assessed.

4528

# TABLE 4-2

## SURFACE WATER SELECTION CRITERIA SUMMARY

| Constituent[a] | FRL[b] | FRL Basis[b] | 95th Percentile Background Level in Surface Water[c,d] | |
|---|---|---|---|---|
| | | | Paddys Run | Great Miami River |
| **General Chemistry (mg/L)** | | | | |
| Fluoride | 2.0 | A | 0.22 | 0.9 |
| Nitrate/Nitrite | 2400 | R | 1.7 | 6.6 |
| **Inorganics (mg/L)** | | | | |
| Antimony | 0.19 | A | ND | ND |
| Arsenic | 0.049 | R | ND | 0.0036 |
| Barium[e] | 100 | R | 0.053 | 0.1 |
| Beryllium | 0.0012 | A | ND | ND |
| Cadmium[e] | 0.0098 | B | ND | 0.01 |
| Chromium VI | 0.010 | D | ND | ND |
| Copper | 0.012 | A | ND | 0.012 |
| Cyanide | 0.012 | A | ND | 0.005 |
| Lead | 0.010 | B | ND | 0.010 |
| Manganese | 1.5 | R | 0.035 | 0.08 |
| Mercury | 0.00020 | D | ND | ND |
| Molybdenum | 1.5 | R | ND | 0.02 |
| Nickel | 0.17 | A | ND | 0.023 |
| Selenium | 0.0050 | A | ND | ND |
| Silver[e] | 0.0050 | D | ND | ND |
| Vanadium | 3.1 | R | ND | ND |
| Zinc | 0.11 | A | ND | 0.045 |

**TABLE 4-2**
**(Continued)**

| Constituent[a] | FRL[b] | FRL Basis[b] | 95th Percentile Background Level in Surface Water[c,d] | |
|---|---|---|---|---|
| | | | Paddys Run | Great Miami River |
| **Radionuclides (pCi/L)** | | | | |
| Cesium-137 | 10 | R | 3.1 | ND |
| Neptunium-237 | 210 | R | - | ND |
| Lead-210 | 11 | R | - | - |
| Plutonium-238 | 210 | R | ND | ND |
| Plutonium-239/240 | 200 | R | 0.09 | ND |
| Radium-226 | 38 | R | 0.35 | 0.41 |
| Radium-228 | 47 | R | 2.1 | 2.2 |
| Strontium-90 | 41 | R | 0.96 | ND |
| Technetium-99 | 150 | R | ND | ND |
| Thorium-228 | 830 | R | ND | 0.62 |
| Thorium-230 | 3500 | R | ND | 0.36 |
| Thorium-232 | 270 | R | ND | ND |
| Uranium, Total (µg/L) | 530 | R | 0.001 | 0.001 |
| **Pesticide/PCBs (µg/L)** | | | | |
| alpha-Chlordane | 0.31 | R | - | - |
| Aroclor-1254 | 0.20 | D | - | - |
| Aroclor-1260 | 0.20 | D | - | - |
| Dieldrin | 0.020 | D | - | - |
| **Semi-Volatiles (µg/L)** | | | | |
| Benzo(a)anthracene | 1.0 | D | - | - |
| Benzo(a)pyrene | 1.0 | D | - | - |
| bis(2-Chloroisopropyl)ether | 280 | R | - | - |
| bis(2-Ethylhexyl)phthalate | 8.4 | A | - | - |
| Dibenzo(a,h)anthracene | 1.0 | D | - | - |

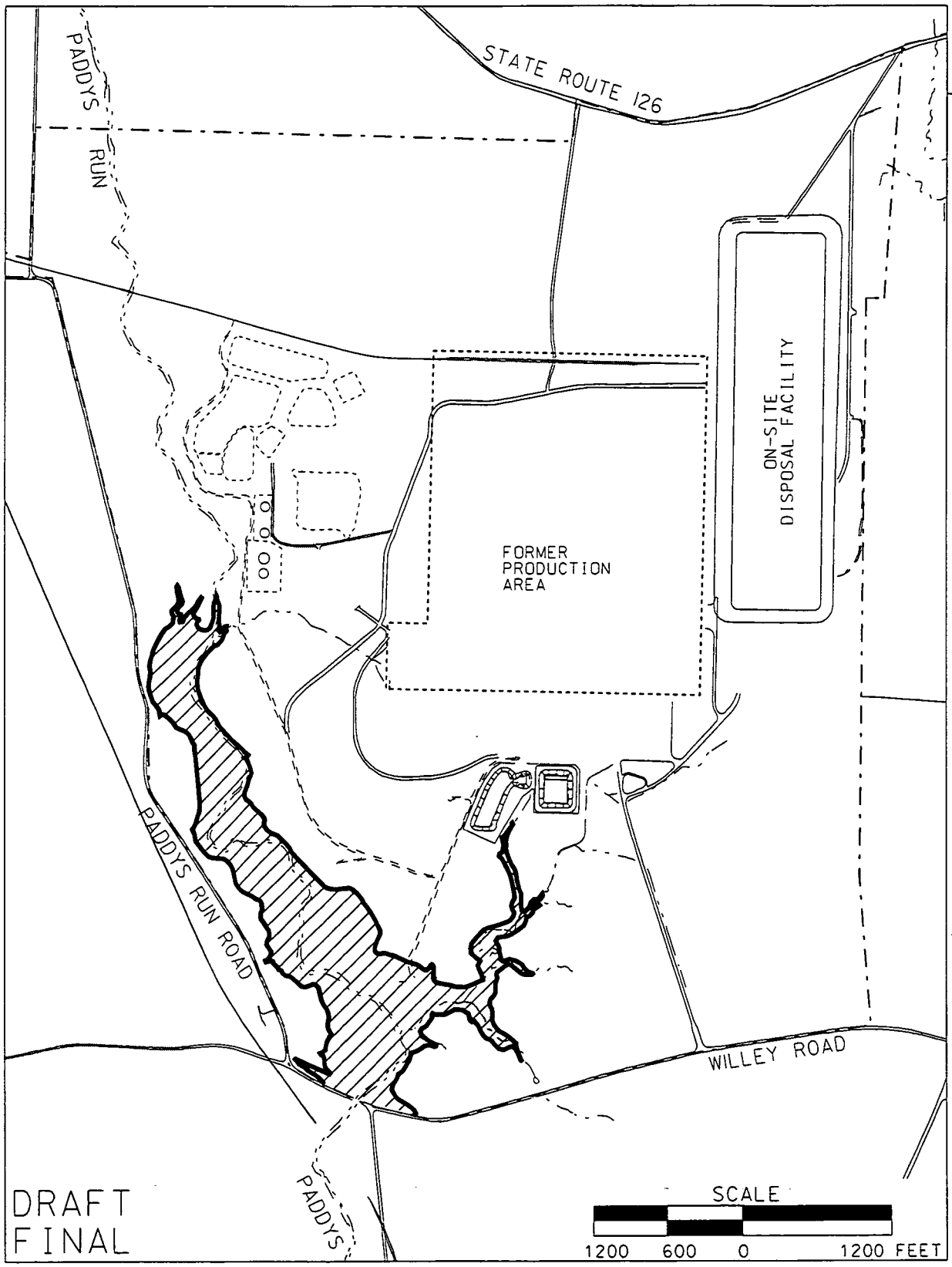
4528

**TABLE 4-2**
**(Continued)**

| Constituent[a] | FRL[b] | FRL Basis[b] | 95th Percentile Background Level in Surface Water[c,d] | |
|---|---|---|---|---|
| | | | Paddys Run | Great Miami River |
| **Semi-Volatiles (µg/L) (Contd.)** | | | | |
| 3,3'-Dichlorobenzidine | 7.7 | R | - | - |
| Di-n-butylphthalate | 6000 | R | - | - |
| Di-n-octylphthalate | 5.0 | D | - | - |
| p-Methylphenol | 2200 | R | - | - |
| 4-Nitrophenol | 7,400,000 | R | - | - |
| **Volatiles (µg/L)** | 280 | R | - | - |
| Benzene | 280 | R | - | - |
| Bromodichloromethane | 240 | R | - | - |
| Bromomethane | 1300 | R | - | - |
| Chloroform | 79 | A | - | - |
| 1,1-Dichloroethene | 15 | R | - | - |
| Methylene chloride | 430 | A | - | - |
| Tetrachloroethene | 45 | R | - | - |
| 1,1,1-Tricholoroethane | 1.0 | D | - | - |
| 1,1,2-Tricholoroethane | 230 | R | - | - |

[a]Highlighting indicates constituents selected for IEMP surface water analysis at locations other than background and NPDES Permit sample locations.
[b]Derived from Operable Unit 5 Record of Decision, Table 9-5
A = ARAR values
B = Background concentrations
D = Analytical detection limit
R = Human health risk
[c]ND = non-detected result
- = not applicable/not available
[d]For small data sets (less than or equal to seven samples), the maximum detected concentration is used as the 95th percentile.
[e]BTVs apply only to barium, cadmium, silver. Barium BTV = 0.145 mg/L; Cadmium BTV = 0.0035 mg/L; Silver BTV = 0.0013 mg/L.
[f]FRL based on chromium VI; however, the analytical results are for total chromium.

0001112




LEGEND:

FEMP BOUNDARY

APPROXIMATE EXTENT OF FEMP PROPERTY WHERE GLACIAL OVERBURDEN HAS BEEN REMOVED BY EROSION

000113

FIGURE 4-3. AREA WHERE GLACIAL OVERBURDEN HAS BEEN REMOVED BY EROSION

v:#5fgpl#dgn#02revision#02rv038.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002

4.4.2.3 Sporadic Exceedances of FRLs and BTVs

To comply with the requirements of the Operable Unit 5 Record of Decision, all surface water FRLs must be achieved and maintained at the completion of the FEMP's remedial actions. (The Operable Unit 5 Feasibility Study acknowledged that BTVs were not a formal part of the FRL development process.) To address the BTVs, the Operable Unit 5 Feasibility Study provided a provision that, if following remediation of the site to achieve FRLs, the concentrations of constituents remained above BTVs for ecological receptors, further investigation and remediation may be warranted. The plan for accommodating the BTVs, as established in the Operable Unit 5 Feasibility Study, is therefore a necessary design consideration for development of the surface water monitoring plan under the IEMP. Surface water BTV constituents were evaluated in the Sitewide Excavation Plan to determine the applicability of the BTVs to surface water at the FEMP. This screening process concluded that barium, cadmium, and silver should continue to be evaluated against surface water BTVs.

To assist in the development of the scope and focus of the IEMP surface water and treated effluent program, a review of the IEMP surface water data is conducted periodically. The last such review was based on data collected under the IEMP program from August 1997 through December 2001. This evaluation was presented and approved by the agencies as a part of the First Quarter 2002 IEMP Report. This evaluation identified a number of parameters, sampled since 1997, that had not exceeded their respective FRL or BTV (or, if an exceedance occurred it had not recurred since the fourth quarter of 1998) and therefore, were eliminated from the IEMP surface water monitoring program. Those parameters, which continue to experience sporadic exceedances of their respective FRL or BTV, will be monitored as indicated in Table 4-3. Appendix B provides maps detailing surface water locations with FRL or BTV exceedances.

During remediation, those constituents that have occasionally exceeded FRLs and/or BTVs should be monitored to document whether the exceedances continue to occur, or, as expected, dissipate as remediation progresses. Because active remediation will be occurring in and near on-property drainages, it is appropriate to monitor for exceedances of the FRLs and BTVs downstream from the remediation areas and upstream from the off-property receptors. Therefore, sample locations should be located at:
1) on-property locations downstream of historical FRL or BTV exceedances; 2) the point where Paddys Run flows off the FEMP property; and 3) the Parshall Flume (PF 4001), where treated effluent is discharged from the FEMP to the Great Miami River. To determine the concentration of the treated effluent constituents outside the mixing zone in the Great Miami River, a conservative calculation using the 10-year low-flow conditions is necessary requiring that flow conditions at the Hamilton Dam gauge be periodically reviewed.

# TABLE 4-3

## SUMMARY OF SURFACE WATER AND TREATED EFFLUENT SAMPLING REQUIREMENTS BY LOCATION

| Location | Constituent[a] | IEMP Characterization Requirements (reason for selection)[b,c] | NPDES Requirements[c] | OU5 ROD/FFCA[c] Requirements |
|---|---|---|---|---|
| SWP-01 and SWR-01 (SWR-01) (Paddys Run and Great Miami River Background) | **General Chemistry:** | | | |
| | Ammonia | - | Quarterly[d] | - |
| | Fluoride | Quarterly (B) | - | - |
| | Nitrate/Nitrite | Quarterly (B) | - | - |
| | Total hardness | - | Quarterly[d] | - |
| | **Inorganics:** | | | |
| | Antimony | Quarterly (B) | - | - |
| | Arsenic | Quarterly (B) | - | - |
| | Barium | Quarterly (B) | - | - |
| | Beryllium | Quarterly (B) | - | - |
| | Cadmium | Quarterly (B) | Quarterly[d] | - |
| | Chromium, Total | Quarterly (B) | Quarterly[d] | - |
| | Cobalt | - | Quarterly[d] | - |
| | Copper | Quarterly (B) | Quarterly[d] | - |
| | Cyanide | Quarterly (B) | - | - |
| | Lead | Quarterly (B) | Quarterly[d] | - |
| | Manganese | Quarterly (B) | Quarterly[d] | - |
| | Mercury | Quarterly (B) | Quarterly[d] | - |
| | Molybdenum | Quarterly (B) | - | - |
| | Nickel | Quarterly (B) | Quarterly[d] | - |
| | Selenium | Quarterly (B) | - | - |
| | Silver | Quarterly (B) | Quarterly[d] | - |
| | Vanadium | Quarterly (B) | - | - |
| | Zinc | Quarterly (B) | Quarterly[d] | - |
| | **Radionuclides:** | | | |
| | Cesium-137 | Quarterly (B) | - | - |
| | Lead-210 | Quarterly (B) | - | - |
| | Neptunium-237 | Quarterly (B) | - | - |
| | Plutonium-238 | Quarterly (B) | - | - |
| | Plutonium-239/240 | Quarterly (B) | - | - |
| | Radium-226 | Quarterly (B) | - | - |
| | Radium-228 | Quarterly (B) | - | - |
| | Strontium-90 | Quarterly (B) | - | - |
| | Technetium-99 | Quarterly (B) | - | - |
| | Thorium-228 | Quarterly (B) | - | - |
| | Thorium-230 | Quarterly (B) | - | - |
| | Thorium-232 | Quarterly (B) | - | - |
| | Uranium, Total | Quarterly (B) | - | - |
| | **Pesticides/PCBs:** | | | |
| | alpha-Chlordane | Quarterly (B) | - | - |
| | Aroclor-1254 | Quarterly (B) | - | - |
| | Aroclor-1260 | Quarterly (B) | - | - |
| | Dieldrin | Quarterly (B) | - | - |
| | **Semi-Volatiles:** | | | |
| | Benzo(a)anthracene | Quarterly (B) | - | - |
| | Benzo(a)pyrene | Quarterly (B) | - | - |
| | bis(2-Chloroisopropyl)ether | Quarterly (B) | - | - |
| | bis(2-Ethylhexyl)phthalate | Quarterly (B) | - | - |
| | Dibenzo(a,h)anthracene | Quarterly (B) | - | - |
| | 3,3'-Dichlorbenzidine | Quarterly (B) | - | - |
| | Di-n-butylphthalate | Quarterly (B) | - | - |
| | Di-n-octylphthalate | Quarterly (B) | - | - |
| | p-Methylphenol | Quarterly (B) | - | - |
| | 4-Nitrophenol | Quarterly (B) | - | - |

**TABLE 4-3**
**(Continued)**

| Location | Constituent[a] | IEMP Characterization Requirements (reason for selection)[b,c] | NPDES Requirements[c] | OU5 ROD/FFCA[c] Requirements |
|---|---|---|---|---|
| SWP-01 and SWR-01 (SWR-4801) (Paddys Run and Great Miami River Background) Contd. | **Volatiles:** | | | |
| | Benzene | Quarterly (B) | - | - |
| | Bromodichloromethane | Quarterly (B) | - | - |
| | Bromomethane | Quarterly (B) | - | - |
| | Chloroform | Quarterly (B) | - | - |
| | 1,1-Dichloroethene | Quarterly (B) | - | - |
| | Methylene chloride | Quarterly (B) | - | - |
| | Tetrachloroethene | Quarterly (B) | - | - |
| | 1,1,1-Trichloroethane | Quarterly (B) | - | - |
| | 1,1,2-Trichloroethane | Quarterly (B) | - | - |
| SWP-02 (Paddys Run) | **Radionuclides:** | | | |
| | Technetium-99 | Quarterly (M) | - | - |
| | Thorium-228[e] | Quarterly (WP) | - | - |
| | Thorium-230[e] | Quarterly (WP) | - | - |
| | Thorium 232[e] | Quarterly (WP) | - | - |
| | Uranium, Total | Quarterly (PC) | - | - |
| SWP-03 (Paddys Run at Downstream Property Boundary) | **Inorganics:** | | | |
| | Chromium, Total | Quarterly (S) | - | - |
| | Copper | Quarterly (S) | - | - |
| | Cyanide | Quarterly (M) | - | - |
| | Mercury | Quarterly (M) | - | - |
| | Silver | Quarterly (M) | - | - |
| | Zinc | Quarterly (M) | - | - |
| | **Radionuclides:** | | | |
| | Radium-226 | Quarterly (M) | - | - |
| | Strontium-90 | Quarterly (M) | - | - |
| | Technetium-99 | Quarterly (M)[f] | - | - |
| | Thorium-228[e] | Quarterly (WP) | - | - |
| | Thorium-230[e] | Quarterly (WP) | - | - |
| | Thorium-232[e] | Quarterly (WP) | - | - |
| | Uranium, Total | Quarterly (PC, M) | - | - |
| SWD-01 (Northeast Drainage) | **Inorganics:** | | | |
| | Mercury | Quarterly (M) | - | - |
| | Cyanide | Quarterly (M) | - | - |
| | **Radionuclides:** | | | |
| | Uranium, Total | Quarterly (PC, M) | - | - |
| SWD-02 (Storm Sewer Outfall Ditch) | **Radionuclides:** | | | |
| | Strontium-90 | Quarterly (M) | - | - |
| | Technetium-99 | Quarterly (M) | - | - |
| | Uranium, Total | Quarterly (PC, M) | - | - |
| SWD-03 (Waste Storage Area) | **Inorganics:** | | | |
| | Copper | Quarterly (S) | - | - |
| | Cyanide | Quarterly (M) | | |
| | Mercury | Quarterly (M) | - | - |
| | Silver | Quarterly (M) | - | - |
| | Zinc | Quarterly (M) | - | - |
| | **Radionuclides:** | | | |
| | Technetium-99 | Quarterly (M) | - | - |
| | Thorium-228[e] | Quarterly (WP) | - | - |
| | Thorium-230[e] | Quarterly (WP) | - | - |
| | Thorium-232[e] | Quarterly (WP) | - | - |
| | Uranium, Total | Quarterly (PC) | - | - |

**TABLE 4-3**
**(Continued)**

| Location | Constituent[a] | IEMP Characterization Requirements (reason for selection)[b,c] | NPDES Requirements[c] | OU5 ROD/FFCA[c] Requirements |
|---|---|---|---|---|
| PF 4001 (Parshall Flume - Treated Effluent) | **General Chemistry:** | | | |
| | Ammonia | - | 3/Week[g] | - |
| | Carbonaceous biochemical oxygen demand | - | 2/Week | - |
| | Total residual chlorine | - | 3/Week | - |
| | Oil and grease | - | 2/Week | - |
| | Total suspended solids | - | Daily | - |
| | **Inorganics:** | | | |
| | Cadmium | Quarterly (S) | 3/Week | - |
| | Chromium, Total | - | 3/Week | - |
| | Cobalt | - | 2/Week | - |
| | Copper | - | 3/Week | - |
| | Cyanide | Quarterly (M) | 3/Week | - |
| | Lead | - | 3/Week | - |
| | Manganese | - | 2/Week | - |
| | Mercury | Quarterly (M) | Monthly | - |
| | Nickel | - | 3/Week | - |
| | Silver | Quarterly (M) | 3/Week | - |
| | Zinc | - | 3/Week | - |
| | **Radionuclides:** | | | |
| | Radium-226 | Quarterly (M) | - | - |
| | Radium-228 | - | - | Monthly |
| | Strontium-90 | Quarterly (M) | - | - |
| | Technetium-99 | Quarterly (M) | - | Monthly |
| | Uranium, Total | Quarterly (PC, M) | - | Daily |
| | **Pesticides/PCBs:** | | | |
| | Toxaphene | - | Monthly | - |
| | **Semi-Volatiles:** | | | |
| | Benzidene | - | Monthly | - |
| | Pentachlorophenol | - | Monthly | - |
| | **Volatiles:** | | | |
| | Trichloroethene | - | Monthly | - |
| | **Other:** | | | |
| | 2,3,7,8-Tetrachlorodibenzo-p-dioxin | - | Quarterly | - |
| | Flow Rate | - | Daily | - |
| SWRB 4002O[h] (Storm Water Retention Basin) | **General Chemistry:** | | | |
| | Total residual chlorine | - | Daily | - |
| | Total suspended solids | - | Daily | - |
| | **Inorganics:** | | | |
| | Beryllium | Quarterly (S) | - | - |
| | Cadmium | Quarterly (S) | - | - |
| | Copper | - | Monthly | - |
| | Cyanide | Quarterly (M, S) | - | - |
| | Manganese | Quarterly (S) | - | - |
| | Mercury | Quarterly (M, S) | Monthly | - |
| | **Radionuclides:** | | | |
| | Radium-226 | Quarterly (M) | - | - |
| | Radium-228 | Quarterly (S) | - | - |
| | Strontium-90 | Quarterly (M) | - | - |
| | Technetium-99 | Quarterly (M, S) | - | - |
| | Uranium, Total | Quarterly (PC, M) | - | Daily |
| | **Other:** | | | |
| | Flow rate | - | Daily | - |

**TABLE 4-3**
**(Continued)**

| Location | Constituent[a] | IEMP Characterization Requirements (reason for selection)[b,c] | NPDES Requirements[c] | OU5 ROD/FFCA[c] Requirements |
|---|---|---|---|---|
| SWRB 4002B (Treatment Bypass) | **Radionuclide:** | | | |
| | Uranium, Total | - | - | Daily during bypass |
| STRM 4003, STRM 4004[i] STRM 4005, STRM 4006 (Drainages to Paddys Run) | **General Chemistry:** | | | |
| | Total suspended solids | - | Semiannually | - |
| | Total residual chlorine (4003, 4005, 4006) | - | Semiannually | - |
| | **Inorganics:** | | | |
| | Copper (4003, 4004, 4006) | - | Semiannually | - |
| | Lead (4004, 4005, 4006) | - | Semiannually | - |
| | Mercury | - | Semiannually | - |
| | Silver | - | Semiannually | - |
| | **Radionuclides:** | | | |
| | Uranium, Total | Quarterly (PC, M, S) | - | - |
| | **Other:** | | | |
| | Fecal coliform | - | Semiannually | - |
| | Flow Rate | - | Semiannually | - |
| STP 4601 (Sewage Treatment Plant Effluent) | **General Chemistry:** | | | |
| | Carbonaceous biochemical oxygen demand | - | 2/Week | - |
| | Ammonia | - | Every two weeks | - |
| | Total suspended solids | - | 2/Week | - |
| | **Other:** | | | |
| | Fecal coliform | - | Weekly (May-Oct) | - |
| | Flow Rate | - | Daily | - |
| SWR-4902 (Downstream of FEMP Effluent) | **General Chemistry:** | | | |
| | Ammonia | - | Quarterly | - |
| | Total Hardness | - | Quarterly | - |
| | **Inorganics** | | | |
| | Cadmium | - | Quarterly | - |
| | Chromium | - | Quarterly | - |
| | Cobalt | - | Quarterly | - |
| | Copper | - | Quarterly | - |
| | Lead | - | Quarterly | - |
| | Manganese | - | Quarterly | - |
| | Mercury | - | Quarterly | - |
| | Nickel | - | Quarterly | - |
| | Silver | - | Quarterly | - |
| | Zinc | - | Quarterly | - |

[a]Field parameter readings, taken at each location, include temperature, specific conductance, pH, and dissolved oxygen.
[b]B = Background Evaluation; M = Based on Modeling; PC – Primary COC; S – Sporadic Exceedances of FRLs or BTVs; WP – Waste Pits Excavation Monitoring
[c]"-"indicates the constituent is not included in the sample program.
[d]Refers only to location SWR-01 (NPDES location SWR-4801); constituents sampled quarterly.
[e]Constituent being monitored during excavation of the waste pits to assess thorium releases as a whole.
[f]The basis for the "M" designation is because of the contribution from an upgradient location (i.e., SWP-02).
[g]Sampled twice a week in winter (November 1 through April 30).
[h]Constituents will be analyzed at each overflow event.
[i]New location STRM 4004A has been identified as an alternative sample location for STRM 4004. STRM 4004A will be sampled for the constituents if no flow is observed at STRM 4004 or is otherwise not accessible.

To provide surveillance monitoring for FRL and BTV exceedances, samples will be collected quarterly and analyzed for those constituents identified in Table 4-3.

4.4.2.4 Impacts to Surface Water Due to Uncontrolled Storm Water Runoff and Remediation Activities
As stated in Section 4.3, IEMP surface water monitoring will occur outside of and downstream from areas where storm water is controlled. Figure 4-2 shows that the majority of highly contaminated storm water drainage from the site (i.e., from the former production area [Operable Unit 3], the waste storage area [Operable Units 1 and 4], and active cells at the on-site disposal facility) has been identified and controlled through contaminant abatement, formal removal actions, and remediation activities.

Numerous engineered controls have been installed to protect surface water drainages downgradient of remediation activities. Several basins were installed at various locations around the FEMP including the northeastern portion of the FEMP, southeast of the silos, east of the waste storage area, west of the new north railyard, and in the on-site disposal facility borrow area.

Several large-scale field activities planned for 2003 and 2004 that could potentially affect the surface water pathway include:

- Waste excavation, waste treatment and waste shipment in the waste storage area
- Continued soil excavations
- Continued waste placement activities at the on-site disposal facility
- Construction and operation activities associated with the Operable Unit 4 Accelerated Waste Retrieval project and Silo 3 Project Treatment Facility, and construction activities associated with Silos 1 and 2 remediation facility.

(Additional information concerning site remedial activities is contained in Section 2.0.)

To identify any potential impact from uncontrolled runoff originating in the area between the waste storage area and the former production area, uncontrolled runoff will be monitored quarterly for total uranium at SWD-03 (Figure 4-4). In addition, because total uranium is the primary constituent of concern at the FEMP, total uranium will be monitored quarterly at a minimum at each of the IEMP sample locations to assist in determining the site's impact on the surface water pathway. Also, as a result of the increased activity around the waste pits and with the active excavation of the waste pits, thorium is now included in the sampling program. Thorium-228, 230, and 232 will be monitored quarterly at SWD-03, SWP-02, and SWP-03 to determine the impact of surface remediation at and around the waste pits.

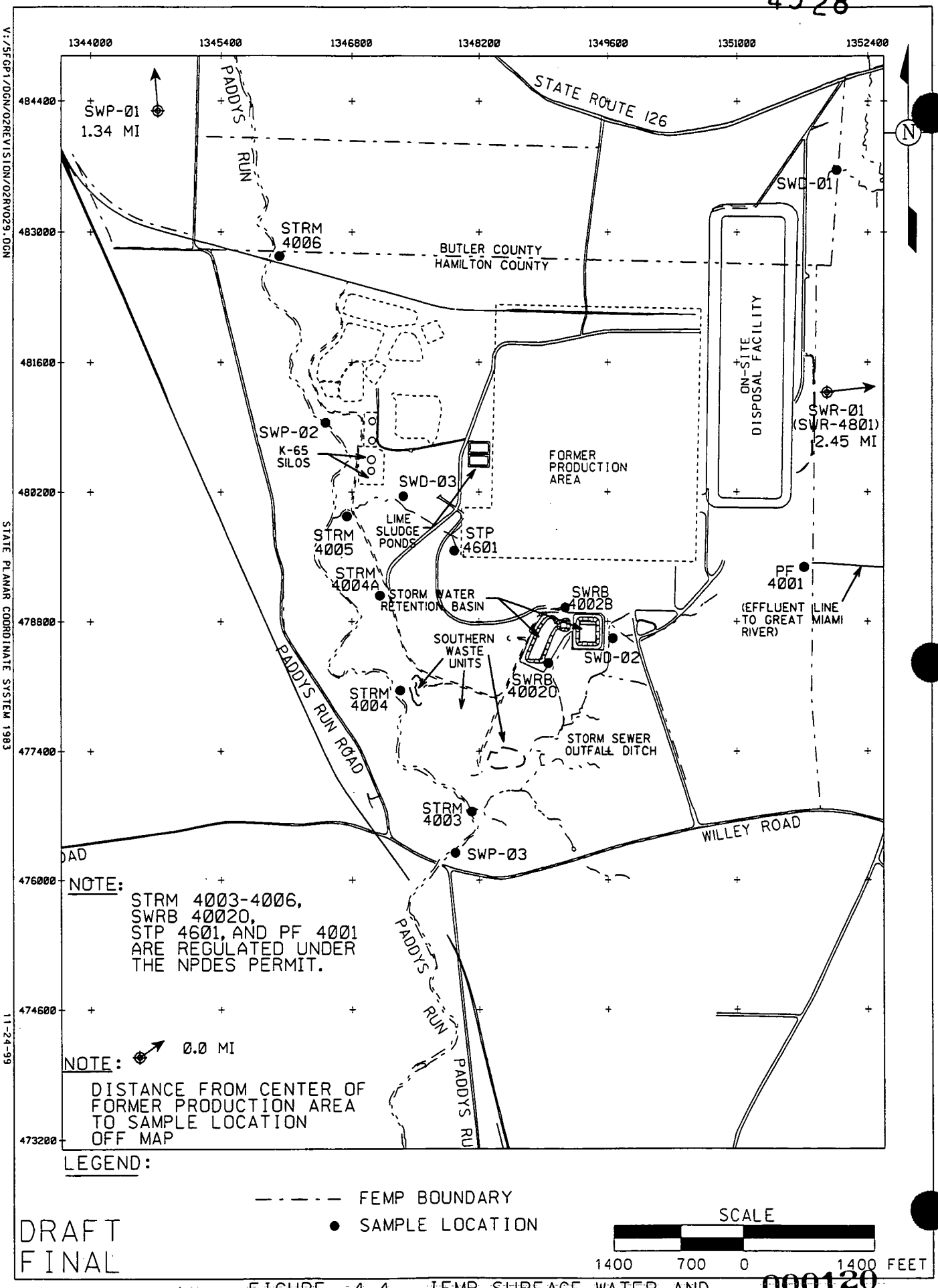



FIGURE 4-4. IEMP SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

These locations were selected because these surveillance locations could be potentially impacted by waste pit excavation. It is important to note that the waste pit drainage area is controlled; however, this monitoring will be done as an appropriate, pro-active step in assessing thorium as a whole.

Figure 4-5 shows the dramatic effect storm water runoff controls have had in lowering the concentrations of uranium, the principal site contaminant, in surface water leaving the site via Paddys Run. Other important distinctions regarding uranium in uncontrolled runoff from the site to Paddys Run, based on the data in Figure 4-5, are that:

- Average concentrations have been far below the human-health-protective surface water FRL concentration of 530 micrograms per liter (μg/L) in each year since 1981. (This includes nine years while the site was in production.)

- Annual average concentrations consistently have been below the human-health-protective groundwater FRL of 30 μg/L since the Storm Water Retention Basin began collecting contaminated runoff in 1986.

Storm water runoff controls currently in place are anticipated to remain until remediation of each respective area is complete. Therefore, it will not be necessary to monitor within these controlled areas for purposes of the IEMP because runoff from these areas is collected and treated. Monitoring of the resultant treated effluent is covered by the NPDES, FFCA, and Operable Unit 5 Record of Decision programs as discussed in Sections 4.4.2.6 and 4.4.2.7.

Additional controls for storm water runoff may be required per the FEMP Storm Water Pollution Prevention Plan for construction activities. As Section 4.3 notes, responsibility for construction and maintenance of storm water runoff controls and monitoring the effectiveness of such controls is the responsibility of each individual project. The specifications of these storm water runoff controls and associated performance monitoring of the storm water runoff controls will be detailed in Operable Unit 5 soil remediation remedial action work plans and other project-specific remedial action documentation, as warranted.

Effective sampling points for this surveillance monitoring need to be:

- At points downstream of the storm water runoff controls and construction/remediation activities
- At the FEMP boundary in Paddys Run
- In the treated effluent routed to the Great Miami River as it leaves the facility
- At the Storm Water Retention Basin spillway, during overflow conditions.

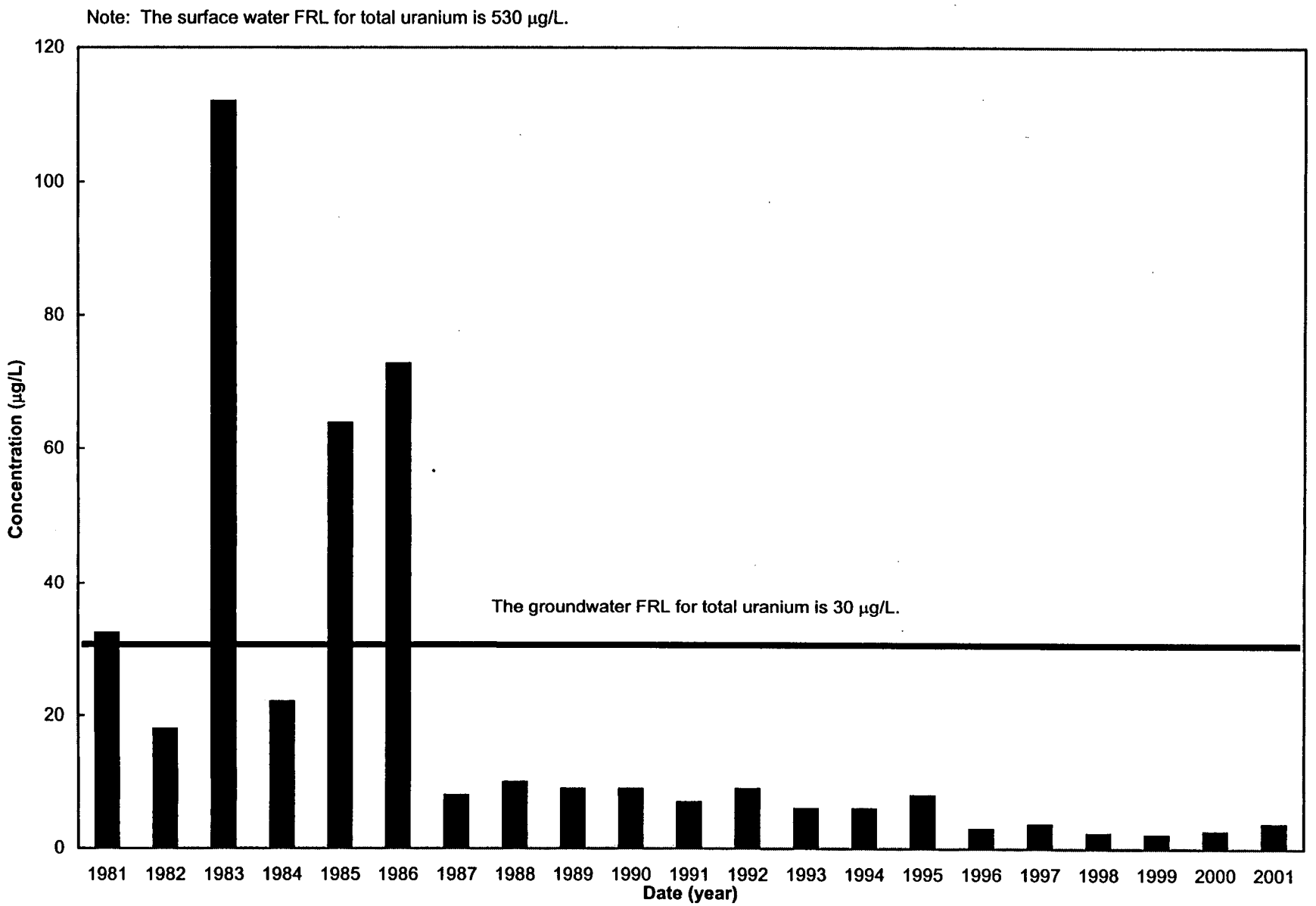



FIGURE 4-5. COMPARISON OF AVERAGE TOTAL URANIUM CONCENTRATIONS IN PADDYS RUN AT WILLEY ROAD SAMPLE LOCATION SWP-03

DRAFT FINAL



000122

- 4528

Parameters for this surveillance monitoring need to be those constituents that:

- Exceed surface water FRLs or BTVs upstream from the sample locations
- Are present in sufficient concentration upstream of the sample locations and are mobile to the degree such that they have the potential to: 1) cause cross-media impacts to groundwater; 2) affect surface water to the degree that human-health-protective FRLs are exceeded; and 3) impact surface water above BTVs.

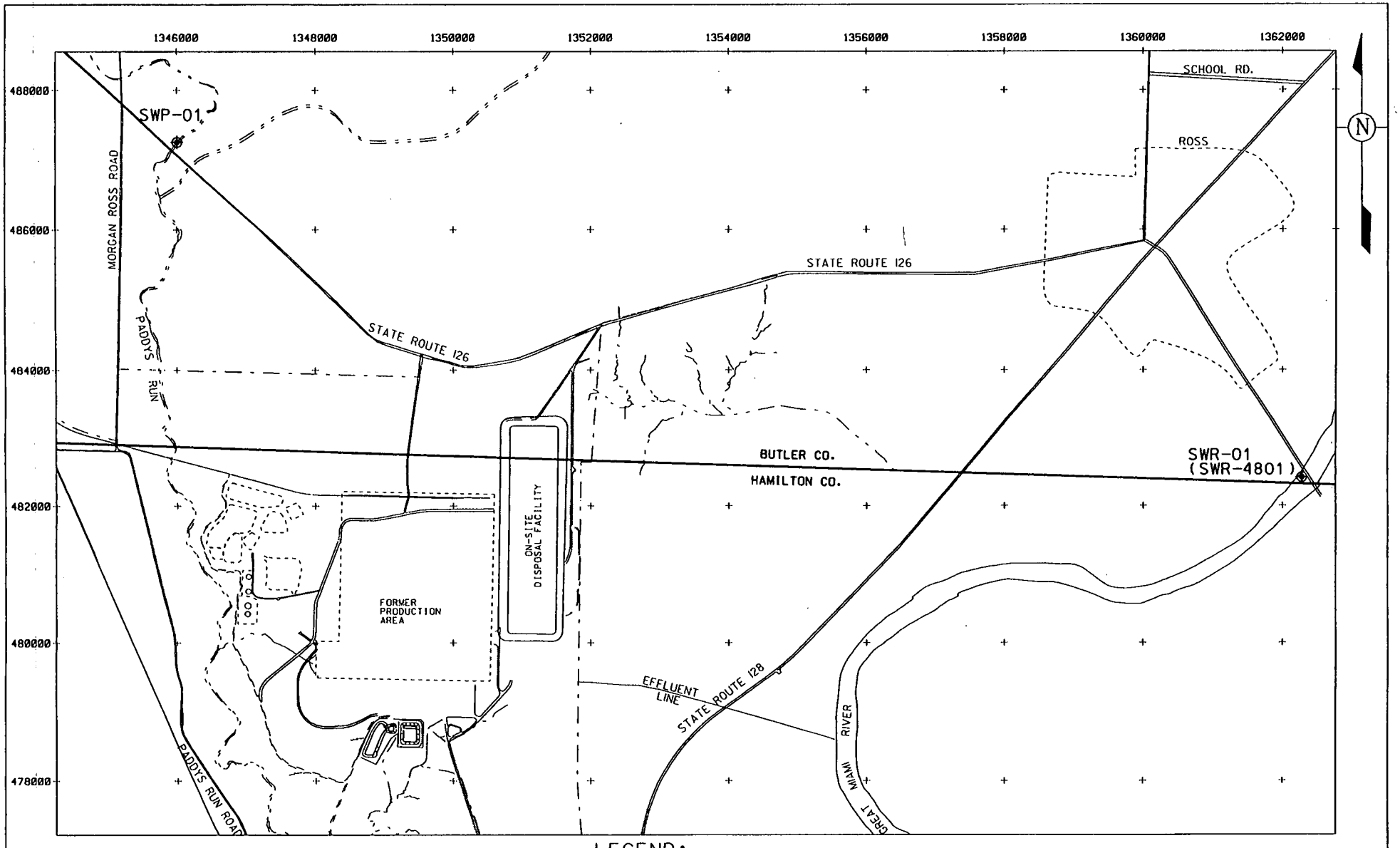
The frequency of sampling to fulfill this expectation should be such that seasonal variations in contaminant concentrations (as well as fluctuations due to varying flow conditions) can be assessed quarterly. To adequately assess the impact of storm water overflows from areas where storm water is controlled, the frequency of sampling at the Storm Water Retention Basin shall be such that each overflow is characterized.

4.4.2.5 Ongoing Background Evaluation

As shown in the Operable Unit 5 Remedial Investigation, the remedial investigation/feasibility study background data set for Paddys Run and the Great Miami River surface water was limited by the number of samples and temporal variability represented by the samples. In addition to this remedial investigation/feasibility study data limitation, background surface water quality is by nature transient (i.e., background surface water quality is subject to variations over time due to changes in activities and runoff conditions within the watershed). To address the limited background data for Paddys Run and the Great Miami River, the following considerations are recommended to maintain the IEMP surface water background sampling program:

- Sample locations (SWP-01 and SWR-01 [NPDES sample location SWR-4801]), shown in Figure 4-6, shall be consistent with those locations established for the former EMP, previous IEMP revisions, and the remedial investigation/feasibility study.
- Constituents analyzed shall represent the constituents for which the Operable Unit 5 Record of Decision established surface water FRLs.
- Sampling frequency shall be such that seasonal variations (as well as variations due to varying flow conditions) can be assessed.

These considerations define the IEMP program for surface water sampling of background locations, which is provided in the following program design section.




LEGEND:

FEMP BOUNDARY

SWR-01 ◆ SAMPLE LOCATION

SCALE

2000 1000 0 2000 FEET

DRAFT
FINAL

V:\5fgp1\dgn\02revision\02rv020.dgn
STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002

FIGURE 4-6. IEMP BACKGROUND SURFACE WATER SAMPLE LOCATIONS

4.4.2.6 Continue to Fulfill National Pollutant Discharge Elimination System Requirements

As noted in Section 4.2, wastewater and storm water discharges from the FEMP are regulated under the state-administered NPDES program. The current permit (OEPA Permit 1I000004*FD) was issued on January 28, 2000, became effective on March 1, 2000, and expires on October 31, 2002. A completed NPDES Permit Renewal Application was submitted to OEPA April 30, 2002. Indications are that a renewed permit will not be issued until the spring of 2003. In any event, all surface water and treated effluent sampling and analysis requirements as they are defined in the current permit or any future renewed or modified permit will be carried forward and integrated in the IEMP as discussed in Section 4.4.3. Figure 4-7 identifies the current NPDES Permit sample locations.

4.4.2.7 Continue to Fulfill Federal Facilities Compliance Agreement and Operable Unit 5 Record of Decision Requirements

As noted in Section 4.2.2, the current FFCA sampling and reporting requirements became effective on May 1, 1996. These requirements specify sampling at the Parshall Flume (PF 4001), the Storm Water Retention Basin spillway (SWRB 4002O), the Storm Water Retention Basin bypass (SWRB 4002B), and the South Plume extraction wells. In addition to these sampling requirements, an estimate of the amount of uranium reaching Paddys Run via uncontrolled storm water runoff is calculated. The IEMP will incorporate sampling of the first three above-described locations and will include a total uranium calculation for uncontrolled storm water runoff, the Parshall Flume, and the Storm Water Retention Basin spillway. Section 3.0 discusses sampling of the South Plume extraction wells. As discussed in Section 8.0, monitoring data required by the FFCA have been incorporated into the comprehensive IEMP reporting structure.

The sampling agreement implemented on May 1, 1996 noted that, pending further evaluation, several radiological constituents might be deleted from the FFCA sampling of treated effluent. Further evaluation was performed in the comprehensive point-by-point constituent selection evaluation completed in support of this IEMP surface water and treated effluent sampling program; therefore, the radiological constituents selected for the treated effluent sampling point at the Parshall Flume are composed of those radiological constituents of concern that were found to be both present in those areas where surface water is controlled and ultimately routed to the Storm Water Retention Basin and/or Parshall Flume, and also mobile to a degree such that surface water may be impacted above FRLs during remediation as indicated by fate-and-transport modeling.

Section 4.4.3 lists these radiological constituents; also listed are all other constituents deemed necessary to fulfill the program expectations outlined in Section 4.4.1 for the Parshall Flume treated effluent sample location as a result of the IEMP constituent-selection process.

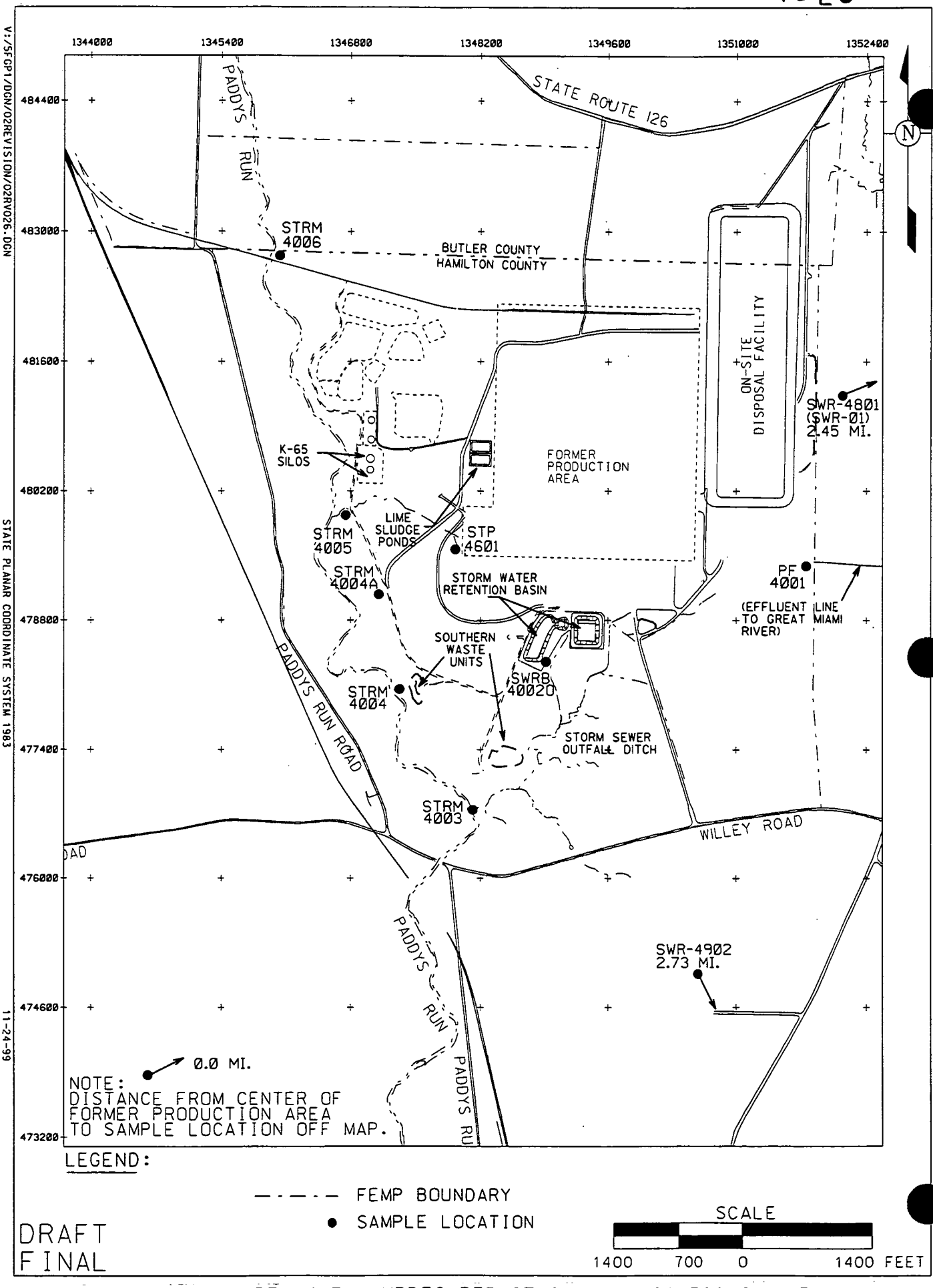



FIGURE 4-7. NPDES PERMIT SAMPLE LOCATIONS

4.4.2.8 Continue to Fulfill DOE Order 5400.1 Requirements

The design considerations provided above, which were based on information and conclusions derived from the existing DOE-compliant environmental monitoring program as well as the comprehensive findings of the FEMP remedial investigation/feasibility study process, are sufficient to meet or exceed the requirements of DOE Order 5400.1 as summarized in Section 4.2.2.

4.4.2.9 Continue to Address Concerns of the Community

The monitoring derived from Section 4.4.2.4 will be sufficient to address the concerns of the community. These concerns focus on limiting the amount of FEMP related contamination entering Paddys Run and the Great Miami River. This monitoring will provide a comprehensive monitoring program on Paddys Run at the facility boundary and in the treated effluent destined for the Great Miami River. Monitoring will also document the reduction in FEMP-related contamination entering these streams that is anticipated to occur as remediation progresses.

4.4.3 Program Design

This section provides the IEMP surface water and treated effluent sampling program for 2003 and 2004 developed from the design considerations provided in Section 4.4.2. Table 4-3 summarizes the program design by providing the sample locations, the frequency, and the constituents to be sampled for at each location. This table also provides the basis for the locations and constituents with respect to program expectations identified in Section 4.4.1. To simplify the presentation of the surface water and treated effluent program, IEMP Characterization consists of the first four "Basis for Selection of Constituent" columns of Table 4-3. This terminology is consistent with the approach used for reporting through the IEMP.

The non-radiological discharge monitoring and reporting related to the NPDES Permit has been incorporated into the IEMP. The radiological discharge monitoring related to the FFCA and Operable Unit 5 Record of Decision has been incorporated into the IEMP.

Near the completion of site remediation, sampling will occur to certify that the surface water pathway at the FEMP is meeting the obligations set forth in the Operable Unit 5 Record of Decision.

## 4.5 MEDIA-SPECIFIC PLAN FOR SURFACE WATER AND TREATED EFFLUENT SAMPLING

This section serves as the media-specific plan for implementation of the sampling, analytical, and data management activities associated with the IEMP surface water and treated effluent sampling program. The activities described in this media-specific plan were designed to provide surface water and treated effluent data of sufficient quality to meet the program expectations as stated in Section 4.4.1. The program expectations, in conjunction with the design considerations presented in Section 4.4.2, were used as the framework for developing the monitoring approach presented in this plan. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 2002c).

Subsequent sections of this media-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance.

### 4.5.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this media-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support and assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standard and assist in evaluating and resolving all quality related concerns.

4.5.2 Sampling Program

To fulfill the requirements of the integrated surface water and treated effluent program, surface water and treated effluent samples shall be collected from locations shown in Figures 4-4, 4-6, and 4-7. Table 4-3 summarizes the surface water and treated effluent sampling frequency and location-specific analytical suites. Tables 4-4 and 4-5 provide the sample collection and analytical method information for these locations and constituents.

Sample analysis will be performed at the on-site FEMP laboratory or a contract laboratory dependent on specific analyses required, laboratory capacity, turn-around time, and performance of the laboratory. The laboratories utilized for analytical testing must be approved by the FEMP in accordance with the criteria specified in Sections 3.1.5, 12.4, and Appendix E of the SCQ. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program. A list of FEMP-approved laboratories and current status of each is maintained by the FEMP quality assurance organization.

## TABLE 4-4

## SURFACE WATER ANALYTICAL REQUIREMENTS FOR CONSTITUENTS AT SAMPLE LOCATIONS SWD-01, SWD-02, SWD-03, SWP-01[a], SWP-02, SWP-03, AND SWR-01[a]

| Constituent | Analytical Method | ASL[b] | Holding Time | Preservative | Container |
|---|---|---|---|---|---|
| **General Chemistry:** | | | | | |
| Fluoride | 300.0[c], 340.2[c], or 4500C[d] | B | 28 days | None | Plastic |
| Nitrate/Nitrite | 353.1[c], 353.3[c], 4500D[d], or 4500E[d] | B | 28 days | Cool 4°C, $H_2SO_4$ to pH < 2 | Plastic or glass |
| **Inorganics:** | | | | | |
| Antimony<br>Arsenic<br>Barium<br>Beryllium<br>Cadmium<br>Chromium, Total<br>Copper<br>Lead<br>Manganese<br>Molybdenum<br>Nickel<br>Selenium<br>Silver<br>Vanadium<br>Zinc | 7000A[e], 3500[d], or 6010B[e] | B | 6 months | $HNO_3$ to pH < 2 | Plastic or glass |
| Mercury | 7470A[e] | B | 28 days | $HNO_3$ to pH < 2 | Plastic or glass |
| Cyanide | 9010[e], 9012[e], 335.2[c], or 335.3[c] | B | 14 days | Cool 4°C, NaOH to pH > 12 | Plastic or glass |
| **Radionuclides:** | | | | | |
| Cesium-137<br>Lead-210<br>Neptunium-237<br>Plutonium-238<br>Plutonium-239/240<br>Radium-226<br>Radium-228<br>Strontium-90<br>Technetium-99<br>Thorium-228<br>Thorium-230<br>Thorium-232<br>Uranium, Total | SCQ[f] | B | 6 months | $HNO_3$ to pH < 2 | Plastic or glass |

**TABLE 4-4**
**(Continued)**

| Constituent | Analytical Method | ASL[b] | Holding Time | Preservative | Container |
|---|---|---|---|---|---|
| **Pesticides/PCBs:** | | | | | |
| alpha-Chlordane<br>Dieldrin<br>Aroclor-1254<br>Aroclor-1260 | 8081A[e] or 8082[e] | B | 7 days to extraction<br>40 days from extraction to analysis | Cool 4°C | Glass (amber wth Teflon lined cap) |
| **Semi-Volatiles:** | | | | | |
| bis(2-Chloroisopropyl)ether<br>bis(2-Ethylhexyl)phthalate<br>3,3'-Dichlorobenzidine<br>Di-n-butylphthalate<br>Di-n-octylphthalate<br>p-Methylphenol<br>4-Nitrophenol | 8270C[e] | B | 7 days to extraction<br>40 days from extraction to analysis | Cool 4°C | Glass (amber wth Teflon lined cap) |
| Benzo(a)anthracene<br>Benzo(a)pyrene<br>Dibenzo(a,h)anthracene | 8310[e] | B | 7 days to extraction<br>40 days from extraction to analysis | Cool 4°C | Glass (amber wth Teflon lined cap) |
| **Volatiles:** | | | | | |
| Benzene<br>Bromodichloromethane<br>Bromomethane<br>Chloroform<br>1,1-Dichloroethene<br>Methylene chloride<br>Tetrachloroethene<br>1,1,1-Trichloroethane<br>1,1,2-Trichloroethane | 8260B[e] | B | 7 days<br>or<br>14 days | Cool 4°C<br>or<br>Cool 4°C, $H_2SO_4$, HCl, or solid $NaHSO_4$ to pH < 2 | Glass (with teflon line septum cap) |
| **Field Parameters:**[g] | SCQ[h] | A | NA[i] | NA[i] | NA[i] |

[a]Only sample locations SWP-01 and SWR-01 are analyzed for all constituents listed in this table. The remaining sample locations are analyzed for a subset of these constituents which is summarized in Table 4-3.
[b]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[c]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020
[d]Standard Methods for the Analysis of Water and Wastewater, 17th edition
[e]Test methods for evaluating solid waste, physical/chemical methods, SW-846
[f]Radionuclide analyses do not have standard methods; Appendix G of the SCQ provides performance specifications.
[g]Field parameters include temperature, specific conductance, pH, and dissolved oxygen.
[h]Appendix K of the SCQ provides field methods.
[i]NA = not applicable

# TABLE 4-5

## SURFACE WATER AND EFFLUENT ANALYTICAL REQUIREMENTS FOR CONSTITUENTS AT SAMPLE LOCATIONS PF 4001, STP 4601, STRM 4003, STRM 4004, STRM 4005, STRM 4006, SWRB 4002O, SWRB 4002B, SWR-4801, AND SWR-4902

| Constituent[a] | Analytical Method[b] | Sample Type[c] | ASL[b,d] | Holding Time[b] | Preservative[b] | Container[b] |
|---|---|---|---|---|---|---|
| **General Chemistry:** | | | | | | |
| Ammonia | 350.1[e], 350.3[e], 4500C[f], or 4500F[f] | Composite or Grab[g] | B | 28 days | Cool 4°C, $H_2SO_4$ to pH < 2 | Plastic or glass |
| Carbonaceous biochemical oxygen demand | 5210B[f] | Composite | B | 48 hours | Cool 4EC | Plastic or glass |
| Chlorine, residual | 4500[f] | Grab | B | Analyze immediately | None | Plastic or glass |
| Oil and grease | 9070[h], 5520B[f], or 413.1[e] | Grab | B | 28 days | Cool 4°C, $H_2SO_4$ to pH < 2 | Glass |
| Total hardness | 2340C[f] | Grab | B | 28 days | Cool 4°C, $H_2SO_4$ to pH < 2 | Plastic |
| Total suspended solids | 160.2[e] or 2540D[f] | Composite | B | 7 days | Cool 4°C | Plastic or glass |
| **Inorganics:** | | | | | | |
| Beryllium<br>Cadmium<br>Chromium, Total<br>Cobalt<br>Copper<br>Lead<br>Manganese<br>Nickel<br>Silver<br>Zinc | 6020[h], 7000A[h], 3500[f], 6010B[h], 200.8[i], 220.2[e], or 272.2[e] | Composite or Grab[g] | B | 6 months | $HNO_3$ to pH < 2 | Plastic or glass |
| Mercury | 7470A[h] or 1631[e,j] | Grab | B | 28 days | $HNO_3$ to pH < 2 | Plastic or glass |
| Cyanide, Free | 9010[h], 9012[h], 335.2[e], or 335.3[e] or 4500-CNI[f] | Grab | B | 14 days | Cool 4°C, NaOH to pH > 12 | Plastic or glass |
| **Radionuclides:** | | | | | | |
| Radium-226<br>Radium-228<br>Technetium-99<br>Strontium-90 | SCQ[k] | Grab | B | 6 months | $HNO_3$ to pH < 2 | Plastic or glass |
| Uranium, Total | SCQ[k] | Grab/Composite[l] | B | 6 months | $HNO_3$ to pH < 2 | Plastic or glass |

4528

**TABLE 4-5**
**(Continued)**

| Constituent[a] | Analytical Method[b] | Sample Type[c] | ASL[b,d] | Holding Time[b] | Preservative[b] | Container[b] |
|---|---|---|---|---|---|---|
| **Pesticides/PCBs:** | | | | | | |
| Toxaphene | 8081A[h] | Grab | B | 7days to extraction 40 days from extraction to analysis | Cool 4°C | Glass (amber wth Teflon lined cap) |
| **Semi-Volatiles:** | | | | | | |
| Benzidine | 605[e] | Grab | B | 7days to extraction 7 days from extraction to analysis | Cool 4°C | Glass (amber wth Teflon lined cap) |
| Pentachlorophenol | 8270C[h] | Grab | B | 7days to extraction 40 days from extraction to analysis | Cool 4°C | Glass (amber wth Teflon lined cap) |
| **Volatiles:** | | | | | | |
| Trichloroethene | 8260B[h] | Grab | B | 14 days | $H_2SO_4$ pH < 2 Cool 4EC | Glass (with Teflon lined septum cap) |
| **Other:** | | | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 8290[h] | Grab | B | 7days to extraction 40 days from extraction to analysis | Cool 4°C | Glass (amber wth Teflon lined cap) |
| Fecal coliform | 9222D[f] | Grab | B | 6 hours | Cool 4°C | Plastic or glass (sterile) |
| Flow rate | NA | 24 hour total | NA | NA | NA | NA |
| **Field Parameters[m]:** | SCQ[n] | Grab | A | NA | NA | NA |

[a]This represents a comprehensive list of constituents taken from the indicated list of surface water and treated effluent monitoring locations. Each individual location will be analyzed for a subset of these constituents which is summarized in Table 4-3.
[b]NA = not applicable
[c]For composite samples for PF 4001 and STP 4601, collect a flow-weighted composite sample over a 24 hour period; for SWRB 4002O, SWRB 4002B, STRM 4003, STRM 4004, STRM 4005, and STRM 4006, composite samples shall be comprised of four samples collected at intervals of at least 30 minutes but not more than two hours.
[d]The ASL may become more conservative if necessary to meet detection limits or data quality objectives.
[e]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020
[f]Standard Methods for the Analysis of Water and Wastewater, 17th Edition
[g]Grab samples are collected at locations SWR-4801 and SWR-4902 for this constituent.
[h]Test Methods for Evaluation Solid Wastes, Physical/Chemical Methods, SW-846
[i]Methods for the Determination of Metals in Environmental Samples, EPA/600/R-94/111
[j]Method 1631 for mercury analysis will only be used at NPDES Permit locations where mercury sampling is required.
[k]Radionuclide analyses do not have standard methods; performance specifications are provided in Appendix G of the SCQ.
[l]Total uranium is a grab sample at STRM 4003, STRM 4004, STRM 4005, and STRM 4006 and a composite sample at all other locations.
[m]Field parameters include dissolved oxygen, pH, specific conductance, and temperature.
[n]Appendix K of the SCQ provides field analytical methods.

4.5.2.1 Sampling Procedures

Specific sampling procedures associated with surface water and treated effluent are separately discussed within this section. The procedures provide sampling instructions, which meet the applicable requirements, outlined in the SCQ as follows:

Sitewide CERCLA Quality (SCQ) Assurance Project Plan

| | |
|---|---|
| Section 4 | Quality Assurance Objectives |
| Section 5 | Field Activities |
| Section 6 | Sampling Requirements |
| Section 7 | Sample Custody |
| Section 8 | Calibration Procedures and Frequency |
| Appendix I | Field Calibration Requirements |
| Appendix J | Field Activity Methods |
| Appendix K | Sampling Methods |

Surface Water Sampling

Surface water samples will be collected from locations in Paddys Run, drainage ditches to Paddys Run, the northeast drainage, the spillway of the Storm Water Retention Basin and the Great Miami River. A qualitative assessment of flow conditions (i.e., base flow, storm flow, or between storm and base flow) will be documented at the time of sample collection at each of these locations. Sampling personnel will ensure that access to the sample locations will not result in the inadvertent introduction of foreign materials into the water sample. Additional precautions will be taken to avoid the introduction of floating organic material such as leaves or twigs during sample collection. Samples will be collected without disturbing bottom sediment. Sample technicians shall approach sample locations from downstream of the location; if sample locations are accessed by way of a bridge, samples shall be collected on the upstream side of the bridge. Associated surface water sampling procedures are:

Standard Operating Procedures

| | |
|---|---|
| 43-C-113 | NPDES Sampling |
| 43-C-108 | IEMP Surface Water Sampling |
| 43-C-104 | Horiba Water Quality Meter Calibration, Operation, and Maintenance |
| EW-0002 | Chain of Custody/Request for Analysis Record for Sample Control |

Samples will be collected using the methods outlined in these procedures including the collection method, container, preservative, and documentation. Tables 4-4 and 4-5 identify the sample preservative, volume, and container requirements for each constituent.

Treated Effluent Sampling

Treated effluent will be collected by means of flow-proportional samplers at the Parshall Flume and at the new sewage treatment plant (STP 4601). Storm water is also sampled from a bypass pipeline when storm water collected in the Storm Water Retention Basin is diverted from treatment during periods of heavy rainfall. Sampling will be conducted according to the following procedures:

Standard Operating Procedures
EW-0002 Chain of Custody/Request for Analysis Record for Sample Control
43-C-108 IEMP Surface Water Sampling
43-C-113 NPDES Sampling

After every 24 hours of operation, the collected liquid is removed from the automatic sampler to provide a daily flow-weighted sample of the treated effluent. A portion of each daily sample is analyzed to determine the estimate of total uranium discharged to the Great Miami River for the day. The Parshall Flume, the new sewage treatment plant, and Storm Water Retention Basin bypass samples will be analyzed for the constituents listed in Table 4-3 for the respective locations. Table 4-5 lists the sample preservative, volumes, container requirements, and analytical methods for each constituent.

4.5.2.2 Quality Control Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as sampling technique, may be responsible for introducing bias in the project's analytical results. Quality control samples will be collected as outlined in Section 4.1.1 and Appendix A, Table 2-3 of the SCQ as follows:

- A duplicate sample shall be collected each quarter at a randomly selected sample location.
- Trip blanks will be prepared and placed in coolers containing samples for volatile organic compound analysis and shall accompany the samples from collection to receipt at the laboratory.
- Field blanks will be collected for each day of quarterly surface water sampling.

4.5.2.3 Decontamination

In general, decontamination of equipment is minimized because reusable equipment is not used during sample collection. However, if decontamination is required, then equipment will be cleaned between sample locations. The decontamination shall be Level II as referenced in Section K.11 of the SCQ. Sampling bailers used in sampling for mercury at NPDES Permit locations will be decontaminated at a contract laboratory.

4.5.2.4 Waste Dispositioning

Contact waste that is generated by the field technicians during field sampling activities are collected, maintained, and dispositioned, as necessary, depending upon the location of waste generation. Contact waste generated outside of radiological control areas will be placed in a clean trash dumpster. Contact waste generated within radiological control areas will be disposed of in a designated radiological contact waste container.

4.5.3 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have written approval by the project team leader or designee, quality assurance representative, and the Field Manager prior to implementation. In accordance with Section 15.3 of the SCQ, the Variance/Field Change Notice form must be completed and approved within one week of the initial written approval. The Variance/Field Change Notice form shall be issued as controlled distribution to team members included in the field data package and become part of the project record. During biennial revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the media-specific plan.

4.5.4 Health and Safety Considerations

The FEMP Health and Safety organization is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified fieldwork will be addressed during team briefings.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the fieldwork required by this media-specific plan. Safety meetings will be conducted prior to beginning fieldwork to address specific health and safety issues. All Fluor Fernald employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to have completed applicable training.

For areas that are subject to more restrictive radiological controls where the potential for exposure is greater, radiation work permits are necessary and will be obtained prior to the fieldwork being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring a radiation work permit.

4.5.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, conform with appropriate sections and appendices of the SCQ, and comply with specific FEMP procedures, such as the Data Validation Procedure, EW-0010.

Data documentation and validation requirements for data collected in 2003 and 2004 for the IEMP generally fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying media-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with media-specific plan-specified analytical support levels (ASLs). Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with SCQ and FEMP procedures.

There are five analytical levels (ASL A through ASL E) defined for the FEMP in Section 2 of the SCQ. For surface water in 2003 and 2004, field data documentation will be at ASL A and laboratory data documentation, in general, will be at ASL B. A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives. In general, ASL B is appropriate for laboratory generated data collected in 2003 and 2004, because the data are being used for surveillance during site restoration. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality assurance/quality control checks.

At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or verification method to ensure accuracy. The hard copy data will be managed in the project file in accordance with FEMP record keeping procedures and DOE Orders.

4.5.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, SCQ and FEMP Quality Assurance Program (RM-0012) requirements.

Recommended quarterly quality assurance assessments or surveillances shall be performed on tasks specified in the media-specific plan. These assessments may be in the form of independent assessments or self-assessments, with at least one independent assessment conducted annually. Independent assessments are the responsibility of designated project quality assurance personnel. Self-assessments are performed by project personnel to self-evaluate the overall quality of work performance. The project team leader and quality assurance will coordinate assessment activities and comply with Section 12 of the SCQ. The project personnel or quality assurance representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

Only laboratories on the approved laboratory list will be used for FEMP sample analyses in accordance with Section 12 and Appendix E of the SCQ.

## 4.6 IEMP SURFACE WATER AND TREATED EFFLUENT MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated by the IEMP surface water and treated effluent sampling program in 2003 and 2004. This section summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated surface water and treated effluent data, including specific information to be reported in IEMP mid-year data summaries and in annual site environmental reports, is also provided.

### 4.6.1 Data Evaluation

Data resulting from the IEMP surface water and treated effluent program will be evaluated to meet the program expectations identified in Section 4.4.1. Based on these expectations, the following questions will be answered through the surface water and treated effluent data evaluation process, as indicated:

- Are surface water contaminant concentrations such that cross-media impacts to the underlying aquifer could be expected?

Data from sample locations near areas where the glacial overburden is breached by site drainages will be compared to surface water and groundwater FRLs to assess potential impacts to the Great Miami Aquifer. Basic statistics, such as the minimum, maximum, and mean, will be generated on a yearly basis. The data generated from individual sampling events will be trended by sample location over time via graphical and, if necessary, statistical methods when sufficient data become available. Should trends above the historical ranges or above FRLs be observed, actions shown in Figure 4-8 will be implemented. Integration of surface water information generated by project-specific monitoring will occur as necessary to determine which project(s) may have caused the observed trend. The findings of data evaluations will be shared with project personnel. Those personnel responsible for the restoration of the Great Miami Aquifer will be informed so that any potential adverse cross-media impacts can be factored into the site groundwater remedy. The Soil & Disposal Facility Project and other source projects will be informed of the findings such that the actions indicated in the decision-making process described in Figure 4-8 can be implemented.

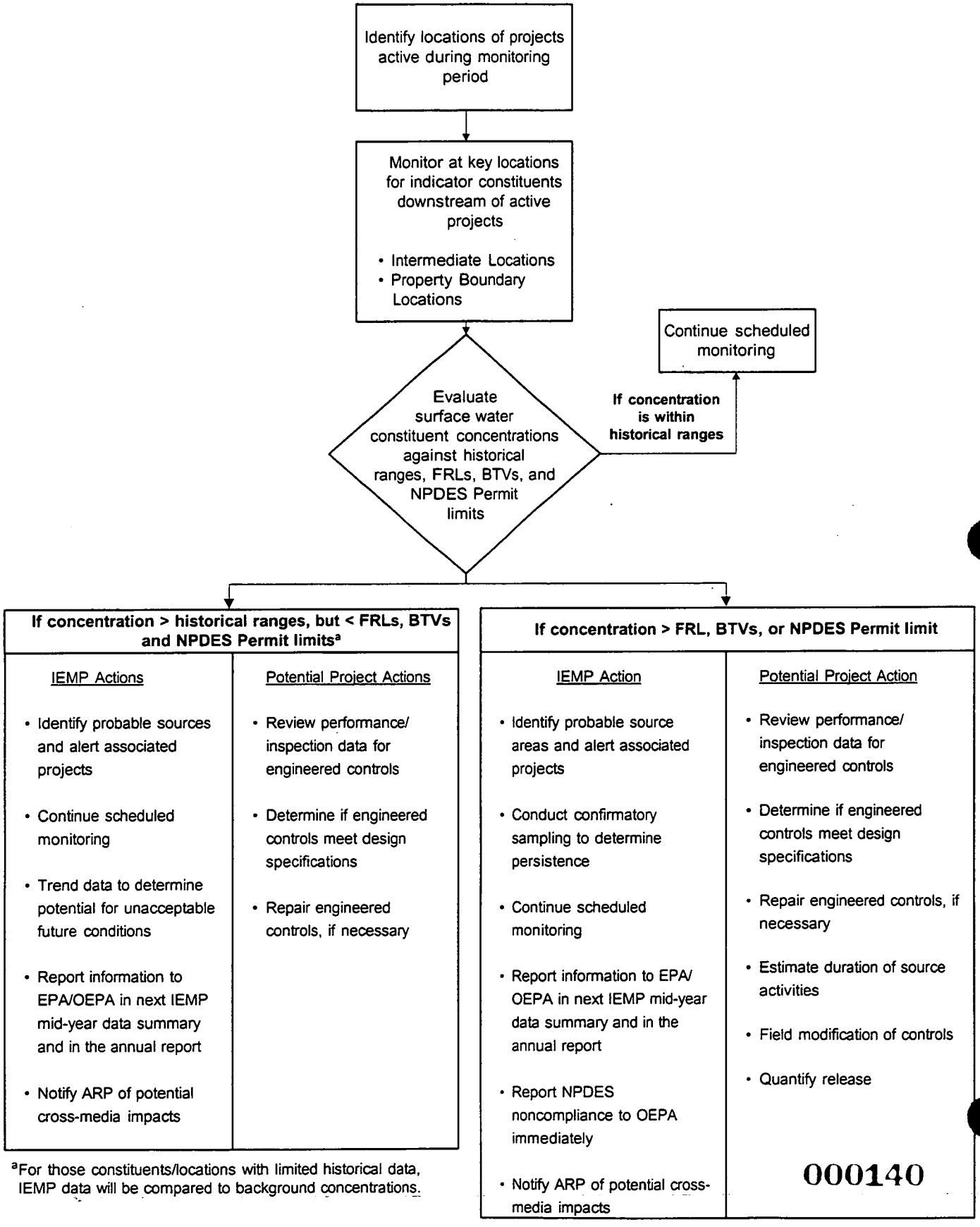
- Do the sporadic exceedances of FRLs and/or BTVs continue to occur, decrease, or increase?

Data evaluation will consist of direct comparison of data to FRLs and/or BTVs. If constituents identified as sporadic exceedances are no longer detected above FRLs and/or BTVs in the surface water and treated effluent at individual locations for one calendar year of sampling (a minimum of four quarters of samples), then the constituent will be removed from the IEMP surface water and treated effluent monitoring program at the identified location unless the constituent was also identified as having the potential to cause an exceedance of surface water FRLs or BTVs based on modeling (Table 4-2). Data will be further evaluated to determine if the constituent can be removed from additional downstream sample locations. Area-specific constituents of concern having the potential to cause an exceedance of a surface water or groundwater FRL or a surface water BTV based on modeling will continue to be monitored until the sources within the drainage area being monitored are certified as being remediated and the surface water and sediment pathways have been certified as achieving the FRLs specified in the Operable Unit 5 Record of Decision.

- Have uncontrolled runoff and implementation of FEMP remediation activities caused an undue adverse impact to the surface water or treated effluent?

Data evaluation to determine the impact of FEMP remediation activities on surface water or treated effluent will consist of direct comparison of data to surface water FRLs and/or BTVs. This assessment will not include data collected from internal monitoring locations within the treated effluent systems (i.e., STP 4601 and SWRB 4002B). To provide a better understanding of the uncontrolled runoff flow patterns as FEMP remediation activities are occurring, updates of the uncontrolled runoff flow directions will also be reported. Additionally, trend analyses of data will be used to identify trends that may require implementation of additional surface water controls to avoid exceedance of FRLs and/or BTVs.

# FIGURE 4-8
# IEMP SURFACE WATER DATA EVALUATION AND ASSOCIATED ACTIONS




[a]For those constituents/locations with limited historical data, IEMP data will be compared to background concentrations.

000140

If increasing trends are observed, then project-specific data will be evaluated to determine which project(s) are adversely affecting surface water or treated effluent quality. Data evaluation findings will be communicated to source project personnel, as appropriate.

- How will the FEMP distinguish between site impacts and background concentrations as remediation progresses?

Background values for surface water in Paddys Run and the Great Miami River were originally established under the Characterization of Background Water Quality for Streams and Ground Water Report (DOE 1995a). This report calculated the 95th percentile statistic for various constituents. As additional data are collected under the IEMP, background surface water values for constituents in Paddys Run and the Great Miami River will be refined.

- Are the requirements of the NPDES Permit being fulfilled?

Data collected to fulfill the site NPDES Permit requirements will be evaluated for compliance with the NPDES Permit provisions. This evaluation will serve to identify if immediate reporting of noncompliances to OEPA is necessary, and to determine the appropriate corrective action to address the noncompliance.

- Are the FFCA and Operable Unit 5 Record of Decision reporting requirements being fulfilled?

Radiological discharges to the Great Miami River and Paddys Run are regulated by the FFCA and Operable Unit 5 Record of Decision. Reporting for these requirements have been incorporated into the IEMP reporting structure and include a cumulative summary of pounds of total uranium discharged, the number of treatment bypass days per reporting period, and the monthly average total uranium concentration discharged to the Great Miami River.

- Are the program and reporting requirements of DOE Order 5400.1 being met?

DOE Order 5400.1 requires that DOE-FEMP implement and report on an environmental protection program for the FEMP. The surface water and treated effluent monitoring program is one component of the sitewide IEMP monitoring program. This IEMP and annual site environmental reports fulfill the requirements of this DOE Order.

- Are community concerns being met through the surface water and treated effluent IEMP program?

The IEMP fulfills the needs of the Fernald community by preparing surface water and treated effluent environmental results in annual site environmental reports. DOE makes these reports available to the public at the Public Environmental Information Center. The specific community concern of the magnitude of FEMP discharges to Paddys Run and the Great Miami River is addressed in IEMP mid-year data summaries and in annual site environmental reports in the surface water and treated effluent section.

4.6.2 Reporting

The IEMP surface water and treated effluent program meets the reporting requirements for the NPDES Permit and the FFCA and Operable Unit 5 Record of Decision. The IEMP surface water and treated effluent data will be reported on the IEMP Data Information Site, the mid-year data summary, and annual site environmental reports. The quarterly FFCA reporting requirement is met through the IEMP Data Information Site where the pertinent FFCA-required data is posted as it becomes available. Additional information on IEMP data reporting is provided in Section 8.3.3.

Data pertaining to the surface water and treated effluent program will be provided on the IEMP Data Information Site. The data will be in the format of searchable data sets and/or downloadable data files. This site will be updated every two to four weeks, as data become available.

The IEMP mid-year data summary will supplement the IEMP Data Information Site by providing a brief summary of the data collected January through June of each year and identifying notable results and/or events related to that data. The mid-year data summary will be submitted at the end of November of each year.

The IEMP annual site environmental report will be issued each June. The comprehensive report will discuss a year of IEMP data previously reported on the IEMP Data Information Site and in the mid-year data summary. The IEMP annual site environmental report will include the following:

- An annual summary of data from the IEMP surface water and treated effluent monitoring program
- Constituent concentrations for each sample location
- Statistical analysis summary for constituents, as warranted by data evaluation
- Status of FFCA and Operable Unit 5 Record of Decision Great Miami River effluent limits, to be presented graphically showing status of compliance with the 30 μg/L and 600 pound total uranium limits as well as indicating the allowable storm water and maintenance related bypass days
- Status of regulatory compliance of the NPDES Permit

- Summary-level information on the effectiveness of the project-specific sediment control structures, if necessary for interpretation of IEMP results
- Actions taken to mitigate unacceptable surface water conditions revealed by the IEMP surface water sampling program
- Observed trends and results of the data comparison to FRLs and/or BTVs.

Because the IEMP is a "living document," a structured schedule of annual reviews and two-year revisions has been instituted. The annual review cycle provides the mechanism for identifying and initiating any surface water and treated effluent program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

# 5.0 SEDIMENT MONITORING PROGRAM

Section 5.0 discusses the monitoring strategy for assessing the impact of remediation activities at the Fernald Environmental Management Project (FEMP) on sediments deposited along area surface water drainages. The focus of this program is on sediment outside the areas where surface water and/or sediment controls are in place as a result of the FEMP's active remediation efforts. This strategy identifies integration objectives for the sediment program and the activities necessary to satisfy requirements for sediment monitoring. A Media-Specific Plan for sediment monitoring activities, discussion of sediment data evaluation, and the reporting structure is also provided.

## 5.1 INTEGRATION OBJECTIVES FOR THE SEDIMENT MONITORING PROGRAM

The Integrated Environmental Monitoring Plan (IEMP) sitewide sediment monitoring program is conducted based on the previous sediment sampling programs at the site and in light of site surface water, and thereby, sediment controls in place and/or planned during remediation. The design considerations for the IEMP sediment monitoring program (discussed in Section 5.4), especially the location of sample points, incorporate these factors. Historically, the sitewide sediment pathway has been evaluated under the site's initial environmental monitoring program, which began in 1974 and the remedial investigation/feasibility study characterization of sediment which focused on a broader range of constituents (both radiological and non-radiological) in site drainages.

The information produced by these two FEMP programs through 1993 were reported and evaluated in the Remedial Investigation Report for Operable Unit 5 (DOE 1995d) and carried forward into the Feasibility Study Report for Operable Unit 5 (DOE 1995b) for the development of sediment clean-up levels. The Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996b) established health-protective final remediation levels (FRLs) for sediment. Achievement of these FRLs will be accomplished within on-site drainages as site soil and sediment are remediated and contaminated source materials are removed.

This presents an opportunity for integration between remediation activities and IEMP sediment sampling. For sediment, further investigation to refine remediation needs in the on-property drainages (Storm Sewer Outfall Ditch, Pilot Plant Drainage Ditch, and Paddys Run) will be part of the project-specific soil excavation planning (i.e., Soil & Disposal Facility Project) to confirm the extent of sediment to be excavated, along with any adjacent contaminated soil in a specific area. The Soil & Disposal Facility Project plans to conduct some pre-design and certification sampling, as well as excavation if necessary,

during the 2003 to 2004 time frame which will be integrated with the IEMP sediment sampling program as discussed below.

For sediment in Paddys Run and the Great Miami River, the Operable Unit 5 Feasibility Study concluded that while constituents of concern above FRLs or benchmark toxicity values (BTVs) were intermittently detected at some locations, the data demonstrate no discernable trend of contamination to indicate that remediation of this sediment would be required (i.e., the current residual concentration of contaminants in the sediment is such that it is not a significant threat to human health and/or the environment). It is recognized, however, that sediment in Paddys Run and the Great Miami River is dynamic (i.e., conditions continually change, especially following a hard rain when sediment is washed out and replaced by new sediment) and that the overall sediment data set is somewhat limited for certification purposes.

Under the current IEMP, the sediment monitoring program will continue to provide FEMP stakeholders with comprehensive sediment data to verify the effectiveness of the FEMP's sediment controls during ongoing remediation activities and future activities that will be initiated in 2003 and 2004.

## 5.2 ANALYSIS OF REGULATORY DRIVERS, DOE POLICIES, AND OTHER FEMP-SPECIFIC AGREEMENTS

This section presents an evaluation of the regulatory drivers governing sediment monitoring during site remediation. The intent of this section is to identify any pertinent regulatory requirements, including applicable or relevant and appropriate requirements (ARARs) and to be considered-based requirements, for the scope and design of the sediment monitoring program. These requirements will be used to confirm that the design specifications satisfy the regulatory obligations stated below and will achieve the intentions of other pertinent criteria, such as U.S. Department of Energy (DOE) Orders and the FEMP's existing agreements, as appropriate that have a bearing on the scope of this monitoring. The results of the evaluation also are used to define, as appropriate for this media, the programmatic boundaries between the IEMP and project-specific emissions-control monitoring conducted by individual project organizations.

### 5.2.1 Approach

The analysis of the regulatory drivers and policies was conducted by examining the FEMP's approved Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) records of decision to identify any sediment-specific monitoring requirements.

5.2.2 Results

The evaluation of regulatory drivers for sediment monitoring resulted in two regulatory requirements governing the technical scope and reporting for the IEMP sediment monitoring program at the FEMP:

- The CERCLA Record of Decision for Remedial Actions at Operable Unit 5 requires remediation of the site such that the sediment pathway is protective of the underlying Great Miami Aquifer and environmental receptors. The FRLs for sediment are specified in the Operable Unit 5 Record of Decision; however, a specified volume or area of sediment to be remediated was not identified due to the sporadic and isolated detections of contaminants above sediment FRLs. Attainment of sediment FRLs in the northeast drainage, Paddys Run, and the Great Miami River will be determined, in part, during 2003 and 2004, through project-specific sampling activities, as committed to in the Feasibility Study Report for Operable Unit 5.

- The CERCLA Feasibility Study Report for Operable Unit 5 stated that if the concentrations of constituents remain above sediment BTVs after completion of the remedial action, then further investigation and remediation may be warranted. The sediment BTVs listed in the Feasibility Study Report for Operable Unit 5 were identified as contaminant concentrations that are protective of ecological receptors.

One other regulatory driver was found to have sediment monitoring implications, but only of a project-specific nature. The project-specific sediment monitoring driver is:

- The CERCLA Record of Decision for Remedial Actions at Operable Unit 5, which requires remediation of the site such that the sediment pathway is protective of the underlying Great Miami Aquifer and environmental receptors. The FRLs for sediment are specified in the Operable Unit 5 Record of Decision; however, a specified volume or area of sediment to be remediated was not identified due to the sporadic and isolated detections of contaminants above sediment FRLs. Further investigation to refine the extent of excavation in the Storm Sewer Outfall Ditch and other on-site drainages will be conducted, in part, in 2003 and 2004, by sampling sediment for the constituents of concern.

DOE Order 5400.1, General Environmental Protection Program, and DOE Order 5400.5, Radiation Protection of the Public, were also evaluated for any to be considered-based criteria that may drive environmental monitoring of sediment at the FEMP. This evaluation concluded that, although sediment sampling has been conducted under previous sampling based on DOE Orders, continued sediment monitoring is not mandated by DOE Orders in light of the well-characterized current site conditions, planned actions regarding IEMP surface water sampling, and the planned sediment verification sampling both on and off property.

To summarize, there are no regulatory requirements mandating continued sediment monitoring as part of the IEMP program during remediation. However, due to ongoing remedial actions, the sediment sampling

scope will be continued under the IEMP in conjunction with project-specific sampling programs for 2003 and 2004. Sampling conducted to verify FRL attainment will occur under certification design planning conducted by the Soil & Disposal Facility Project following remediation of areas within the drainage's watershed. In particular, some excavation under the Stream Corridors excavation design subproject (Paddys Run and the Storm Sewer Outfall Ditch), following sampling and design work, is planned during 2003 and 2004.

Table 5-1 lists the regulatory drivers for sediment sampling for project-specific sediment monitoring. Sections 5.6 and 8.0 provide the FEMP's current and long-range plan for the evaluation and reporting of sediment monitoring data.

## 5.3 PROGRAMMATIC BOUNDARY FOR THE SEDIMENT MONITORING PROGRAM

This section identifies the programmatic boundary that has been established between the IEMP and project-specific activities. The intent behind the boundary definition is to: 1) clearly delineate the scope and geographic extent of the IEMP monitoring responsibility; and 2) establish a recognized interface between the "downstream" surveillance focus of the IEMP and the predominant emission-control and verification (in on-property drainages as part of soil remediation) focus of project-specific monitoring.

The IEMP sediment sampling program is confined to the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River. However, the IEMP sediment sampling objectives will be encompassed within the project-specific sediment sampling for the Stream Corridors excavation design subproject conducted during 2003 and 2004 by the Soil & Disposal Facility Project. In the event that this sampling is not performed in 2003 or 2004, or if all sampling locations are not covered in the project-specific plan, then the annual IEMP sampling program described in Section 5.5 will be implemented to cover the balance of sampling locations (e.g., sample locations in the Great Miami River).

**TABLE 5-1**

**FEMP SEDIMENT MONITORING PROGRAM
REGULATORY DRIVERS AND RESPONSIBILITIES**

| | DRIVER | ACTION | PROJECT PLAN |
|---|---|---|---|
| PROJECT | Operable Unit 5 Record of Decision<br>Operable Unit 5 Feasibility Study | Sampling of on-site drainages and streams, as necessary, to determine excavation depth, if any, and certify clean for FRLs and BTVs | Sitewide Excavation Plan; Integrated Remedial Design Package |

Project-specific sediment investigations to refine remediation needs in the Storm Sewer Outfall Ditch and other on-property drainages (planned to be included in the stream corridors excavation design) will be detailed in a project-specific sampling plan incorporating the requirements of the Sitewide Excavation Plan.

## 5.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

### 5.4.1 Program Expectations

The 2003 and 2004 sediment monitoring program is essentially a two-year continuation of the IEMP, Revision 2 (DOE 2001b), sediment surveillance monitoring program. Where appropriate, the IEMP sampling objectives will be integrated with the project-specific sampling planned for 2003 and 2004 under the Stream Corridors excavation design subproject. The expectations for the program during 2003 and 2004 are to collect data sufficient to:

- Determine if substantive changes to residual contaminant conditions (as defined by the current sampling program) occur in the sediments found in the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River as a result of runoff from the site, including sediment locations downstream of active remedial excavations and treated effluent discharges from the FEMP
- Determine if the IEMP program should continue as is or be refined in scope as remediation progresses
- Continue to address the concerns of the community associated with remedial activities at the FEMP.

5.4.2 Sediment Program Design Considerations

The sampling design considerations to address the above-listed expectations are as follows:

- Sample locations should, in general, be consistent with recent environmental monitoring locations so that comparable areas are evaluated.
- Sampling frequency, constituents analyzed, and the analytical support level (ASL) should be consistent with the recent IEMP monitoring program so that appropriate comparisons can be made and the findings of the annual assessment can be reported to regulatory agencies and the public.

The design of the sediment monitoring program for 2003 and 2004 was developed in recognition of the potential excavation activities and construction activities expected to be active during this time period. These include:

- Potential excavation under the Stream Corridors subproject (Storm Sewer Outfall ditch and Paddys Run)
- Potential excavation activities in the Area 2, Phase 2 area
- Soil excavation activities in Areas 4A, 4B, 5, and 6 (refer to Figure 5-1) planned for 2003 and 2004
- Construction activities associated with on-site disposal facility Cells 6 and 7
- Construction activities associated with Operable Unit 4
- Waste pit excavation, processing, and load-out operations associated with Operable Unit 1.

Regarding public concerns of contaminated sediment mobilization, it should be noted that controls currently in place (and planned future controls) for site surface water and sediment runoff from the more highly contaminated areas reduce the contamination leaving the site. This is explained in detail for surface water in Section 4.0. As expected, the sediment sampling results from the 1994 through 2001 monitoring programs indicate reductions of total uranium contamination in sediment when compared to remedial investigation/feasibility study and earlier sediment sampling program data collected in the late 1980s and early 1990s. These reductions are attributable to the control of contaminated storm water runoff that began in 1986 with the installation of the Storm Water Retention Basin. The 2001 sediment data, the latest data set available, indicate that all constituents are below the sediment FRLs as has been the case since sampling commenced under the IEMP in 1997. In fact, since 1991, the only FRL exceedance occurred in a 1996 sediment sample from the Storm Sewer Outfall Ditch for thorium-232 (sample result of 1.8 picoCuries per gram [pCi/g] versus the FRL of 1.6 pCi/g).

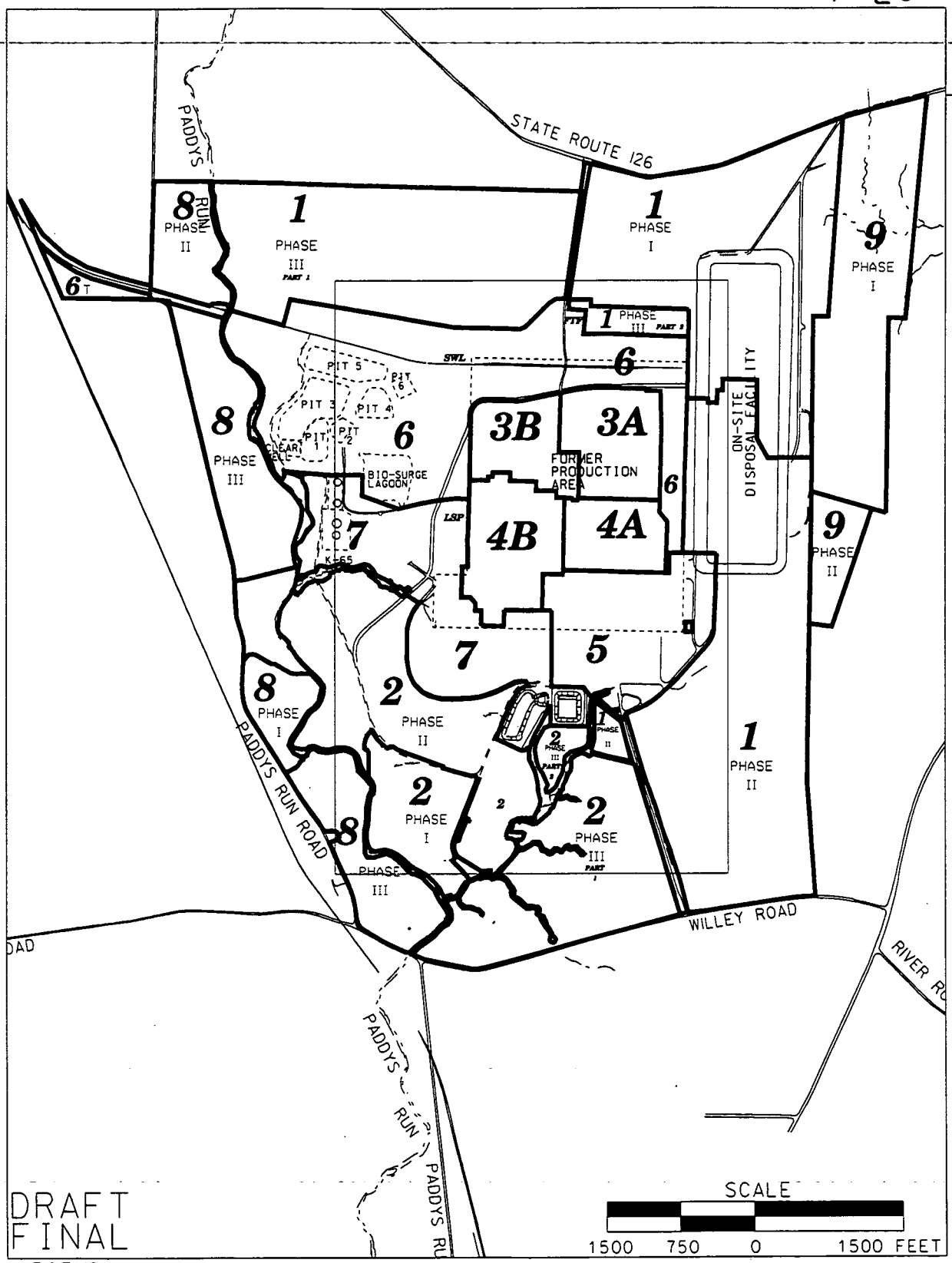



FIGURE 5-1. SITEWIDE REMEDIATION AREAS



v:#5fgp1#dgn#02rrevision#02rv024.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002

Based on the recent data, sediments from the FEMP do not currently pose a risk to the public. However, continued monitoring is recommended in this IEMP in conjunction with the project-specific Stream Corridors pre-design sampling and certification sampling to determine if this conclusion remains valid during the continuing stages of remediation.

5.4.3 Sediment Program Design

The sediment monitoring program for 2003 and 2004 will continue to provide stakeholders with comprehensive data to assess the impact of FEMP remediation activities. For 2003, the IEMP will maintain the same sediment locations (Figure 5-2) and constituents as in the previous IEMP revision based on the recent data continuing to indicate a trend of low concentrations below the FRLs. The sampling for 2003 is planned to be encompassed under the Stream Corridors excavation design sampling program to the extent possible as discussed above. For 2004, the IEMP sampling objectives are expected to be fulfilled under the certification sampling program for the Stream Corridors subproject to the extent possible. Any sampling locations and analytical requirements not included under these project-specific programs will be performed under the IEMP sampling program.

Due to recent and planned areas of remedial excavations and waste processing occurring in 2003 and 2004 in several remediation projects, the primary radiological constituents of concern in the soil and wastes for these areas will be utilized as the analytical suite for all sediment sample locations except for the Great Miami River locations (total uranium only). In addition, the purpose of assessing the primary constituents of concern at location PS1 is to verify that the radiological constituents for the active remedial actions (e.g., soil excavation, waste processing, construction activities) are not mobilized and transported to the sediment monitoring locations.

The sediment monitoring program during 2003 and 2004 will include the locations illustrated in Figure 5-2 as follows: one background location along Paddys Run north of the site boundary; eight locations along Paddys Run (five north of the Storm Sewer Outfall Ditch and three south of the Storm Sewer Outfall Ditch) taken at strategic locations to ensure that the most recent sediment deposited is collected (described in Section 5.5.2.1 and sediment sampling operating procedures); five locations along the Storm Sewer Outfall Ditch; and two locations along the Great Miami River (one background location upstream of the FEMP treated-effluent discharge point and one location just below the FEMP treated-effluent discharge point inside the big bend on the west bank).

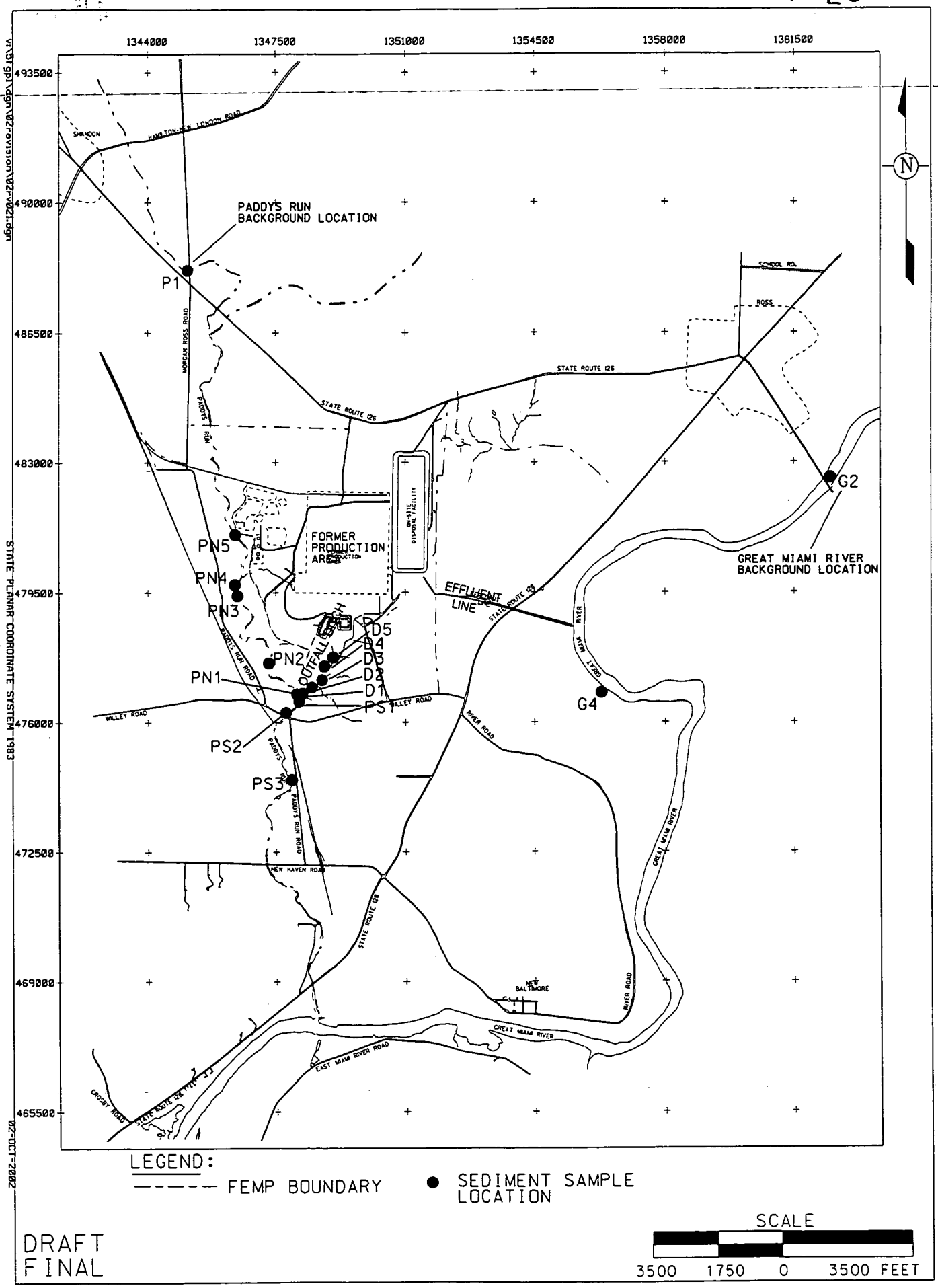



FIGURE 5-2. SEDIMENT SAMPLE LOCATIONS

Because radium-226, thorium, and uranium are primary contaminants in Operable Units 1 and 4, and the former production area, these constituents are analyzed in samples collected at locations downstream of these areas (i.e., in Paddys Run and in the Storm Sewer Outfall Ditch). It is important to note that all storm water runoff from the aforementioned areas are controlled and routed for treatment or verification sampling.

## 5.5 MEDIA-SPECIFIC PLAN FOR SEDIMENT MONITORING

This section serves as the Media-Specific Plan for implementation of the sampling, analytical, and data management activities associated with the IEMP sediment monitoring program. The activities described in this Media-Specific Plan were designed to provide sediment data of sufficient quality to meet the program expectations as stated in Section 5.4.1. The program expectations, in conjunction with the design considerations presented in Section 5.4.2, were used as the framework for developing the monitoring approach presented in this Media-Specific Plan. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 2002c).

As discussed in previous sections, the IEMP sampling requirements and majority of sampling locations are planned to be integrated with project-specific sampling programs, specifically the Stream Corridors subproject implemented by the Soil & Disposal Facility Project, for 2003 and 2004. For IEMP sampling locations not encompassed under the project-specific sampling plans, this Media-Specific Plan is to be followed to meet IEMP sediment sampling objectives.

Subsequent sections of this Media-Specific Plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance.

### 5.5.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this Media-Specific Plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this project-specific plan, in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all Media-Specific Plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support, and to assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standards, and to assist in evaluating and resolving all quality related concerns.

5.5.2 Sampling Program

Sediment samples will be collected on an annual basis, typically in the summer, from 16 locations within the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River. Sampling is usually performed in the summer in order to take advantage of the abundance of fresh sediment deposited during flood conditions that commonly occur after the winter and spring seasons and to enable sampling during low-flow or dry conditions. Sampling at other times of the year is also acceptable although sample collection may be more difficult due to water flow. Figure 5-2 depicts the IEMP sediment sample locations. Table 5-2 includes a summary of the sample locations, constituents to be analyzed, and the design purposes. Table 5-3 summarizes the field sample collection information for each group of locations. Sample analysis will be performed at the on-site FEMP laboratory or a contract laboratory dependent on specific analyses required, laboratory capacity, turn-around time, and performance of the laboratory. The laboratories utilized for analytical testing must be approved by the FEMP in accordance with the criteria specified in Sections 3.1.5, 12.4, and Appendix E of the SCQ. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program. A list of FEMP-approved laboratories and current status of each is maintained by the FEMP quality assurance organization.

## TABLE 5-2

## ANNUAL SEDIMENT SAMPLING PROGRAM DESIGN

| Location | Constituent | Expectation |
|---|---|---|
| Paddys Run background (1 sample location - P1) | Radium-226<br>Radium-228<br>Thorium-228<br>Thorium-230<br>Thorium-232<br>Uranium, Total | Establish range of background concentrations in Paddys Run |
| Paddys Run north of the Storm Sewer Outfall Ditch (5 sample locations - PN1, PN2, PN3, PN4, and PN5) | Radium-226<br>Radium-228<br>Thorium-228<br>Thorium-230<br>Thorium-232<br>Uranium, Total | Measure the impact of surface water runoff from western portion of the site including the waste pits and K-65 Silos (Operable Units 1 and 4) |
| Paddys Run south of the Storm Sewer Outfall Ditch (3 sample locations - PS1, PS2, and PS3) | Radium-226<br>Radium-228<br>Thorium-228<br>Thorium-230<br>Thorium-232<br>Uranium, Total | Measure impact of surface water runoff from the site |
| Storm Sewer Outfall Ditch (5 sample locations - D1, D2, D3, D4, and D5) | Radium-226<br>Radium-228<br>Thorium-228<br>Thorium-230<br>Thorium-232<br>Uranium, Total | Measure the impact of any overflows of the Storm Water Retention Basin, surface water runoff from the eastern portion of the site (certified) and residual contaminant concentrations from past releases |
| Great Miami River (1 sample location - G4) | Uranium, Total | Measure the impact of the site effluent |
| Great Miami River background (1 sample location - G2) | Uranium, Total | Establish range of background concentration in Great Miami River |

4528

## TABLE 5-3

## SEDIMENT SAMPLE ANALYTICAL REQUIREMENTS

| Location | Number of Locations[a] | Sample Frequency | Constituent[b] | ASL[c] | Container | Holding Time | Preservative |
|---|---|---|---|---|---|---|---|
| Storm Sewer Outfall Ditch (D1, D2, D3, D4, and D5) | 5 | Annually | Radium-226<br>Radium-228<br>Thorium-228<br>Thorium-230<br>Thorium-232<br>Uranium, Total | B | 500 mL glass or plastic jar | 6 months | None |
| Great Miami River (G4) | 1 | Annually | Uranium, Total | B | 500 mL glass or plastic jar | 6 months | None |
| Paddys Run north of the Storm Sewer Outfall Ditch (PN1, PN2, PN3, PN4, and PN5) | 5 | Annually | Radium-226<br>Radium-228<br>Thorium-228<br>Thorium-230<br>Thorium-232<br>Uranium, Total | B | 500 mL glass or plastic jar | 6 months | None |
| Paddys Run south of the Storm Sewer Outfall Ditch (PS1, PS2, and PS3) | 3 | Annually | Radium-226<br>Radium-228<br>Thorium-228<br>Thorium-230<br>Thorium-232<br>Uranium, Total | B | 500 mL glass or plastic jar | 6 months | None |
| Great Miami River background (G2) | 1 | Annually | Uranium, Total | B | 500 mL glass or plastic jar | 6 months | None |
| Paddys Run background (P1) | 1 | Annually | Radium-226<br>Radium-228<br>Thorium-228<br>Thorium-230<br>Thorium-232<br>Uranium, Total | B | 500 mL glass or plastic jar | 6 months | None |
| Rinsate Sample | 1 | Annually | Uranium, Total | B | Plastic (total of ten liters) | 6 months | $HNO_3$ to pH<2 |

[a]The number of samples may vary depending on the availability of recently deposited sediment.
[b]Radionuclide analyses do not have standard methods; Appendix G of the SCQ provides performance specifications.
[c]A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives.

5.5.2.1 Sampling Procedures

Sediment sampling is conducted in accordance with standard operating procedures referenced below. The procedures provide sampling instructions which incorporate the requirements outlined in the SCQ as follows:

Standard Operating Procedures

| | |
|---|---|
| ADM-02 | Field Project Prerequisites |
| SMPL-01 | Solids Sampling |
| SMPL-21 | Collection of Field Quality Control Samples |
| EW-0002 | Chain of Custody/Request for Analysis Record for Sample Control |

Sitewide CERCLA Quality (SCQ) Assurance Project Plan

| | |
|---|---|
| Section 4 | Quality Assurance Objectives |
| Section 5 | Field Activities |
| Section 6 | Sampling Requirements |
| Section 7 | Sample Custody |
| Section 8 | Calibration Procedures and Frequency |
| Appendix I | Field Calibration Requirements |
| Appendix J | Field Activity Methods |
| Appendix K | Sampling Methods |

Project-specific sampling considerations are outlined below:

- Only recently deposited surface sediment shall be collected, typically from deposition locations such as slow flow-rate areas (e.g., obstructions in the stream bed that allow sediment to be deposited).
- Samples shall be collected from the top two inches and consist of fine-grained material.
- Sample collection shall begin at the farthest downstream location and proceed upstream.
- Any non-sediment materials shall be discarded from the sample, any free water drained, and placed in the sample container.

The exact locations of the sediment sample points are approximate and may change from year to year, based on where stream flow has deposited sufficient material for sampling. Sediment samples are collected and analyzed according to Table 5-3.

5.5.2.2 Quality Control Sampling Requirements

Quality control samples will be taken according to the frequency recommended in Appendix A, Table 2-3 of the SCQ and detailed below. These samples will be collected and analyzed to evaluate the possibility that some controllable practice, such as decontamination, sampling or analytical technique, may be responsible for introducing bias in the analytical results. Approximately one field duplicate will be collected for every

20 samples. One rinsate sample will also be collected following decontamination of the sediment sampling scoop or sampling device. Ten liters of rinsate water are typically necessary to perform the required analyses.

The State of Ohio, through its Agreement in Principle with DOE, empowers the Ohio Environmental Protection Agency (OEPA) to take samples that are independent of the split-sampling program. In addition, sediment samples may be split annually. These samples further supplement the quality assurance program by providing a means to evaluate comparability between laboratories. Samples collected with OEPA are analyzed for the same constituents as those established in Table 5-3 for the location being sampled.

5.5.2.3 Decontamination

Decontamination of sampling equipment will be performed between sample locations to prevent the introduction of contaminants or cross-contamination into the sampling process. The decontamination shall be Level II as referenced in Section K.11 of the SCQ.

5.5.2.4 Waste Dispositioning

Contact wastes that are generated by the field technicians during field sampling activities are collected, maintained, and dispositioned depending upon the location of waste generation (i.e., former production area or off site). Contact waste generated outside of radiological control areas will be placed in a clean trash dumpster. Contact waste generated within radiological control areas will be disposed of in a designated radiological contact waste container.

5.5.3 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have written approval by the project team leader or designee, quality assurance representative, and the Project Lead prior to implementation. In accordance with Section 15.3 of the SCQ, the Variance/Field Change Notice form must be completed and approved within one week of the initial written approval. The Variance/Field Change Notice form shall be issued as controlled distribution to team members, included in the field data package and become part of the project record. During biennial revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the media-specific plan.

5.5.4 Health and Safety Considerations

The FEMP Health and Safety organization is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed during team briefings.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this media-specific plan. Safety meetings will be conducted prior to beginning field work to address specific health and safety issues. All Fluor Fernald employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to have completed applicable training.

For areas that are subject to more restrictive radiological controls where the potential for exposure is greater, radiation work permits are necessary and will be obtained prior to the field work being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring a radiation work permit.

5.5.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, conform with appropriate sections and appendices of the SCQ, and comply with specific FEMP procedures, such as the Data Validation Procedure, EW-0010.

Data documentation and validation requirements for data collected in 2003 and 2004 for the IEMP generally fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying media-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with media-specific plan-specified ASLs. Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with SCQ and FEMP procedures.

There are five analytical levels (ASL A through ASL E) defined for the FEMP in Section 2 of the SCQ. Field data documentation will be at ASL A and laboratory data documentation, in general, will be at ASL B. A more conservative ASL may be required for laboratory data in order to meet required detection

limits or in order to ensure data quality objectives. In general, ASL B is appropriate for laboratory-generated data because the data are being used for surveillance during site remediation. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality assurance/quality control checks.

At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or verification method to ensure accuracy. The hard copy data will be managed in the project file in accordance with FEMP record keeping procedures and DOE Orders.

5.5.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, SCQ and FEMP Quality Assurance Program (RM-0012) requirements.

A quality assurance assessment or surveillance shall be performed on tasks specified in the Media-Specific Plan during one of the two annual sediment sampling events conducted under this revision of the IEMP. This assessment may be in the form of an independent assessment or a self-assessment. Independent assessments are the responsibility of designated project quality assurance personnel. Self-assessments are performed by project personnel to self-evaluate the overall quality of work performance. The project team leader and quality assurance will coordinate assessment activities and comply with Section 12 of the SCQ. The project personnel or quality assurance representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

Only laboratories on the approved laboratory list will be used for FEMP sample analyses in accordance with Section 12 and Appendix E of the SCQ.

## 5.6 IEMP SEDIMENT MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated by the IEMP sediment sampling program in 2003 and 2004. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated sediment data to be reported in IEMP annual site environmental reports is provided.

### 5.6.1 Data Evaluation

Data resulting from the IEMP sediment program will be evaluated to meet the program expectations identified in Section 5.4.1. Based on these expectations, the following questions will be answered through the sediment data evaluation process, as indicated:

- Have changes in the residual contaminant concentrations occurred in sediments found in the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River as a result of runoff and treated effluent from the site?

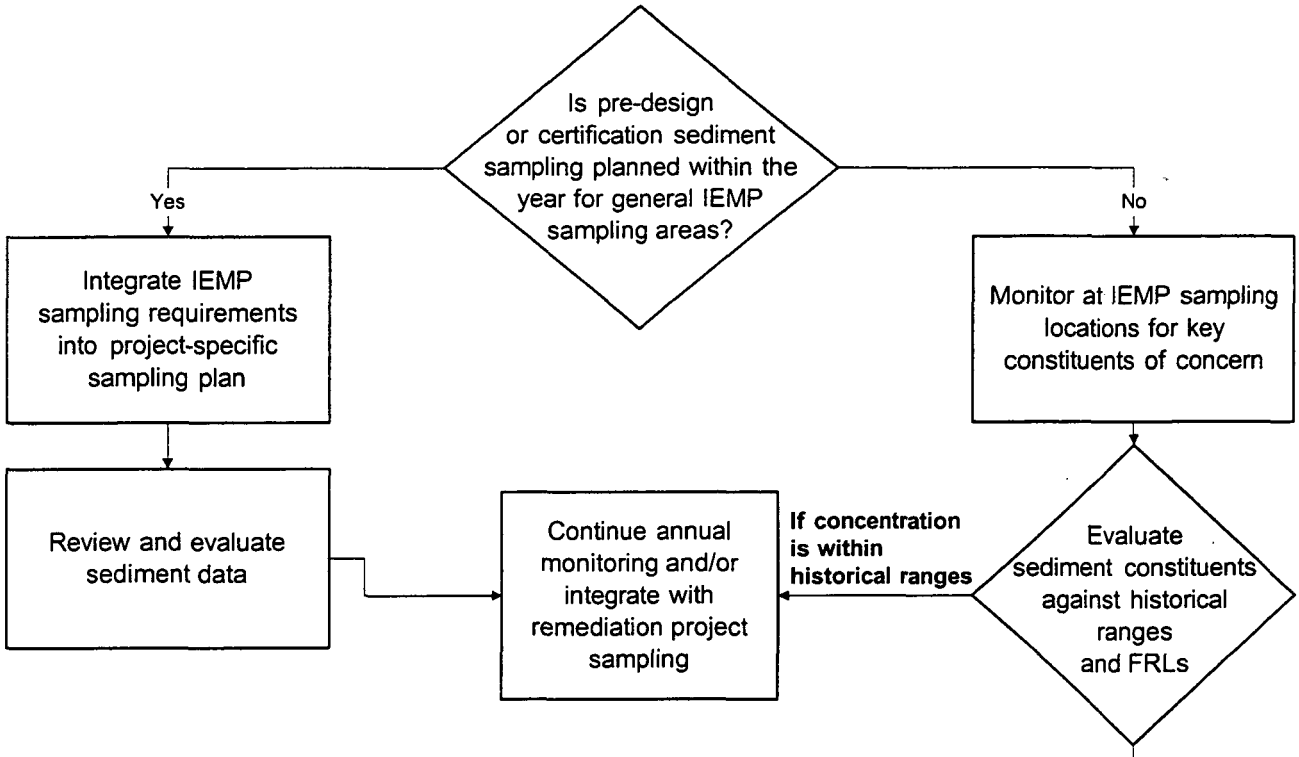
Data evaluation will consist of basic statistical analysis, such as minimum, maximum, and mean, and comparison to historical data and FRLs. This evaluation will identify long-term trends of targeted radiological constituents in sediment to determine if the potential exists for an FRL exceedance in the future due to FEMP remediation activities. As indicated in Figure 5-3, results of the data interpretation will be communicated to project personnel to implement appropriate actions, as necessary. As previously discussed, the future excavation and certification plans will also be factored into this evaluation of data results.

- Should the sediment program be refined in scope as remediation progresses?

Data evaluation to determine if the IEMP sediment program should be revised will be based on 1) the planned project-specific excavation and certification plans for the individual drainage channels or streams and 2) for those sampling locations that will continue to be sampled under the IEMP, the comparison to historic ranges will be taken into consideration for revising the IEMP program. Data evaluation to address any remaining expectations identified in Section 5.4.1 is encompassed in the data evaluation techniques described above.

- Are community concerns being met through the IEMP sediment program?

# FIGURE 5-3
## IEMP SEDIMENT DATA EVALUATION AND ASSOCIATED ACTIONS




| If concentration > historical ranges[a], but <FRLs | |
|---|---|
| IEMP Actions | Potential Project Actions (as necessary) |
| • Identify probable sources and alert associated projects as necessary<br>• Continue annual monitoring until stream is certified<br>• Trend data to determine potential for unacceptable future conditions.<br>• Report information to EPA/OEPA in next IEMP mid-year data summary and in the annual report | Evaluate the need for the following actions with respect to sediment remediation schedule:<br>• Review performance/ inspection data for engineered controls<br>• Review performance/ inspection data for engineered controls<br>• Verify that engineered controls meet design specifications<br>• Repair engineered controls, if necessary |

| If concentration > FRL | |
|---|---|
| IEMP Action | Potential Project Action (as necessary) |
| • Identify probable source areas and alert associated projects<br>• Conduct confirmatory sampling to verify exceedance or coordinate with remediation project<br>• Continue annual monitoring until stream is certified<br>• Report information to EPA/OEPA in next IEMP mid-year data summary and in the annual report | Evaluate the need for the following actions with respect to sediment remediation schedule:<br>• Review performance/ inspection data for engineered controls<br>• Determine if engineered controls meet design specifications<br>• Repair engineered controls, if necessary<br>• Estimate duration of source activities<br>• Redesign engineered controls<br>• Quantify release<br>• Remediate sediment, if necessary |

[a]Historical range established by sediment data collected from 1990 through 2001

The IEMP fulfills the needs of the Fernald community by preparing sediment environmental results in annual site environmental reports. DOE makes these reports available to the public at the Public Environmental Information Center.

- Are the program and reporting requirements of DOE Order 5400.1 being met?

DOE Order 5400.1 requires that DOE implement and report results from the environmental protection program for the FEMP. The sediment monitoring program is one component of the sitewide IEMP monitoring program. This IEMP and annual site environmental reports fulfill the requirements of this DOE Order.

5.6.2 Reporting

The IEMP sediment program data or project-specific sampling data from the Stream Corridors excavation design subproject will be reported on the IEMP Data Information Site and in the annual site environmental report. Additional information on IEMP data reporting is provided in Section 8.3.3.

Data pertaining to the IEMP sediment monitoring program will be provided on the IEMP Data Information Site. The data will be in the format of searchable data sets and/or downloadable data files. The IEMP Data Information Site will be updated when sediment data become available. The annual site environmental report will supplement the IEMP Data Information Site by providing a brief summary and assessment of the data results and identifying notable results and/or events related to that data.

The IEMP annual site environmental reports will be issued each June. The IEMP annual site environmental reports will include the following:

- An annual summary of data from the IEMP sediment monitoring program or equivalent data from the project-specific sampling programs
- Graphical presentation of data trends over time at each sample location
- Statistical summary by constituent (i.e., minimum, maximum, and mean) by location
- Summary-level information on the effectiveness of the project-specific sediment control structures (to include sediment control efficiency data, if necessary for interpretation of sitewide impacts).

If necessary, sediment results will be presented prior to the submittal of annual site environmental reports to the EPA and OEPA if significant changes in sediment contaminant concentrations are evident.

Because the IEMP is a "living document", a schedule of annual reviews and two-year revisions have been instituted. The annual review cycle provides the mechanism for identifying and initiating any sediment program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review will be communicated to EPA and OEPA.

Section 6.0

# 6.0 AIR MONITORING PROGRAM

Section 6.0 discusses the monitoring strategy for assessing the sitewide impact of the Fernald Environmental Management Project's (FEMP's) remediation activities on the air pathway. The strategy identifies the activities conducted to satisfy requirements for particulate, radon, and direct radiation monitoring. A media-specific plan for conducting sitewide and off-property air monitoring activities is provided, along with a plan for reporting air-related activities.

## 6.1 INTEGRATION OBJECTIVES FOR AIR

The IEMP air monitoring program objectives for 2003 and 2004 are consistent with program objectives in previous IEMP revisions and generally involve physically monitoring the air pathway and providing dose assessments to satisfy 40 CFR 61, Subpart H and the requirements of DOE Orders. These assessments will be integrated with the assessments of the other media sampled under the IEMP and provided to regulatory agencies in reports, according to the reporting schedule established in Section 6.6 and summarized for all media in Section 8.0.

The air monitoring program describes a monitoring-based approach for demonstrating compliance with the requirements of 40 CFR 61, Subpart H that reflects the nature of emission sources. The primary emission sources for 2003 and 2004 are expected to be fugitive emissions resulting from a diverse range of activities including building decontamination and dismantling, large-scale excavations, material handling, and waste processing operations. It is difficult to predict or measure emissions from such diffuse sources with certainty. Monitoring at the facility fenceline will provide a direct integrated measure of the environmental impact resulting from the full range of planned remediation activities at the FEMP, and therefore, provide a reliable, accurate assessment of dose received by off-site receptors via the air pathway.

The design of the air monitoring program for 2003 and 2004 was developed in recognition of the potential major sources of emissions and accelerated clean-up schedule initiatives expected to be active during this time period. The major sources and initiatives include:

- Construction and waste placement activities associated with on-site disposal facility Cells 2, 3, and 4.
- Initiate waste placement in three on-site disposal facility cells simultaneously
- Waste excavation, processing and load-out operations associated with Operable Unit 1
- Radon emissions from the operation of the Silos 1 and 2 radon control system and the silo area

- Construction and startup of Silo 3 operations
- Construction and operations of the Silos 1 and 2 Accelerated Waste Retrieval Project
- Demolition activities associated with structures within the former production area including Plant complexes 2,3,8 and the Pilot Plant
- Excavation activities in Areas 4A, 4B, 5, and 6
- Continue a 24/7 schedule for Waste Pit dryer operations concurrent with the operation of the pugmill ventilation system.
- Increase the annual Waste Pit dryer production rate as well as allow higher activity waste to be used as dryer feed material
- Accelerate the demolition activities associated with structures within the former production area by mobilizing additional work crews.

The focus of the program will be to monitor the collective sitewide effects of remediation activities occurring in 2003 and 2004. The results will be evaluated as frequently as possible to provide necessary feedback to the projects to ensure that cumulative sitewide impacts remain below established thresholds. Ultimately, this information will assist in tracking trends during remediation to help identify changes needed in the air monitoring program emphasis and/or design. A reporting plan is provided in Section 6.6 to combine the results of the air monitoring program and the National Emissions Standards Hazardous Air Pollutant (NESHAP) dose assessments into a single reporting mechanism to facilitate regulatory agency review of the sitewide remediation activities and associated emission controls. Appendix C outlines the FEMP's plan for demonstrating NESHAP Subpart H compliance and producing required dose assessments during remediation.

## 6.2 ANALYSIS OF REGULATORY DRIVERS, DOE ORDERS, AND OTHER FEMP-SPECIFIC AGREEMENTS

The intent of this section is to identify the pertinent regulatory requirements, including applicable or relevant and appropriate requirements (ARARs) and to be considered-based requirements, for the scope and design of the air monitoring program. These requirements will be used to confirm that the program satisfies the regulatory obligations for monitoring that have been activated by the FEMP's records of decision and will achieve the intentions of other pertinent criteria, such as DOE Orders and the FEMP's existing agreements, as appropriate that have a bearing on the scope of air monitoring. The results of the evaluation are also used to define the programmatic boundaries between the sitewide IEMP responsibilities and the project-specific emissions-control monitoring conducted by the individual project organizations.

### 6.2.1 Approach

The analysis of the additional regulatory drivers and policies for air monitoring was conducted by identifying the suite of ARARs and to be considered-based requirements in the FEMP's approved Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) records of decision and FEMP legal agreements that contain specific air monitoring requirements. This subset was then further divided to identify those monitoring requirements with sitewide implications (and which, therefore, fall under the scope of the IEMP) and those which pertain to emission control monitoring that would be the responsibility of the individual remediation projects.

### 6.2.2 Results

The following regulatory drivers govern the technical scope and reporting requirements for the IEMP's sitewide air monitoring program:

- DOE Order 5400.1, General Environmental Protection Program, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine effluent monitoring and environmental surveillance activities of the facility. The IEMP strategy is responsive to the changing site mission and associated remediation needs and complies with DOE Orders.

- DOE Order 5400.5, Radiation Protection of the Public and Environment, which establishes radiological dose limits and guidelines for the protection of the public and environment. Under this requirement, the exposure to members of the public associated with activities from DOE facilities from all pathways must not exceed, in one year, an effective dose equivalent of 100 millirem (mrem). For radiological dose due to airborne emissions only, the DOE Order requires compliance with 40 CFR 61, Subpart H limit of an effective dose equivalent of 10 mrem/year to a member of the public. Demonstration of compliance with this standard is to be based on an air monitoring approach. The DOE Order also provides guidelines for radionuclide concentrations in air, known as Derived Concentration Guides, and radon concentration limits for interim storage of sources during remediation. These radon limits are 100 picoCuries per liter (pCi/L) at any given point, 30 pCi/L annual average sitewide, 3 pCi/L annual average above background at the facility fenceline, and 20 picoCuries per square meter per second (pCi/m$^2$/sec) flux rate for storage of radon generating wastes (per 40 CFR 61, subpart Q). The guidance document associated with this DOE Order (DOE 1991) recommends confirmatory air monitoring surveillance, which is incorporated into the IEMP.

- Proposed 10 CFR 834, DOE Facilities Radiation Protection of the Public and Environment, which is similar in intent to DOE Order 5400.5. However, differences include the deletion of the 100 pCi/L limit and 30 pCi/L annual limit, lowering the fenceline limit to 0.5 pCi/L above background, changes to facility and facility boundary definitions, and clarifications to the definition of point of compliance. Because this is only a proposed rule, these limits are to be used as guidelines and should not override the requirements of DOE Order 5400.5. If the rule is promulgated, a compliance strategy will be developed to accommodate the FEMP's site-specific circumstances relative to meeting the new standards.

- NESHAP 40 CFR 61, Subpart H, which provides national emissions standards for radionuclides other than radon. Per this requirement, emissions of radionuclides (excluding radon) to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent in excess of 10 mrem/year. Demonstration of compliance with this standard is to be based on an air monitoring approach.

- Federal Facility Agreement (FFA), Control and Abatement of Radon-222 Emissions, signed November 19, 1991, which ensures that DOE takes all necessary actions to control and abate radon-222 emissions at the FEMP. This agreement acknowledges that the K-65 Silos (Operable Unit 4) exceed the radon emission of 20 pCi/m$^2$/sec, but allows the FEMP to address this exceedance by implementing a removal action to bring radon emissions from the silos to a level as low as reasonably achievable, and to attain the NESHAP Subpart Q standard upon completion of final remediation. The removal action work plan included a radon monitoring system, which was previously monitored under the predecessor Environmental Monitoring Plan, and is now incorporated into the IEMP. The FFA also requires demonstration of compliance with the Subpart Q standard (upon completion of remedial actions) for the waste pits, clearwell, and any other sources found to emit radon in excess of 20 pCi/m$^2$/sec.

- DOE Order 5820.2A Chapter III.3.k, Environmental Monitoring, which requires low-level radioactive waste disposal facilities to perform environmental monitoring that meets requirements in DOE Order 5400.1 for all media, including the air pathway. This requirement applies to the on-site disposal facility, as it is the only disposal facility at the FEMP. Instead of a separate monitoring plan for the on-site disposal facility, the air monitoring program for the on-site disposal facility will be integrated and incorporated into the IEMP's air monitoring program.

Upon evaluating the IEMP ARARs in consideration of protection of human health and/or the environment, the 10 mrem/year dose limit was determined to be the most stringent emission limit. Therefore, the 10 mrem/year NESHAP standard provides a reasonable benchmark for ensuring compliance with all other air standards (excluding radon) and ensuring an adequate level of protectiveness.

Twelve other regulatory drivers have air monitoring implications, of a project-specific emissions-control nature, which fall outside the scope of the IEMP. These requirements pertain to the monitoring of fugitive area emission controls and the monitoring of point source emissions. The project-specific air monitoring drivers for fugitive dust include:

- Permit to Install New Sources, Criteria for Decision by Director, Ohio Administrative Code (OAC) 3745-31-05(A)(3), which requires the use of Best Available Technology (BAT) when installing, modifying, and operating an air contaminant source. The BAT Determination for Remedial Construction Activities on the FEMP provides a method for using BAT as it applies to fugitive dust sources. During 1997, DOE and the Ohio Environmental Protection Agency (OEPA) negotiated a BAT determination that established control measures, emission standards, and record keeping requirements for the control of fugitive dust from roads (paved and unpaved), material storage piles, parking areas, and construction areas. This BAT determination has been approved by OEPA and is contained in procedure RM-0047.

- Ohio General Provisions on Air Pollution Control, Air Pollution Nuisances Prohibited, OAC 3745-15-07 and Ohio Revised Code (ORC) 3704.01-.05, which prohibits the emission or

escape into the open air of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, and odors in such amounts that may cause a public nuisance. Control of such emissions is the responsibility of the projects through source control, as described in the BAT Determination for Remedial Construction Activities on the FEMP.

- Ohio Emissions of Particulate Matter, Restriction of Emission of Fugitive Dust, OAC 3745-17-08, which provides for the restriction of emission of fugitive dust by the use of control measures. Such control measures include, for example, water or dust suppression chemicals for control of fugitive dust from demolition of buildings or on dirt or gravel roads, the use of hoods or fans to enclose and control fugitive dust, and the use of canvas or other coverings for stockpiles.

The project-specific regulatory drivers for point and other sources include:

- NESHAP 40 CFR 61, Subpart Q, which provides national emissions standards for radon. The standard for this regulation is that no source at a DOE facility shall emit more than 20 pCi/m$^2$/sec of radon-222, as an average for the entire source, into the air. A source is defined in the regulation as any building structure, pile, impoundment, or area used for storage or disposal that contains sufficient quantities of radium so as to exceed the standard. Staging of material, such as the silo residues, during the implementation of remedial actions does not constitute interim storage under NESHAP subpart Q. To demonstrate compliance with the standard, radon monitoring is conducted at the source. Such source monitoring, with the exclusion of that conducted at the K-65 Silos, will be addressed within project remedial design and remedial action documents. The K-65 Silo headspace and area environmental monitoring will be conducted under the IEMP.

- NESHAP 40 CFR 61, Subpart H, which provides national emissions standards for radionuclides other than radon. This regulation also requires emission measurements at point sources with a potential to discharge radionuclides into the air in quantities which could cause an effective dose equivalent in excess of one percent of the standard (10 mrem/year).

- Ohio Particulate Matter Standards, Restrictions on Particulate Emissions from Industrial Processes, OAC 3745-17-11, which describes emission restrictions for particulates from industrial processes. These restrictions apply to operations, processes, or activity other than those subject to fugitive dust regulations in OAC 3745-17-08 (discussed above), and are therefore applicable to process units.

- Particulate Matter Standards, Control of Visible Emissions from Stationary Sources, OAC 3745-17-07(A), which sets visible particulate emission limitations for stacks. Visible particulate emissions from any stack cannot exceed 20 percent opacity, as a six-minute average.

- Air Quality Standards, Control of Emissions of Organic Materials from Stationary Sources, OAC 3745-21-07(G)(2), which sets a discharge limit of 40 pounds of organic material per day, and no more than eight pounds per hour, for any article, machine, equipment, or other contrivance used for applying, evaporating, or drying and photochemically reactive material unless the discharge has been reduced by at least 85 percent.

- Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Miscellaneous Units, 40 CFR 264.601 through .603, and OAC 3745-57-91 through 93, which requires that miscellaneous units be designed, operated, and maintained to prevent releases to the air pathway. Monitoring may be necessary to evaluate the effectiveness of air emission controls. Operable Unit 1 remedial actions may require the use of miscellaneous units for the management or treatment of Resource Conservation and Recovery Act-regulated hazardous waste.

- Permit to Install New Sources, Criteria for Decision by Director, OAC 3745-31-05(A)(3), which requires the use of BAT when installing, modifying, and operating an air contaminant source. Any treatment units for remediation activities will be designed to include BAT.

- General Provisions on Air Pollution Control, Malfunction of Equipment, Scheduled Maintenance, Reporting, OAC 3745-15-06(A)(1) and (2), which requires scheduled maintenance of air pollution control equipment in order to prevent a malfunction. Shutdown of the operating unit, if required to conduct the maintenance, must be accompanied by the shutdown of the associated air pollution sources. Project-specific remedial design and remedial action work plans will include a maintenance program to address this requirement.

- Ohio Standards for Active and Inactive Asbestos Disposal Sites, OAC 3745-20-06 and OAC 3745-20-07(A) and (C), which prohibit visible emissions of asbestos during and after placement. Asbestos management is primarily limited to asbestos removal conducted prior to building demolition and disposal either off-site or in the on-site disposal facility. The visible emission standard for asbestos is closely tied to asbestos management, and is not within the scope of the IEMP.

Table 6-1 lists all of the above requirements and includes each of the air monitoring regulatory requirements to be conducted under the IEMP and the associated monitoring designed to comply with each requirement. Table 6-1 also lists each regulatory driver for project-specific air monitoring, the monitoring conducted to meet the requirement, and the project-specific plan that will describe the monitoring program. Sections 6.6 and 8.0 outline the FEMP's current and long-range plan for complying with the reporting requirements invoked by the IEMP regulatory drivers.

## 6.3 BOUNDARY DEFINITION

This section identifies the programmatic boundary(s) established between the IEMP and the project-specific activities. The intent behind the boundary definition is to clearly delineate the scope of the IEMP's monitoring responsibility and establish a recognized interface between the sitewide focus of the IEMP and the fugitive and point source emission-control focus of the project-specific monitoring.

In general, the program boundaries for air monitoring are defined in the following two fundamental areas:

### Fugitive Emissions Monitoring

As stated earlier, the air monitoring program presented in the IEMP will serve as the vehicle for demonstrating compliance with the NESHAP Subpart H limit ensuring that no member of the public receives an effective dose equivalent in excess of 10 mrem/year from radionuclide emissions (excluding radon) as a result of FEMP operations. As such, the air monitoring approach presented in this plan will provide a continual measurement of the collective effectiveness of fugitive and point source emissions from the site relative to this health protective standard. Each project is responsible for controlling fugitive

4528

## TABLE 6-1

## FEMP MONITORING PROGRAM
## REGULATORY DRIVERS AND RESPONSIBILITIES

| | DRIVER | ACTION |
|---|---|---|
| IEMP | DOE Order 5400.1,<br>General Environmental Protection Program<br>Environmental Monitoring Plan for all media | The IEMP describes effluent and surveillance monitoring as required by DOE Order 5400.1. |
| | DOE Order 5400.5,<br>Proposed 10 CFR 834 Radiation Protection of the Public and Environment | The IEMP describes on-site and off-site monitoring for radon and other radionuclides and monitoring to determine annual dose from the air pathway. |
| | NESHAP 40 CFR 61, H<br>Emission Standards for Radionuclides (excluding radon) | The IEMP includes an assessment of the annual dose to the public from the air pathway by employing a fenceline monitoring program. |
| | Federal Facility Agreement Control and Abatement of Radon-222 Emissions | The IEMP includes radon monitoring at the Operable Unit 4 Silos and the Operable Unit 1 waste pits. |
| | DOE Order 5820.2A, Environmental Monitoring for Low-Level Radioactive Waste Disposal Facilities | The IEMP fenceline air monitoring includes air monitoring at locations adjacent to the on-site disposal facility. |

**TABLE 6-1**
**(Continued)**

| | DRIVER | ACTION | PROJECT PLAN |
|---|---|---|---|
| PROJECT | NESHAP 40 CFR 61, Q Emission Standards for Radon for Storage and Disposal Units or Areas | Radon flux monitoring at Operable Unit 1 and Operable Unit 4 storage and disposal units if applicable to ensure compliance with the standard | Operable Unit 1 Remedial Design/Remedial Action Documents Package; Operable Unit 4 Remedial Design Packages |
| | OAC 3745-17-11, Ohio Particulate Matter Standards Industrial Processes | Visible emission monitoring for Operable Unit 1 waste pit treatment unit stacks/vents and Operable Unit 4 treatment units, as determined necessary to ensure compliance with the standard | Operable Unit 1 Remedial Design/Remedial Action Documents Package; Operable Unit 4 Remedial Design Packages |
| | 40 CFR 264.601-.603; OAC 3745-57-91 through 93 Miscellaneous Hazardous Waste Management Units | Monitoring at vents/stacks at Operable Unit 1 hazardous waste treatment of storage units, as determined necessary by modeling | Operable Unit 1 Remedial Design/Remedial Action Documents Package |
| | OAC 3745-31-05(A)(3), BAT for New Air Sources | Air monitoring at stacks/vents for Operable Unit 1 and Operable Unit 4 treatment units, as determined necessary to ensure compliance with the standard | Operable Unit 1 Remedial Design/Remedial Action Documents Package; Operable Unit 4 Remedial Design Packages |

**TABLE 6-1**
**(Continued)**

| | DRIVER | ACTION | PROJECT PLAN |
|---|---|---|---|
| PROJECT - FUGITIVE DUST CONTROL | OAC 3745-17-07(a), Ohio Particulate Matter Standards Visible Particulate Emissions for Stacks | Visible emission monitoring for Operable Unit 1 waste pit treatment unit stacks/vents and Operable Unit 4 treatment units, as determined necessary to ensure compliance with the standard | Operable Unit 1 Remedial Design/Remedial Action Documents Package; Operable Unit 4 Remedial Design Packages |
| | OAC 3745-21-07(G)(2), Ohio Air Quality Standards for Organics | Air monitoring at stacks/vents for Operable Unit 1 treatment units, as determined necessary by modeling | Operable Unit 1 Remedial Design/Remedial Action Documents Package |
| | OAC 3745-31-05(A)(3), BAT for New Air Sources | Visible emission monitoring for roadways and parking areas and storage piles associated with the Operable Unit 1 waste pits, soil excavation, and on-site disposal facility projects and other construction activities as determined necessary to ensure compliance with the standard | BAT Determination for Remedial Construction Activities at the FEMP |
| | OAC 3745-15-07; ORC 3704.01-.05, Ohio General Provisions on Air Pollution Control, Prohibition of Public Nuisance | Visible fugitive emission monitoring for waste pit excavation, soil excavation areas, and on-site disposal facility construction and waste placement as determined necessary to ensure compliance with the standard | BAT Determination; Sitewide Excavation Plan |
| | OAC 3745-17-08, Ohio Emissions of Particulate Matter Control of Emissions of Fugitive Dust | Visible fugitive emission monitoring for waste pit excavation, soil excavation areas, and on-site disposal facility construction and waste placement as determined necessary to ensure compliance with the standard | BAT Determination; Sitewide Excavation Plan; On-Site Disposal Facility Impacted Materials Placement Plan, and Borrow Area Management and Restoration Plan |
| | OAC 3745-17-07(B)(4) through (6), Ohio Emissions of Particulate Matter Roadways, Parking Areas, and Storage Piles | Visible emission monitoring for roadways, parking areas, and storage piles associated with the Operable Unit 1 waste pits, soil excavation, and on-site disposal facility | BAT Determination; Operable Unit 1 Remedial Action Documents Package; Sitewide Excavation Plan |

dust to comply with the BAT determination for the FEMP. The standards and control techniques are provided in procedure RM-0047, which has been approved by OEPA. Procedure RM-0047 outlines the administrative and engineered controls for mitigating fugitive dust. Additional air monitoring at the project level to determine the effectiveness of specific administrative and engineered controls for fugitive dust abatement (above those required under the BAT determination) are not necessary to ensure protection of the public or support compliance with NESHAP, Subpart H. However, the air monitoring information maintained by the projects will be used as necessary to support the data interpretations conducted through the IEMP. Likewise, the air monitoring data collected through the IEMP will be used to provide continual feedback to the remediation projects on the effectiveness of emission controls.

Point Source Monitoring

Point source monitoring (i.e., stacks and vents) is designated as a remediation project responsibility due to the direct emission and process control nature of this monitoring activity. The technical approach and design of stack monitoring systems will be an integral part of the process control scheme and overall system design for existing and future remediation treatment units (e.g., waste pits remedial action project and silos project). The data collected from stack monitoring systems, including radon and particulate data will provide critical information that will serve as process control feedback on unit operations. As such, the individual remediation project responsible for the process must maintain responsibility for the monitoring system design and operation. However, as discussed in Section 1.0, the data collected from point source emissions will be integrated into the IEMP reporting framework as necessary to support sitewide data interpretations.

## 6.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

### 6.4.1 Program Expectations

The IEMP air monitoring program has been designed to collect data sufficient to meet the following expectations for 2003 and 2004:

- Provide a program that will provide a continual assessment of the collective emissions accompanying multiple concurrent remediation projects at the FEMP and provide necessary early warning feedback regarding the cumulative sitewide effectiveness of project-specific emission controls relative to applicable protective health standards
- Provide monitoring data sufficient to demonstrate compliance with 40 CFR 61, Subpart H, requirements ensuring that no member of the public receives an annual effective dose equivalent in excess of 10 mrem
- Provide data sufficient to determine compliance with the radon concentration limits of DOE Order 5400.5

- Provide measurements of direct radiation sufficient to support the annual dose assessment calculations required by DOE Order 5400.5 accounting for all significant exposure pathways
- Provide a program that promotes the continued confidence of the public and is responsive to concerns raised by stakeholders regarding forthcoming remediation activities
- Provide a program capable of assessing trends from year to year so that necessary modifications or adjustments in program focus can be accommodated.

### 6.4.2 Program Design

The air monitoring program is comprised of three distinct components:

- Radiological air particulate monitoring
- Radon monitoring
- Direct radiation monitoring.

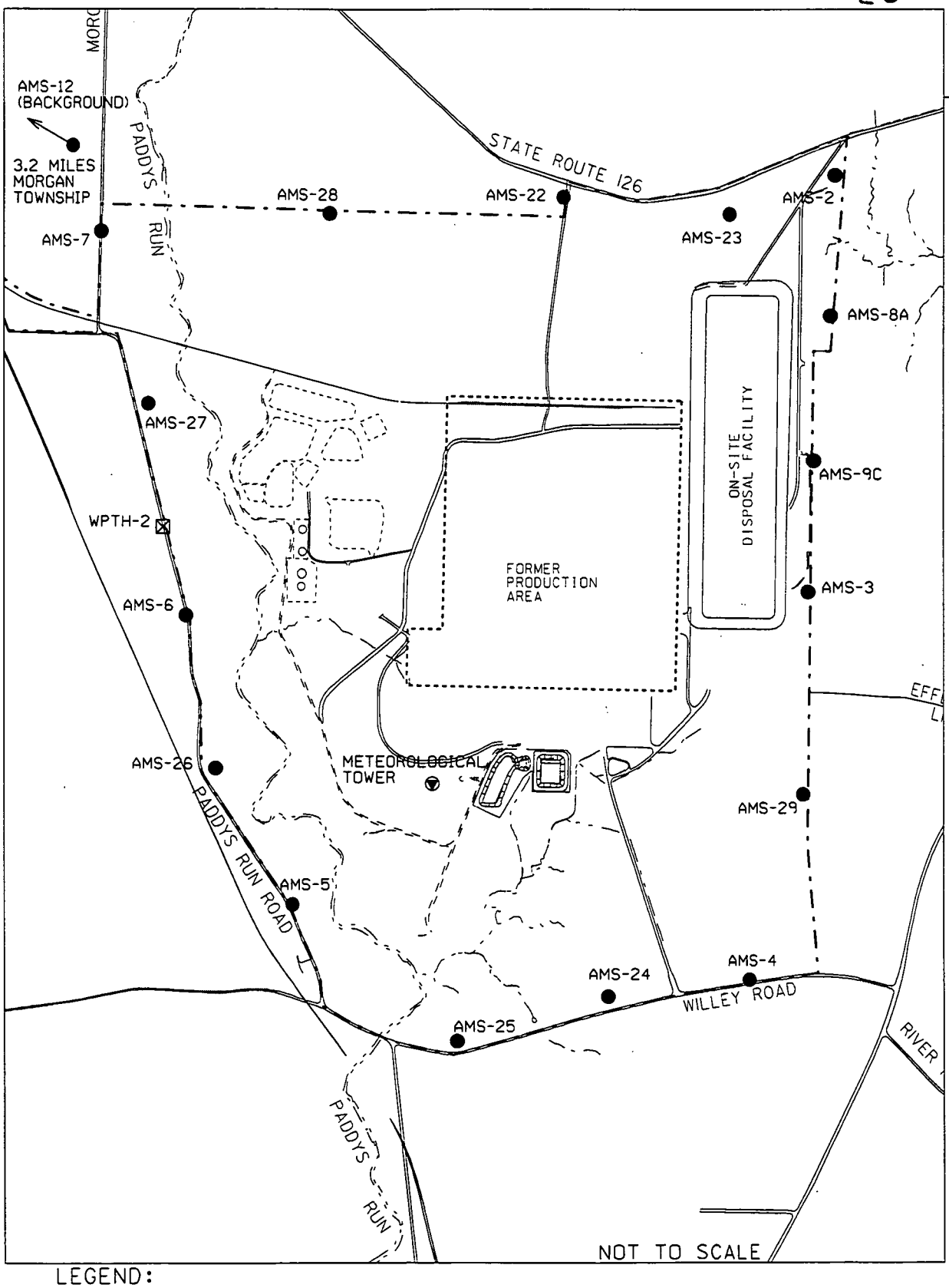
Each component of the sitewide air monitoring program is designed to address a unique aspect of air pathway monitoring, and as such, reflects distinct sampling methodologies and analytical procedures. The following sections and Appendix C provide a detailed discussion on the design of the IEMP air monitoring program.

#### 6.4.2.1 Radiological Air Particulate Monitoring Design Summary

The radiological air particulate monitoring program for 2003 and 2004 is designed to fulfill the following primary program expectations:

- Provide a continual assessment of the collective emissions accompanying multiple concurrent remediation projects at the FEMP and provide necessary early warning feedback regarding the cumulative sitewide effectiveness of project-specific emission controls relative to the health protective NESHAP standard of 10 mrem
- Provide sufficient monitoring data to demonstrate compliance with 40 CFR 61, Subpart H requirements ensuring that no member of the public receives an annual effective dose equivalent greater than 10 mrem.

To meet these expectations, the program design is based on taking direct measurements of radionuclide concentrations in the environment at the facility fenceline and a background location (Figure 6-1). A network of 18 high volume air monitoring stations have been established, based on the location of potential off-site receptors and in consideration of the 16 primary wind rose sectors (Figure 6-2). The monitoring network encompasses all the current and expected diffuse and point sources at the FEMP. Because the point of compliance under NESHAP Subpart H is the public receptor location, monitoring




LEGEND:

- FEMP BOUNDARY
- AMS LOCATION
- DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO AMS LOCATION OFF MAP
- THORIUM MONITOR LOCATION

DRAFT
FINAL

FIGURE 6-1. IEMP AIR MONITORING LOCATIONS

V:/5FGP1/DGN/02REVISION/02RV022.DGN

11-24-99

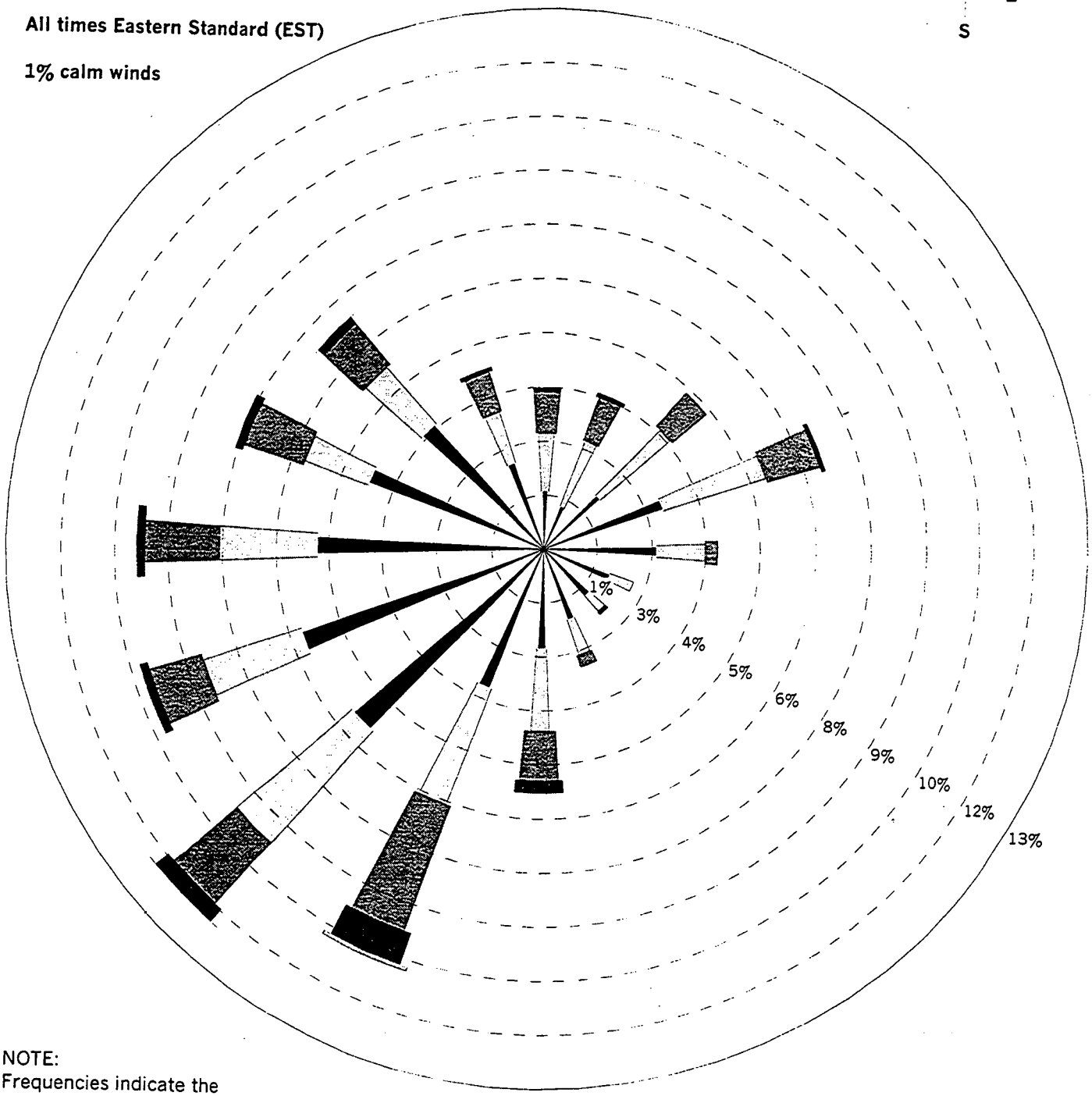
# FEMP Wind Rose (10 m level)

4528

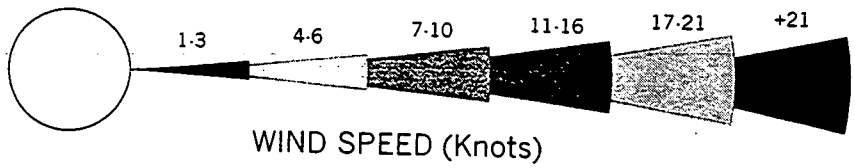
Starts: January 01, 1997 at 1 AM
Ends : December 31, 2001 at Midnight

All times Eastern Standard (EST)

1% calm winds




NOTE:
Frequencies indicate the direction from which the wind is blowing.




DRAFT FINAL

FIGURE 6-2. AVERAGE FEMP WIND ROSE DATA, 1997-2001

locations are designated at the FEMP property boundary in wind rose sectors where potential receptors are located adjacent to the property boundary (primarily in the south and west). In sectors where the closest potential receptors are not immediately adjacent to the FEMP property boundary (primarily northwest and east), monitors are designated at the FEMP property boundary in line with these receptor locations. The Environmental Regulatory Guide for Radiological Effluent Monitoring (DOE 1991) and EPA siting criteria (40 CFR 58, Appendix E) were considered when selecting these locations.

As originally designed, the IEMP air particulate monitoring program included two background air monitoring locations. Dual background locations provided a measure of assurance that the background concentrations of airborne particulate would be measured in the event that there were difficulties in maintaining the monitoring equipment or analyzing the samples from a background monitor. Experience has shown that maintaining the monitoring equipment and analyzing the samples is less problematic than originally envisioned. The equipment has operated over 95 percent of the time over the past five years and there has been minimal loss of data as the off site contract lab gained experience in the analysis of the quarterly composite samples. Based on this experience and the development of a database of typical background concentrations, there is no need to maintain two background monitors. Beginning in 2003, AMS-12 will be the only background monitoring location. AMS-16 was eliminated as a background monitor based on operational experience and the presence of light industry and a highway maintenance facility near AMS-16, which are creating conditions that are not entirely representative of a background area.

The sampling and analysis plan for air particulate monitoring program is designed to meet the following two fundamental criteria:

- Provide routine analysis that supports a timely evaluation of the effectiveness of sitewide emission controls
- Account for the major contributors to dose as defined in 40 CFR 61.93(b)(5)(ii) for the purposes of demonstrating NESHAP Subpart H compliance.

Based on these criteria, the sampling and analysis frequency for the radiological air particulate monitoring program for 2003 and 2004 consists of the following:

- Biweekly Uranium and Total Particulate Samples

  Filters will be exchanged biweekly at all air monitoring stations (AMS). AMS-2 through AMS-29 will be analyzed for total uranium and total particulate. The data will provide the basis for conducting an ongoing assessment of the effectiveness of sitewide emission controls. The results of this assessment will be provided to the remediation projects on a routine basis as feedback to support timely project decision making as necessary. Section 6.6 presents the data evaluation process. Uranium represents the most pervasive contaminant at the site; it can be analyzed quickly, reliably, and inexpensively and is expected to be one of the major contributors to dose (in addition to thorium) based on the remediation activities scheduled over the next two years.

  The total particulate data will be used to evaluate particulate loading on the filters. The particulate loading will be monitored to ensure that acceptable flow-rates are maintained through the filter. If loading becomes excessive due to increased activity at the site and in the surrounding community, then adjustments will be made to the sampling frequency.

- Monthly Thorium Samples

  During certain remediation projects, thorium may surpass uranium as the major contributor to dose. The waste pits remedial action project has the potential to generate particulate emissions containing elevated levels of uranium and thorium. Although thorium isotopes are measured on a quarterly frequency at AMS-2 through AMS-29, more frequent analysis for thorium is judged to be necessary to provide regular monitoring of fenceline thorium levels. Based on fenceline monitoring results, thorium-230 has proven to be the major contributor to air inhalation dose from waste pits remedial action project emissions. While the application of administrative and engineering controls for fugitive dust abatement will minimize waste pits remedial action project emissions, there is a need to confirm thorium emissions remain at low levels during the waste pits remedial action project project. Therefore, a portion of the biweekly filters from AMS-2 through AMS-29 and WPTH-2 will be used to form a monthly composite sample, except for 4 months when quarterly composites are collected, that will be analyzed for thorium (thorium-228, thorium-230, and thorium-232) at an off site laboratory.

  Beginning in January 2003, the thorium analysis will change from biweekly to monthly analysis. The following factors and conditions support the change to monthly thorium analysis:

  - Biweekly analysis provided timely data for monitoring the start-up and operations development phases of waste pits remedial action project. These phases are now complete and allow the frequency of analysis to be decreased from biweekly to monthly

  - Following the start of the waste pits remedial action project pug mill ventilation system, fenceline thorium-230 concentrations have remained low and comparatively stable while dryer throughput and thorium-230 concentration in feed material have increased.

- Accelerated schedule and projects (Silos, Building D&D, On-Site Disposal Facility) do not have significant potential to increase fenceline thorium concentrations beyond current or historical levels

- Monthly thorium isotopic analysis will provide sufficient feedback regarding the cumulative sitewide effectiveness of project-specific emission controls.

- Monthly thorium analysis represents a balance between the need to periodically confirm that waste pits remedial action project thorium emissions remain at low levels and the costs and sample turn-around time associated with offsite analysis.

- Quarterly Composite Sampling

  A portion of each biweekly sample (AMS-2 through AMS-29) will be used to form a quarterly composite sample for each air monitoring station for demonstrating NESHAP Subpart H compliance. The quarterly composite samples will be analyzed at an off-site laboratory for the expected major contributors to dose over the next two years, including uranium-238, uranium-235/236, uranium-234, thorium-232, thorium-230, thorium-228, and radium-226. The results of the quarterly composite data will be used to track compliance against the NESHAP Subpart H standard and will serve as the basis for demonstrating annual compliance. The data will also be incorporated into the on-going evaluation of emission controls.

The key isotopes selected for quarterly analysis represent the major contributors to dose based on the following considerations:

- Radionuclides which are stored in large quantities at the FEMP and which will be handled or processed during the remediation effort (uranium, thorium-230, thorium-232, and radium-226)

- Radionuclides which have been the major contributors to dose based on environmental and stack filter measurements (uranium and thorium-230)

- Radionuclides which, due to their concentration in waste and contaminated soil, will be the major contributors to dose if the waste or soil is released in the form of fugitive dust (uranium, thorium-228, and thorium-230).

Additional technical information supporting the sampling and analysis plan presented here is provided in Appendix C. Table 6-2 presents a summary of the analytical and sampling information provided above.

**TABLE 6-2**

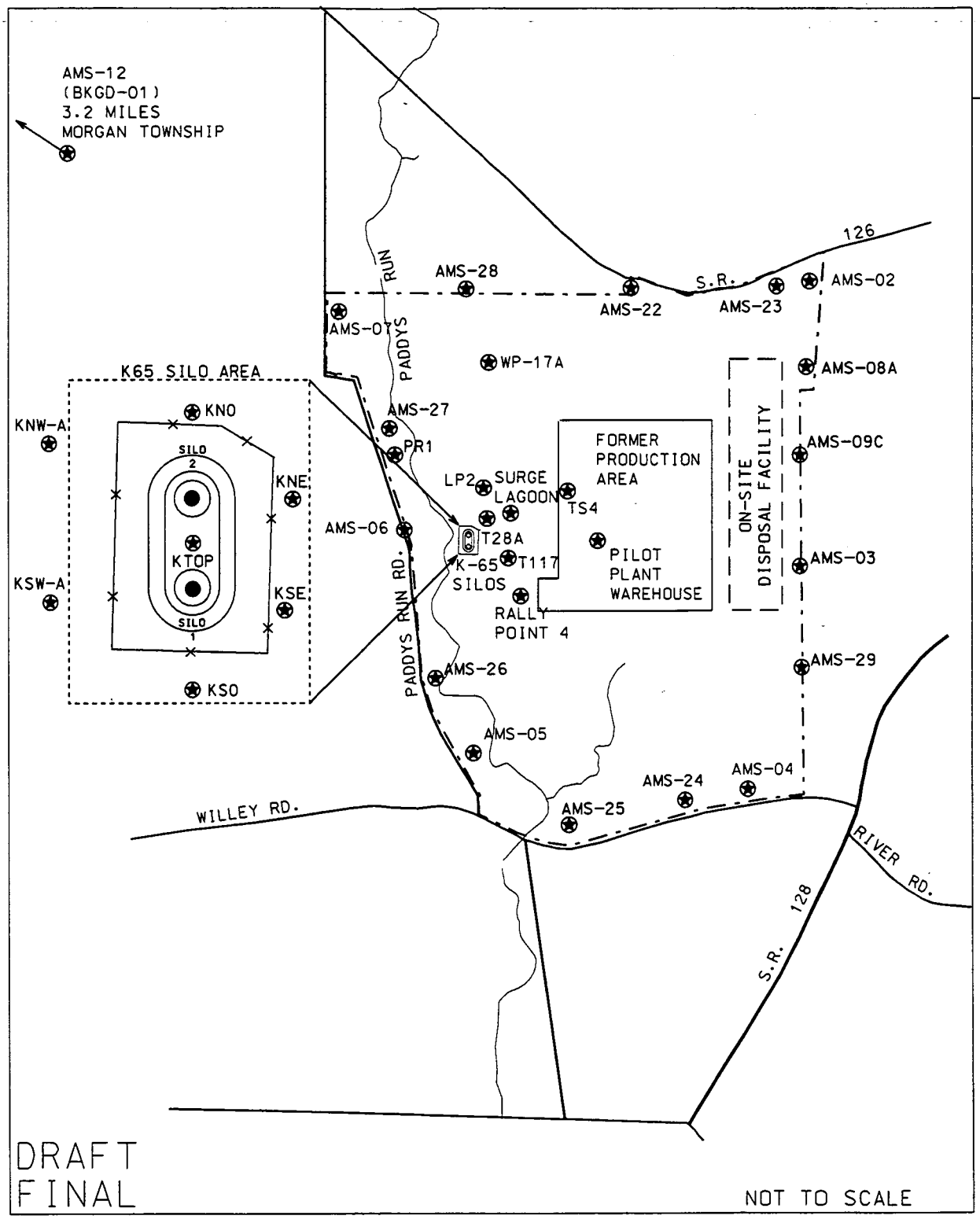
**SAMPLING AND ANALYTICAL SUMMARY FOR RADIOLOGICAL AIR PARTICULATE SAMPLES**

| Locations | Constituent | Sample Matrix | Sample Frequency | ASL[a] | Detection Level | Container |
|---|---|---|---|---|---|---|
| AMS-2 through AMS-29 | Total Uranium | Air | Biweekly | B | 2 µg/filter | 20 cm x 25 cm polypropylene 0.3 µm filter |
| AMS-2 through AMS-29 | Total Particulate | Air | Biweekly | A | NA[b] | 20 cm x 25 cm polypropylene 0.3 µm filter |
| AMS-2 through AMS-29, and WPTH-2 | Thorium-228<br>Thorium-230<br>Thorium-232 | Air | Monthly (8 times per year) | E | 0.4pCi/filter | 20 cm x 25 cm polypropylene 0.5 µm filter or dissolved filter solution in approved container |
| AMS-2 through AMS-29 | Uranium-234<br>Uranium-235/236<br>Uranium-238<br>Thorium-228<br>Thorium-230<br>Thorium-232<br>Radium-226 | Air | Quarterly composite | E | $9x10^{-5}$ pCi/m$^3$<br>$9x10^{-5}$ pCi/m$^3$<br>$9x10^{-5}$ pCi/m$^3$<br>$7x10^{-6}$ pCi/m$^3$<br>$7x10^{-6}$ pCi/m$^3$<br>$7x10^{-6}$ pCi/m$^3$<br>$2x10^{-4}$ pCi/m$^3$ | 0.5 liter amber glass |

[a]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[b]NA = not applicable

6.4.2.2 Radon Monitoring Design Summary

The radon monitoring component of the IEMP program is designed to collect environmental radon measurements in order to gauge emissions from radon-generating materials contained on site. The monitoring design is influenced by the radon concentration limits established in DOE Order 5400.5 and satisfies FFA mandated monitoring requirements. Continuous environmental radon monitors collect data representing the short-term fluctuations in radon concentrations. These monitors are placed at various locations on site, at the facility fenceline, and at an off-site background location. The monitoring locations reflect DOE guidance (DOE 1991) for siting environmental samplers. Figure 6-3 depicts the locations of continuous alpha scintillation monitors.




LEGEND:

FEMP BOUNDARY

ENVIRONMENTAL RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATION

DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO LOCATION OFF MAP

SILO HEAD SPACE RADON MONITORING - CONTINUOUS ALPH SCINTILLATION LOCATION

FIGURE 6-3. RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATIONS



v:\fdp1\fdp\02revision\02rv023.dgn
02-OCT-2002

Data from the monitors are used to assess compliance with the following limits outlined in DOE Order 5400.5:

- 100 pCi/L at any given location and any given time
- Annual average concentration of 30 pCi/L (above background) over the facility
- Annual average concentration of 3 pCi/L (above background) at and beyond the facility fenceline (FEMP boundary).

To assess the appropriateness of the radon monitoring locations during 2003 and 2004, the current and expected radon sources during this period were evaluated. The sources included the Silos 1 and 2, Silo 3, the waste dryer, the waste pit material handling building, the railcar loadout building, and the waste pit area. As remediation activities are undertaken at the FEMP, the radon monitoring program may change to ensure effective radon monitoring as a result of changing work activities.

Based on a review of the current and expected radon sources during 2003 and 2004, the monitoring program utilizes a network of 33 continuous environmental radon monitors to measure ambient radon concentrations. Monitors are placed near a variety of sources and are used during site-specific project activities that could release radon. The program is mostly concentrated near Silos 1 and 2, waste pit area, and at the facility fenceline. An off-site location (AMS-12) that is considered outside the influence of the FEMP radon sources serves as the background location.

As originally designed, the IEMP radon monitoring program included multiple background locations. Multiple background locations provided a measure of assurance that the background concentrations would be measured in the event that there were difficulties in maintaining the monitoring equipment. Experience has shown that maintaining the monitoring equipment is less problematic than originally envisioned. The equipment has operated more than 95 percent of the time over the past five years and there has been minimal loss of data due to instrument malfunctions. Based on this experience and the development of a database of typical background radon concentrations, there is no need to maintain two background monitors. Beginning in January 2003, AMS-12 will be the only background radon monitoring location. AMS-16 was eliminated as a background monitor based on operational experience and data from 1998 through 2001 which indicates that the annual average radon concentration at AMS-16 is comparable to the AMS-12 concentration.

Table 6-3 summarizes the sampling and analysis plan for the radon monitoring program.

**TABLE 6-3**

**SAMPLING ANALYTICAL SUMMARY FOR CONTINUOUS RADON DETECTORS**

| Constituent | Sample Matrix | Sample Frequency | ASL | Holding Time | Preservative | Detection Level | Detection Method |
|---|---|---|---|---|---|---|---|
| Radon-222 | Air | Continuous/24 hours | A | NA[a] | NA[a] | 0.05 to 0.15 pCi/L | Alpha Scintillation |

[a]NA = not applicable

Locations near Silos 1 and 2 and the waste pit area fulfill the need to monitor both the instantaneous ambient 100 pCi/L radon limit as well as the 30 pCi/L annual limit for facilities. Program changes in 2001 included the addition of five environmental radon monitors in the vicinity of the silos to provide additional monitoring of radon levels during the Silo 1 and 2 Accelerated Waste Retrieval Project and subsequent treatment operations for Silos 1, 2, and 3 material. The additional monitors are designated as KNO, KSO, LP2, T117, and PR1 and are shown in Figure 6-3. Other on-site monitors are placed at FFA mandated locations or established IEMP locations.

Fenceline monitors are co-located with the high volume air particulate samplers; these locations represent the 16 primary wind rose sectors and provide data for determining compliance with the fenceline radon limit of 3 pCi/L annual average above background.

The monitors provide feedback of environmental radon conditions on a timely basis (i.e., daily). Hourly data collected from all of the monitors will be summarized on a monthly basis to provide the minimum daily average, maximum daily average, and hourly median concentration for the month.

The instrument background is the combination of the laboratory-determined count rate for a specific electronic instrument (also known as electronic noise) and any counts from trace radioactive decay products and impurities found in the scintillation material of the continuous radon monitor as measured in a radon free environment. Instrument background is subtracted from the measurement data prior to comparing data from fenceline and on-site monitors to data from the background monitor. Instrument background corrected data will be presented in IEMP summary reports.

6.4.2.3 Direct Radiation Monitoring Design Summary

The direct radiation monitoring component of the IEMP program is designed to collect measurements of environmental radiation levels resulting from radioactive materials on site. This is accomplished using a network of 36 environmental thermoluminescent dosimeters (TLDs). DOE guidance (DOE 1991) and American National Standards Institute (ANSI) recommendations (ANSI 1975) were considered in selecting monitoring locations.

Silos 1 and 2 are the single largest source of direct (gamma) radiation at the FEMP. Therefore, TLD locations radiate outward from the silo area with emphasis on the nearby and publicly accessible western boundary of the site. The existing IEMP TLD monitoring network has been modified in late 2002 to take into account the pending relocation of the wastes stored in Silos 1 and 2. As necessary, current TLD locations will be adjusted and new TLD locations added to adequately characterize and monitor the direct radiation in the vicinity of the AWR project and the site fenceline. The following additional TLD locations were added to the Silo area:

- Location 43 located on the western side of the Silos, near the KNW-A radon monitor
- Location 44 located on the western side of the Silos, near the KSW-A radon monitor
- Location 45 located on the southern side of the Silos, near the KSO radon monitor
- Location 46 located on the project boundary south on the transfer tank area building
- Location 47 located on the project boundary south on the waste treatment facility.

Additional TLDs are located at air monitoring stations at the facility fenceline and at background measurement points. Figure 6-4 identifies the TLD monitoring locations.

The network of TLDs provides a mechanism to measure and track ambient radiation levels at the facility fenceline, from gamma emitting radioactive materials (primarily radium-226, thorium-232, and their decay products) that are handled and processed during remediation.

Three individual TLDs are placed at each location in order to assess the precision of the data. The TLDs are placed one meter above the ground and exchanged quarterly in accordance with industry standards and DOE guidance (DOE 1991). The TLDs are processed at the DOE Laboratory Accreditation Program-approved on-site dosimetry laboratory or equivalent vendor laboratory.

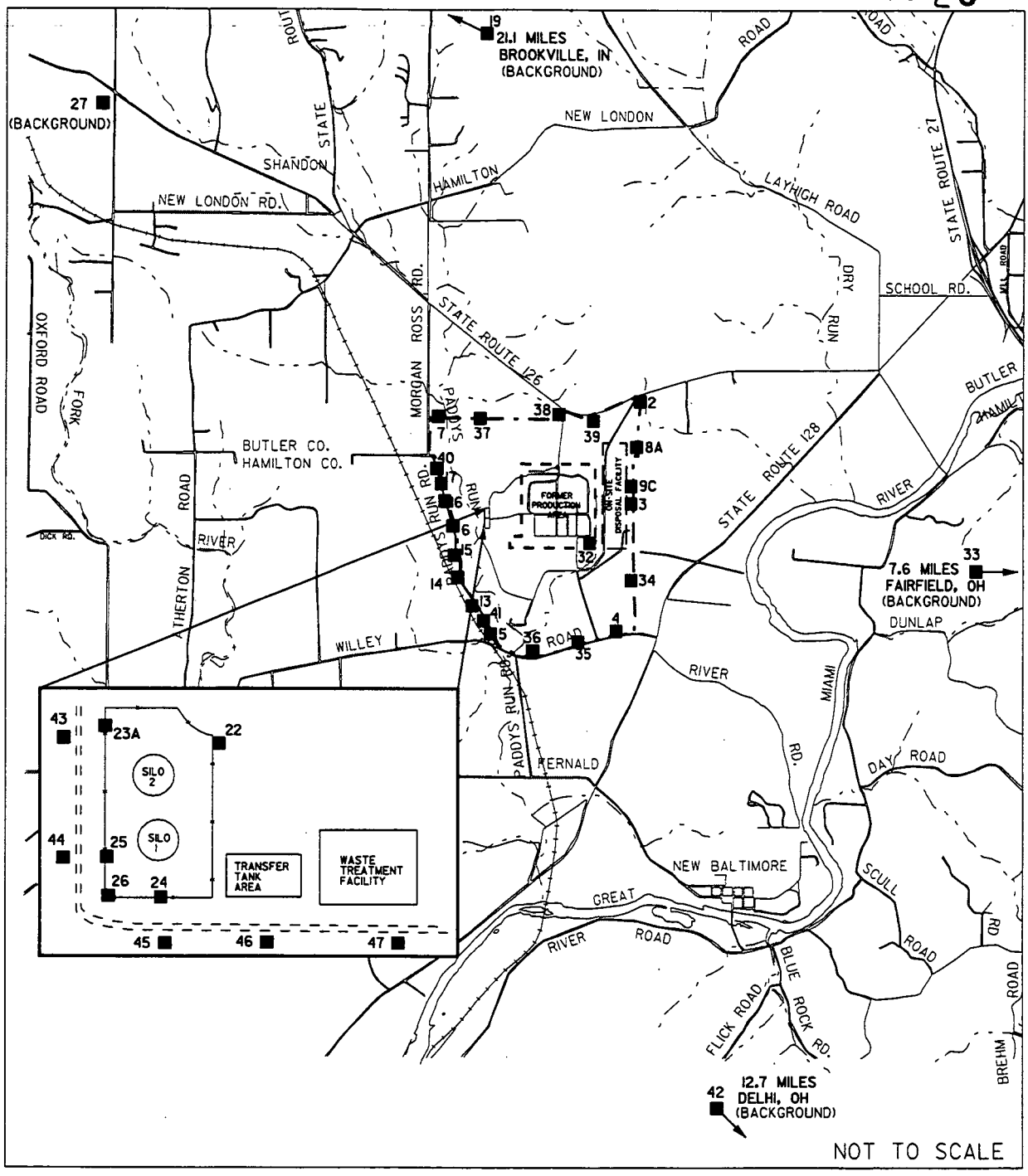
Data from the TLDs are used to assess the direct radiation component of the air pathway dose calculation (Appendix C). Table 6-4 summarizes the sampling and analysis plan for the direct radiation monitoring program.

**TABLE 6-4**

**ANALYTICAL SUMMARY FOR DIRECT RADIATION (TLD)**

| Analyte | Sample Matrix | Sample Frequency | ASL[a] | Holding Time[b] | Preservative | Detection Level | Container |
|---|---|---|---|---|---|---|---|
| Gamma Radiation (TLD) | TLD | Quarterly | B | NA[c] | NA[c] | 5 mrem | NA[c] |

[a]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[b]TLDs are read soon after collection by on-site laboratory (typically within one week).
[c]NA = not applicable




LEGEND:

DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO SAMPLE LOCATIONS OFF MAP

FEMP BOUNDARY

DIRECT RADIATION (TLD) MONITORING LOCATION

DRAFT
FINAL

FIGURE 6-4. DIRECT RADIATION (THERMOLUMINESCENT DOSIMETER) MONITORING LOCATIONS



V:/5FGPI/DGN/02REVISION/02RV005.DGN

11-24-99

6.4.2.4 Meteorological Monitoring Program Design Summary

Although not a distinct component of the existing sitewide air monitoring program, the meteorological monitoring program is designed to provide data on the atmospheric conditions which influence the dispersion and transport of contaminants in the air pathway. This program provides critical data for the evaluation and interpretation of air monitoring data. The meteorological monitoring program also supports the design and operation of the IEMP air monitoring program and as such, is presented in this section.

The FEMP meteorological monitoring system consists of a single 60-meter meteorological tower located west of the Storm Water Retention Basin (Figure 6-1). Monitoring instruments record wind speed, wind direction, temperature, barometric pressure, precipitation, relative humidity, and store one-minute and 15-minute average data on the meteorological database. The system has been developed based on the requirements of DOE Order 5400.5 and DOE guidance (DOE 1991) and complies with industry standards for calibration and data recovery.

Meteorological data are used in the evaluation and interpretation of environmental data collected from the air, radon, and project-specific monitoring data. Short-term meteorological data will be used to relate air monitoring results to specific projects, when necessary. For example, if the results from a specific monitor are higher than expected, then the monitoring result would be evaluated using the wind rose developed from meteorological measurements collected during the monitoring period. A remediation project upwind of the monitor during the monitoring period would then be considered a possible source of the higher-than-expected results. In addition to supplying data necessary to support monitoring and surveillance, the meteorological monitoring system serves to support the day-to-day operations for construction, emergency preparedness, and engineering design.

## 6.5 MEDIA-SPECIFIC PLAN FOR SITEWIDE ENVIRONMENTAL AIR MONITORING

This section serves as the media-specific plan for implementation of the sampling, analytical, and data management activities associated with the sitewide environmental air monitoring program. The program expectations and design presented in Section 6.4 were used as the framework for developing the monitoring approach presented in this section. The activities described herein were designed to provide environmental data of sufficient quality to meet the intended data use as described in the program design in Section 6.4.2. All sampling procedures and analytical protocols described or referenced in this media-specific plan are consistent with the requirements of the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 2002c).

The sitewide environmental air monitoring program is comprised of the following three distinct components:

- Radiological air particulate monitoring
- Radon monitoring
- Direct radiation monitoring.

The sampling and analytical aspects of each component are unique; therefore, this media-specific plan is organized to present a separate discussion of the sampling program for each component. The subsections of this media-specific plan define the following:

- Program organization and associated responsibilities
- Sampling programs (radiological air particulate, radon, and direct radiation)
- Change control
- Health and safety
- Data management
- Project quality assurance.

### 6.5.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this media-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support and assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standards and assist in evaluating and resolving all quality related concerns.

6.5.2 Sampling Program - Radiological Air Particulates

This sampling program is designed to collect radiological air particulate data which are representative of ambient air conditions at the facility fenceline (Figure 6-1). The data collected under this program will be used to assess the collective effect of concurrent remediation activities on the air pathway, provide continual feedback to the remediation projects on the effectiveness of emission controls, and provide a monitoring basis to support the implementation and track the effectiveness of corrective actions as necessary. As such, field procedures and analytical methods are designed to support the necessary level of data quality.

The monitoring design incorporates a network of 18 high volume continuous air monitoring stations. Filter media collected on a biweekly basis at AMS-2 through AMS-29 and WPTH-2 will be for total uranium on a biweekly frequency and isotopic thorium on a monthly frequency at analytical support level (ASL) B. ASL B provides qualitative, semi-qualitative and quantitative data with some quality assurance/quality control checks. A portion of each biweekly sample is retained for a quarterly composite sample, which is analyzed at ASL E by an off-site laboratory for those radionuclides expected to be the major contributors to dose. For the quarterly composites, ASL E provides quantitative data with fully defined quality assurance/quality control and complete data packages, including raw data and requires lower detection levels than ASL B. Section 6.4.2.1 and Appendix C provide greater detail on the sampling design.

Sample analysis will be performed at the on-site FEMP laboratory or a contract laboratory dependent on specific analyses required, laboratory capacity, turn-around time, and performance of the laboratory. The laboratories utilized for analytical testing must be approved by the FEMP in accordance with the criteria specified in Sections 3.1.5, 12.4, and Appendix E of the SCQ. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits and an internal quality assurance program. A list of FEMP-approved laboratories and current status of each is maintained by the FEMP quality assurance organization.

6.5.2.1 Sampling Procedures - Radiological Air Particulates

The air filters from the high volume air monitoring stations are collected and analyzed in accordance with the following procedures which incorporate the requirements of the SCQ listed below and the Environmental Regulatory Guide for Radiological Effluent Monitoring:

| Standard Operating Procedure | |
|---|---|
| ADM-02 | Field Project Prerequisites |
| SMPL-08 | High Volume Air Monitoring |
| EQT-18 | Calibration of Graseby GMW High Volume Air Sampler |
| ADM-09 | Air Monitoring Data Review and Analysis |
| EW-0002 | Chain of Custody/Request for Analysis Record for Sample Control |

Table 6-5 provides the technical specifications for radiological air particulate monitoring using high volume air monitoring equipment and filter media.

**TABLE 6-5**

**TECHNICAL SPECIFICATIONS FOR RADIOLOGICAL AIR PARTICULATE MONITORING**

| Monitor Type | Flow Rate | Filter Type | Gauge/Meters | Indicator |
|---|---|---|---|---|
| High volume continuous | 45 cfm | Multi-ply polypropylene | Hours<br>Flow Rate Set Point | Low Flow Warning Light |

Sample collection is accomplished by using high volume air monitoring stations that continuously collect samples of airborne particulates. Any changes in flow rate are accounted for by the automatic flow controller in the monitor and are documented on a flow chart recorder which continuously records flow data. Air monitoring equipment must meet the following criteria per DOE guidance (DOE 1991) and industry practice:

- Environmental air samplers shall be mounted in locked, all-weather stations with the sampler discharge positioned to prevent the recirculation of air.
- The air sampling system shall have a flow-rate meter, and the total air flow or total running time should be indicated.
- The air sampling rate should not vary by more than 10 percent of the monitor set point of 45 cfm for the collection of a given sample.
- Linear flow rate across air particulate filters should be maintained between 20 and 50 meters per minute (m/min).
- Air sampling systems shall be flow-calibrated, tested, and routinely inspected according to written procedures (DOE 1991). Flow calibration shall be at least as often as recommended by the manufacturer.

The monitors are inspected and calibrated at least once yearly in accordance with recommendations from the manufacturer. All units placed in the field are tracked via a field tracking log which provides information pertaining to when calibrations were last completed and the date of the next scheduled calibration. Fenceline monitors are checked daily to ensure continuous operation.

6.5.2.2 Quality Control Sampling Requirements - Radiological Air Particulates

Quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as sampling or analytical practice, may be responsible for introducing bias in the project's analytical results. The following quality assurance samples will be collected under this sampling program:

Air Particulate Samples

- Two blank samples will be submitted for analysis with each batch of biweekly filters from AMS-2 through AMS-29 for uranium analyses; one blank sample will be submitted for analysis with each batch of monthly thorium filters from AMS-2 through AMS-29 and WPTH-2 for thorium analyses; and with each set of quarterly composite samples.
- The laboratory is also required to perform analyses on method blanks, matrix spikes, and laboratory control samples as required by the SCQ for the corresponding ASL and analytical method. For the quarterly composite samples, analyzed under ASL E, a method blank, duplicate, matrix spike, and laboratory control sample will be analyzed for each batch of samples.

6.5.2.3 Decontamination

The decontamination of the air monitoring equipment is necessary only for those monitors deployed in the former production and waste storage areas. Decontamination for these monitors is conducted, at a minimum, under the radiological controls program for releasing equipment from the site. Radiological surveys are performed when equipment is required to be released for transport and/or analysis. These surveys are conducted in accordance with established radiological control procedures.

6.5.2.4 Waste Dispositioning

Contact waste that are generated by the field technicians during field sampling activities are collected, maintained, and dispositioned, as necessary, depending upon the location of waste generation (i.e., former production area or off site). Radiological control procedures govern the disposal of contact wastes generated during air monitoring activities.

6.5.3 Sampling Program - Radon Monitoring

This sampling program is designed to collect measurements of radon concentrations, considering the radon-generating materials contained on site. Sample locations on site, at the boundary fenceline, and off site provide representative measurements for assessing compliance with established limits. In addition, data collected will be used to assess radon concentrations both on site and at the fenceline during remediation activities. As such, field procedures and analytical methods are designed to support the necessary level of data quality.

The monitoring design consists of 33 continuous environmental radon monitors. Data are recorded hourly and compiled into daily averages. The data from the monitors are collected at ASL A. Section 6.4.2.2 provides greater detail on sampling design.

6.5.3.1 Sampling Procedures -Radon Monitoring

The continuous environmental radon monitors are operated in accordance with the following procedures which incorporate the requirements of the SCQ and the Environmental Regulatory Guide for Radiological Effluent Monitoring:

| Standard Operating Procedure | |
|---|---|
| ADM-02 | Field Project Prerequisites |
| SMPL-06 | Radon Sampling from Headspace of K-65 Silos |
| SMPL-09 | Pylon AB-5, Continuous Environmental Radon Monitoring |
| SMPL-25 | Pylon CRM-2, Continuous Environmental Radon Monitoring |
| ADM-14 | Evaluating Continuous Radon Monitoring Data |
| ADM-09 | Air Monitoring Data Review and Analysis |
| RP-0026 | Control and Labeling of Radioactive Material |
| EM-0030 | Silos Area Emergency Procedure |

| Sitewide CERCLA Quality (SCQ) Assurance Project Plan | |
|---|---|
| Section 4 | Quality Assurance Objectives |
| Section 5 | Field Activities |
| Section 6 | Sampling Requirements |
| Section 7 | Sample Custody |
| Section 8 | Calibration Procedures and Frequency |
| Appendix I | Field Calibration Requirements |
| Appendix K | Sampling Methods |

Continuous environmental radon monitors are calibrated as a unit at least once per year (as specified per sampling procedures) with National Institute of Standards and Technology traceable sources. Monitors are tracked upon deployment in the field via an equipment tracking log and field logbooks. The instrument background reading is also recorded for use in data evaluation and reporting. Additionally, an

equipment maintenance/calibration logbook is used to track and schedule units requiring maintenance and/or calibrations.

Table 6-3 provides a sample and analytical summary for the radon monitoring program. The continuous environmental radon monitors used at the FEMP are alpha scintillation detectors, consisting of a continuous passive radon detector attached to either a Pylon AB-5 or CRM-2. They are passive devices meaning radon diffuses into the continuous passive radon detector without the aid of a pump. Alpha particles generated by radioactive decay of the radon and its daughters interact with the inside surface of the detector, producing photons of light. The light photons interact with a photo-multiplier tube which generates electrical pulses. The number of pulses in a given time period is proportional to a radon concentration. The monitors are set to collect measurements of one-hour duration.

6.5.3.2 Quality Control Sampling Requirements - Radon Monitoring

Quality control practices for the continuous environmental radon monitors will be maintained per established maintenance and calibration schedules outlined in the applicable operating procedures. Quality control data will be recorded on process control charts and only instruments demonstrating acceptable performance will be used in the field to collect data. At a minimum, the continuous environmental radon monitors will be source checked monthly. Acceptable performance is defined as generating source check results that fall within three standard deviations of the mean expected efficiency in accordance with typical industry standard practices. If the source check results for an instrument fall outside the three standard deviation control limits, then that instrument will not be used again until it is examined, repaired, and calibrated, if necessary.

6.5.4 Sampling Program - Direct Radiation (TLDs)

This sampling program is designed to measure the direct radiation at the FEMP from locations which are representative of radiological environmental conditions at select locations on site, at the facility fenceline and in the local community (Figure 6-4). The data collected under this program will be used to assess the collective effect of current remediation activities on the air pathway. As such, field procedures and analytical methods are designed to support the necessary level of data quality.

The monitoring design incorporates a network of 36 TLD locations. Three TLDs are deployed quarterly at each location and submitted to either the on-site dosimetry laboratory or an equivalent vendor laboratory for analysis. External gamma radiation measurements are recorded from each TLD read. All TLDs are analyzed at ASL B.

6.5.4.1 Sampling Procedures - Direct Radiation (TLDs)

The TLDs are collected from environmental monitoring locations in accordance with the following operating procedures which incorporate the requirements of the SCQ and the Environmental Regulatory Guide for Radiological Effluent Monitoring:

Standard Operating Procedures

| | |
|---|---|
| ADM-02 | Field Project Prerequisites |
| SMPL-10 | Environmental Direct Radiation Monitoring |
| EW-0002 | Chain of Custody/Request for Analysis Record for Sample Control |
| ADM-09 | Air Monitoring Data Review and Analysis |

Sitewide CERCLA Quality (SCQ) Assurance Project Plan

| | |
|---|---|
| Section 4 | Quality Assurance Objectives |
| Section 5 | Field Activities |
| Section 6 | Sampling Requirements |
| Section 7 | Sample Custody |
| Section 8 | Calibration Procedures and Frequency |
| Appendix I | Field Calibration Requirements |
| Appendix K | Sampling Methods |

Table 6-4 provides a sample and analytical summary for the direct radiation monitoring program. Sample collection is accomplished using Panasonic UD-814 dosimeters or equivalent dosimeters. Environmental TLDs must meet the following criteria as per DOE guidance (DOE 1991):

- Environmental TLDs shall be mounted at one meter above ground.
- The frequency of exchange should be based on predicted exposure rates from site operations.
- The exposure rate should be long enough (typically one calendar quarter) to produce a readily detectable dose (DOE 1991).
- Annealing, calibration, readout, storage, and exposure periods used should be consistent with the ANSI standard recommendations (ANSI 1975).

All TLDs placed in the field are tracked via a field tracking log which provides information pertaining to when and where dosimeters were deployed as well as scheduled collection date.

6.5.4.2 Quality Control Sampling Requirements - Direct Radiation (TLDs)

Quality control samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as sampling or analytical practice, may be responsible for introducing bias in the project's analytical results. Quarterly data from the three TLDs at each location must agree within 15 percent or will be considered suspect and invalid data. A TLD that repeatedly differs by more than

15 percent from the other two co-located TLDs will be removed from service. The following quality assurance practices will be conducted under this sampling program:

- TLD reader is calibrated semiannually and quality control checks are performed prior to reading each batch of TLDs.
- Quarterly, spiked dosimeters with a known amount of gamma radiation are submitted for analysis (agreement within 25 percent of known dose).
- The FEMP will participate in interlaboratory comparisons conducted by DOE. The comparison studies require the FEMP to submit a set of TLDs which are then exposed (along with TLDs from other study participants) to a known amount of environmental radiation. The TLDs are then returned to the FEMP for processing. The results from all participants are then compared to known value of radiation and the 30 percent performance specification from ANSI-N545.

6.5.4.3 Decontamination

Decontamination of environmental TLD is not necessary because the units are self-contained, unless collected from known areas of high contamination. Only the units which hold the TLD, and have been stationed in the former production area, are required to undergo cleaning and decontamination if deemed necessary upon a radiological survey. Radiological surveys are performed when equipment and/or samples are required to be released from the former production area for transport and/or analysis. These surveys are conducted in accordance with established radiological control procedures.

6.5.4.4 Waste Dispositioning

Contact wastes generated by the field technicians during sample collection activities are collected, maintained and dispositioned as necessary, depending upon the location of waste generation (i.e., former production area or off site). Contact waste generated outside of radiological control areas will be placed in a clean trash dumpster. Contact waste generated within radiological control areas will be disposed of in a designated radiological contact waste container.

6.5.5 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have written approval by the project team leader or designee, quality assurance representative, and the Field Manager prior to implementation. In accordance with Section 15.3 of the SCQ, the Variance/Field Change Notice form must be completed and approved within one week of the initial written approval. The Variance/Field Change Notice form shall be issued as controlled distribution to team members,

included in the field data package and become part of the project record. During biennial revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the media-specific plan.

6.5.6 Health and Safety Considerations

The FEMP Health and Safety organization is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed during team briefings.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this media-specific plan. Safety meetings will be conducted prior to beginning field work to address specific health and safety issues. All Fluor Fernald employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to have completed applicable training.

For areas which are subject to more restrictive radiological controls where the potential for exposure is greater, radiation work permits are necessary and will be obtained prior to the field work being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring a radiation work permit.

6.5.7 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, conform with appropriate sections and appendices of the SCQ, and comply with specific FEMP procedures, such as the Data Validation Procedure, EW-0010.

Data documentation and validation requirements for data collected in 2003 and 2004 for the IEMP generally fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying media-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with media-specific plan-specified ASLs. Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with SCQ and FEMP procedures.

There are five analytical levels (ASL A through ASL E) defined for the FEMP in Section 2 of the SCQ. For 2003 and 2004 field data documentation will be at ASL A and laboratory data documentation, in general, will be at ASL B. For some air programs, a more conservative ASL is required for laboratory

data to meet regulatory commitments, to meet required detection limits, or to ensure data quality objectives are met. The specific air monitoring ASL requirements are detailed in the above sampling programs subsections and in Appendix C.

At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or verification method to ensure accuracy. The hard copy data will be managed in the project file in accordance with FEMP record keeping procedures and DOE Orders.

6.5.8 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, SCQ, and FEMP Quality Assurance Program (RM-0012) requirements.

Recommended quarterly quality assurance assessments or surveillances shall be performed on tasks specified in the media-specific plan. These assessments may be in the form of independent assessments or self-assessments, with at least one independent assessment conducted annually. Independent assessments are the responsibility of designated project quality assurance personnel. Self-assessments are performed by project personnel to self-evaluate the overall quality of work performance. The project team leader and quality assurance will coordinate assessment activities and comply with Section 12 of the SCQ. The project personnel or quality assurance representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

Only laboratories on the approved laboratory list will be used for FEMP sample analyses in accordance with Section 12 and Appendix E of the SCQ.

## 6.6 IEMP AIR MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated by the IEMP air monitoring program in 2003 and 2004. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated air monitoring data, including specific information to be reported in IEMP mid-year data summaries and in annual site environmental reports, is also provided.

### 6.6.1 Data Evaluation

Data resulting from the IEMP air monitoring program will be evaluated to meet the program expectations identified in Section 6.4.1. Based on these expectations, the following questions will be answered for all air monitoring programs:

- Are the program and reporting requirements of DOE Order 5400.1 being met?

DOE Order 5400.1 requires that DOE-FEMP implement and report on an environmental protection program for the FEMP. The air monitoring program is one component of the sitewide IEMP monitoring program. This IEMP and annual site environmental reports fulfill the requirements of this DOE Order.

- Are community concerns being met through the air monitoring IEMP program?

The IEMP fulfills the needs of the Fernald community by presenting air monitoring results in IEMP annual site environmental reports. DOE makes these reports available to the public at the Public Environmental Information Center.

Specific air program (i.e., radiological air particulate, radon, and direct radiation) evaluation process questions are identified in the following subsection.

#### 6.6.1.1 Radiological Air Particulate Data Evaluation

Based on the expectations in Section 6.4.1, the following questions will be answered for the radiological air particulate program:

- Are the emission control measures executed by the remediation projects effective in maintaining exposures to the public below the annual 10 mrem NESHAP Subpart H standard?

Biweekly uranium and quarterly composite data from air monitoring locations AMS-2 through AMS-29 and monthly thorium data from AMS-2 through AMS-29 and WPTH-2 will be compared to historical air measurements and trend analysis will be performed to assess the collective effectiveness of emission control measures. Basic statistics, such as minimum, maximum, and mean, will be generated per sample

location on a routine basis (as the data are received from the laboratory). The data generated from individual sampling events will be trended by sample location over time via graphical and statistical (when sufficient data have been generated) methods. Monitoring results will be evaluated in light of project operations active during the period and the associated meteorological conditions (i.e., wind roses, precipitation levels, etc.) in order to correlate monitoring results with (upwind) project activities. In addition, any project-specific monitoring and operations data will be used to support this data evaluation. If monitoring data indicate an increasing trend which, if sustained, could result in an exceedance of the 10 mrem NESHAP standard, then immediate notification will be made to the project(s) suspected of contributing to the increased emissions (based on the monitoring location[s] exhibiting the elevated results, the prevailing meteorological conditions, and project activities conducted during the sampling period) and action will be taken at the project level to further control fugitive emissions. If increasing trends are identified, but indicate the NESHAP standard is not in jeopardy of being exceeded (based on current trend analysis and the anticipated schedule of project activities), then projects will review remediation activities and the application of the sitewide BAT determination for fugitive dust control to ensure all project activities are compliant. Additional fugitive dust controls may be implemented as provided for in the BAT determination based on the project review. Figure 6-5 provides a schematic of the specific decision-making process for the radiological air particulate monitoring program. Additionally, this information will support the collective decision-making process as outlined in Section 1.0.

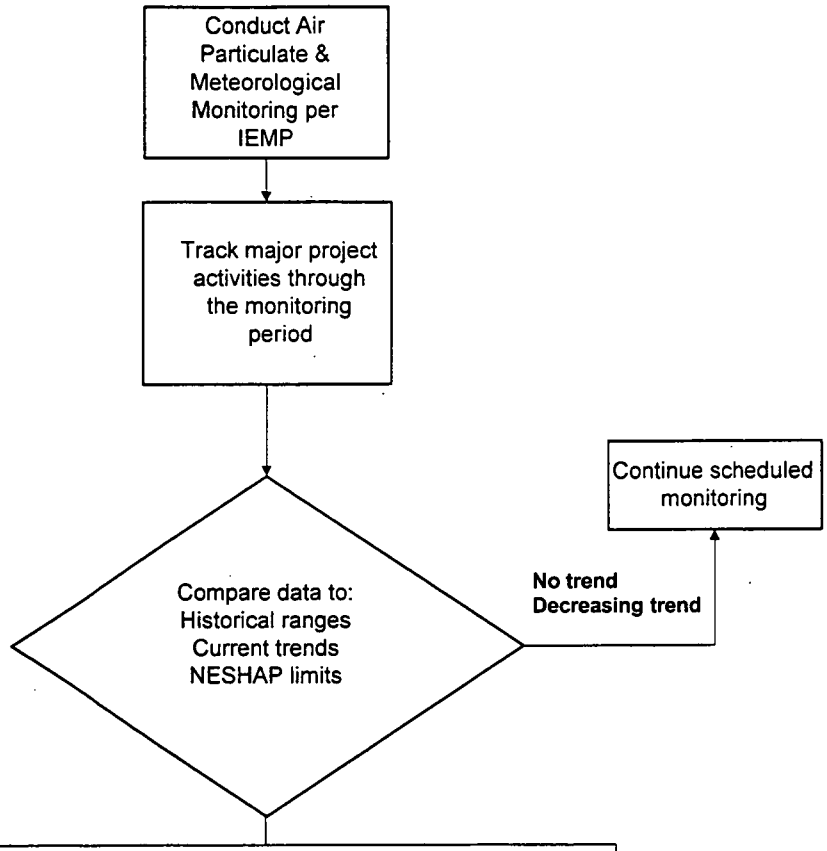
- Do the results of quarterly composite radionuclide concentrations indicate that the dose limit of NESHAP, Subpart H may be exceeded?

Data evaluation will consist of direct comparison of the quarterly composite data to the NESHAP Subpart H Appendix E, Table 2 values. If, after considering the planned remediation activities for the rest of the year, the sum of the fractions (measured concentrations divided by the corresponding NESHAP limit) indicates that exceeding the 10 mrem/year limit is likely, then increased emission control measures (modification and/or curtailment of remediation activities) will be initiated.

- Are modifications or adjustments in program focus necessary?

The quarterly composite results will be compared to the NESHAP Appendix E, Table 2 values. If the comparison indicates a contaminant other than uranium and thorium is contributing the largest percentage of dose, then modifications to the IEMP air monitoring and analytical schedule may be proposed in order to better monitor the major contributors to inhalation dose. The biweekly total particulate measurements will be used to evaluate the filter loading and may result in changes to the sampling frequency if excessive loading is observed based on total particulate concentrations in conjunction with diminishing flow-rates through the filter.

# FIGURE 6-5
# IEMP AIR PARTICULATE DATA EVALUATION AND ASSOCIATED ACTIONS




| If concentration is trending above historical ranges[a], but not expected to exceed NESHAP limit | |
|---|---|
| IEMP Actions | Potential Project Actions |
| Review pertinent project-specific data | Review performance/ inspection data for engineered controls |
| Identify probable source(s) and alert associated project(s) | Determine if emission controls meet design specifications |
| Continue scheduled monitoring | Estimate duration of source activities |
| Report information to EPA/ OEPA in next IEMP mid-year data summary and in the annual report | Repair/enhance emission controls, if necessary |

[a] These determinations will be based on the significance of the trend and the projected scope and duration of the source activity.

| If concentration is trending above historical ranges,[a] and potential exceedance of NESHAP limit exists | |
|---|---|
| IEMP Action | Potential Project Action |
| Review pertinent project-specific data | Review performance/ inspection data for engineered controls |
| Identify probable source(s) and alert associated project(s) | Determine if emission controls meet design specifications |
| Evaluate need for increasing sampling frequency and/or analytical regime to track performance of corrective actions | Estimate duration of source activities |
| Notify EPA/OEPA immediately upon disovery of condition or trend | Repair/enhance existing emission controls |
| | Implement additional emission controls as necessary |
| | Modify project schedule as necessary to limit emission rate |

6.6.1.2 Radon Data Evaluation

Data resulting from the radon monitoring program will be evaluated with respect to the program expectations identified in Section 6.4.1 and radon monitoring design summary in Section 6.4.2.2. Based on these expectations, the following questions will be answered through the radon data evaluation processes indicated by the text following each of the questions:

- Are radon concentrations below the limits set in DOE Order 5400.5?

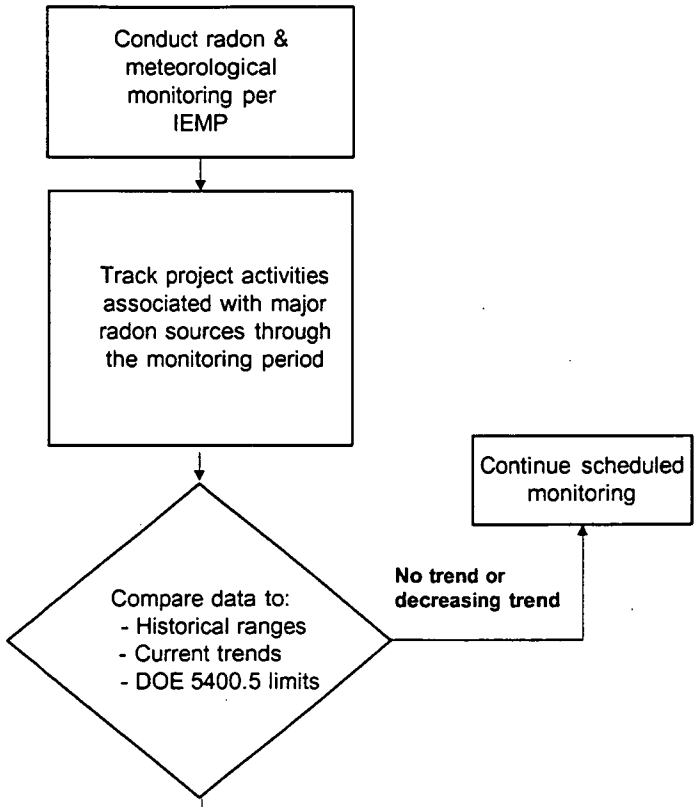
Data from the alpha scintillation continuous radon monitoring locations will be compared to the annual limits (3 pCi/L fenceline and 30 pCi/L sitewide) and short-term (100 pCi/L) limits of DOE Order 5400.5. Basic statistics, such as minimum, maximum, and mean, will be generated on a monthly basis for the alpha scintillation monitors. The data generated from individual sampling events will be trended by sample location over time via graphical, tabular, and statistical (when sufficient data have been generated) methods. If historic data are available for or near a particular IEMP sample location, then the IEMP-generated trends will be evaluated with respect to the historic trends in order to assess whether current conditions are similar to the past, increasing, or decreasing. Meteorological data (e.g., wind roses, temperature inversions) from the sampling period will be used to determine which radon source is likely to have contributed to the observed data. In addition, any project-specific monitoring and operational data from radon source areas will be used to support this data evaluation. If trends indicate that radon concentrations will exceed DOE Order 5400.5, then actions shown in Figure 6-6 will be implemented. Integration of radon air monitoring information generated by project-specific monitoring (i.e., the Operable Unit 4 remediation facilities) will occur as necessary in interpreting the sitewide radon data via the IEMP data evaluation process. The findings of data evaluations will be shared with project personnel. Those personnel responsible for Silos 1 and 2, waste pit excavation, and other radon emission sources will be informed of the findings as indicated on Figure 6-6.

- Do current radon monitoring and reporting activities comply with FFA/Federal Facilities Compliance Agreement requirements?

Removal Action No. 4 requires that monitoring of the radon concentration in the head space of Silos 1 and 2 be performed on a continuous basis until the radium-bearing materials inside are removed. In addition to reporting this data, data from all continuous monitors are reported.

- Are modifications or adjustments in the radon program focus necessary?

# FIGURE 6-6
# IEMP RADON DATA EVALUATION AND ASSOCIATED ACTIONS




| If concentration is trending above historical ranges,[a] but not expected to exceed DOE Order 5400.5 limits | |
|---|---|
| IEMP Actions | Potential Project Actions |
| Review pertinent project-specific data | Review performance/ inspection data for engineered controls |
| Identify probable source(s) and alert associated project(s) | Determine if emission controls meet design specifications |
| Continue scheduled monitoring | Estimate duration of source activities |
| Report information to EPA/ OEPA in next IEMP mid-year data summary and in the annual report | Repair/enhance emission controls, if necessary |

| If concentration is trending above historical ranges[a] and potential exceedance of DOE Order 5400.5 limits exist | |
|---|---|
| IEMP Actions | Potential Project Actions |
| Review pertinent project-specific data | Review performance/inspection data for engineered controls |
| Identify probable source(s) and alert associated project(s) | Determine if emission controls meet design specifications |
| Evaluate need for increasing data review frequency to track performance of corrective actions | Estimate duration of source activities |
| Report information to EPA/ OEPA in next IEMP mid-year data summary and in the annual report | Repair/enhance existing emission controls |
| | Implement additional emission controls as necessary |
| | Modify project schedule as necessary to limit emission rate |

[a]For those constituents/locations with limited historical data, IEMP data will be compared to background concentrations.

Changes to the monitoring program will be evaluated based on the expected changing configuration of the primary radon source materials at the site (most importantly the Silos 1 and 2 material), prior to remediation of these materials. Revisions to the program will be proposed through the annual review and biennial revision process as outlined in Section 1.0.

6.6.1.3 Direct Radiation Monitoring Data Evaluation

Data resulting from the direct radiation monitoring program will be evaluated with respect to the program expectations identified in Section 6.4.1 and direct radiation monitoring design summary in Section 6.4.2.3. Based on these expectations, the following questions will be answered through the direct radiation data evaluation processes indicated by the text following each of the questions:

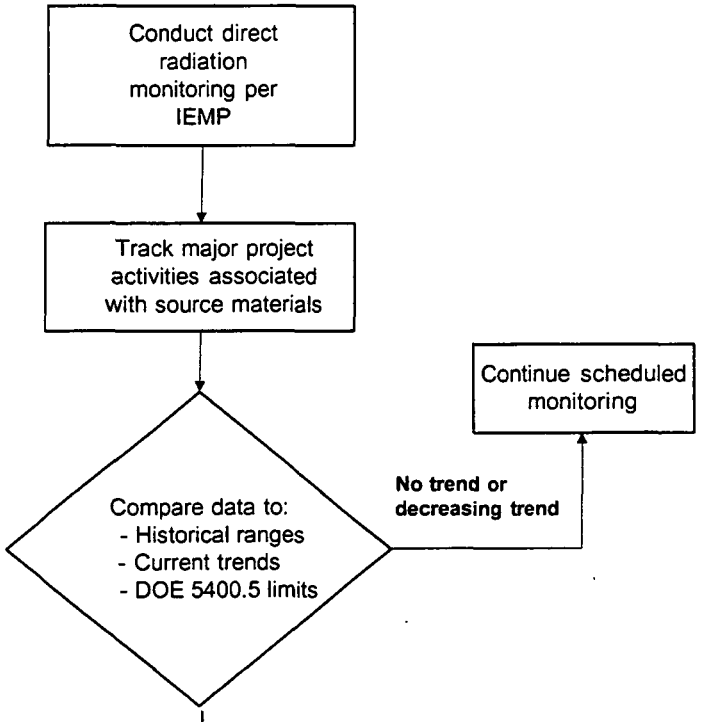
- Do direct radiation levels indicate a significant increase which could contribute to an exceedance of the 100 mrem/year all-pathway dose limit from DOE Order 5400.5?

The data generated from individual TLD locations will be trended over time via graphical and statistical (when sufficient data have been generated) methods. Basic statistics, such as minimum and maximum, will be generated on a quarterly basis. Historic TLD monitoring data will be used to assess whether current trends are similar to the past, increasing, or decreasing. In addition, any project-specific and operational data from areas with large sources of direct radiation will be used to support the evaluation and interpretation of TLD results. Data from the TLD locations will be used to assess the direct radiation component of the all-pathway dose (Appendix C). If trends indicate a significant increase above historical ranges which could contribute to an exceedance of the 100 mrem/year all-pathway dose limit, then actions shown in Figure 6-7 will be implemented. Direct radiation monitoring information generated by project-specific occupational monitoring will be used as necessary in interpreting the sitewide direct radiation data via the IEMP data evaluation process. The findings of the ongoing data evaluations will be shared with project personnel. Those personnel responsible for Silos 1 and 2 and other direct radiation sources will be informed of the findings as indicated on Figure 6-7.

- Are modifications or adjustments in program focus necessary?

Changes to the direct radiation monitoring program will be evaluated based on the changing configuration of source materials (primarily the Silos 1 and 2 waste materials) at the site, prior to remediation of these materials. Revisions to the program will be proposed through the annual review and biennial revision process as outlined in Section 1.0.

# FIGURE 6-7
# IEMP TLD DATA EVALUATION AND ASSOCIATED ACTIONS




| If radiation levels are trending above historical ranges,[a] but not expected to exceed DOE Order 5400.5 limits | |
|---|---|
| IEMP Actions | Potential Project Actions |
| Review pertinent project-specific data | Review performance/ inspection data for engineered controls |
| Identify probable source(s) and alert associated project(s) | Determine if controls meet design specifications |
| Continue scheduled monitoring | Estimate duration of source activities |
| Report information to EPA/ OEPA in next IEMP mid-year data summary and in the annual report | Repair/enhance controls, if necessary |

| If radiation levels are trending above historical ranges[a] and potential exceedance of DOE Order 5400.5 limits exist | |
|---|---|
| IEMP Actions | Potential Project Actions |
| Review pertinent project-specific data | Review performance/inspection data for engineered controls |
| Identify probable source(s) and alert associated project(s) | Determine if controls meet design specifications |
| Evaluate need for increasing sampling frequency | Estimate duration of source activities |
| Report information to EPA/ OEPA in next IEMP mid-year data summary and in the annual report | Repair/enhance existing controls |
| | Implement additional controls as necessary |

[a] These determinations will be based on the significance of the trend and the projected scope and duration of the source activity.

6.6.2 Reporting

The IEMP air monitoring program will meet the reporting requirements for the NESHAP Subpart H and the FFA compliance, as follows:

- The NESHAP Subpart H report has been incorporated into IEMP annual site environmental reports.
- The quarterly FFA reporting is being fulfilled via the IEMP Data Information Site.

IEMP air program data will be reported on the IEMP Data Information Site in the form of electronic files, in the mid-year data summaries, and annual site environmental reports. Additional information on IEMP data reporting is provided in Section 8.3.3.

The IEMP Data Information Site data is in the form of searchable data sets and/or downloadable data files. This site will be updated every four weeks, as data become available.

The IEMP mid-year data summary will supplement the IEMP Data Information Site by providing and identifying notable results and/or events related to that data. The IEMP mid-year data summary will be submitted in November of each year and will cover from the January to June period.

The IEMP annual site environmental reports will be issued each June for the previous year. The comprehensive report will discuss a year of IEMP data previously reported on the IEMP Data Information Site and in the mid-year data summary. The air monitoring portion of the IEMP annual site environmental report will consist of the following:

- An annual summary of data from the IEMP air monitoring program
- Constituent concentrations for each sample location
- Statistical analysis summary for each constituent, as warranted by data evaluation
- Status of regulatory compliance with NESHAP Subpart H
- Summarize FFA radon information (primarily headspace and silo area exclusion fence radon levels)
- Information that indicates an impact at or beyond the FEMP fenceline at a location not covered by the IEMP monitoring network

- Information that indicates the exceedance of an ARAR at an on-site location (for example, the radon limit of 100 pCi/L)
- Information that is relevant to explaining significant changes in the data from the IEMP air monitoring network.

Biweekly and monthly air particulate data will continue to be provided to the EPA and OEPA via electronic mail as the data becomes available. Additionally, any notable events or findings related to compliance will be discussed in the weekly teleconferences with regulatory personnel.

Because the IEMP is a living document, a structured schedule of annual reviews and two-year revisions have been instituted. The annual review cycle provides the mechanism for identifying and initiating any air monitoring program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

Section 7.0

# 7.0 BIOTA MONITORING PROGRAM

-- 4528

Section 7.0 provides the monitoring strategy for assessing the sitewide impact of the Fernald Environmental Management Project (FEMP's) remediation activities on biota (primarily produce) in the vicinity of the FEMP. This section also identifies the integrated objectives for biota monitoring; analyzes program drivers; describes the programmatic boundary for the IEMP biota monitoring program; presents the program expectations and design considerations, a biota sampling and analysis Media-Specific Plan, and a discussion of data evaluation. The IEMP program for monitoring biota during remediation is much more limited than the other monitoring programs presented. The distinctions are discussed in detail in this section.

## 7.1 INTEGRATION OBJECTIVES FOR THE BIOTA MONITORING PROGRAM

The IEMP biota monitoring program and objectives for 2003 and 2004 remain similar to previous biota monitoring under earlier IEMP revisions. The IEMP biota monitoring program includes sampling at three-year intervals (previously performed in 1997 and 2000) to determine concentrations of contaminants in samples of area biota for comparison to current and historic concentrations; this analysis assesses impacts to biota that may be related to site remediation. This assessment will be integrated with the assessments of the other media sampled under the IEMP in annual site environmental reports, according to the reporting schedule established in Section 7.6 and summarized for all media in Section 8.0. Ultimately, the IEMP will provide the approach for determining when biota monitoring related to remediation can be discontinued.

## 7.2 ANALYSIS OF REGULATORY DRIVERS, DOE ORDERS, AND OTHER FEMP-SPECIFIC AGREEMENTS

### 7.2.1 Approach

This section presents an evaluation of the regulatory drivers governing biota monitoring during site remediation. The intent of this section is to identify the pertinent regulatory requirements, including applicable or relevant and appropriate requirements (ARARs) and to be considered-based requirements, for the scope and design of the biota monitoring program.

The analysis of the regulatory drivers and policies was conducted by examining each of the FEMP's approved Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) operable unit's record of decision to identify any biota-specific monitoring requirements. An evaluation of the

FEMP's regulatory drivers for biota monitoring was conducted to confirm that the existing environmental monitoring program scope, which historically has satisfied public concerns and U.S. Department of Energy (DOE) Orders 5400.1 and 5400.5 requirements, also meets any additional requirements for biota monitoring that may have been activated by each of the FEMP's CERCLA operable unit's record of decision.

7.2.2 Results

The results of the evaluation indicate the drivers of the IEMP biota monitoring program are the following DOE Orders (no CERCLA-driven requirements were identified):

- DOE Order 5400.1, General Environmental Protection Program, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine effluent monitoring and environmental surveillance activities of the facility.

- DOE Order 5400.5, Radiation Protection of the Public and the Environment, which establishes radiological dose limits and guidelines for the protection of the public and environment. Under this requirement, the exposure to members of the public associated with activities at DOE facilities from all pathways must not exceed, in one year, an effective dose equivalent of 100 millirem (mrem). Compliance with this limit is determined by calculating the radiological dose using monitoring data. In accordance with the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE 1991) media-specific surveillance monitoring is not required if doses from secondary pathways (such as produce, fish, meat, and milk) are less than one mrem per year. Based on repeated sampling of fish in the Great Miami River, and produce, grass, meat, and milk obtained from the area surrounding the FEMP, the doses from these secondary pathways are consistently less than one mrem per year. Therefore, surveillance monitoring of secondary pathways is not specifically required at the FEMP.

Table 7-1 outlines the above regulatory drivers and the associated monitoring for biota. As discussed in Section 7.4.2, the monitoring of secondary and tertiary exposure pathways, with the exception of produce, has been discontinued with the first IEMP issue in 1997. Produce sampling will be continued to accommodate specific public interest in this medium. Sections 7.6 and 8.0 provide the FEMP's current and long-range plan for complying with the biota sampling requirements involved by the IEMP regulatory drivers.

4528

**TABLE 7-1**

**FEMP BIOTA MONITORING PROGRAM
REGULATORY DRIVERS AND RESPONSIBILITIES**

| | DRIVER | ACTION |
|---|---|---|
| IEMP | DOE Order 5400.1 | The IEMP describes surveillance biota monitoring as required by DOE Order 5400.1. |
| | DOE Order 5400.5 | The IEMP describes off-site biota monitoring for radionuclides to assess compliance with dose limits to the public. |

## 7.3 PROGRAMMATIC BOUNDARY FOR THE BIOTA MONITORING PROGRAM

This section identifies the programmatic boundary that has been established between the IEMP and activities conducted by other projects. The intent of establishing a boundary definition is to clearly delineate the scope and geographic extent of the IEMP's monitoring responsibility. In 2003 and every third year thereafter, the IEMP biota monitoring program will include only produce sampling. A second boundary important to discussion of the biota monitoring program is the physical boundary. The FEMP property boundary represents the starting point from which biota samples will be collected.

## 7.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

### 7.4.1 Biota Monitoring Program Expectations

The IEMP biota sampling program expectations are to collect data sufficient to:

- Determine if substantive changes occur in contaminant concentrations observed in area biota (produce)
- Determine if the program should continue as is, be refined in scope, or be discontinued in the future, based on accumulated results
- Continue to address the concerns of the community associated with future remediation activities at the FEMP.

7.4.2 Biota Monitoring Program Design Considerations

The IEMP will include produce sampling to accommodate public concerns. As discussed in Section 7.2.2, there are no specific regulatory drivers requiring the continuation of the fish, meat, milk, grass, and soil sampling. Regardless of the lack of regulatory drivers requiring monitoring of this media, there is sufficient historical data to justify not monitoring these media, as discussed in the IEMP, Revision 1 (DOE 1999a).

The IEMP is focusing on those primary pathways (air, surface water, and groundwater) to various receptors to provide indications about the impacts of site remediation on the surrounding environment. If, in the future, monitoring of the primary pathways suggests a potential for increased levels of exposure through the secondary or tertiary pathways, then further evaluation may be warranted. The evaluation to determine additional monitoring needs in secondary and tertiary pathways will be completed annually as part of IEMP review and reporting, and is consistent with the "living document" role of the IEMP.

The implementing guidance for DOE Orders 5400.1 and 5400.5 also specifies that surveillance monitoring of various media may be necessary for other reasons, including addressing public concerns. During meetings, members of the public have expressed an interest in the continuation of produce sampling near the FEMP as an assurance measure; therefore, produce sampling will continue at three-year intervals during remediation.

The design considerations to address the expectations listed in Section 7.4.1 are as follows:

- Sample locations should, in general, be consistent with current environmental monitoring locations so that comparable areas are evaluated.
- Sampling frequency, constituents analyzed, and analytical support level (ASL) should be consistent with the historical data so that appropriate comparisons can be made.
- Sampling should provide data to continue to confirm that dose received from eating produce grown near the site is below the threshold established by DOE Order 5400.5.

The biota sample program was initiated in the late 1980s in response to FEMP stakeholder concerns about the impacts of historical and then current emissions from the site. Through the 1990s, the program has been gradually scaled back as the data repeatedly confirmed that site emissions had no measurable impact on biota.

### 7.4.3 Biota Monitoring Program Design

Under the biota monitoring program, the produce sample locations are selected using the following guides:

- Locations that are next to or near the site are preferred.
- Locations that are downwind of the site (based on the predominant wind direction) are preferred.
- Locations that have commonly grown vegetables such as beans, corn, or tomatoes are preferred.
- Background locations that are at least three miles from the site and in the least predominant wind direction are preferred.

Sample locations vary from year to year, depending on the willingness of the property owner to participate in the program and on local weather fluctuations that can influence the success and desirability of domestic gardening.

Typically, 20 samples from about 10 to 15 locations are collected and analyzed for total uranium and thorium-230.

## 7.5 MEDIA-SPECIFIC PLAN FOR PRODUCE SAMPLING

This section serves as the Media-Specific Plan for implementation of the sampling, analytical, and data management activities associated with the sitewide environmental biota sampling program. The activities described in this plan were designed to provide produce sampling data of sufficient quality to meet the program expectations as stated in Section 7.4.1. The program expectations in conjunction with the design considerations presented in Section 7.4.2 were used as the framework for developing the monitoring approach presented in this Media-Specific Plan. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 2002c).

Subsequent sections of this Media-Specific Plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance.

7.5.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this Media-Specific Plan. The key positions and associated responsibilities required for successful implementation are described below.

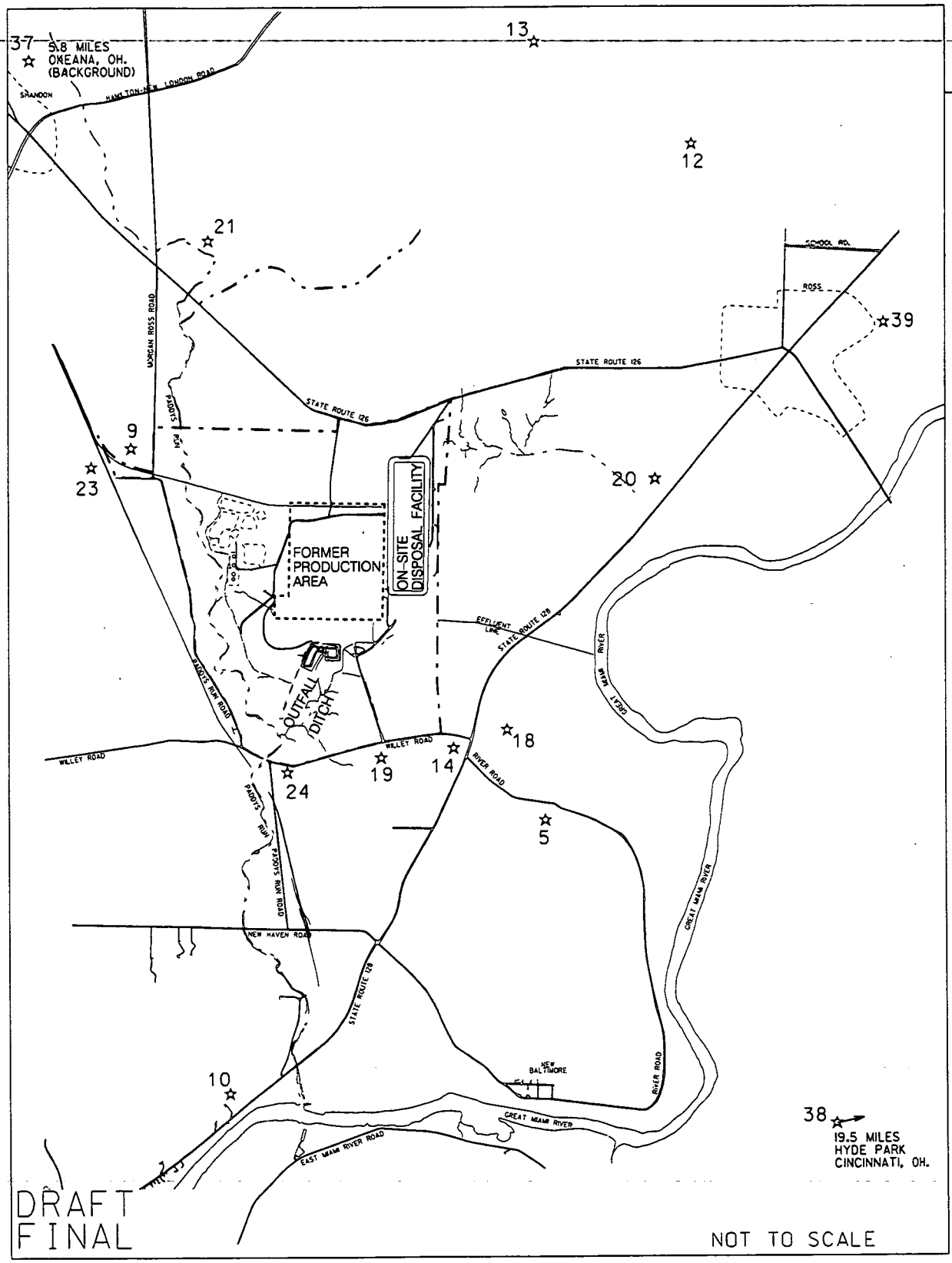
The project team leader will have full responsibility and authority for the implementation of this project-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all Media-Specific Plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support, and to assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standards and to assist in evaluating and resolving all quality related concerns.

7.5.2 Sampling Program

Figure 7-1 depicts the locations for produce sample collection. The locations shown in Figure 7-1 are approximate and change based on the availability of samples from farms and gardens and the willingness of local residents to participate in the program. An estimated minimum of 15 produce samples is required to meet the program expectations. Produce samples will be collected every three years and




LEGEND:

☆ PRODUCE MONITORING LOCATION

— · — · — FEMP BOUNDARY

☆ DISTANCE FROM FORMER PRODUCTION AREA TO MONITORING LOCATIONS OFF MAP

NOTE: THESE ARE PROPOSED LOCATIONS (BASED ON AVAILABILITY)

FIGURE 7-1. PRODUCE MONITORING LOCATIONS

v:\5fgp1\dgn\02revision\02rv025.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002

analyzed according to the analytical requirements shown in Table 7-2. The most recent round of produce sampling was conducted in August and September of 2000 and the next round will be performed in 2003.

**TABLE 7-2**

**ANNUAL PRODUCE SAMPLE ANALYTICAL REQUIREMENTS**

| Location | Sample Size (grams,wet wt.) | Type | Number of Samples[a] | Constituent[b] | ASL[c] | Container | Holding Time | Preservative |
|---|---|---|---|---|---|---|---|---|
| See Figure 7-1 | ≥500 | Grab | Min. of 15 | Uranium, Total<br>Thorium -230 | B | Plastic bag | 6 months | Freezing |

[a]The number of individual produce samples will vary depending upon private participation and availability. Approximately 20 produce or crop locations exist for which samples may be collected.
[b]Analysis for other constituents may be performed to address concerns about the impact from other radionuclides in airborne emissions from the FEMP.
[c]A more conservative ASL may be required for laboratory data in order to meet required detection limits or to ensure data quality objectives.

Sample analysis will be performed at a contract laboratory dependent on specific analyses required, laboratory capacity, turn-around time, and performance of the laboratory. The laboratories utilized for analytical testing must be approved by the FEMP in accordance with the criteria specified in Sections 3.1.5, 12.4, and Appendix E of the SCQ. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program. A list of FEMP-approved laboratories and current status of each is maintained by the FEMP quality assurance organization.

7.5.2.1 Sampling Procedures

Produce sampling is conducted in accordance with the task-specific standard operating procedures referenced below to assess the impact of FEMP remediation activities on produce grown near the FEMP. The procedures incorporate the requirements of the SCQ as follows:

| Standard Operating Procedure | |
|---|---|
| ADM-02 | Field Project Prerequisites |
| SMPL-14 | Produce Sampling |
| EW-0002 | Chain of Custody/Request for Analysis Record for Sample Control |
| PM-4000 | Miscellaneous Shipping Order Preparation |

-- 4528

Sitewide CERCLA Quality (SCQ) Assurance Project Plan

| | |
|---|---|
| Section 4 | Quality Assurance Objectives |
| Section 5 | Field Activities |
| Section 6 | Sampling Requirements |
| Section 7 | Sample Custody |
| Section 8 | Calibration Procedures and Frequency |
| Appendix J | Field Activity Methods |
| Appendix K | Sampling Methods |

Sampling conditions to be considered during sampling are as follows:

- Produce should be in good (edible) condition.
- Commonly grown fruits and vegetables (e.g., tomatoes, beans, and corn) should be selected for sampling.
- When possible, collect a portion of the total sample from several plants within the garden. The produce should not be rinsed.
- Collect a minimum of 500 grams (wet weight) of produce per sample.

The sample location shall be described and/or sketched in the field log for the sampling event. Calibration of the field balance before field activities is required by the SCQ.

7.5.2.2 Quality Control Sampling Requirements

Quality control samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as decontamination, sampling or analytical technique, may be responsible for introducing bias in the analytical results. The radiological data will be sampled and analyzed at ASL B. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality assurance/quality control checks. Field duplicates will be collected for every 20 samples in accordance with the standard operating procedure.

7.5.2.3 Decontamination

As stated in Section K.11 of the SCQ, sample collection equipment shall be decontaminated between sample locations using a Level II decontamination process to prevent the introduction of contaminants or cross-contamination into the sampling process.

7.5.2.4 Waste Dispositioning

Contact wastes that are generated by the field technicians during field sampling activities are collected, maintained, and dispositioned depending upon the location of waste generation (i.e., former production area or off site). Contact waste generated outside of radiological control areas will be placed in a clean trash dumpster. Contact waste generated within radiological control areas will be disposed of in a designated radiological contact waste container.

7.5.3 Change Control

Changes to the Media-Specific Plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the Media-Specific Plan must have written approval by the project team leader or designee, quality assurance representative, and the media lead prior to implementation. In accordance with Section 15.3 of the SCQ, the Variance/Field Change Notice form must be completed and approved within one week of the initial written approval. The Variance/Field Change Notice form shall be issued as controlled distribution to team members, included in the field data package and become part of the project record. During biennial revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the Media-Specific Plan.

7.5.4 Health and Safety Considerations

The FEMP Health and Safety organization is responsible for the development and implementation of health and safety requirements for this Media-Specific Plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed during team briefings.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this Media-Specific Plan. Safety meetings will be conducted prior to beginning field work to address specific health and safety issues. All Fluor Fernald employees and subcontractor personnel who will be performing field work required by this Media-Specific Plan are required to have completed applicable training.

4528

7.5.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives conform with appropriate sections and appendices of the SCQ, and comply with specific FEMP procedures, such as the Data Validation Procedure, EW-0010.

Data documentation and validation requirements for data collected in 2003 for the IEMP generally fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying Media-Specific Plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with Media-Specific Plan-specified ASLs. Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with SCQ and FEMP procedures.

There are five analytical levels (ASL A through ASL E) defined for the FEMP in Section 2 of the SCQ. For produce collected in 2003, field data documentation will be at ASL A and laboratory data documentation, in general, will be at ASL B. A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives are met. In general, ASL B is appropriate for laboratory generated data collected in 2003, because the data are being used for surveillance during site restoration.

At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or verification method to ensure accuracy. The hard copy data will be managed in the project file in accordance with FEMP record keeping procedures and DOE Orders.

7.5.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, SCQ, and FEMP Quality Assurance Program (RM-0012) requirements.

A quality assurance assessment or surveillance shall be performed on tasks specified in the Media-Specific Plan during each produce sampling event (once every three years). This assessment may be in the form of an independent assessment or a self-assessment. Independent assessments are the responsibility of designated project quality assurance personnel. Self-assessments are performed by project personnel to self-evaluate the overall quality of work performance. The project team leader and quality assurance will coordinate assessment activities and comply with Section 12 of the SCQ. The project personnel or quality assurance representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

Only laboratories on the approved laboratory list will be used for FEMP sample analyses in accordance with Section 12 and Appendix E of the SCQ.

## 7.6 IEMP BIOTA MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated by the IEMP produce sampling program in 2003. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for produce data, including specific information to be reported in annual site environmental reports, is also provided.

### 7.6.1 Data Evaluation

Data resulting from the IEMP produce sampling will be evaluated to meet the program expectations identified in Section 7.4.1. Based on these expectations, the following questions will be answered through the produce data evaluation process, as indicated:

- Have substantive changes occurred in contaminant concentrations observed in area produce?

Data evaluation will consist of basic statistical analysis (i.e., minimum, maximum, and mean) and comparison to historical data and background to determine if substantive changes occur in contaminant concentrations in area produce. Additionally, should air emissions exceed historical ranges for a sustained period, modification of the IEMP biota monitoring program will be considered. Data evaluation will also address whether produce sampling should continue on a three-year cycle.

- Are the program and reporting requirements of DOE Order 5400.1 being met?

DOE Order 5400.1 requires that DOE-FEMP implement and report on an environmental protection program for the FEMP. The biota monitoring program, specifically produce sampling, is one component of the sitewide IEMP monitoring program. This IEMP and annual site environmental reports fulfill the requirements of this DOE Order.

- Are community concerns being met through the produce sampling?

The IEMP fulfills the needs of the Fernald community by presenting produce results once every three years in annual site environmental reports. DOE makes these reports available to the public at the Public Environmental Information Center.

7.6.2 Reporting

The IEMP biota program data will be reported in the IEMP Data Information Site and annual site environmental report. Additional information on IEMP data reporting is provided in Section 8.3.3.

Data pertaining to the IEMP biota program will be provided on the IEMP Data Information Site. The data will be in the format of searchable data sets and/or downloadable data files. This site will be updated when biota data become available.

The IEMP annual site environmental reports will be issued each June. The comprehensive report will discuss a year of IEMP data previously reported on the IEMP Data Information Site. The IEMP annual site environmental reports will include the following:

- An annual summary of data from the IEMP produce sampling
- Constituent concentrations for each produce sample
- Statistical analysis summary for constituents, as warranted by initial data evaluation.

Because the IEMP is a living document, a structured schedule of annual reviews and two-year revisions have been instituted. The annual review cycle provides the mechanism for identifying and initiating any biota monitoring program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review would be communicated to the EPA and OEPA.

Section 8.0

# 8.0 PROGRAM SUMMARY AND REPORTING

4528

## 8.1 INTRODUCTION

This section summarizes the Integrated Environmental Monitoring Plan (IEMP), highlighting two key program areas: program design and integrated reporting strategy. The program design section explains the technical approach taken in developing the IEMP and outlines the strategy for reviewing and revising the IEMP. The reporting section integrates the reporting discussion in Sections 3.0 through 7.0 and provides an overview of the entire IEMP reporting strategy.

## 8.2 PROGRAM DESIGN

As discussed throughout this plan, the IEMP combines remediation-based environmental monitoring requirements that have been activated by the applicable or relevant and appropriate requirements (ARARs) and to be considered-based requirements (contained in the FEMP's Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] remedy decision documents) as well as other ongoing monitoring programs required by other regulatory requirements. In combining these elements, the IEMP establishes a sitewide environmental monitoring program that is aligned with the broad range of remediation activities being implemented at the FEMP, and continues to meet the effluent and surveillance monitoring requirements of U.S. Department of Energy (DOE) Orders 5400.1 and 5400.5. Furthermore, by focusing the monitoring program design on a discrete two-year window of remediation activities, the IEMP program will forecast and be responsive to emerging monitoring needs.

IEMP media-specific monitoring programs were developed through a systematic evaluation of existing monitoring scope, technical considerations, pertinent regulatory drivers, and critical FEMP stakeholder concerns. Programmatic boundaries between the IEMP and project-specific monitoring were identified during this evaluation to clearly delineate the scope and geographic extent of the IEMP monitoring and reporting responsibilities.

### 8.2.1 Programmatic Boundaries

Programmatic boundaries between the sitewide environmental monitoring program and the remediation projects have been identified as part of the IEMP. As discussed in Section 1.0, these boundaries are defined for monitoring and reporting activities. The IEMP presents a sitewide monitoring approach focused on assessing the collective impacts of FEMP remediation activities. As such, a fundamental

programmatic boundary exists between the global monitoring approach of the IEMP and the primarily emissions-control monitoring focus of the individual remediation projects.

The IEMP is designed to provide accurate, accessible, and manageable environmental monitoring information during remediation to support the following:

- Continued compliance with the monitoring and reporting requirements contained in DOE Orders 5400.1 and 5400.5
- Monitoring the performance of the Great Miami Aquifer groundwater remedy, including determination of when restoration activities are complete
- Providing a consolidated reporting mechanism for environmental data.

The following list summarizes the activities that fall outside the scope of the IEMP:

- Project-specific emission-control monitoring for both point and area sources (except for ambient radon monitoring in the Silos Project area)
- The soil remediation pre-certification and certification sampling program which will be conducted as part of the work scope of the Soil and Disposal Facility Project
- The ambient air sampling and direct radiation measurements conducted for worker health and safety purposes as part of the FEMP's occupational monitoring program
- The FEMP's spill and chemical release reporting required under Superfund Amendments and Reauthorization Act Title III.

### 8.2.2 IEMP Monitoring Summary for 2003 and 2004

The 2003 and 2004 IEMP monitoring scope for groundwater, surface water, sediment, air, and biota has been described in detail in Sections 3.0 through 7.0. The summary that follows is intended to provide a synopsis of and basis for each media-monitoring program. Evaluation of each program will form the basis for any IEMP program modifications in the future.

Groundwater: The groundwater monitoring program for the Great Miami Aquifer provides for monitoring water quality and water levels in monitoring wells distributed over the aquifer restoration area, along the FEMP's downgradient property boundary, and at a few private well locations. These wells provide a monitoring network to track the progress of the aquifer restoration and monitor groundwater quality in the area of the on-site disposal facility. The analytical requirements for this monitoring program are based on the final remediation levels (FRLs) documented in the Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996b).

Surface Water: The surface water and treated effluent monitoring program is designed to assess the impacts of FEMP remediation activities on surface water. The non-radiological discharge monitoring and reporting related to the National Pollutant Discharge Elimination System (NPDES) Permit have been incorporated into the IEMP. The radiological discharge monitoring related to the Federal Facility Compliance Agreement (FFCA) has been incorporated into the IEMP. All constituents that exceeded FRLs and/or benchmark toxicity values will be monitored. There are 15 monitoring locations.

Sediment: The sediment sampling program consists of 16 monitoring locations for key site-specific radiological constituents. It is designed to determine whether substantial changes to current residual contaminant conditions occur in the sediment along the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River, as a result of runoff and treated effluent from the site.

Air: The air monitoring program consists of three distinct sampling elements: approximately 18 airborne particulate monitoring stations, 34 radon monitoring locations, and 37 direct radiation monitoring locations, with each element supported by the meteorological monitoring program. Each element has a network of monitoring locations on site, at the FEMP boundary, and off site that are used to measure the collective sitewide effects of remediation activities. The analytical requirements for the air monitoring program focus on the principle contaminants of each monitoring element.

Biota: The biota monitoring program consists of the analysis of produce samples from approximately 14 local farms and gardens in order to address FEMP stakeholder concerns regarding this secondary pathway. Frequency of sampling is once every three years, with the next sampling scheduled for the summer of 2003. All samples are analyzed for uranium and thorium-230, the principle contaminants of concern.

### 8.2.3 Program Review and Revision

As stated in Section 1.0, the IEMP is a "living document" and, will be updated or revised annually with any program changes. This approach to developing the IEMP acknowledges the dynamic nature of the remediation effort, allowing the plan to focus on the current and evolving mix of FEMP remediation activities from year to year that accompany the FEMP's site schedule for closure in 2006 as defined in the Fernald closure contract.

To facilitate timely changes to the IEMP program, a schedule of annual reviews and biennial revisions has been incorporated into the IEMP. This schedule meets the requirements of DOE Order 5400.1 for review and revision of environmental monitoring plans. Annual reviews will evaluate the current IEMP program against the anticipated mix of remediation activities scheduled to occur in the subsequent two years. The annual review cycle provides the mechanism for identifying and initiating any program modifications that are necessary to align the IEMP with the mix of near-term remediation activities. For example, constituent

selection and sample locations, frequency, and media will be reviewed and evaluated annually. Any resultant modifications to the IEMP will be communicated to the regulatory agencies.

The two-year revision will incorporate all changes initiated as a result of the annual review process. The revision also will identify any program modifications necessary as a result of progressive findings of the IEMP and any changes to existing regulatory agreements or requirements applicable to sitewide monitoring. This submittal is the third biennial IEMP revision.

In addition to the IEMP-sponsored review and revision obligations identified above, an independent review and assessment mechanism exists through the Cost Recovery Grant reached between the Ohio Environmental Protection Agency (OEPA) and DOE. The Cost Recovery Grant provides an avenue for OEPA to conduct an independent review of DOE environmental monitoring programs. OEPA's role, as defined in the Cost Recovery Grant, is to independently verify the adequacy and effectiveness of DOE's environmental monitoring programs through program review and independent data collection. Results of the OEPA review are summarized in an annual report that will be considered during the IEMP annual review process. Modifications to the scope or focus of the IEMP, as a result of OEPA's activities, will be incorporated as necessary via the annual IEMP review process.

## 8.3 REPORTING

As stated in Section 1.0, a primary objective of the IEMP is to successfully integrate the numerous routine environmental reporting requirements under a single comprehensive framework. The IEMP provides the vehicle to centralize, streamline, and focus sitewide environmental monitoring and associated reporting under a single controlling document.

### 8.3.1 Regulatory Drivers for Reporting Monitoring Data

An analysis of regulatory drivers and policies was conducted by examining ARARs within each of the operable unit's record of decision, FEMP compliance agreements, and DOE Orders applicable to monitoring each media. These regulatory drivers are identified in Sections 3.0 through 7.0 of the IEMP

and were evaluated for reporting requirements. The following reporting drivers are in the IEMP reporting strategy:

- DOE Order 5400.1, General Environmental Protection Program Requirements, which requires DOE facilities to submit annual site environmental reports that summarize the environmental monitoring data results
- The September 7, 2000, OEPA Director's Findings and Orders (OEPA 2000), which requires continuation of the groundwater monitoring program as specified in this IEMP to meet Resource Conservation and Recovery Act (RCRA)/Ohio hazardous waste regulations for groundwater monitoring
- The current NPDES Permit for the FEMP, which requires monthly reports to demonstrate compliance with provisions in the NPDES Permit
- The 1986 FFCA, which, per an agreement made with the EPA and OEPA in January 1996, requires submittal of quarterly data reports. Note that this requirement is being fulfilled through the posting of all IEMP data to the IEMP Data Information Site as it becomes available, which is acceptable by the EPA and OEPA as signified by their approval of this IEMP revision.
- National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 Code of Federal Regulations 61, Subpart H, which requires submittal of an annual NESHAP report to demonstrate compliance with emission standards for radionuclides other than radon
- The Federal Facility Agreement (FFA), Control and Abatement of Radon-222 Emissions, signed November 19, 1991, which requires, per an agreement made with EPA and OEPA in January 1996, submittal of the continuous air monitoring data in selected on-site areas in a quarterly progress report.

### 8.3.2 Reporting Responsibilities

Under the IEMP consolidated reporting concept, each project is responsible for maintaining records of its project-specific monitoring program and reporting the data as defined in the appropriate project-specific controlling document. Concurrently, the data generated by sitewide environmental monitoring will be maintained and managed by the IEMP program. Project-specific data and interpretations thereof are being transmitted to the IEMP program to status the regulators, to support the annual review and biennial revision to the IEMP, and to support IEMP-sponsored annual site environmental reports. IEMP data are communicated to the remediation projects as warranted by evaluation of the IEMP data.

8.3.3 IEMP Reporting

This revision to the IEMP documents a change in the frequency of reporting IEMP data in hard copy form. The revised IEMP reporting frequency will be semiannually with a continued emphasis on timely data reporting in the form of electronic files. The semiannual reporting schedule will consist of a mid-year data summary report and the annual site environmental report, both of which are further discussed below. A password-protected IEMP Data Information Site, established in 2000, provides the regulatory agencies with timely access to data as it becomes available from the laboratories and data verification process. The mid-year data summary report, submitted annually at the end of November, will include sufficient information so that access to and use of the IEMP Data Information Site is not necessary for these reports to be meaningful. The format content and detail will be similar to past IEMP quarterly reports. The annual site environmental reports, along with the accompanying appendices, will remain unchanged. These reports will continue to be submitted annually by June 1 to provide a comprehensive annual evaluation of IEMP data for both the regulatory agencies and the public. More information on each aspect of IEMP reporting is provided below.

The IEMP Data Information Site

The password-protected IEMP Data Information Site allows the regulatory agencies access to data in a timely manner. The data is available to the agencies on the IEMP Data Information Site after analysis, analytical validation, entry into FEMP data systems, and review by environmental media personnel. These data are provided in the format of downloadable data files, and in some cases, user-defined queries for specific data sets are available. The IEMP Data Information Site data files also include a comment field that can be used to flag certain results, or provide the reason that a result is unavailable. The use of the IEMP Data Information Site for reporting IEMP data provides the agencies with access to IEMP data up to several months sooner than through the previous reporting structures. In addition to the environmental media addressed in the IEMP, water quality and water accumulation rate data from the on-site disposal facility is included on the IEMP Data Information Site.

Mid-Year Data Summaries

The mid-year data summaries represent a change from the previous IEMP quarterly status reports. This data summary will compile and summarize the data collected from January through June of each year.

The content of the mid-year data summaries will include tabular and graphical summaries of the January-June IEMP data, along with a brief discussion of any notable results or events related to that data. Notable results or events include anything that could potentially necessitate a change in site project operations or routine IEMP monitoring for the purpose of protecting human health and the environment. This includes unexpected FRL (or other action level) exceedances, results that show an unexpected upward trend, suspect results, etc. The tables and graphs contained in the report will include summary level data from the groundwater extraction system and total uranium plume; on-site disposal facility cell accumulation rates and water quality data; surface water and effluent discharge data; and air monitoring particulate and radon data. DOE will continue to work cooperatively with EPA and OEPA to identify which data should be routinely provided in this data summary to meet the needs of regulatory personnel.

The mid-year data summaries will be submitted to the regulatory agencies for their review by November 30 of each year. The reports will be made available to the public via the Public Environmental Information Center.

Annual Site Environmental Reports

The IEMP annual site environmental reports will continue to be submitted to EPA and OEPA on June 1 of each year. This report will remain essentially the same as in years past, serving as the comprehensive report for a full calendar year of IEMP data. It will continue to document the technical approach and data reported for the groundwater , surface water, sediment, air, and biota monitoring programs, and will summarize CERCLA, RCRA, and waste management activities. The report will also include water quality and water accumulation rate data from the on-site disposal facility monitoring program. The summary report serves the needs of both the regulatory agencies and the public. The accompanying, detailed appendices compile the information reported on the IEMP Data Information Site, and are intended for a more technical audience including the regulatory agencies.

Figure 8-1 identifies the media that are being reported under the IEMP umbrella and the associated calendar schedule. As previously identified, because the IEMP is a "living document," a structured schedule of annual reviews and two-year revisions has been instituted. The annual review cycle provides the mechanism for identifying and initiating any IEMP program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review will be communicated to EPA and OEPA.

# FIGURE 8-1

## IEMP REPORTING SCHEDULE FOR 2003 AND 2004

| | 2003[a] | | | | | | | | | | | | 2004[a] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | First Quarter | | | Second Quarter | | | Third Quarter | | | Fourth Quarter | | | First Quarter | | | Second Quarter | | | Third Quarter | | | Fourth Quarter | | |
| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
| **GROUNDWATER/OSDF[b]** | ✶ | ✶ | ✶ | ✶ | ✶ | ✶ ✪ | ✶ | ✶ | ✶ | ✶ | ✶ ♦ | ✶ | ✶ | ✶ | ✶ | ✶ | ✶ | ✶ ✪ | ✶ | ✶ | ✶ | ✶ | ✶ ♦ | ✶ |
| **SURFACE WATER[c]** | ✶ | ✶ | ✶ | ✶ | ✶ | ✶ ✪ | ✶ | ✶ | ✶ | ✶ | ✶ ♦ | ✶ | ✶ | ✶ | ✶ | ✶ | ✶ | ✶ ✪ | ✶ | ✶ | ✶ | ✶ | ✶ ♦ | ✶ |
| **NPDES Permit Compliance** | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ | ✧ |
| **SEDIMENT[d]** | | | | | | ✪ | | | | | ✶ | | | | | | | ✪ | | | | | ✶ | |
| **BIOTA[e]** | | | | | | | | | | | ✶ | | | | | | | ✪ | | | | | | |
| **AIR[f]** | ✶ | ✶ | ✶ | ✶ | ✶ | ✶ ✪ | ✶ | ✶ | ✶ | ✶ | ✶ ♦ | ✶ | ✶ | ✶ | ✶ | ✶ | ✶ | ✶ ✪ | ✶ | ✶ | ✶ | ✶ | ✶ ♦ | ✶ |

✶ = Extranet Reporting
✧ = Monthly Reporting
♦ = Mid-Year Data Summary
✪ = Annual Reporting

[a]There is a time lag for reporting analytical results because of the time needed for analysis, analytical validation, entry into FEMP data systems, and review by environmental media personnel.
[b]Encompasses aquifer restoration operational assessment, aquifer conditions, and on-site disposal facility groundwater monitoring
[c]Encompasses NPDES, FFCA, and IEMP characterization monitoring
[d]Sediment data are collected annually, and will be added to the IEMP Data Information Site as they become available. This data will be covered in the annual site environmental report.
[e]Biota (i.e., produce), which is sampled every three years, will be sampled in the summer of 2003 and will be reported in the 2003 Site Environmental Report to be issued in June 2004.
[f]Encompasses all air monitoring programs including FFA and NESHAP Subpart H



000227

- 4528

References

# REFERENCES

Aller, L., T. W. Bennet, G. Hackett, R. J. Petty, J. H. Lehr, H. Sedoris, D. M. Nielson, J. E. Denne, 1989, Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, EPA Base 600/4-89/034, National Water Well Association, Columbus, OH.

American National Standards Institute, 1975, "American National Standards Institute - Performance, Testing and Procedural Specifications for Thermoluminescent Dosimetry: Environmental Applications," ANSI N545-1975.

FERMCO 1995, "Fernald Site Environmental Monitoring Plan," Revision 2, PL-1002, prepared for U.S. Department of Energy, Fernald Field Office, Cincinnati, OH.

Ohio Environmental Protection Agency, 2000, "Ohio EPA Director's Final, Findings and Orders, in the Matter of: U.S. Department of Energy, Fernald Environmental Management Project, P.O. Box 398704, Cincinnati, OH 45239," Ohio EPA, Columbus, OH.

Ohio Environmental Protection Agency, 1993, "Ohio EPA Director's Final, Findings and Orders, in the Matter of: U.S. Department of Energy, Fernald Environmental Management Project, P.O. Box 398704, Cincinnati, OH 45239," Ohio EPA, Columbus, OH.

U.S. Dept. of Energy, 2002a, "Design for Remediation of the Great Miami Aquifer South field Phase II Module," Draft Final, Revision A, Fernald Environmental Management Project, U.S. Dept. of Energy, Cincinnati, OH.

U.S. Dept. of Energy, 2002b, "Fernald Closure Project Performance Management Plan," Fernald Environmental Management Project, U.S. Dept. of Energy, Cincinnati, OH.

U.S. Dept. of Energy, 2002c, "Sitewide CERCLA Quality Assurance Project Plan," Revision 1, Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 2002d, "Site Environmental Report," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 2002e, "Technical Memorandum for On-Site Disposal Facility Cells 1, 2, and 3 Baseline Groundwater Conditions,"

U.S. Dept. of Energy, 2001a, "Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas," Draft Final, Revision A, Fernald Environmental Management Project, U.S. Dept. of Energy, Cincinnati, OH.

U.S. Dept. of Energy, 2001b, "Integrated Environmental Monitoring Plan," Revision 2, Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 2001c, "Sitewide Excavation Plan," Revision 1, Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

**REFERENCES**
**(Continued)**

U.S. Dept. of Energy, 2000a, "Conceptual Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Cincinnati, OH.

U.S. Dept. of Energy, 2000b, "Re-Injection Demonstration Test Report for the Aquifer Restoration and Wastewater Project," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Cincinnati, OH.

U.S. Dept. of Energy, 1999a, "Integrated Environmental Monitoring Plan," Revision 1, Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1999b, "Integrated Site Environmental report," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1998, "Sitewide Excavation Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997a, "Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1)," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997b, "Integrated Environmental Monitoring Plan," Revision 0, Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997c, "On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997d, "Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997e, "Restoration Area Verification and Sampling Program, Project Specific Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1996a, "Phase VII Removal Actions and Reporting Requirements Under the Fernald Environmental Management Project Legal Agreements," letter DOE-0395-96 from Johnny Reising, U.S. DOE to James A. Saric, U.S. EPA, and Tom Schneider, Ohio EPA, dated January 16, 1996.

U.S. Dept. of Energy, 1996b, "Record of Decision for Remedial Actions at Operable Unit 5," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1996c, "Remedial Design Work Plan for Remedial Actions at Operable Unit 5," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

**REFERENCES**
**(Continued)**

U.S. Dept. of Energy, 1995a, "Characterization of Background Water Quality for Streams and Groundwater Report," Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1995b, "Feasibility Study Report for Operable Unit 5," Final, Fernald Environmental Management Project, Final, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1995c, "Proposed Plan for Operable Unit 5," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1995d, "Remedial Investigation Report for Operable Unit 5," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1993, "Routine Groundwater Monitoring Program Along the Downgradient Boundary of the FEMP," Revision 1, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1992, "The Work Plan for the South Contaminated Plume Removal Action," Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1991, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance," DOE/EH-0173T, Assistant Secretary for Environment, Safety and Health, Washington, DC.

U.S. Environmental Protection Agency, 1992, "General Methods for Remedial Operation Performance Evaluatons," Kerr Environmental Research Laboratory, Ada, OK.

Appendix A

# APPENDIX A

# THE REVISED GROUNDWATER MONITORING APPROACH

# TABLE OF CONTENTS

-- 4528

Page

Appendix A The Revised Groundwater Remedy Performance Monitoring Approach ..... A-1

References ..... A-9

## LIST OF TABLES

Table A-1 Groundwater FRL Exceedances Based on Samples and Locations Since IEMP Inception (from August 1997 through 2001)

Table A-2 Groundwater FRL Exceedances from 1997 through 2001 by Quarter

Table A-3 IEMP Constituents with FRL Exceedances, Location of Exceedances, and Revised Monitoring Program

## LIST OF FIGURES

Figure A-1 Groundwater Aquifer Zones and Aquifer Restoration Footprint

Figure A-2 Monitoring Well Locations with Concentrations above the FRL for Antimony

Figure A-3 Monitoring Well Locations with Concentrations above the FRL for Arsenic

Figure A-4 Monitoring Well Locations with Concentrations above the FRL for Boron

Figure A-5 Monitoring Well Locations with Concentrations above the FRL for Carbon Disulfide

Figure A-6 Monitoring Well Locations with Concentrations above the FRL for Fluoride

Figure A-7 Monitoring Well Locations with Concentrations above the FRL for Lead

Figure A-8 Monitoring Well Locations with Concentrations above the FRL for Manganese

Figure A-9 Monitoring Well Locations with Concentrations above the FRL for Molybdenum

Figure A-10 Monitoring Well Locations with Concentrations above the FRL for Nickel

Figure A-11 Monitoring Well Locations with Concentrations above the FRL for Nitrate/Nitrite

Figure A-12 Monitoring Well Locations with Concentrations above the FRL for Technetium-99

Figure A-13 Monitoring Well Locations with Concentrations above the FRL for Trichloroethene

Figure A-14 Monitoring Well Locations with Concentrations above the FRL for Uranium, Total

Figure A-15 Monitoring Well Locations with Concentrations above the FRL for Vanadium

Figure A-16 Monitoring Well Locations with Concentrations above the FRL for Zinc

Figure A-17 Locations for Semi-Annual Total Uranium Monitoring

Figure A-18 Locations for Semi-Annual Uranium and Non-Uranium Monitoring Property/Plume Boundary, South Field, and Waste Storage Area

# APPENDIX A

# THE REVISED GROUNDWATER MONITORING APPROACH

4528

## A.1 INTRODUCTION

This appendix provides detailed justification for the revised groundwater sampling program provided in Section 3.0. The groundwater monitoring program is being revised based on the results and findings derived from evaluating the nearly five years of groundwater data that have been collected under the Integrated Environmental Monitoring Plan (IEMP). The general absence of final remediation level (FRL) exceedances, based on the five years of sampling under the IEMP program, indicated further review of the program was warranted to identify refinements that are consistent with the program objectives.

The groundwater sampling program conducted under the IEMP has remained largely unchanged for the last five years since it was initiated in August 1997. The sampling program objectives are to develop and use a representative monitoring strategy to successfully track remedy progress and ultimately determine groundwater restoration completion while satisfying regulatory commitments and administrative requirements. These objectives remain unchanged in the revised approach.

Conservative constituent selection criteria were developed to support the sampling program. These criteria included categorizing the 50 FRL constituents according to their fate and transport mobility characteristics and identifying the location-specific distribution of each constituent's FRL exceedances in the aquifer. The initial basis for each constituent's distribution was sampling results from 1988 through 1995 (IEMP Rev. 0). This sampling was conducted in support of the Operable Unit 5 Remedial Investigation/Feasibility Study and subsequent, pre-IEMP programs. The constituent FRL exceedance distributions were updated with IEMP data through 1999 in the IEMP Revision 2. The distribution of the constituent-specific FRL exceedances was evaluated on a zone-by-zone basis to identify the geographic distribution of the exceedances. The five established zones, 0 through 4, include areas both inside and outside the 10-year, uranium-based groundwater restoration footprint and are comprised of the following general areas:

- Zone 0 – The area outside of Zones 1 through 4
- Zone 1 – Waste Storage Area
- Zone 2 – South Field
- Zone 3 – Northeastern portion of the site
- Zone 4 – Southern portion of the South Plume.

000233

Figure A-1 shows the areas covered by each zone along with the 10-year, uranium-based groundwater restoration footprint. The following sections provide a summary of the IEMP groundwater data results and findings (Section A.2), the groundwater monitoring approach (Section A.3), and the general conclusions (Section A.4).

## A.2 IEMP GROUNDWATER RESULTS AND FINDINGS

The overall summary results and findings of the IEMP groundwater data (1997 through 2001) are provided in two tables: Table A-1 presents the overall information for the 50 constituents with FRLs and Table A-2 provides specific information for those constituents that have FRL exceedances. Additionally, Figures A-2 through A-16 provide constituent-specific locations of those wells that have exceedances with respect to the site and the aquifer zones.

### IEMP Groundwater Data for the 50 FRL Constituents

Table A-1 summarizes of groundwater sampling results since the inception of IEMP program and contains the following information:

- Column 1 lists the 50 constituents for which FRLs were established in the Operable Unit 5 Record of Decision
- Column 2 lists the respective FRL concentration for each of the constituents
- Column 3 identifies the basis for each FRL constituent (i.e. Risk, applicable or relevant and appropriate requirement [ARAR], Background, or Detection limit) as defined in the Operable Unit 5 Feasibility Study Report
- Column 4 documents the number of samples that have been analyzed for each constituent since the start of IEMP sampling
- Column 5 notes the number of samples that have had a concentration greater than the FRL for each constituent
- Column 6 notes the percent of the samples for each constituent that have had a concentration greater than the FRL
- Column 7 identifies the zones where FRL exceedances have been observed and the number of wells in each zone that had exceedances
- Column 8 shows the above FRL concentration range for each constituent that had FRL exceedances.

As can be seen in the table, 35 of the constituents have not had any FRL exceedances while 15 of the 50 FRL constituents have had at least one FRL exceedance. Of the 15 constituents having FRL exceedances the following observations are noted:

- As expected, uranium is by far the predominant constituent of concern with approximately 25% of the sample results exceeding the FRL
- Two other constituents have greater than 5% of their sample results above the FRL (zinc ~ 8% and manganese ~ 6%)
- Five constituents (nickel, lead, technetium-99, nitrate, and arsenic) have between1% and 2% of their sample results above their respective FRL
- Six constituents (boron, molybdenum, carbon disulfide, trichloroethene, antimony, and fluoride) have more than one FRL exceedance, but all six have less than 1% of their sample results exceeding their respective FRL
- One constituent, vanadium, has only a one-time exceedance in 1998 in one well.

IEMP Groundwater Data for the FRL Exceedances

Figures A-2 through A-16 show the geographic distribution for the 15 constituents with FRL exceedances. Of the 126 wells sampled, these maps indicate that:

- Uranium is the constituent that has the greatest number of wells with exceedances. These exceedances have occurred in Zones 1 through 4.
- Both zinc and manganese have exceedances in Zone 0 through 4 in 36 and 27 wells, respectively. The remaining 12 constituents have exceedances in less than nine wells, with vanadium having an exceedance in only one well.
- Four constituents have exceedances in only one zone (i.e., boron – Zone 2 [South Field], molybdenum – Zone 1 [Waste Storage Area], technetium-99 – Zone 1 [Waste Storage Area], and trichloroethene – Zone 1 [Waste Storage Area])
- Five constituents (boron, molybdenum, nitrate/nitrite, technetium-99, and trichloroethene) have exceedances solely inside the 10-year restoration footprint; nine constituents have exceedances both inside and outside the footprint, while vanadium has an exceedance in solely one well which is located outside the footprint.

With the exception of uranium, for the most part these constituents had exceedances in a limited number of wells and the spatial distribution of these exceedances indicates many of these constituents are not associated with a plume.

Table A-2 identifies the frequency of FRL exceedances for each well and constituent that had an exceedance since the inception of the IEMP. This table contains the following information:

- Column 1 lists the 14 non-uranium constituents which have FRL exceedances since the inception of the IEMP
- Column 2 lists the respective wells that have FRL exceedances for each of the constituents
- Column 3 identifies the corresponding zone for each well with an exceedance
- Column 4 identifies the frequency each constituent is monitored at the well of interest
- Columns 5 through 9 show for each year and quarter (August 1997 through December 2001), the distribution of each constituent/well FRL exceedance. The "Xs" denote when an exceedance occurred.

From review of Table A-2, the following observations can be made for the 14 non-uranium constituents with more than one FRL exceedance:

- Overall in 2001 there are fewer FRL exceedances than for the previous years: antimony (Zone 2), manganese (Zones 0, 1, 3), molybdenum (Zone 1), nickel (Zone 2), nitrate/nitrite (Zone 1), technetium-99 (Zone 1), trichloroethene (Zone 1), and zinc (Zones 0 and 4).
- The reduction in the number of exceedances in 2001 is particularly striking for metals which may be attributable to sample filtering. Filtering of samples requiring metals analysis was instituted in 2001 (per IEMP Rev. 2) for samples with turbidity greater than 5 NTU. The 2001 filtered sample results indicate that previous metals results from unfiltered, turbid samples, may be biased high due to dissolution of fine particles suspended in the sample by the sample preservative.
- In general, most constituents do not have concentrations that are consistently above their respective FRLs. Those constituents with consistent exceedances include: boron (Zone 2), manganese (Zone 1), molybdenum (Zone 1), nickel (Zone 2), nitrate/nitrite (Zone 1), technetium-99 (Zone 1), trichloroethene (Zone 1), and zinc (Zones 2 and 3).

Note: Consistent exceedances are considered to be any constituent/well combination that has at least four consecutive exceedances. Sampling frequencies, which are identified in Table A-2, have been factored into this evaluation.

Conclusions

All the information presented in the above referenced tables and figures identify the general absence of FRL exceedances for many of the FRL constituents since the inception of IEMP sampling. This absence of FRL exceedances indicates the need to revise the IEMP groundwater sampling program to be more focused on those constituents that have been and continue to exceed their respective FRLs in the areas where these exceedances are occurring. In revising the sampling program, first and foremost it is necessary to ensure the overall objectives of the groundwater sampling program are achieved. Therefore, the monitoring approach will ensure that those constituents that have had FRL exceedances will continue to be monitored to track the progress of the remedy and to determine if it is necessary to change the design of the aquifer remedy. Additionally, those constituents that have not had FRL exceedances will continue to be monitored to ensure that remediation of the source operable units is not adversely impacting aquifer conditions. Monitoring requirements will also continue to satisfy regulatory commitments and administrative requirements (Paddys Run Road Site).

## A.3 MONITORING APPROACH

The following subsections describe the details associated with the monitoring approach:

- Monitoring FRL constituents with exceedances – Section A.3.1
- Monitoring FRL constituents without exceedances – Section A.3.2
- Monitoring to satisfy regulatory commitments and administrative requirements – Section A.3.3.

Each section provides the constituents to be monitored along with the frequencies and locations.

### A.3.1 Monitoring FRL Constituents With Exceedances

Constituents with exceedances have, in the past, been monitored as frequently as quarterly or at least annually. Slow groundwater flow rates and the resultant slow plume migration rates justify going to a semi-annual sampling schedule. Specifically, on average the uranium contamination only travels 33-83 feet per year (Remedial Investigation Report for Operable Unit 5 [DOE 1995]). Therefore, monitoring at a semi-annual frequency should be sufficient to track the overall groundwater remedy.

To successfully address the monitoring of those constituents that had FRL exceedances, the following criteria were considered:

- Geographic location (i.e., zones) of exceedances
- Consistency and recentness of exceedances.

For the 15 constituents shown to have exceedances the following monitoring is recommended:

1. Uranium, which is the primary constituent of concern and has the greatest number of wells with exceedances, will be monitored site-wide. Monitoring locations are presented in Figure A-17. Review of Figure A-17 indicates the spatial distribution and density of monitoring wells will be sufficient to ensure that remedy performance is successfully monitored. Note that in 2001/2002 an additional 37 monitoring wells were installed in to support monitoring of the Waste Storage Area Phase 1 Module (11 new monitoring wells) and the South Field Phase II Groundwater Restoration Module (26 new monitoring wells). These 37 wells were added to site-wide uranium monitoring program.

2. Constituents that have FRL exceedances in multiple zones (i.e., antimony, arsenic, fluoride, lead, manganese, nickel, and zinc) will be monitored as follows:

   - At a minimum, all constituents will be monitored at locations which will include existing property boundary/On-Site Disposal Facility wells along the eastern perimeter of the site and additionally those wells along the eastern/southern boundary of the South Plume. Figure A-18 (Area C) shows the configuration of this monitoring network, which lies in Zones 0, 2, 3, and 4 and for the most part outside of the restoration footprint. Monitoring at these locations will ensure that the progress of the remedy is being tracked and determine if it is necessary to change the design of the aquifer remedy.

     Note: Carbon disulfide and nitrate/nitrite are considered to have legitimate exceedances in only one zone (i.e., Zone 1) and are discussed below (item #3).

   - In addition to being monitored in Zones 0, 2, 3, and 4, constituents that have exceedances in multiple zones were evaluated with respect to Zone 1 to determine if monitoring should be conducted to address consistent/recent exceedances in this area. Monitoring will be addressed in this zone, in addition to the monitoring at the Property/Plume Boundary, to ensure that the constituents exhibiting consistent/recent exceedances are being monitored near potential sources. From review of Table A-2, only manganese in Zone 1 appears to have recent and consistent exceedances. Therefore, it will be monitored in this zone at wells that have exceedances. Refer to Figure A-18 (Area A) for the locations to be monitored in Zone 1.

3. Constituents that have FRL exceedances in only one zone will be monitored solely in that zone. The monitoring will consist of the following: carbon disulfide, molybdenum, nitrate/nitrite, technetium-99, and trichloroethene in Zone 1/Waste Storage Area and boron in Zone 2/South Field. Specific monitoring locations will be based on the wells that have exceedances. Refer to Figure A-18 for the monitoring locations in Zones 1 and 2, which will be monitored for these constituents (Areas A and B, respectively).

   Note: Carbon disulfide primarily has exceedances in Zone 1. The two wells that have exceedances outside Zone 1 were property boundary wells 2432 and 3069. These wells were sampled quarterly and exceedances were minimally above the FRL (6 μg/L with respect to the 5.5 μg/L FRL). For well 2432, there have been no additional exceedances since the occurrence during first quarter 1999. In regard to the one exceedance for well 3069 that occurred during fourth quarter 2001, a duplicate result during the sampling event was below the FRL (Refer to Figure A-5). Results in 2002 will be used to evaluate persistence for well 3069.

   Nitrate/nitrite primarily has exceedances in Zone 1. One well, 2017, which is located in Zone 2, had a one-time exceedance in 1998.

4. Vanadium has a one-time exceedance in 1998 during IEMP quarterly sampling at one well, 2426 (Refer to Table A-2). This constituent will be monitored on a less than semi-annual frequency due to the lack of exceedances. Monitoring for this constituent will be addressed in Section A.3.2 (Monitoring for FRL constituents without exceedances).

**Summary**

To facilitate the review, Table A-3 consolidates the above information pertaining to non-uranium constituents that have FRL exceedances and identifies whether these constituents have single or multiple zone exceedances. The table identifies which constituents have consistent/recent exceedances (i.e., manganese in Zone 1) and also identifies the monitoring program in which these constituents will be monitored.

The monitoring ensures that all FRL exceedances are monitored at sufficient frequencies (semi-annually) and locations to ensure that the remedy progress is being tracked, that monitoring near potential sources is occurring, and data is being collected to determine whether the remedy needs to be modified. Specifically, uranium will be monitored site-wide to track the overall remedy and determine when restoration is complete. Additionally, monitoring for non-uranium constituents both inside and outside the restoration footprint is addressed by sampling those constituents that have:

- Exceedances solely in one zone (carbon disulfide, molybdenum, nitrate/nitrite, technetium-99, and trichloroethene in Zone 1 and boron in Zone 2) in the zone/wells of concern. This sampling addresses the objectives of monitoring near potential sources and tracking of overall remedy progress.

- Multiple zone exceedances (antimony, arsenic, fluoride, lead, manganese, nickel, and zinc) at the Property/Plume Boundary, which encompasses Zones 0, 2, 3, and 4. This sampling addresses tracking of overall remedy progress and indicates whether a change to the remedy is necessary. Additionally, sampling for constituents with multiple zone exceedances that prove to be consistent/recent in Zone 1 (i.e., manganese [Zone 1]) will be conducted to monitor near potential sources and track the overall remedy progress.

### A.3.2 Monitoring FRL Constituents Without Exceedances

In general, those non-uranium FRL constituents, with no exceedances since the inception of the IEMP, will be monitored less frequently (i.e., every five years). All 50 FRL constituents were monitored in 2001 at approximately 90 locations, with the exception of the two dioxins and chromium VI, which were sampled at 19 and five locations, respectively. The overall lack of exceedances identified in this extensive 2001 sampling effort, along with the FEMP area groundwater flow rates, justify the frequency of monitoring every five years. In 2006, the entire list of constituents with FRLs will be sampled (47 at all IEMP groundwater sampling locations, three at select locations based on previous commitments as described below) to ensure the overall tracking of the remedy progress and to determine if any changes to the remedy design are necessary.

The following are some specific monitoring requirements for dioxins (i.e., octachlorodibenzo-p-dioxin and 2,3,7,8-tetrachlorodibenzo-p-dioxin) and chromium VI as part of the five-year monitoring:

- Sampling for dioxins will be at eight locations in the Waste Storage Area (2008, 2009, 2010, 2032, 2037, 2648, 2649, and 2821. In 2001, 19 locations (2008, 2009, 2010, 2016, 2032, 2027, 2045, 2046, 2048, 2385, 2648, 2649, 2821, 3009, 3032, 3045, 3046, 3385, and 3821) were monitored (reference DOE letter # DOE-0642-01, "Request to Reduce the Number of IEMP Groundwater Monitoring Wells to be Sampled for Dioxin", dated June 13, 2001). Of the 19 locations that were sampled for dioxins in 2001, there were no locations with detected dioxin results. Based on the results of the 2001 dioxin sampling, monitoring for dioxins should be reduced to the only remaining potential source area for dioxin, the waste pits.

- Sampling for chromium VI will be at Wells 22299, 22300, 22301, 22302, and 22303 as identified in the IEMP, Rev. 2 (DOE 2001). These wells are located within 25 feet of the re-injection wells.

A.3.3 Monitoring to Satisfy Regulatory Commitments and Administrative Requirements

The monitoring protocol outlined in Sections A.3.1 and A.3.2 will satisfy regulatory requirements currently identified in the IEMP, Rev. 2, Table 3-1 by continuing:

- Routine monitoring to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer

- Routine monitoring at wells located at the property boundary to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer

- Routine monitoring to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer

- Monitoring private wells to support the annual dose assessment that evaluates the contribution of the groundwater pathway to the annual dose to the public

- Routine sampling of the South Plume wellfield in terms of the total volume extracted and the amount of uranium removed.

With respect to administrative requirements, monitoring for Paddys Run Road Site constituents will continue. No change will be made to the current Paddys Run Road Site sampling program with respect to constituents and locations (Refer to Figure A-18 [shaded part of Area C] for monitoring locations). Monitoring will be conducted on a semi-annual basis concurrently with the Property/Plume Boundary sampling activity. Sampling for Paddys Run Road Site plume constituents (i.e., phosphorous, arsenic, potassium, sodium, benzene, ethyl benzene, isopropyl benzene, toluene, and total xylene) will continue in order to document the influence, or lack thereof, that the FEMP's remedial groundwater pumping is having on the Paddys Run Road Site plume.

## A.4 CONCLUSIONS

The sampling approach is considered conservative because constituents that had FRL exceedances during the five years of sampling under the IEMP will be monitored semi-annually in areas of concern. Additionally, those constituents that have not exceeded their FRL will continue to be monitored on a five-year basis. The sampling activities will still ensure that the groundwater sampling program objectives of satisfying regulatory commitments, developing and using representative monitoring constituent lists to successfully track remedy progress, and ultimately determining when groundwater restoration activities are complete will continue to be met.

## REFERENCES

U.S. Dept. of Energy, 2001, "Integrated Environmental Monitoring Plan," Rev. 2, Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1998, "Restoration Area Verification Sampling Program Summary Report," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997, "On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1995, "Remedial Investigation Report for Operable Unit 5," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

# TABLE A-1

## GROUNDWATER FRL EXCEEDANCES BASED ON SAMPLES AND LOCATIONS SINCE IEMP INCEPTION (FROM AUGUST 1997 THROUGH 2001)

| (1) Constituents | (2) Groundwater FRL[a] | (3) Basis for FRL[b] | (4) No. of Samples[c] | (5) No. of Samples > FRL[c,d] | (6) Percent of Samples > FRL | (7) Zones with FRL Exceedances (No. of Wells with exceedances in each Aquifer Zone)[c,d,e] | (8) Range above FRL[c,d,e] |
|---|---|---|---|---|---|---|---|
| Uranium, Total | 30 µgL | A | 2473 | 632 | 25.56% | 1(9) 2(35) 3(2) 4(16) | 30.13 J/844.991 - |
| Zinc | 0.021 mg/L | B | 854 | 70 | 8.20% | 0(10) 1(5) 2(14) 3(5) 4(2) | 0.0216 -/13.6 - |
| Manganese | 0.90 mg/L | B | 1025 | 62 | 6.05% | 0(5) 1(6) 2(8) 3(5) 4(3) | 0.916 -/105 J |
| Nickel | 0.10 mg/L | A | 853 | 19 | 2.23% | 0(1) 2(7) 3(1) | 0.101 -/1.54 - |
| Lead | 0.015 mg/L | A | 853 | 12 | 1.41% | 0(2) 1(2) 2(4) 3(1) | 0.0157 -/0.201 - |
| Technetium-99 | 94 pCi/L | R* | 1089 | 15 | 1.38% | 1(3) | 101.08 -/1352.266 J |
| Nitrate[f] | 11 mg/L | B | 1625 | 19 | 1.17% | 1(5) 2(1)[g] | 11.4 -/331 NV |
| Arsenic | 0.050 mg/L | A | 1046 | 12 | 1.15% | 0(1) 1(1) 2(1) 4(4) | 0.0547 -/0.125 - |
| Boron | 0.33 mg/L | R | 1516 | 14 | 0.92% | 2(2) | 0.331 -/1.16 - |
| Molybdenum | 0.10 mg/L | A | 674 | 5 | 0.74% | 1(1) | 0.207 -/0.69 - |
| Carbon disulfide | 0.0055 mg/L | A | 854 | 5 | 0.59% | 0(1)[h] 1(3) 2(1)[h] | 0.006 -/0.014 - |
| Trichloroethene | 0.0050 mg/L | A | 983 | 5 | 0.51% | 1(2) | 0.0207 -/0.120 - |
| Antimony | 0.0060 mg/L | A | 854 | 4 | 0.47% | 0(1) 1(1) 2(2) | 0.0073 J/0.0196 J |
| Fluoride | 4 mg/L | A | 1045 | 4 | 0.38% | 0(2) 1(1) 3(1) | 5.3 -/12.3 - |
| Vanadium | 0.038 mg/L | R | 810 | 1 | 0.12% | 0(1) | 0.0664 J[i] |
| 1,1-Dichloroethane | 0.28 mg/L | A | 86 | 0 | 0% | NA | NA |
| 1,1-Dichloroethene | 0.0070 mg/L | A | 323 | 0 | 0% | NA | NA |
| 1,2-Dichloroethane | 0.0050 mg/L | A | 602 | 0 | 0% | NA | NA |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 0.000010 mg/L | D | 19 | 0 | 0% | NA | NA |
| 4-Methylphenol | 0.029 mg/L | R | 86 | 0 | 0% | NA | NA |
| 4-Nitrophenol | 0.32 mg/L | R | 86 | 0 | 0% | NA | NA |
| alpha-Chlordane | 0.0020 mg/L | A | 490 | 0 | 0% | NA | NA |
| Aroclor-1254 | 0.00020 mg/L | D | 86 | 0 | 0% | NA | NA |
| Barium | 2.0 mg/L | A | 176 | 0 | 0% | NA | NA |
| Benzene | 0.0050 mg/L | A | 764 | 0 | 0% | NA | NA |
| Beryllium | 0.0040 mg/L | A | 762 | 0 | 0% | NA | NA |
| bis(2-Chloroisopropyl) ether | 0.0050 mg/L | D | 238 | 0 | 0% | NA | NA |
| bis(2-Ethylhexyl)phthalate | 0.0060 mg/L | A | 86 | 0[j] | 0% | NA[j] | NA |
| Bromodichloromethane | 0.10 mg/L | A | 489 | 0 | 0% | NA | NA |
| Bromomethane | 0.0021 mg/L | R | 86 | 0 | 0% | NA | NA |
| Cadmium | 0.014 mg/L | B | 853 | 0 | 0% | NA | NA |

# TABLE A-1
## (Continued)

| (1) Constituents | (2) Groundwater FRL[a] | (3) Basis for FRL[b] | (4) No. of Samples[c] | (5) No. of Samples > FRL[c,d] | (6) Percent of Samples > FRL | (7) Zones with FRL Exceedances (No. of Wells with exceedances in each Aquifer Zone)[c,d,e] | (8) Range above FRL[c,d,e] |
|---|---|---|---|---|---|---|---|
| Carbazole | 0.011 mg/L | R | 238 | 0 | 0% | NA | NA |
| Chloroethane | 0.0010 mg/L | D | 86 | 0 | 0% | NA | NA |
| Chloroform | 0.10 mg/L | A | 86 | 0 | 0% | NA | NA |
| Chromium VI | 0.022 mg/L | R | 12 | 0 | 0% | NA | NA |
| Cobalt | 0.17 mg/L | R | 762 | 0 | 0% | NA | NA |
| Copper | 1.3 mg/L | A | 101 | 0 | 0% | NA | NA |
| Mercury | 0.0020 mg/L | A | 1640 | 0 | 0% | NA | NA |
| Methylene chloride | 0.0050 mg/L | A | 86 | 0 | 0% | NA | NA |
| Neptunium-237 | 1.0 pCi/L | R* | 1396 | 0 | 0% | NA | NA |
| Octachlorodibenzo-p-dioxin | 1.0E-7 mg/L | D | 19 | 0 | 0% | NA | NA |
| Radium-226 | 20 pCi/L | A | 174 | 0 | 0% | NA | NA |
| Radium-228 | 20 pCi/L | A | 86 | 0 | 0% | NA | NA |
| Selenium | 0.050 mg/L | A | 853 | 0 | 0% | NA | NA |
| Silver | 0.050 mg/L | A | 746 | 0 | 0% | NA | NA |
| Strontium-90 | 8.0 pCi/L | A | 1204 | 0 | 0% | NA | NA |
| Thorium-228 | 4.0 pCi/L | R* | 850 | 0 | 0% | NA | NA |
| Thorium-230 | 15 pCi/L | R* | 86 | 0 | 0% | NA | NA |
| Thorium-232 | 1.2 pCi/L | R* | 775 | 0 | 0% | NA | NA |
| Vinyl chloride | 0.0020 mg/L | A | 489 | 0 | 0% | NA | NA |

[a]From Operable Unit 5 Record of Decision, Table 9-4
[b]From Operable Unit 5 Feasibility Study, Table 2-16:
A - ARAR based
B - Based on 95th percentile background concentrations
D - Based on lowest achievable detection limit
R - Risk based Preliminary Remediation Goal (PRG)
R*- Risk based Preliminary Remediation Level includes the radionuclide risk-based PRG plus its 95th percentile background concentration.
[c]Based on filtered and unfiltered samples from the August 1997 through 2001 IEMP groundwater data
[d]Sample results having a -, J, or NV qualifier were used:
- = result is confident as reported
J = result is quantitatively estimated
NV = result is not validated
[e]NA = not applicable
[f]Nitrate/nitrite results are evaluated with respect to the nitrate FRL.
[g]Since the IEMP inception, there has been only one nitrate/nitrite exceedance at Well 2017 in 1998, which has not occurred in later years (refer to Figure A-11).
[h]Since the IEMP inception, there has been one isolated exceedance for carbon disulfide at two locations (refer to Figure A-5)
[i]Since the IEMP inception, there has been only one vanadium exceedance at Well 2426 in 1998, which has not occurred in later years (refer to Figure A-15).
[j]Of the 86 samples analyzed for bis(2-Ethylhexyl)phthalate, a common laboratory containment, five had results above the FRL. The above FRL results are all considered suspect due to laboratory analysis issues, laboratory blank and field blank contamination, or field duplicate results being non-detected. The five results exceeding are as follows: 0.014J mg/L, Well 2398 and 0.010J mg/L, Well 3390 in Aquifer Zone 2; 0.016J mg/L, Well 2109 in Aquifer Zone 3; 0.008J mg/L, Well 2125 and 0.13J mg/L, Well 3095 in Aquifer Zone 4.

# TABLE A-2

## NON-URANIUM GROUNDWATER FRL EXCEEDANCES FROM 1997 THROUGH 2001 BY QUARTER

| Constituent | Well | Aquifer Zone | Sampling Frequency[a] | 1997 | | 1998 | | | | 1999 | | | | 2000[c] | | | | 2001 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 3[b] | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Antimony** | | | | | | | | | | | | | | | | | | | | | |
| | 2386 | 2 | A | | | | | x | | | | | | | | | | | | | |
| | 2426 | 0 | Q | | | | | | | | | | | | | | | | x | | |
| | 2551[d] | 2 | A | | | | | | | | | | | x | | | | | | | |
| | 3032 | 1 | A | | x | | | | | | | | | | | | | | | | |
| **Arsenic** | | | | | | | | | | | | | | | | | | | | | |
| | 2010 | 1 | A | | | | | | | | | | | | x | | | | | | |
| | 2385 | 2 | A | | | | | | | | | | | | | x | | | | | |
| | 2426 | 0 | A | | | x | x | | | | | | | | | | | | | | |
| | 2625 | 4 | Q | | | | | | | | | | | | x | | | | | | |
| | 2636 | 4 | Q | | x | x | | x | | x | x | | | | | | | | | | |
| | 2898 | 4 | Q | | | | | | | | | | | x | | | | | | | |
| | 2900 | 4 | Q | | | | | | | | | | | x | | | | | | | |
| **Boron** | | | | | | | | | | | | | | | | | | | | | |
| | 2045 | 2 | Q | | | | | | | | x | | x | | x | | | | | | |
| | 2049 | 2 | Q | x | x | | | x | x | x | x | x | x | x | x | | x | | | | |
| **Carbon disulfide** | | | | | | | | | | | | | | | | | | | | | |
| | 2027 | 1 | A | | | | | | | | | | x | | | | | | | | |
| | 2432 | 0 | Q | | | | | | | x[e] | | | | | | | | | | | |
| | 2649 | 1 | A | | | | | | x | | | | | | | | | | | | |
| | 3069 | 2 | Q | | | | | | | | | | | | | | | | | | x[f] |
| | 3821 | 1 | A | | | | | | | | | | x | | | | | | | | |
| **Fluoride** | | | | | | | | | | | | | | | | | | | | | |
| | 2424 | 0 | Q | | | | | | x | | | | | | | | | | | | |
| | 2431 | 0 | Q | | | | | | x | | | | | | | | | | | | |
| | 3821 | 1 | Q | | | | | | x | | | | | | | | | | | | |
| | 4067 | 3 | Q | | | | | | x | | | | | | | | | | | | |
| **Lead** | | | | | | | | | | | | | | | | | | | | | |
| | 2054 | 3 | A | | | | | | | | | | | | x | | | | | | |
| | 2385 | 2 | A | | | | | | | | | | | | | x | | | | | |
| | 2431 | 0 | Q | | | | | | | | | | | x | | | | | | | |
| | 2648 | 1 | A | | x | | | | | | | | | | | | | | | | |
| | 3032 | 1 | A | | x | | | | | | | | | | | | | | | | |
| | 3045 | 2 | A | x | | | | | | | | x | | | | | | | | | |
| | 3068[g] | 2 | A | x | | | | | | | | | | | | | | | | | |
| | 3387 | 2 | A | | | | | x | | | | x | | | | | | | | | |
| | 3733 | 0 | Q | x | | | | | | | | | | | | | x | | | | |

# TABLE A-2
## (Continued)

| Constituent | Well | Aquifer Zone | Sampling Frequency[a] | 1997 | | 1998 | | | | 1999 | | | | 2000[c] | | | | 2001 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 3[b] | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Manganese** | | | | | | | | | | | | | | | | | | | | | |
| | 2010 | 1 | A | | | | | | | | | | | | | x | | | | x | |
| | 2027 | 1 | A | | | | | | | | | | | | x | | | | | | |
| | 2054 | 3 | A | | x | | | | | | | | | | x | | | | | | |
| | 2118 | 3 | A | | | | | | | | | | x | | x | | | | | | |
| | 2385 | 2 | A | | | | | x | | | | x | | | | x | | | | | |
| | 2386 | 2 | A | | | | | x | | | | | | | | | | | | | |
| | 2389 | 3 | A | | | | | | | | | | x | | x | | | | x | | |
| | 2397 | 2 | A | | | | | | | | | | | | | x | | | | | |
| | 2417 | 3 | Q | | | | | | | | | | | | | x | | | | | x |
| | 2424 | 0 | Q | | | | | | | | | | | | | x | | | | | |
| | 2426 | 0 | Q | | | x | x | | | | | x | | | | | | | | | |
| | 2429 | 0 | Q | | | | | | | | | | | | | | x | | | | |
| | 2430 | 3 | Q | x | | x | x | | | | | | | | | x | x | | | | |
| | 2431 | 0 | Q | | | x | x | | | | | | | | | | | | | | |
| | 2432 | 0 | Q | | | | | | | | | | | | | | x | | | x | x |
| | 2648 | 1 | A | | x | | | | x | | | | x | | x | | | | x | | |
| | 2899 | 4 | A | | | | | | | | | | | | | x | | | | | |
| | 2900 | 4 | A | | | | | | | | | | | | | x | | | | | |
| | 3027[g] | 1 | A | | x | | | | x | | | | x | | x | | x | | | | |
| | 3032 | 1 | A | | x | | | | | | | | | | | | | | | | |
| | 3045 | 2 | A | x | | | | | | | | x | | | | x | | | | | |
| | 3068[g] | 2 | A | x | | | | | | | | | | | | | | | | | |
| | 3385 | 2 | A | x | | | | x | | | | | | | | | | | | | |
| | 3387 | 2 | A | | | | | x | | | | x | | | | | | | | | |
| | 3397 | 2 | A | x | | | | | | | | | | | | | | | | | |
| | 3821 | 1 | A | | | | | | | | | | x | | x | | | | x | | |
| | 3880 | 4 | A | | | | | x | | | | | | | | | | | | | |
| **Molybdenum** | | | | | | | | | | | | | | | | | | | | | |
| | 2649 | 1 | A | | x | | | | x | | | | x | | x | | | | x | | |
| **Nickel** | | | | | | | | | | | | | | | | | | | | | |
| | 2054 | 3 | A | | | | | | | | | | | | x | | | | | | |
| | 22198 | 0 | Q | | | | | | | | | | x | | | | | | | | |
| | 2385 | 2 | A | | | | | | | | | | | | | x | | | | | |
| | 2386 | 2 | A | | | | | x | | | | x | | | | x | | | | | |
| | 2387 | 2 | A | | | | | x | | | | x | | | | x | | | | | |
| | 2398 | 2 | Q | x | | x | x | x | x | | | x | x | | | | | | | | |
| | 2434 | 2 | Q | | | | | | | | | | | | | | | | | | x |
| | 3387 | 2 | A | | | | | x | | | | | | | | | | | | | |
| | 4398 | 2 | Q | | | | | | | x | | | | | | | | | | | |

# TABLE A-2
## (Continued)

| Constituent | Well | Aquifer Zone | Sampling Frequency[a] | 1997 | | 1998 | | | | 1999 | | | | 2000[c] | | | | 2001 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 3[b] | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Nitrate/Nitrite** | | | | | | | | | | | | | | | | | | | | | |
| | 2017 | 2 | NA[h] | | | | | x[h] | | | | | | | | | | | | | |
| | 2648 | 1 | Q | | | | x | | | | | | x | | x | | | x | | | |
| | 2649 | 1 | Q | | x | | x | | x | | x | | x | | x | | x | x | x | x | x |
| | 2821 | 1 | Q | | | | | | | | | | x | | | | | | | | |
| | 3009 | 1 | Q | | | | x | | | | | | | | | | | | | | |
| | 3821 | 1 | Q | | | | | | | | | | | | | | x | | | | |
| **Technetium-99** | | | | | | | | | | | | | | | | | | | | | |
| | 2648 | 1 | Q | | | | | | | | | | x | | | | | x | x | | |
| | 2649 | 1 | Q | | x | | x | | x | | x | | x | | x | | x | x | x | x | x |
| | 2821 | 1 | Q | | | | | | | | | | x | | | | | | | | |
| **Trichloroethene** | | | | | | | | | | | | | | | | | | | | | |
| | 2649 | 1 | A | | | | | | x | | | | x | | x | | | | x | | |
| | 3009 | 1 | A | | | | | | | | | | x | | | | | | | | |
| **Vanadium** | | | | | | | | | | | | | | | | | | | | | |
| | 2426 | 0 | Q | | | | x[i] | | | | | | | | | | | | | | |
| **Zinc** | | | | | | | | | | | | | | | | | | | | | |
| | 2010 | 1 | A | | | | | | | | | | | | x | | | | | | |
| | 2051 | 0 | Q | | | | | | | | | | | | | | | | | | x |
| | 2054 | 3 | A | | x | | | | | | | | | | x | | | | | | |
| | 2068 | 2 | A | x | | | | | | | | | | | | x | | | | | |
| | 2106 | 2 | Q | x | | | | | | | | | | | | | | | | | |
| | 2118 | 3 | A | | x | | | | | | | | | | | | | | | | |
| | 2385 | 2 | A | | | | | x | | | | | | | | x | | | | | |
| | 2398 | 2 | Q | | | | x | | | | | | | | | | | | | | |
| | 2424 | 0 | Q | | | | | x | x | x | | | | x | | | | | | | |
| | 2426 | 0 | Q | | | x | x | | | | | | | x | | | | | | | |
| | 2430 | 3 | Q | | | | | | | | | | | x | | x | x | | | | |
| | 2431 | 0 | Q | | | | | x | x | | | | | x | | | | | | | |
| | 2432 | 0 | Q | | | | | | | x | | | | x | | | x | | | | |
| | 2434 | 2 | Q | | | | | | x | | | | | | | x | | | | | |
| | 2551[d] | 2 | A | | | | | | | | | | | x | | | | | | | |
| | 2648 | 1 | A | | x | | | | x | | | | | | | | | | | | |
| | 2733 | 0 | Q | | | | | | | | x | | | | | | | | | | |
| | 2900 | 4 | A | | | | | | | | | | | | | x | | | | | |
| | 3027[g] | 1 | A | | x | | | | | | | | | | | | | | | | |
| | 3032 | 1 | A | | x | | | | | | | | | | | | | | | | |
| | 3045 | 2 | A | x | | | | | | | | x | | | | x | | | | | |
| | 3067 | 3 | Q | | | | | | | | | | | | | x | | | | | |
| | 3068[g] | 2 | A | x | | | | | | | | | | | | | | | | | |

# TABLE A-2
## (Continued)

| Constituent | Well | Aquifer Zone | Sampling Frequency[a] | 1997 | | 1998 | | | | 1999 | | | | 2000[c] | | | | 2001 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 3[b] | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Zinc (Cont'd)** | | | | | x | | | | | | | | | | | | | | | | |
| | 3069 | 2 | Q | | x | | | | | | | | | | | | | | | | |
| | 3106 | 2 | Q | | | x | | | | | | | | | | | | | | | |
| | 3385 | 2 | A | x | | | | x | | | | x | | | | x | | | | | |
| | 3387 | 2 | A | x | | | | x | | | | x | | | | x | | | | | |
| | 3397 | 2 | A | x | | | | x | | | | | | | | x | | | | | |
| | 3402 | 2 | A | | | | | | | | | | | | | x | | | | | |
| | 3426 | 0 | Q | | | | | | | | x | | x | | | | | | | | |
| | 3429 | 0 | Q | | | | | | | x | x | | | | | | | | | | |
| | 3821 | 1 | A | | | | | | x | | | | | | | | | | | | |
| | 3899 | 4 | A | | | | | | | | | | | | | | | | x | | |
| | 4067 | 3 | Q | | | | | x | x | x | x | x | x | | | | | | | | |
| | 4426 | 0 | Q | | | | | | | | x | | | | | | | | | | |
| | 41217 | 0 | Q | | | | | x | | | | | | | | | | | | | |

[a]As defined in the IEMP, Rev. 2, the sampling frequencies are:
A = annual
Q = quarterly
[b]Sampling for the IEMP was initiated in August 1997.
[c]Those constituents that have exceedances in multiple zones and have had exceedances based on annual 2000 sample results will be evaluated for persistence with 2002 data.
[d]As identified in the IEMP, Rev. 2, Well 2551 was plugged and abandoned in 2000 after the landowner chose not to renew the access agreement.
[e]Well 2432 had a carbon disulfide exceedance (6 µg/L with respect to the 5.5 µg/L FRL) in the first quarter of 1999. At no other time has this well had an exceedance.
[f]Well 3069 had a one time carbon disulfide exceedance (6 µg/L with respect to 5.5 µg/L FRL) in fourth quarter 2001. The field duplicate result (5 µg/L) from this well was below the FRL.
[g]In 2000 this well was plugged and abandoned.
[h]Well 2017 had a nitrate/nitrite exceedance (331 mg/L with respect to 11 mg/L FRL) in third quarter 1998. At no other time has this well had an exceedance. Results have been usually less than 1 mg/L. The well was sampled as per the Re-Injection Test Plan.
[i]Well 2426 had a vanadium exceedance (0.0664 mg/L with respect to 0.038 mg/L FRL) in second quarter 1998. At no other time has this well had an exceedance.

-- 4528

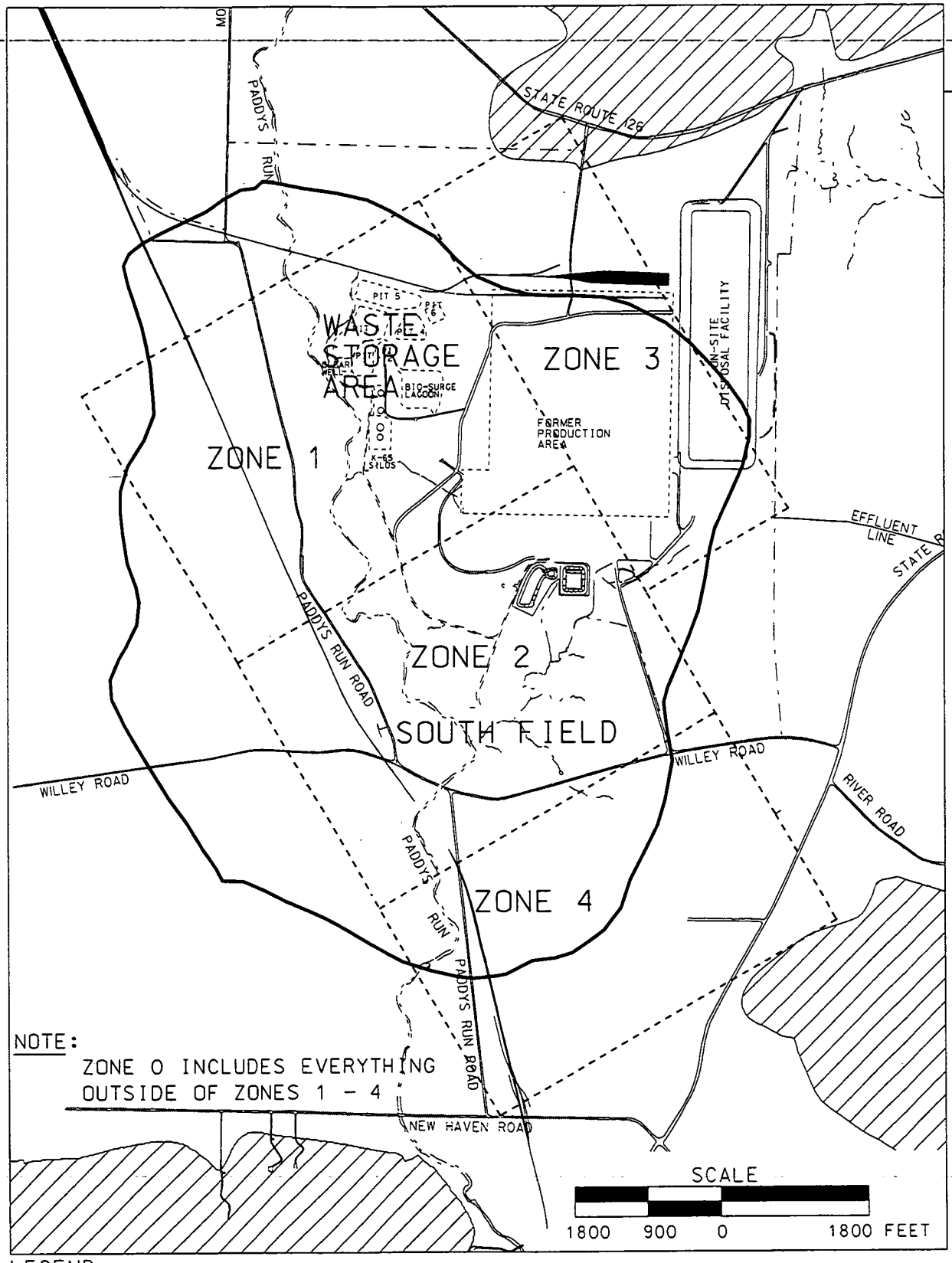
## TABLE A-3

## IEMP NON-URANIUM CONSTITUENTS WITH FRL EXCEEDANCES, LOCATION OF EXCEEDANCES, AND REVISED MONITORING PROGRAM

| Parameter | Aquifer Zones with Exceedances | Monitoring Program |
|---|---|---|
| Antimony | Multiple Zones | Property/Plume Boundary |
| Arsenic | Multiple Zones | Property/Plume Boundary |
| Boron | Aquifer Zone 2 (South Field) | South Field |
| Carbon Disulfide | Aquifer Zone 1 (Waste Storage Area) | Waste Storage Area |
| Fluoride | Multiple Zones | Property/Plume Boundary |
| Lead | Multiple Zones | Property/Plume Boundary |
| Manganese | Multiple Zones[a] | Property/Plume Boundary, Waste Storage Area |
| Molybdenum | Aquifer Zone 1 (Waste Storage Area) | Waste Storage Area |
| Nickel | Multiple Zones | Property/Plume Boundary |
| Nitrate/Nitrite | Aquifer Zone 1 (Waste Storage Area) | Waste Storage Area |
| Technetium-99 | Aquifer Zone 1 (Waste Storage Area) | Waste Storage Area |
| Trichloroethene | Aquifer Zone 1 (Waste Storage Area) | Waste Storage Area |
| Zinc | Multiple Zones | Property/Plume Boundary |

[a]There are consistent/recent exceedances of manganese in Zone 1; therefore, this constituent will be monitored in the Waste Storage Area.

000250




NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

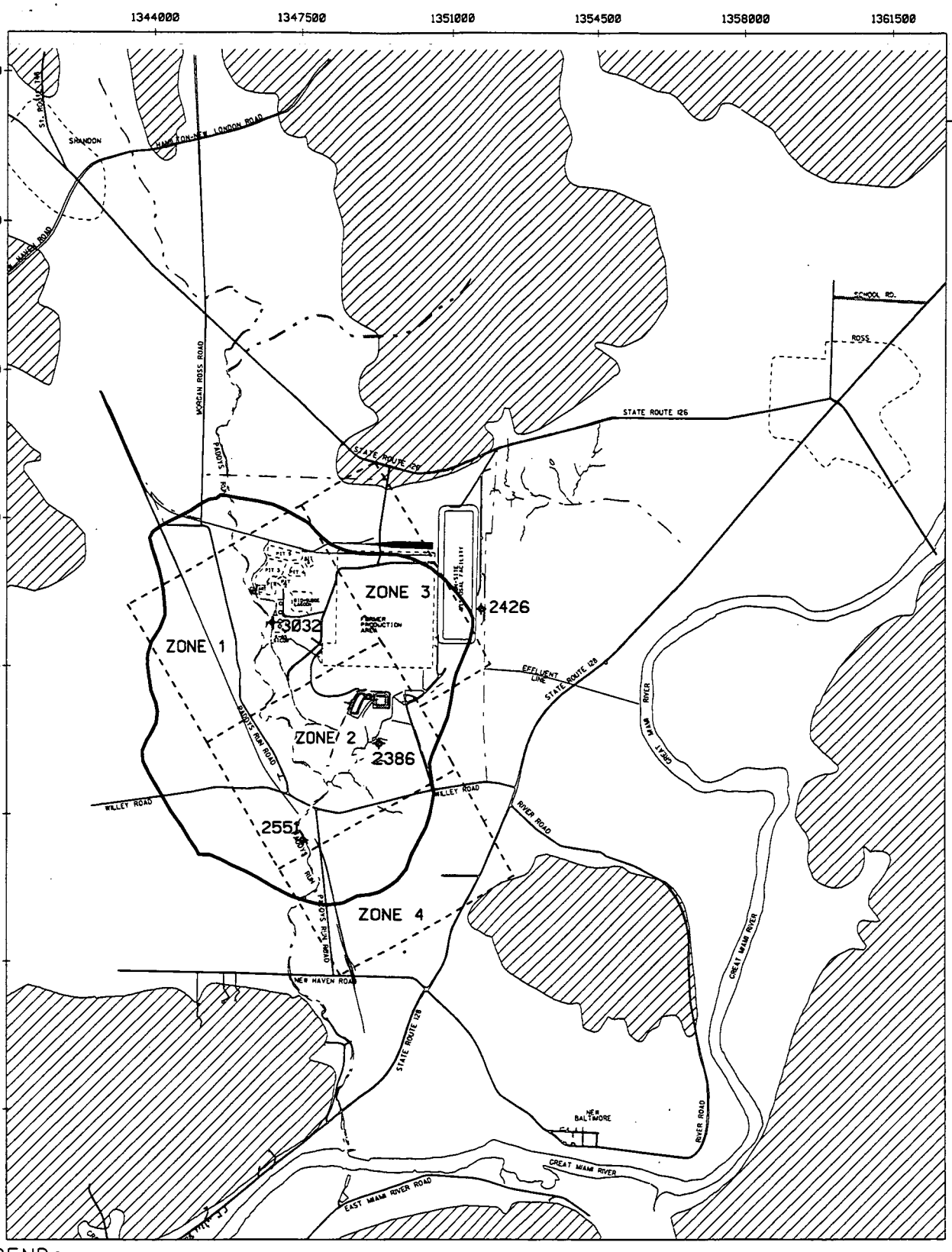
LEGEND:
10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
FEMP BOUNDARY
BEDROCK HIGHS

DRAFT
FINAL

000251

FIGURE A-1. GROUNDWATER AQUIFER ZONES AND AQUIFER RESTORATION FOOTPRINT

v:\5fop1\dgn\02revision\epa-letter\02rvlet03.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




LEGEND:

- - - - - FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

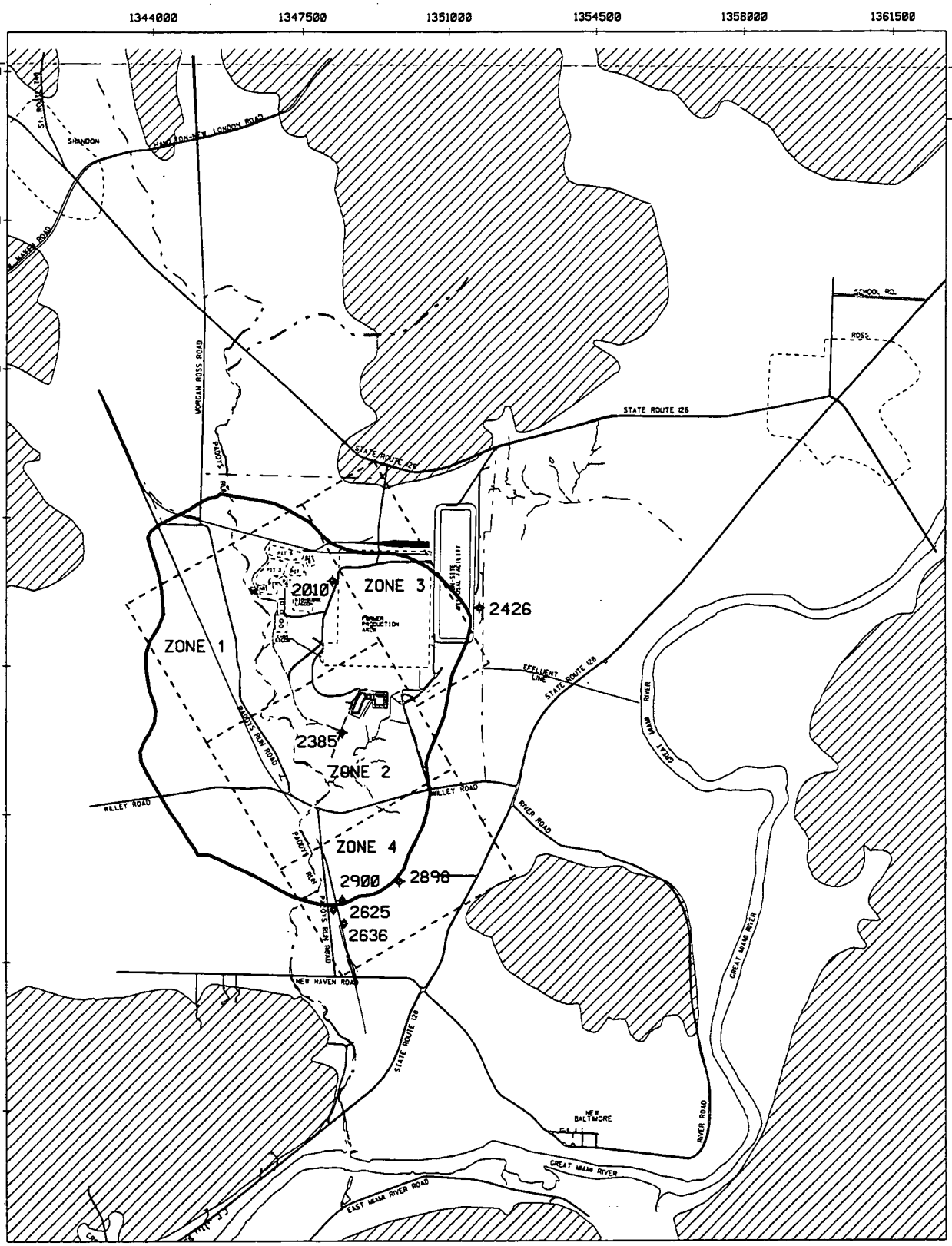
DRAFT FINAL

v:\5fgp1\dgn\02revision\epa-letter\impconst03.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002

FIGURE A-2. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR ANTIMONY




LEGEND:

- - - - FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

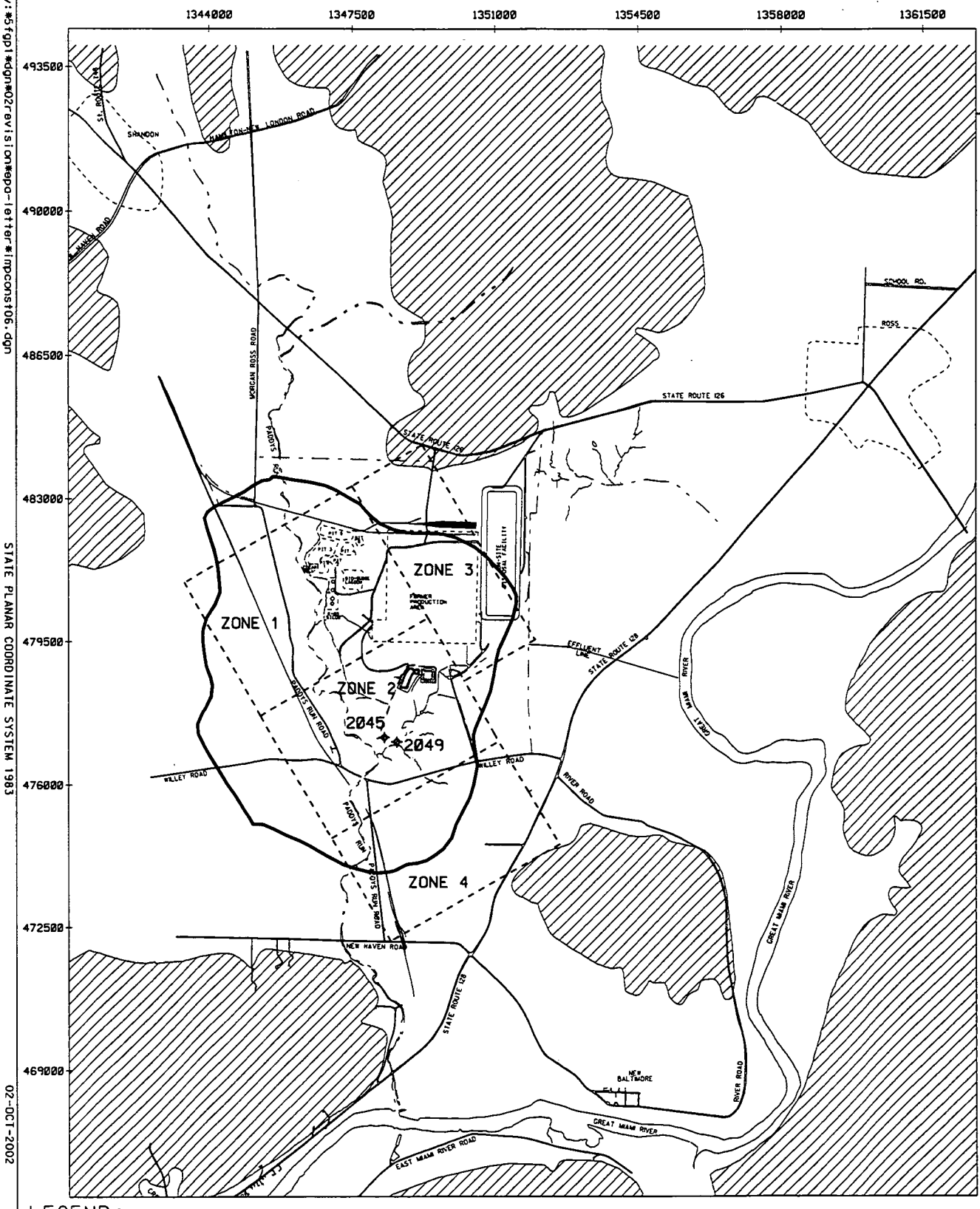
3500 1750 0 3500 FEET

DRAFT FINAL

FIGURE A-3. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR ARSENIC



v:\fdp1\dgn\02revision\epa-letter\impconst04.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 – 4

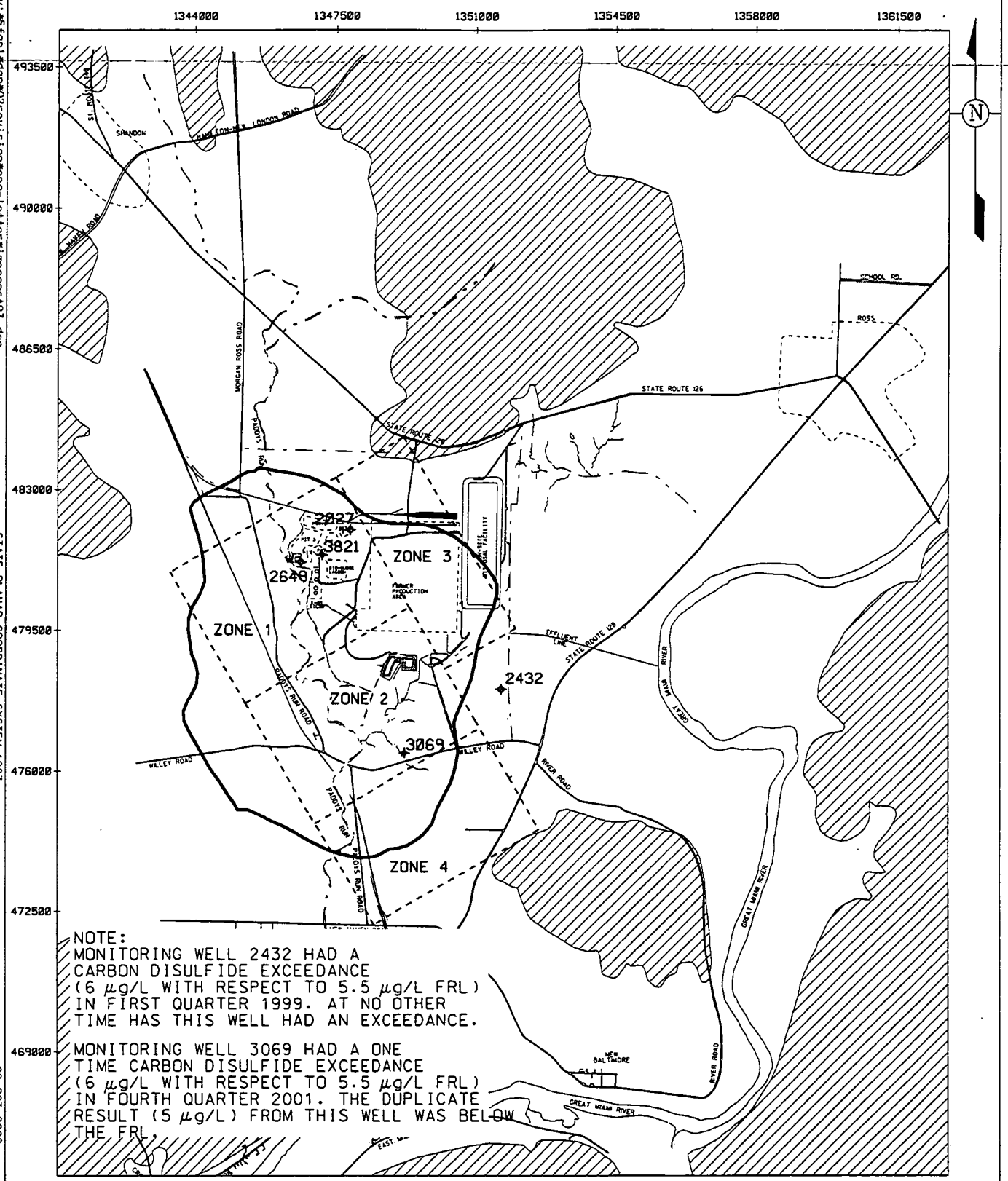
SCALE
3500 1750 0 3500 FEET

DRAFT
FINAL

FIGURE A-4. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR BORON



v:\5fp1\dgn\02revision\epa-letter\inpconst06.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




v:\5fgp1\dgn\02revision\epo-letter\impconst07.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002

LEGEND:

- - - - FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

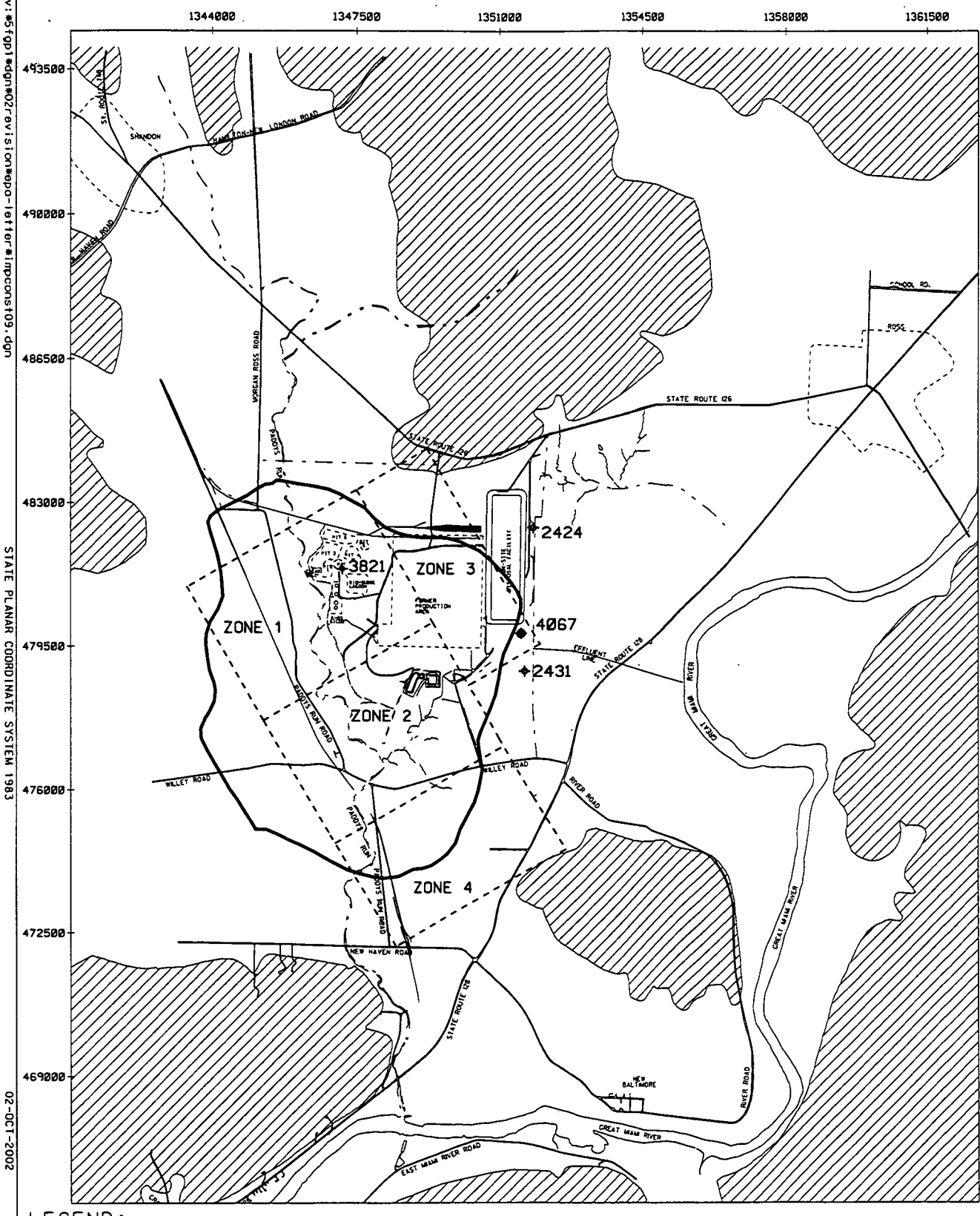
NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 – 4

SCALE

3500 1750 0 3500 FEET

DRAFT FINAL

FIGURE A-5. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR CARBON DISULFIDE




LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

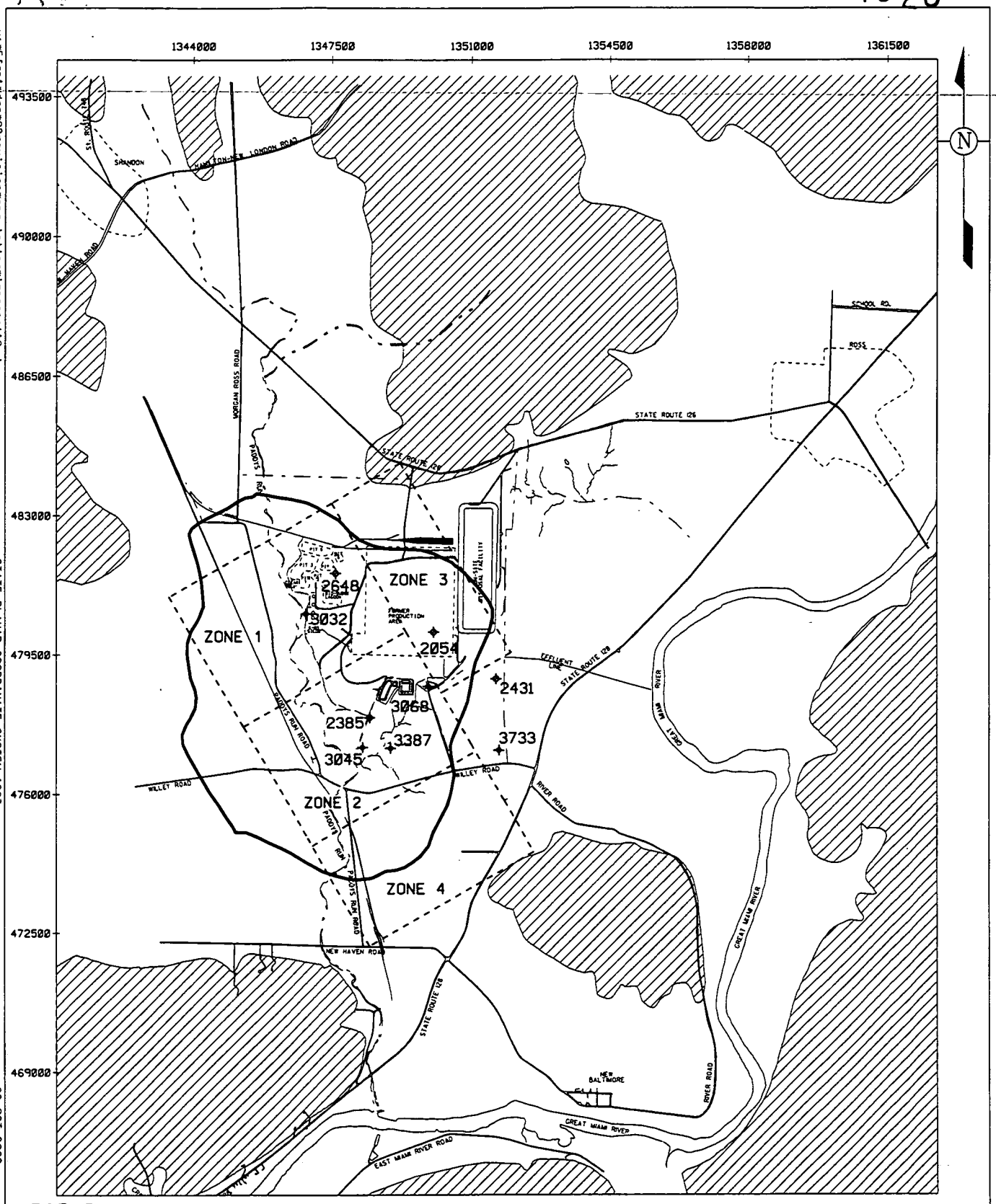
SCALE
3500 1750 0 3500 FEET

DRAFT
FINAL

FIGURE A-6. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR FLUORIDE



v:\5fgp1\dgn\02revision\epa-letter\impconst09.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

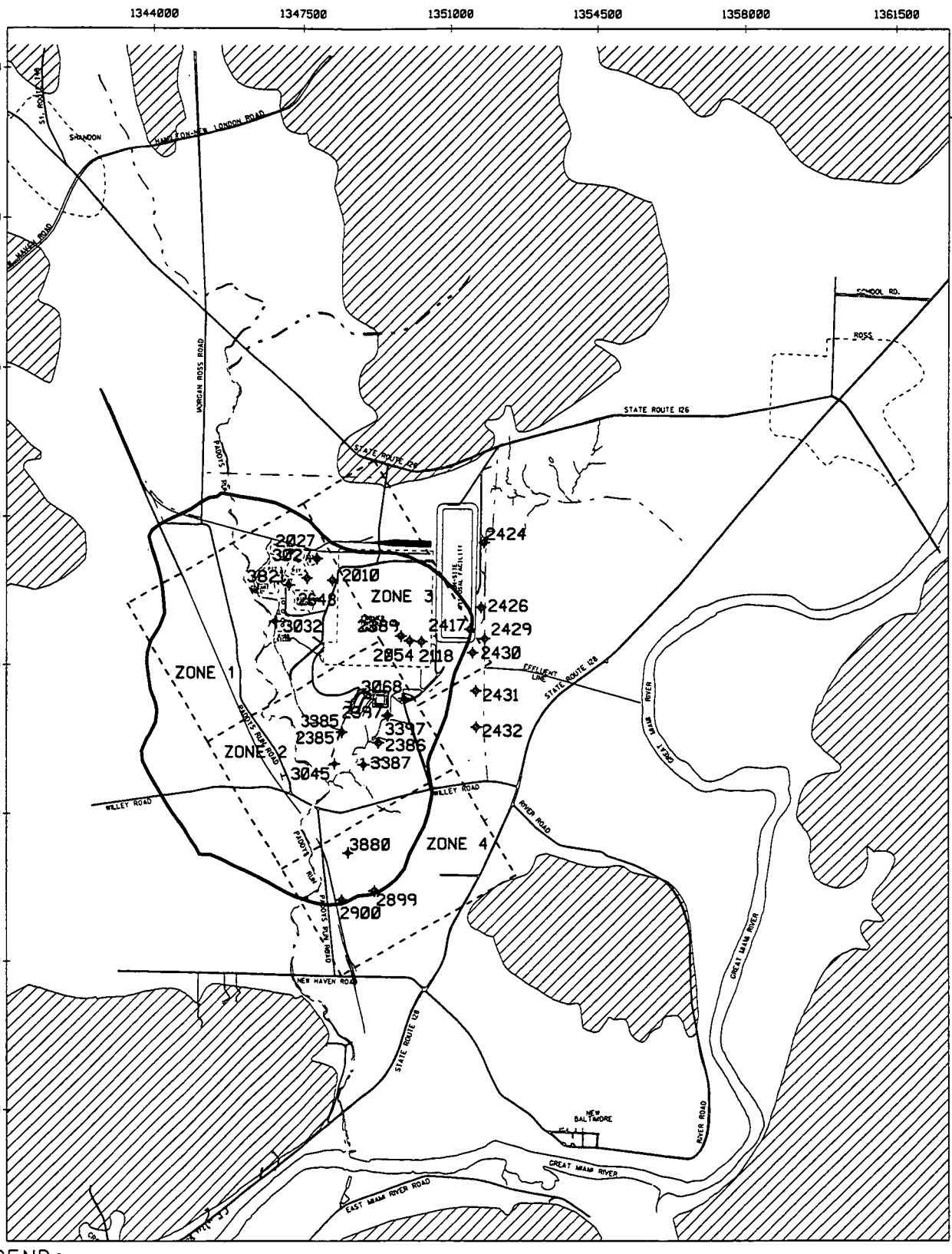
3500 1750 0 3500 FEET

DRAFT FINAL

FIGURE A-7. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR LEAD



v:\5fr01dgn\02revision\epa-letter\impconst10.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

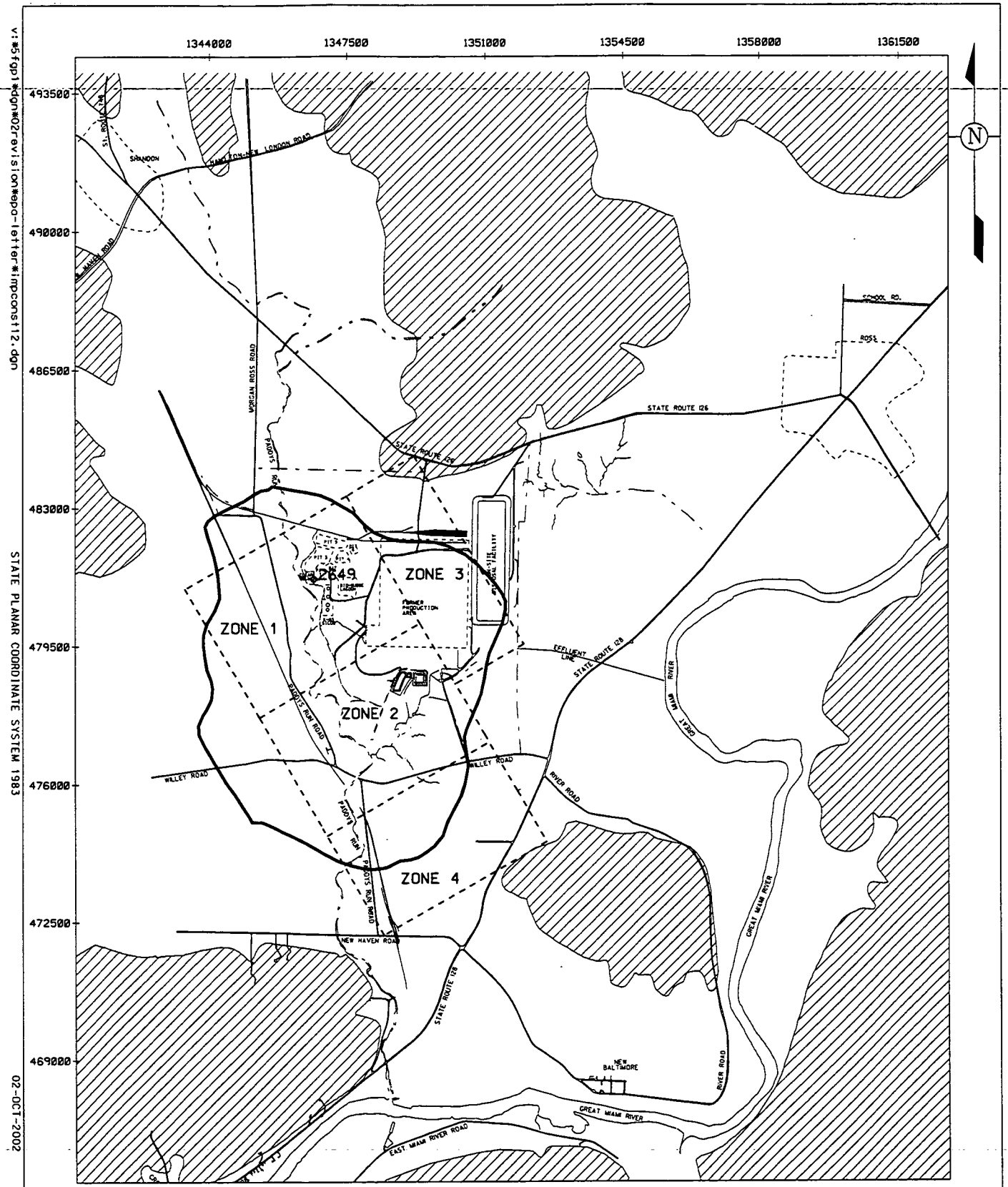
DRAFT FINAL

v:\5fgp1\dgn\02revision\epa-letter\impconst11.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002

FIGURE A-8. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR MANGANESE




LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

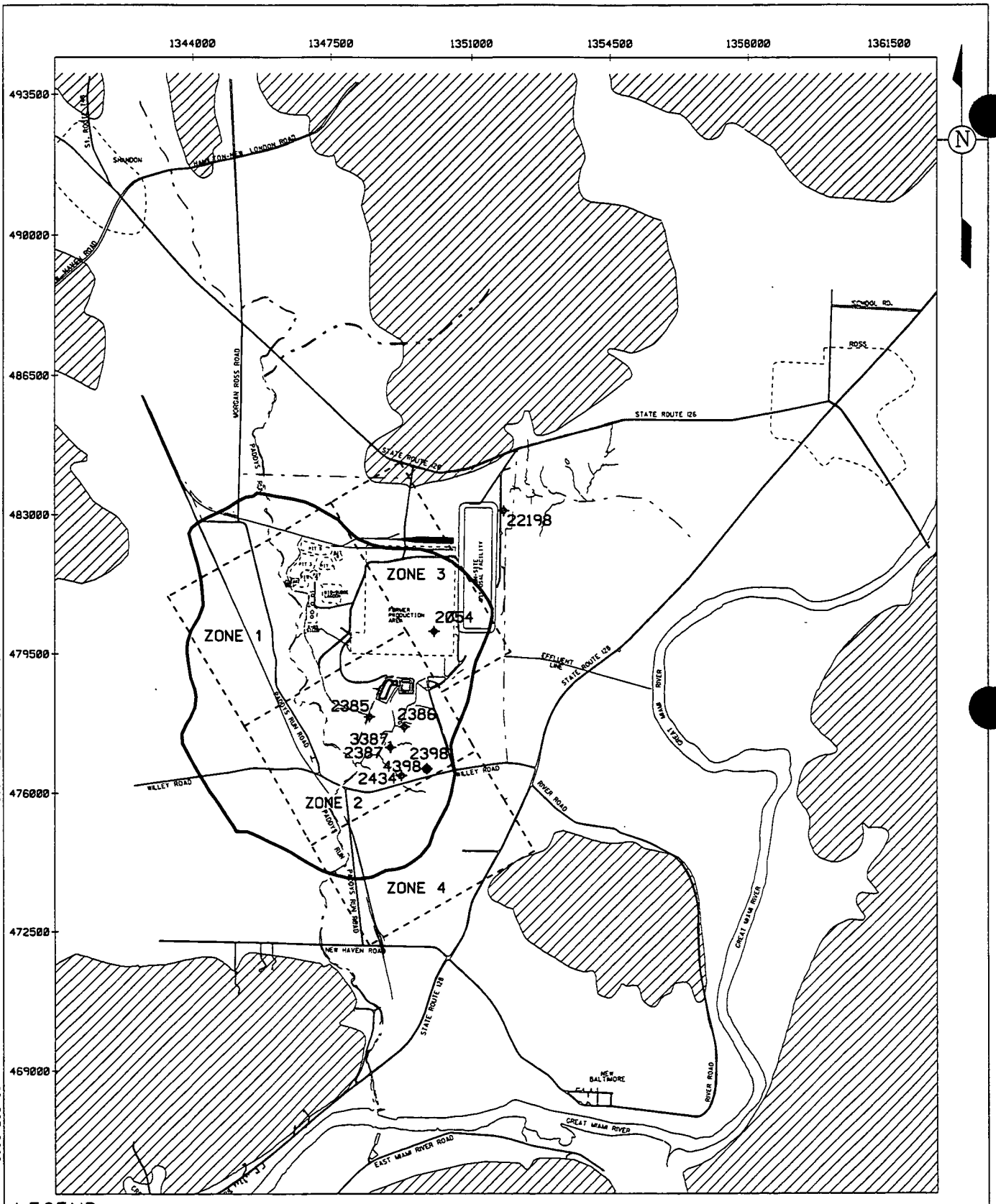
3500 1750 0 3500 FEET

DRAFT FINAL

FIGURE A-9. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR MOLYBDENUM



v:\5fqp1\dgn\02revision\epa-letter\inpconst12.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE:

ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 – 4

SCALE

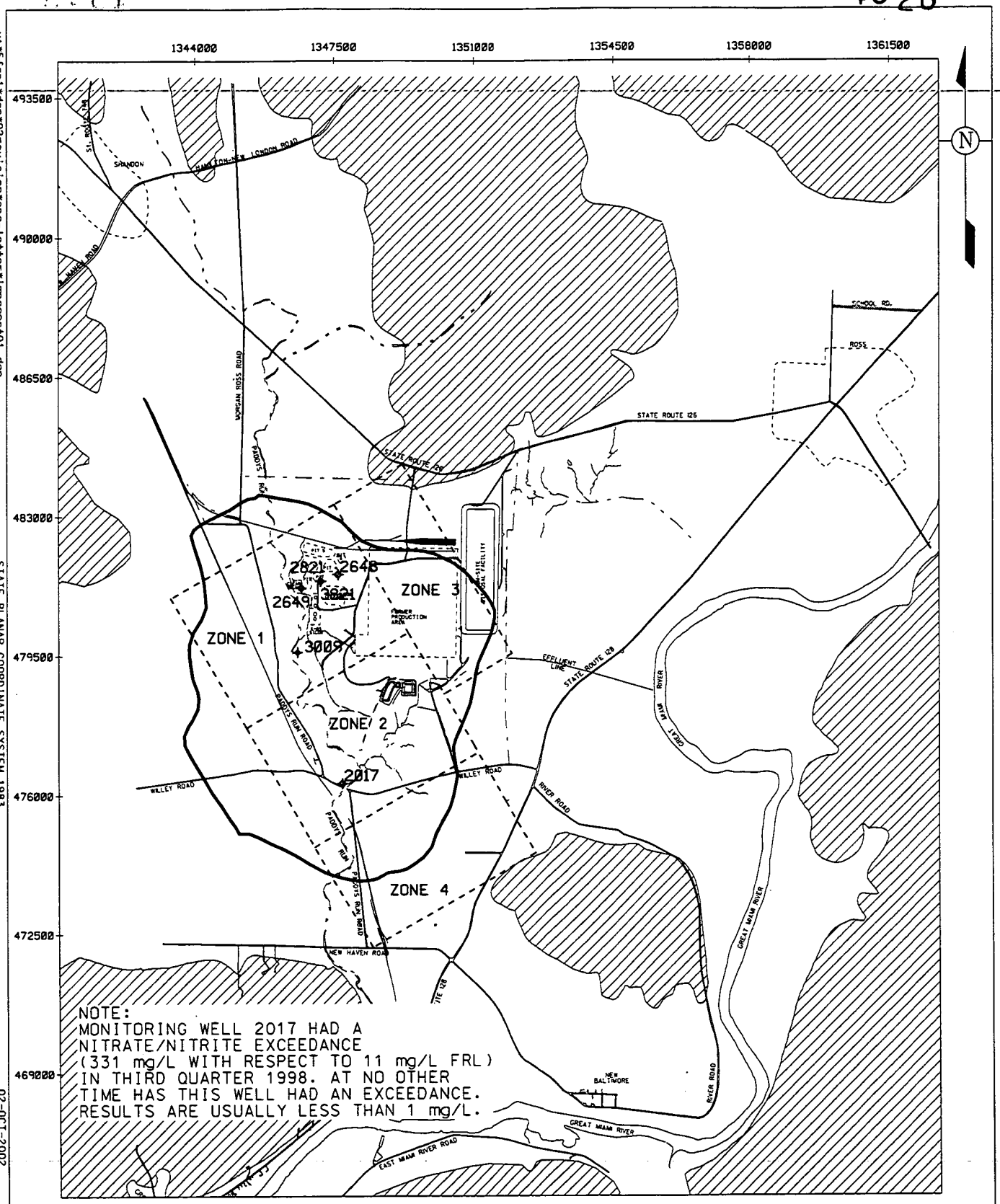
3500 1750 0 3500 FEET

DRAFT FINAL

FIGURE A-10. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR NICKEL



v:\5fgp1\dgn\02revision\epa-letter\impcons113.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




LEGEND:

- FEMP BOUNDARY
- 3120 ✦ MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE
3500 1750 0 3500 FEET

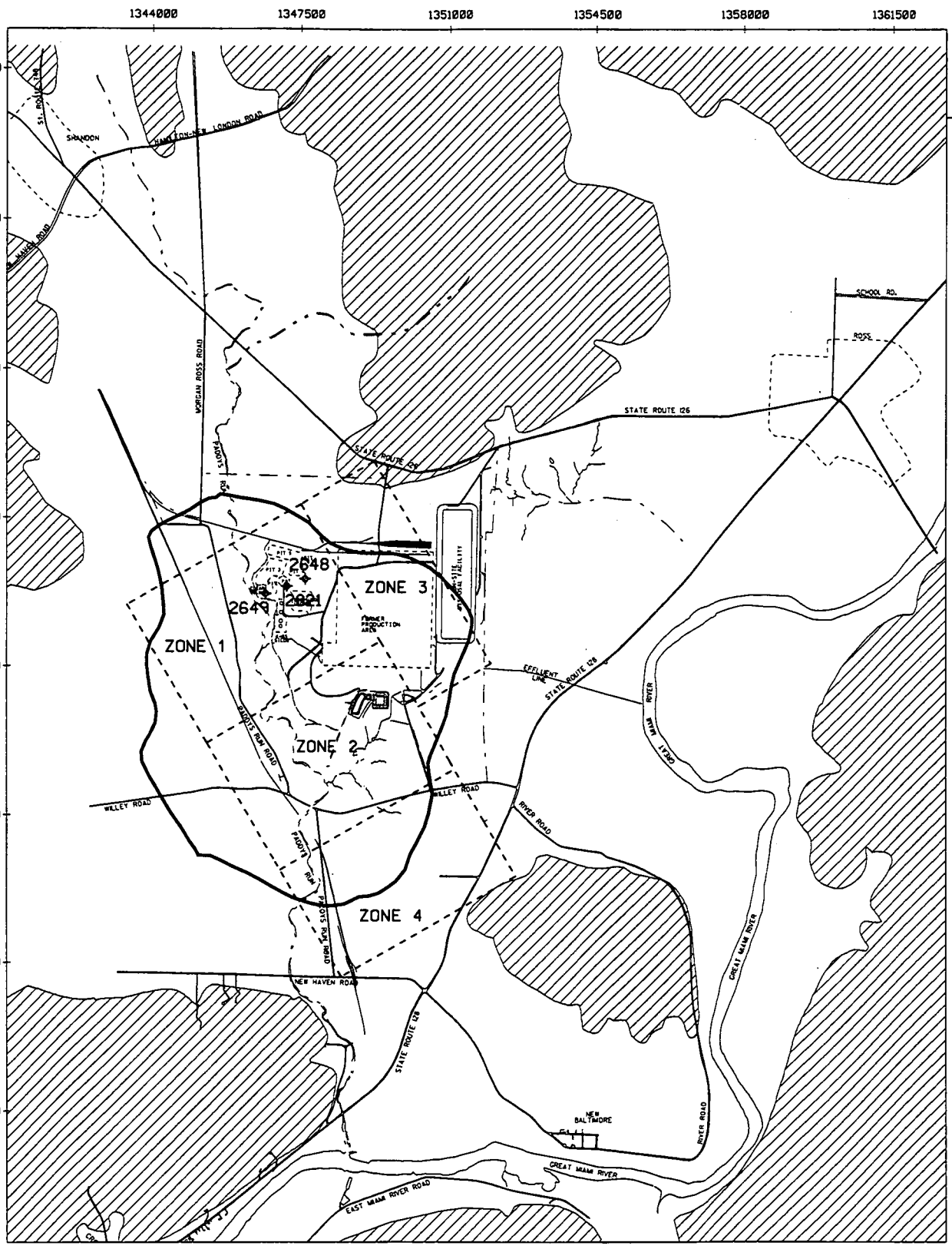
DRAFT
FINAL

v:\5fp1\dgn\02revision\epa-letter\impconst01.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002

FIGURE A-11. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR NITRATE/NITRITE




LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

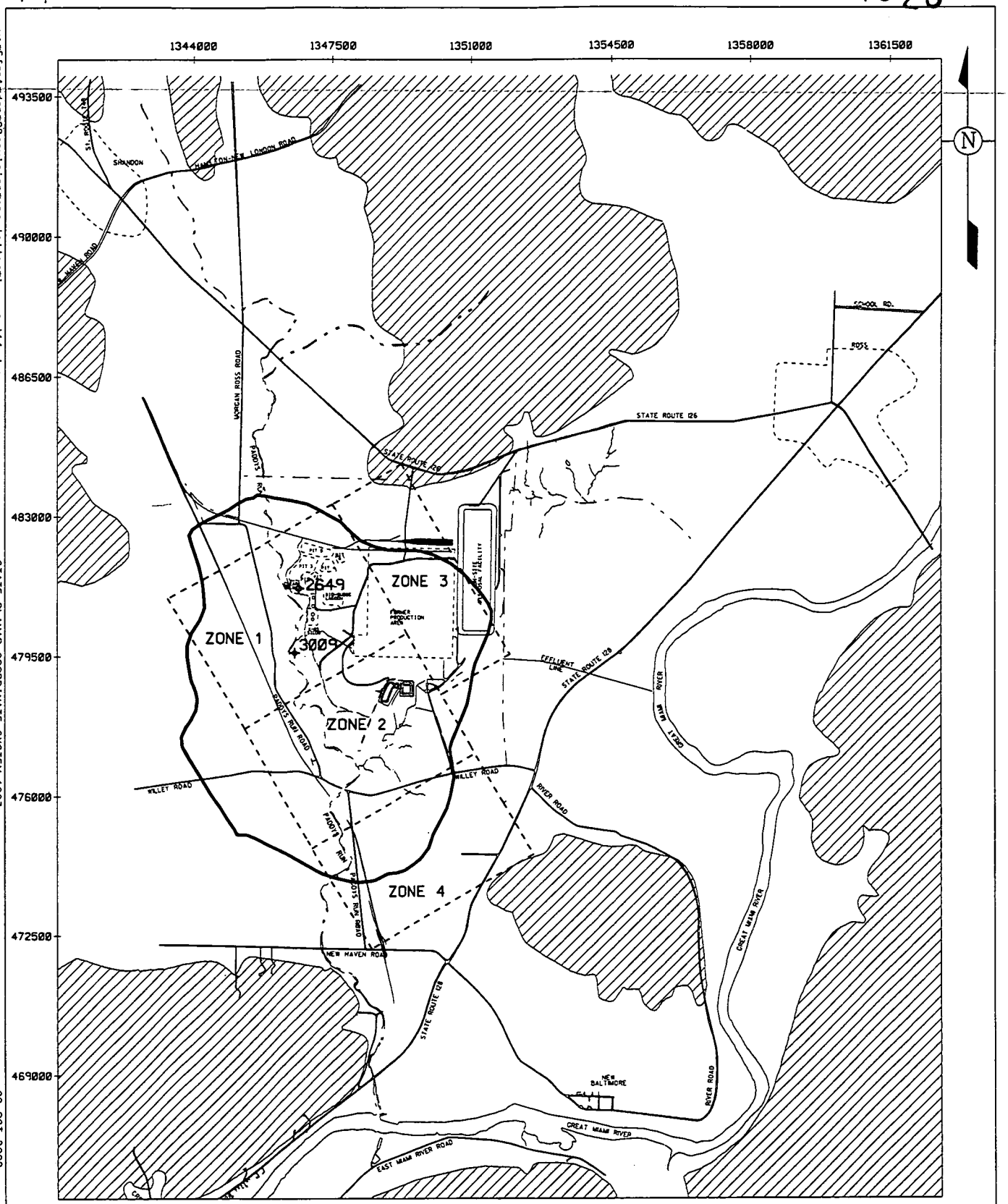
DRAFT FINAL

FIGURE A-12. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR TECHNETIUM-99

v:\5fgp1\dgn\02revision\epa-letter\impconst02.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002




LEGEND:

- FEMP BOUNDARY
- 3120 ✦ MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

DRAFT FINAL

v:\5fgp1\dgn\02revision\epa-letter\impconst14.dgn

STATE PLANAR COORDINATE SYSTEM 1983

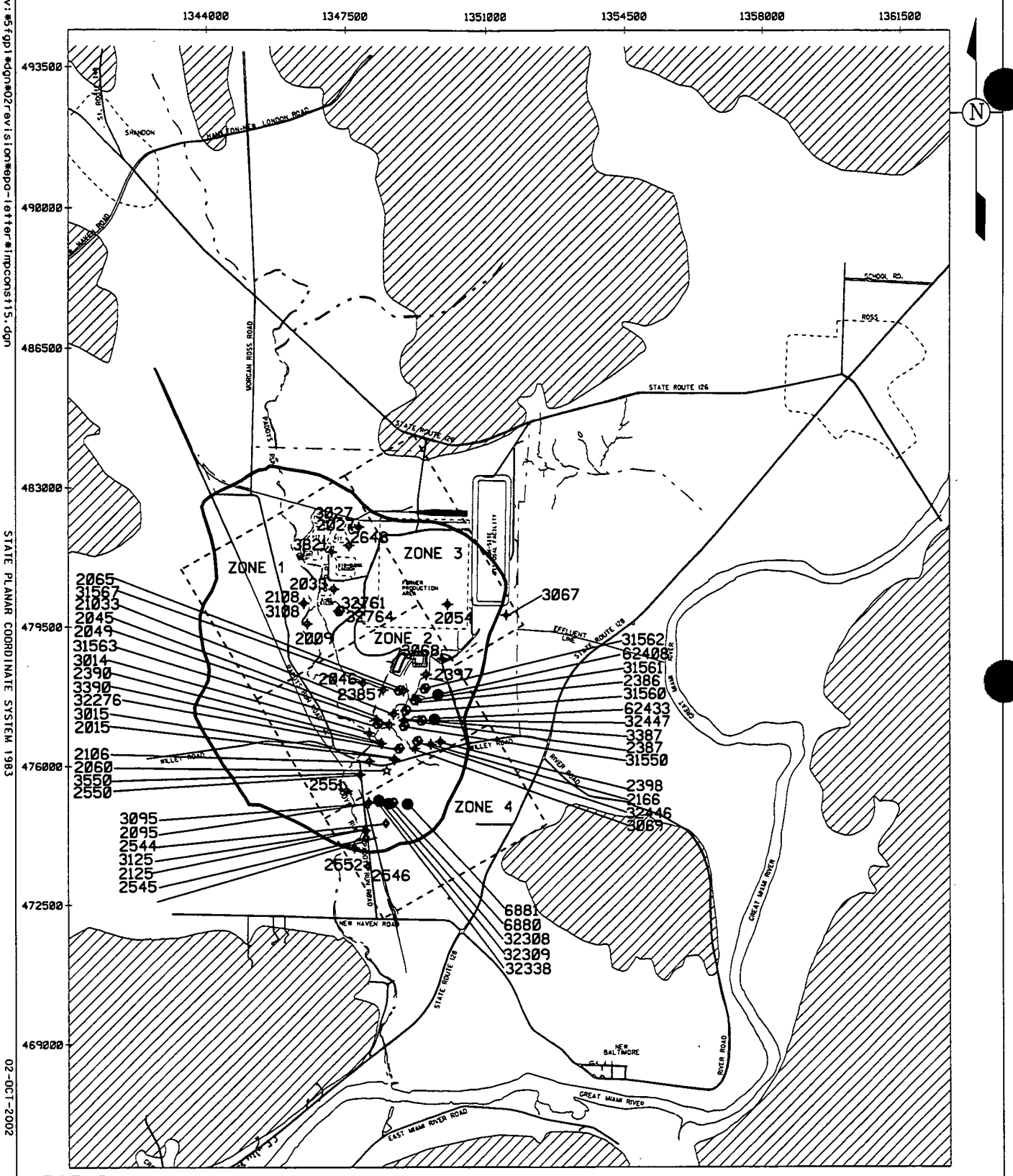
02-OCT-2002

FIGURE A-13. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR TRICHLOROETHENE

v:#5fgp1#dgn#02revision#epa-letter#impcons115.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002




LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE:

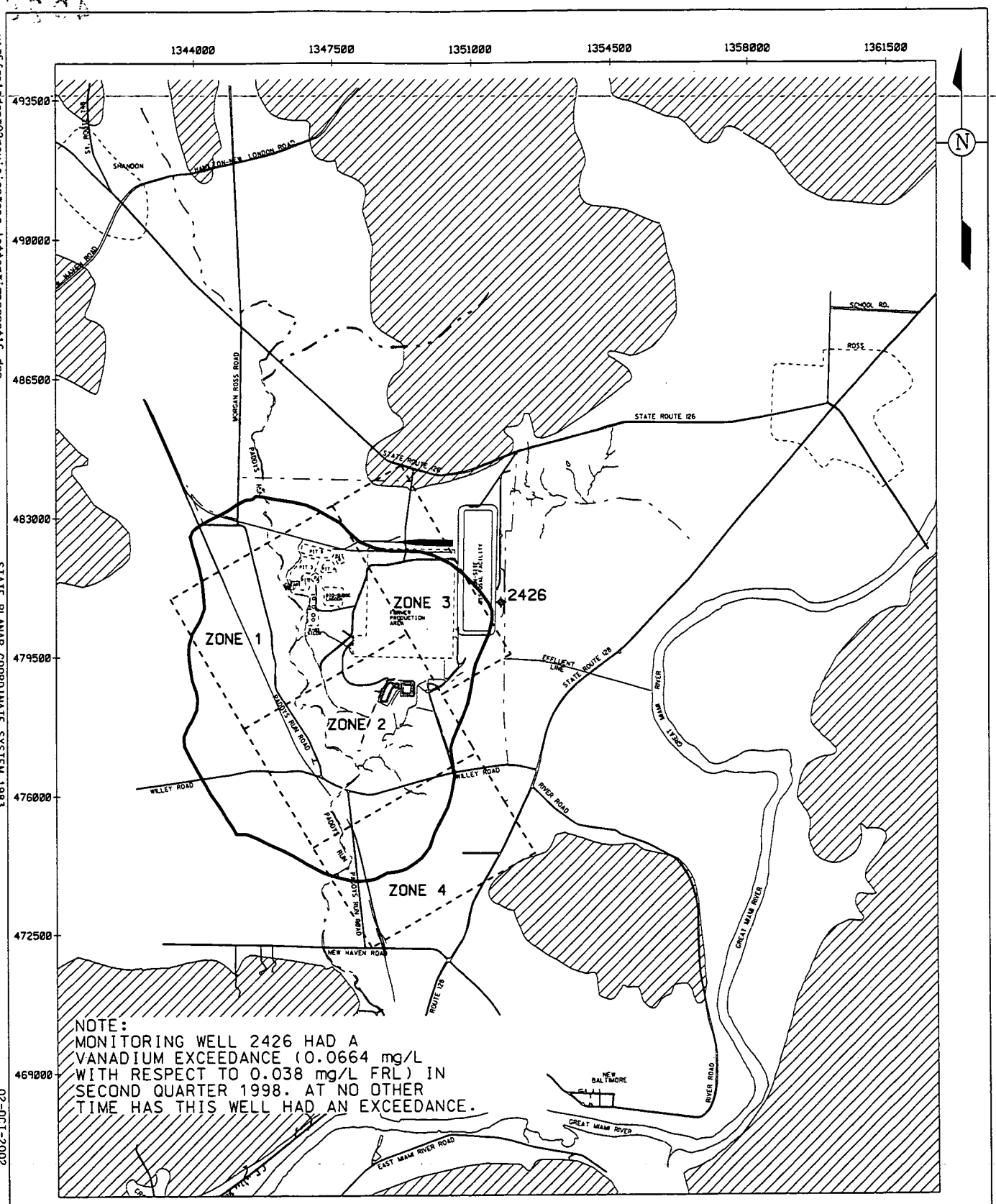
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

DRAFT FINAL

FIGURE A-14. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR URANIUM, TOTAL




LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 – 4

SCALE

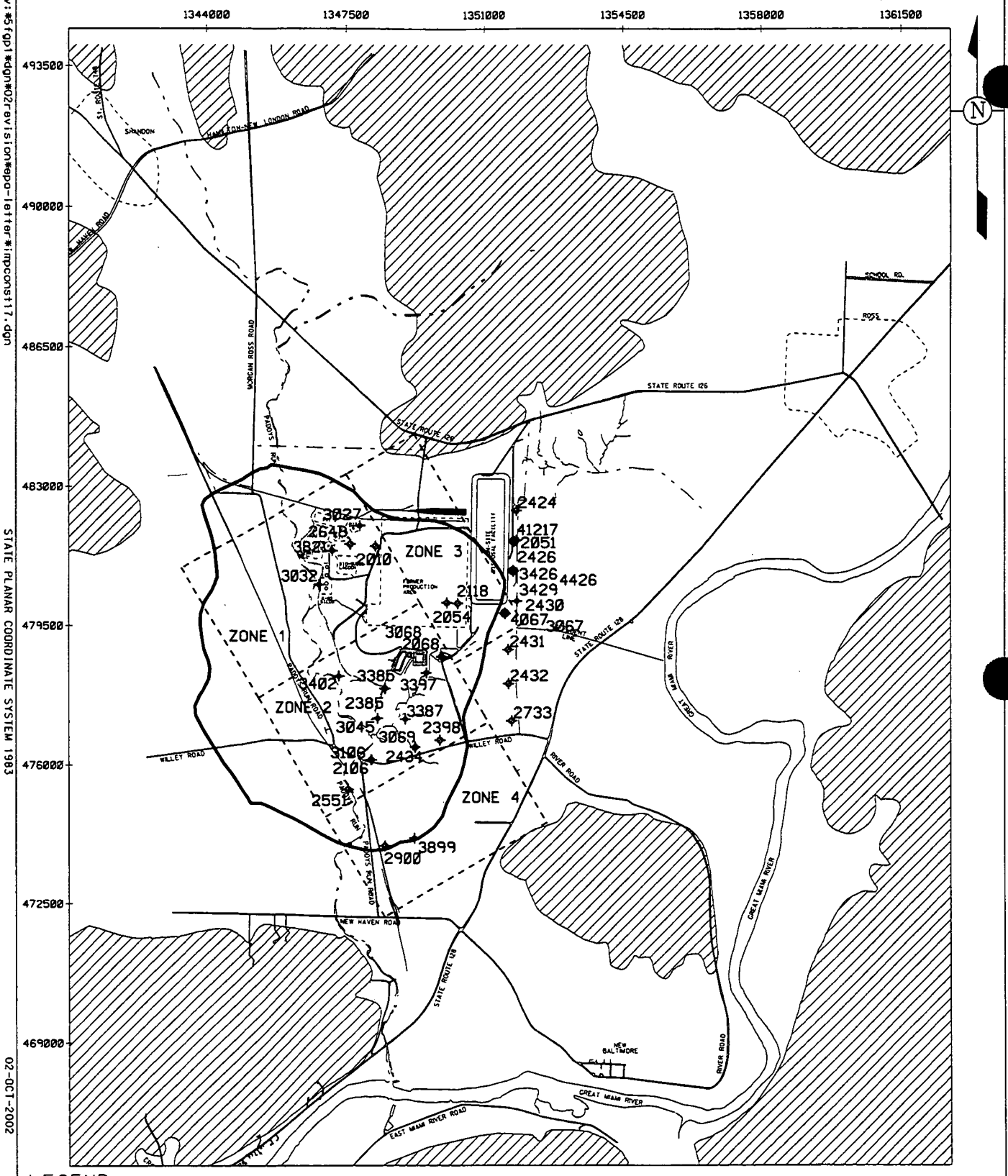
3500 1750 0 3500 FEET

DRAFT FINAL

FIGURE A-15. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR VANADIUM



v:\5fpl\dgn\02revision\epa-letter\impconst16.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

DRAFT FINAL

FIGURE A-16. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR ZINC



v:#5fgp1#dgn#02r#vision#epa-letter#impconst17.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002

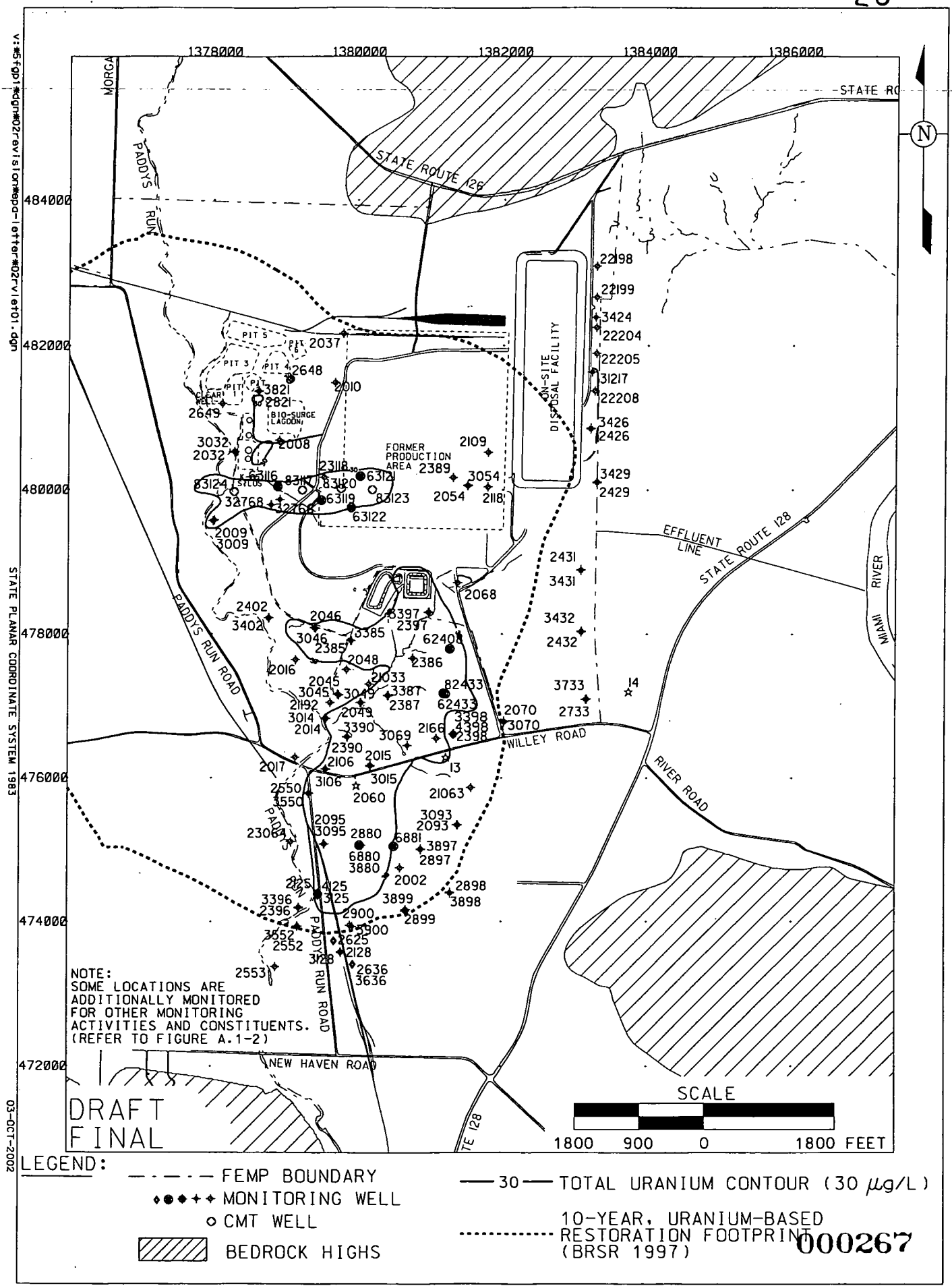
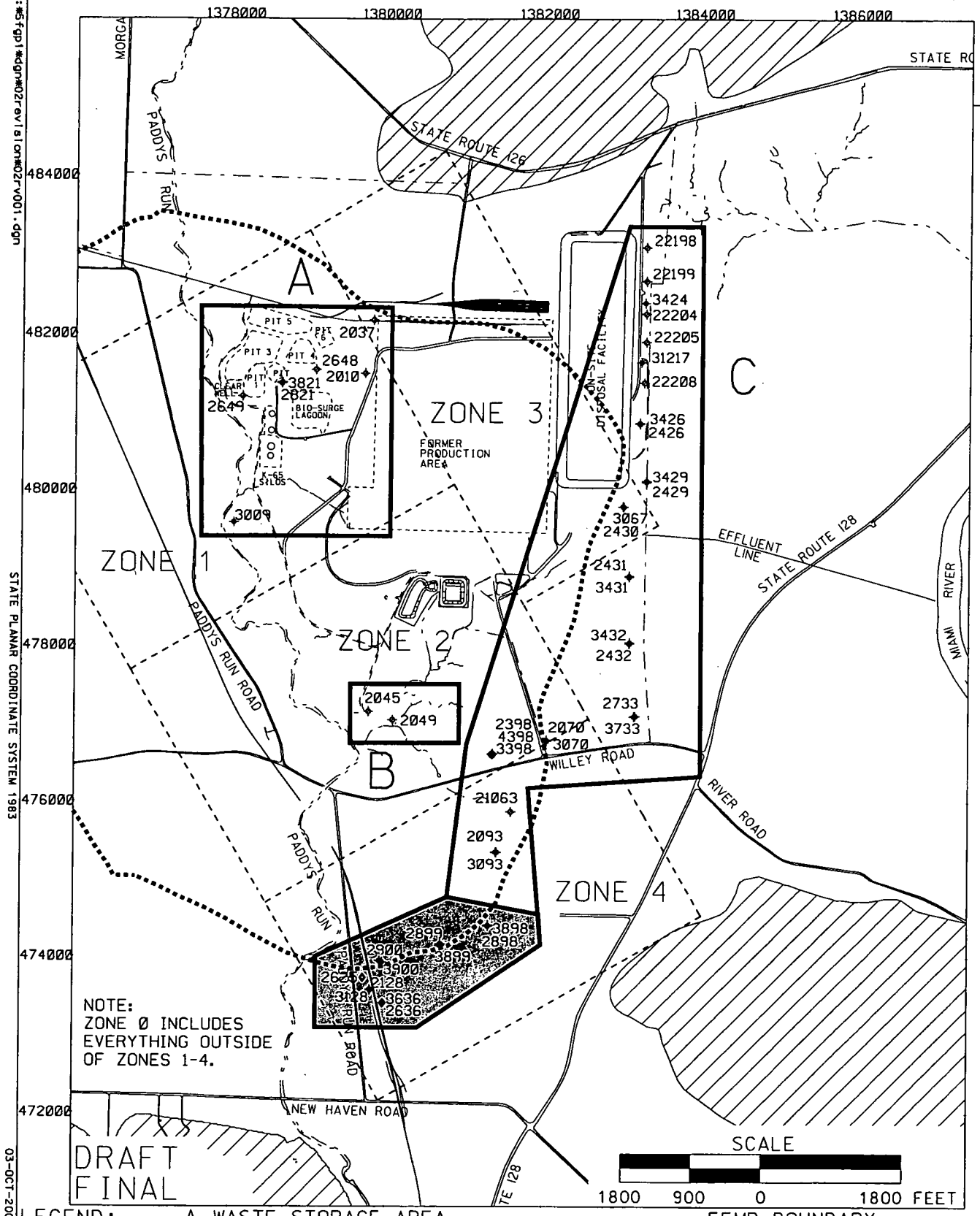



FIGURE A-17. LOCATIONS FOR SEMI-ANNUAL TOTAL URANIUM MONITORING




000268

FIGURE A-18. LOCATIONS FOR SEMI-ANNUAL URANIUM AND NON-URANIUM MONITORING PROPERTY/PLUME BOUNDARY, SOUTH FIELD, AND WASTE STORAGE AREA

# APPENDIX B

## SURFACE WATER FINAL REMEDIATION LEVEL (FRL) AND BENCHMARK TOXICITY VALUE (BTV) EXCEEDANCES

-- 4528

# APPENDIX B

## SURFACE WATER FINAL REMEDIATION LEVEL (FRL) AND BENCHMARK TOXICITY VALUE (BTV) EXCEEDANCES

This appendix provides further information regarding the final remediation level (FRL) and benchmark toxicity value (BTV) exceedances. As discussed in Section 4.4.2.3, a limited number of constituents have been sporadically detected above their respective FRLs and/or BTVs at several surface water sample locations. To better quantify the actual number and location of exceedances, data collected under the IEMP (from August 1997 through December 2001) were compiled and compared to FRLs and BTVs to determine the number and locations of the exceedances.

This appendix provides figures that document, by constituent, the particular sample location where FRLs and BTVs have been exceeded. On all of these figures, the number of exceedances is shown in parentheses for each location when the number of exceedances was greater than one. Figures B-1 through B-11 show, by constituent, those locations with FRL exceedances, and Figures B-12 through B-14 show locations with BTV exceedances. Additionally, Table B-1 identifies those constituents that were removed from monitoring based on the evaluation of insufficient historical data and/or sporadic FRL/BTV exceedances, which was approved by the OEPA and EPA and included in the transmittal of the first quarter 2002 IEMP summary report.

# TABLE B-1
## EVALUATION OF CONSTITUENTS SELECTED FOR IEMP CHARACTERIZATION SURFACE WATER MONITORING DUE TO SPORADIC FRL/BTV EXCEEDANCES OR INSUFFICIENT HISTORICAL DATA

| Location | Currently Monitored COCs | Basis for Selection of Constiuent Code[a, b] | No. of Analyses[c] | No. of FRL Exceedances[c] | Date of Last FRL Exceedance (No. of samples since exceedance)[c] | No. of BTV Exceedances[c] | Date of Last BTV Exceedance (No. of samples since exceedance)[c] |
|---|---|---|---|---|---|---|---|
| SWP-02 (Paddys Run) | **Inorganics:** | | | | | | |
| | Beryllium | S | 24 | 1 | 10/28/1997 (21) | - | - |
| | Cadmium | S | 24 | 1 | 10/28/1997 (21) | 2 | 02/12/1998 (18) |
| | Chromium, Total | S | 24 | 2 | 12/15/1998 (11) | - | - |
| | Copper | S | 24 | 2 | 05/11/1998 (15) | - | - |
| | Manganese | S | 24 | 1 | 10/28/1997 (21) | - | - |
| | Mercury | S | 24 | 1 | 10/28/1997 (21) | - | - |
| | **Radionuclides:** | | | | | | |
| | Technetium-99 | M, S | 24 | 0 | - | - | - |
| | Total Uranium[d] | S[d] | 24 | 0 | - | - | - |
| SWP-03 (Paddys Run at Downstream Property Boundary) | **Inorganics:** | | | | | | |
| | Mercury | M, S | 21 | 1 | 04/13/1998 (14) | - | - |
| | Silver | M, S | 22 | 0 | - | 1 | 10/281997 (20) |
| | Chromium, Total | S | 22 | 3 | 10/05/2000 (4) | - | - |
| | Copper | S | 22 | 1 | 09/25/2000 (5) | - | - |
| | Barium | S | 22 | 0 | - | 0 | - |
| | Beryllium | S | 22 | 0 | - | - | - |
| | Cadmium | S | 22 | 0 | - | 0 | - |
| | Lead | S | 22 | 0 | - | - | - |
| | Manganese | S | 22 | 0 | - | - | - |
| | Selenium | S | 22 | 0 | - | - | - |
| | **Radionuclides:** | | | | | | |
| | Total Uranium[d] | M, S[d] | 22 | 0 | - | - | - |
| | Technetium-99[e] | M, S | 22 | 0 | - | - | - |
| | Lead-210 | I | 15 | 0 | - | - | - |
| | **Semi-Volatiles:** | | | | | | |
| | bis(2-Ethylhexyl)phthalate[f] | S | 22 | 0 | - | - | - |
| | 3,3'-Dichlorobenzidine | I | 14 | 0 | - | - | - |
| | Benzo(a)anthracene | I | 15 | 0 | - | - | - |
| | Benzo(a)pyrene | I | 15 | 0 | - | - | - |
| | Dibenzo(a,h)anthracene | I | 15 | 0 | - | - | - |
| | Di-n-octyl phthalate | S | 22 | 0 | - | - | - |
| | **Volatiles:** | | | | | | |
| | Tetrachloroethene | S | 23 | 0 | - | - | - |
| | 1,1,1-Trichloroethane | S | 23 | 0 | - | - | - |
| SWD-01 (Northeast Drainage) | **Inorganics:** | | | | | | |
| | Cyanide | M, S | 25 | 0 | - | - | - |
| | Beryllium | S | 26 | 0 | - | - | - |
| | Lead | S | 26 | 0 | - | - | - |
| | Manganese | S | 26 | 0 | - | - | - |
| | Zinc | S | 26 | 4 | 11/12/1998 (12) | - | - |

000271

4528

**TABLE B-1**
**(Continued)**

| Location | Currently Monitored COCs | Basis for Selection of Constituent Code[a, b] | No. of Analyses[c] | No. of FRL Exceedances[c] | Date of Last FRL Exceedance (No. of samples since exceedance)[c] | No. of BTV Exceedances[c] | Date of Last BTV Exceedance (No. of samples since exceedance)[c] |
|---|---|---|---|---|---|---|---|
| **SWD-02 (Storm Sewer Outfall Ditch)** | **Inorganics:** | | | | | | |
| | Cadmium | S | 28 | 0 | - | 0 | - |
| | Manganese | S | 28 | 0 | - | - | - |
| | **Radionuclides:** | | | | | | |
| | Total Uranium[d] | M, S[d] | 53 | 0 | - | - | - |
| | **Semi-Volatiles:** | | | | | | |
| | bis(2-Ethylhexyl)phthalate | S | 28 | 0 | - | - | - |
| **SWD-03 (Waste Storage Area)** | **Inorganics:** | | | | | | |
| | Copper | S | 27 | 2 | 04/20/2001 (2) | - | - |
| | Barium | S | 27 | 0 | - | 0 | - |
| | Chromium, Total | S | 27 | 0 | - | - | - |
| | Lead | S | 27 | 0 | - | - | - |
| | Manganese | S | 27 | 0 | - | - | - |
| | **Radionuclides:** | | | | | | |
| | Total Uranium[d] | S[d] | 50 | 0 | - | - | - |
| | **Semi-Volatiles:** | | | | | | |
| | bis(2-Ethylhexyl)phthalate | S | 27 | 0 | - | - | - |
| | **Volatiles:** | | | | | | |
| | Tetrachloroethene | S | 27 | 0 | - | - | - |
| | 1,1,1-Trichloroethane | S | 27 | 0 | - | - | - |
| **PF 4001 (Parshall Flume - Treated Effluent)** | **Inorganics:** | | | | | | |
| | Cyanide | M, S | 290 | 0 | - | - | - |
| | Mercury | M, S | 50 | 0 | - | - | - |
| | Beryllium | S | 52 | 0 | - | - | - |
| | Cadmium[h] | S | 313 | 0 | - | 3[g] | 12/19/2001 (4) |
| | Chromium, Total[h] | S | 313 | 0 | - | - | - |
| | Copper[h] | S | 386 | 0 | - | - | - |
| | Manganese[h] | S | 226 | 0 | - | - | - |
| | **Radionuclides:** | | | | | | |
| | Technetium-99 | M, S | 54 | 0 | - | - | - |
| | Total Uranium[d] | M, S[d] | 1604 | 0 | - | - | - |
| | Lead-210 | I | 18 | 0 | - | - | - |
| | Radium-228[h] | S | 53 | 0 | - | - | - |
| | **Semi-Volatiles:** | | | | | | |
| | Benzo(a)anthracene | S | 18 | 0 | - | - | - |
| | Benzo(a)pyrene | S | 18 | 0 | - | - | - |
| | Dibenzo(a,h)anthracene | S | 18 | 0 | - | - | - |
| | Di-n-octyl phthalate | S | 18 | 0 | - | - | - |
| | 3,3'-Dichlorobenzidine | S | 17 | 0 | - | - | - |

000272

4528

**TABLE B-1**
**(Continued)**

| Location | Currently Monitored COCs | Basis for Selection of Constiuent Code[a, b] | No. of Analyses[c] | No. of FRL Exceedances[c] | Date of Last FRL Exceedance (No. of samples since exceedance)[c] | No. of BTV Exceedances[c] | Date of Last BTV Exceedance (No. of samples since exceedance)[c] |
|---|---|---|---|---|---|---|---|
| **SWRB 4002O** | **Inorganics:** | | | | | | |
| **(Storm Water Retention** | Cyanide | M, S[i] | 2 | 0 | - | - | - |
| **Basin)** | Manganese | S[i] | 2 | 0 | - | - | - |
| | Mercury | M, S[i] | 2 | 0 | - | - | - |
| | **Radionuclides:** | | | | | | |
| | Radium-228 | S[i] | 2 | 0 | - | - | - |
| | Technetium-99 | M, S[i] | 2 | 0 | - | - | - |
| **STRM 4003[j]** | **Radionuclides:** | | | | | | |
| **(Drainage to Paddys Run)** | Total Uranium[d] | M[d], S[d] | 14 | 0 | - | - | - |
| **STRM 4004[j]** | **Radionuclides:** | | | | | | |
| **(Drainage to Paddys Run)** | Total Uranium[d] | M[d], S[d] | 9 | 0 | - | - | - |
| **STRM 4005[j]** | **Radionuclides:** | | | | | | |
| **(Drainage to Paddys Run)** | Total Uranium[d] | M[d], S[d] | 30 | 0 | - | - | - |
| **STRM 4006[j]** | **Radionuclides:** | | | | | | |
| **(Drainage to Paddys Run)** | Total Uranium[d] | M[d], S[d] | 12 | 0 | - | - | - |

Shading indicates location-specific COCs will be removed from monitoring based on evaluation or removal of a monitoring criteria (e.g., S).

[a]M = Based on Modeling; S = Sporadic Exceedances; I = Insufficient Number of Historical Analyses

[b]Those constituents monitored based on Modeling (M) will continue to be monitored even if there has been no FRL/BTV exceedance; therefore, these constituents are not shaded.

[c]Based on analytical data from August 1997 through December 2001.

[d]Total uranium will continue to be monitored quarterly whether there is a basis or not (i.e., M, S, I) and the monitoring criteria will be identified as a Primary COC (PC).

[e]Based on historical information, technetium-99 should also have been identified for monitoring due to modeling criteria from an upgradient area in addition to sporadic FRL/BTV exceedances. Therefore, the revised Table 4-3 will reflect modeling as a monitoring criterion.

[f]On October 10, 2000, there was a result of 70.3 at this location (FRL is 8.4 ug/L); however, the laboratory identified laboratory contamination issues. The constituent was sampled quarterly and there have been no other exceedances.

[g]The FRL for cadmium is based on background (0.0098 mg/L) and the BTV is 0.003 mg/L, which is lower than the FRL. During 2001, there were some BTV exceedances in the Great Miami River when using the mixing equation; however, this is because the mixing equation utilizes the background number which is higher than the associated BTV. The constituent is monitored under NPDES three times a week and will continue to be evaluated.

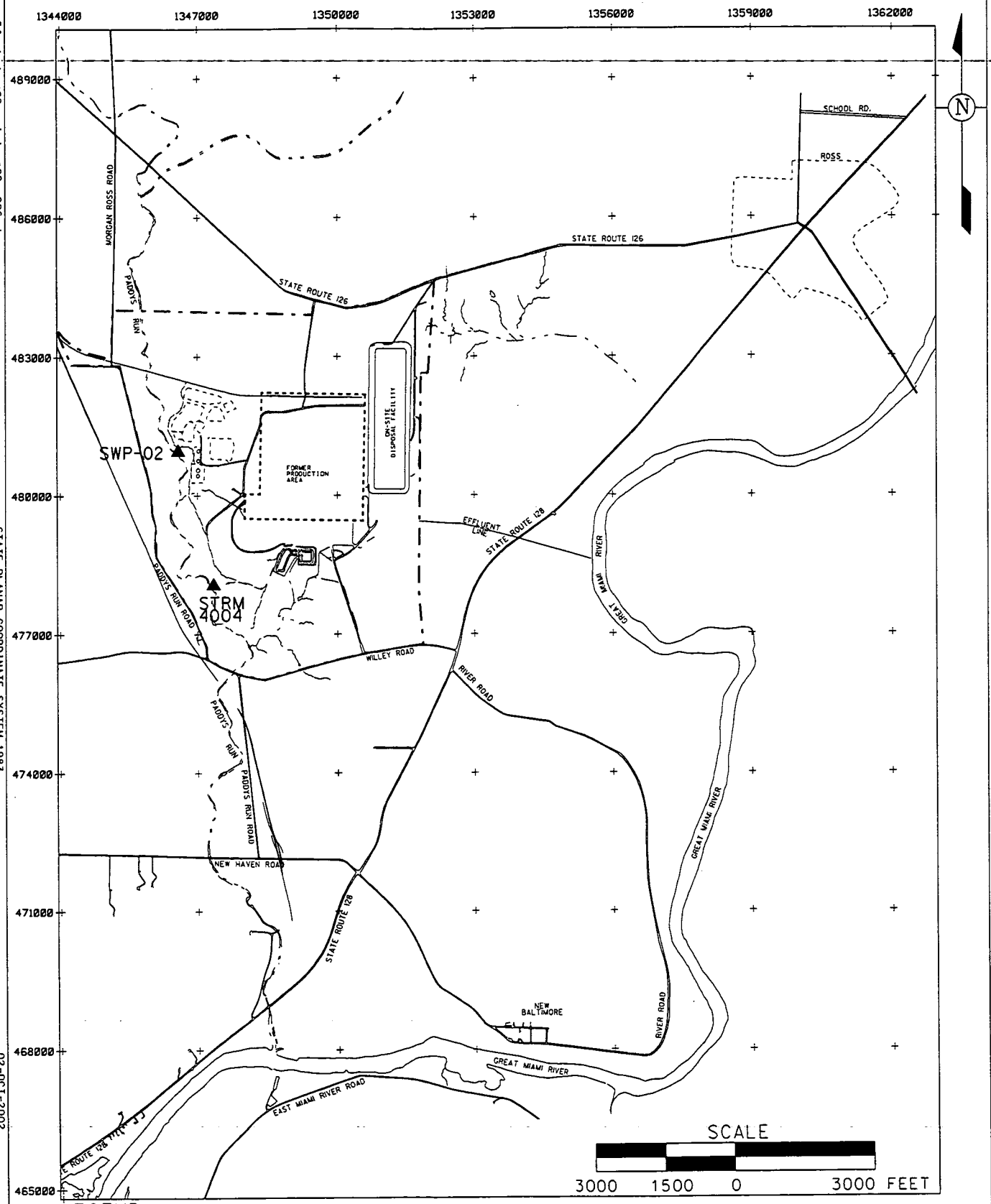
[h]These constituents will continue to be monitored under NPDES or FFCA requirements.

[i]There was insufficient data from which to make an evaluation.

[j]The basis for the selection criteria for these locations have been changed from "M,S" to "PC" for the purpose of accurately reflecting the basis for monitoring.

000273

4528




LEGEND:

FEMP BOUNDARY

▲ 1997-2001 IEMP EXCEEDANCE

DRAFT
FINAL

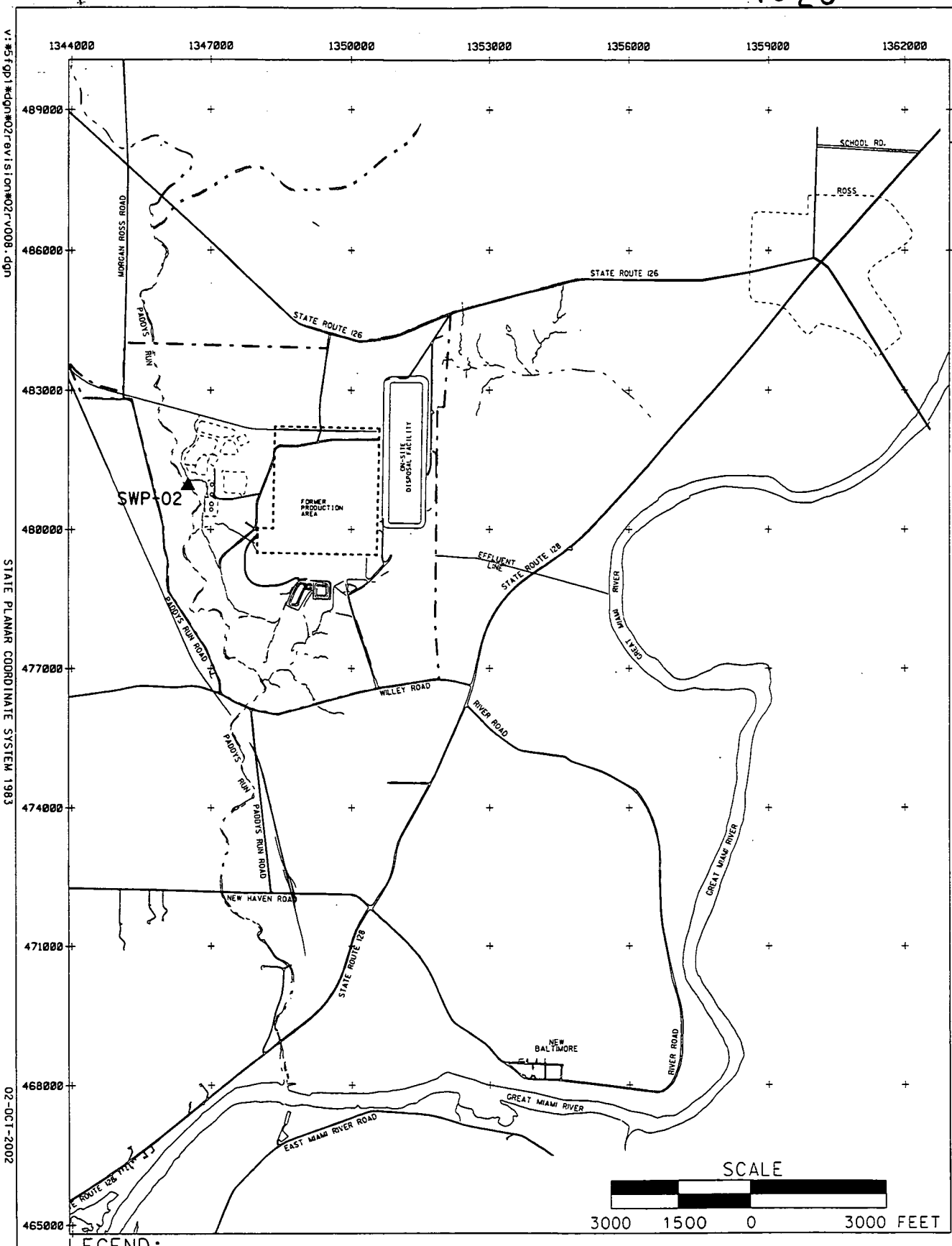
000274

FIGURE B-1. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR BERYLLIUM

v:\5fgp1\dgn\02revision\02rv006.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002




LEGEND:

— · — · — FEMP BOUNDARY

▲ 1997-2001 IEMP EXCEEDANCE

DRAFT
FINAL

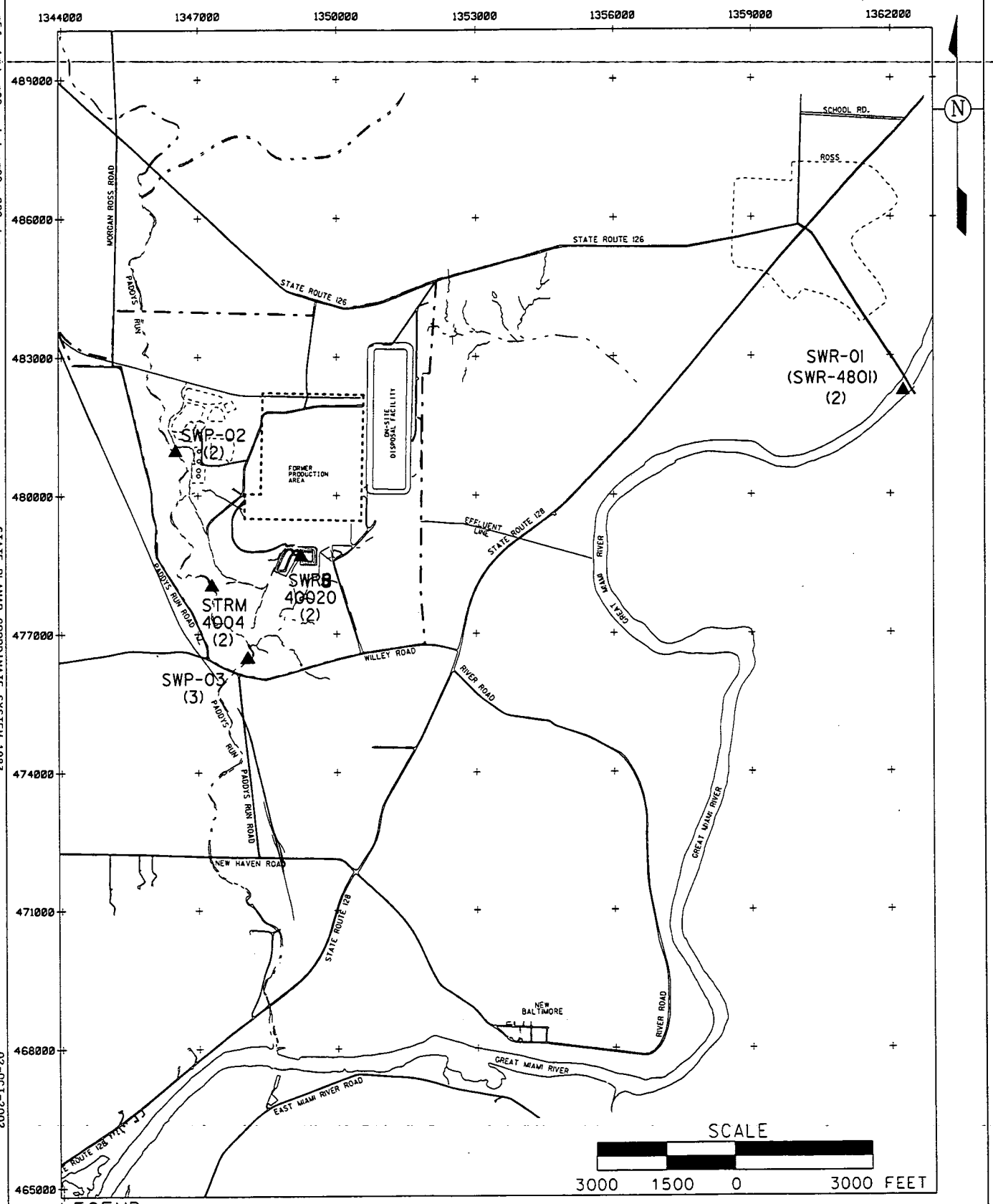
000275

FIGURE B-2. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR CADMIUM

v:\5fdp1\dgn\02revision\02rv008.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002




LEGEND:

— · — · — FEMP BOUNDARY

(2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

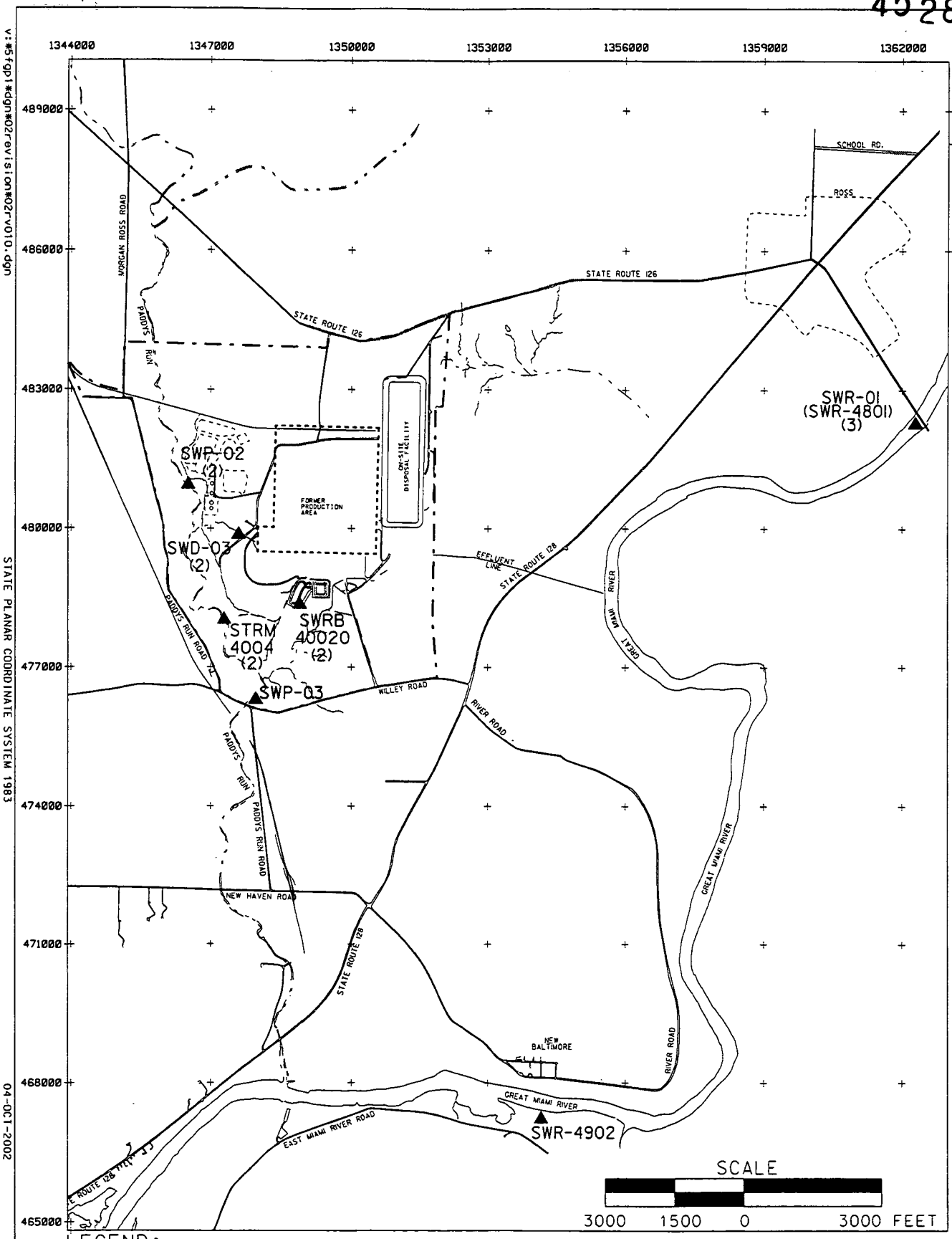
▲ 1997-2001 IEMP EXCEEDANCE

DRAFT FINAL

000276

FIGURE B-3. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR TOTAL CHROMIUM

v:\5fap1\dgn\02revision\02rv009.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




LEGEND:

— · — · — FEMP BOUNDARY

(2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

▲ 1997-2001 IEMP EXCEEDANCE

DRAFT FINAL

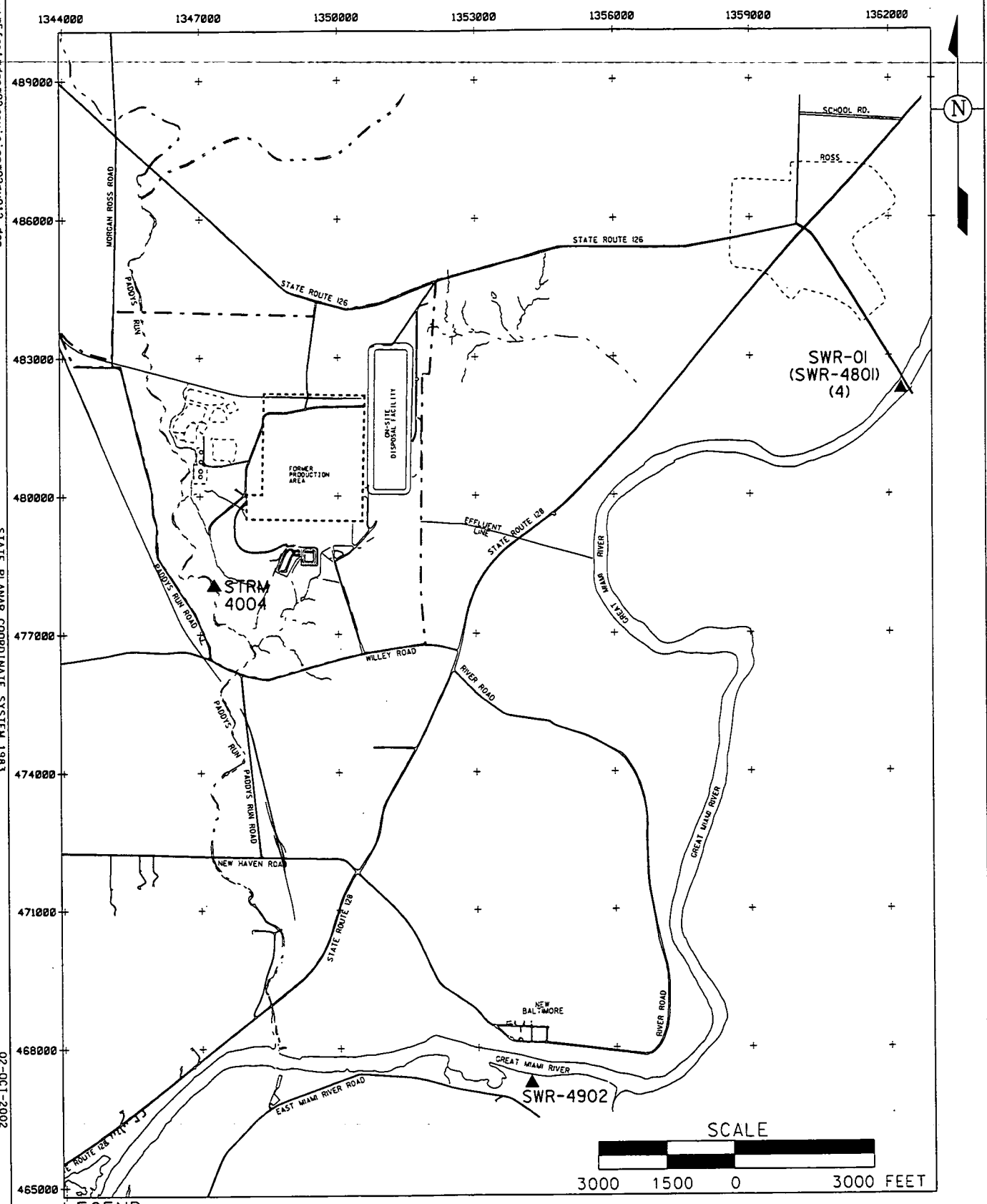
000277

FIGURE B-4. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR COPPER

v:\5fgp1\dgn\02revision\02rv010.dgn

STATE PLANAR COORDINATE SYSTEM 1983

04-OCT-2002




LEGEND:

FEMP BOUNDARY

▲ 1997-2001 IEMP EXCEEDANCE

DRAFT
FINAL

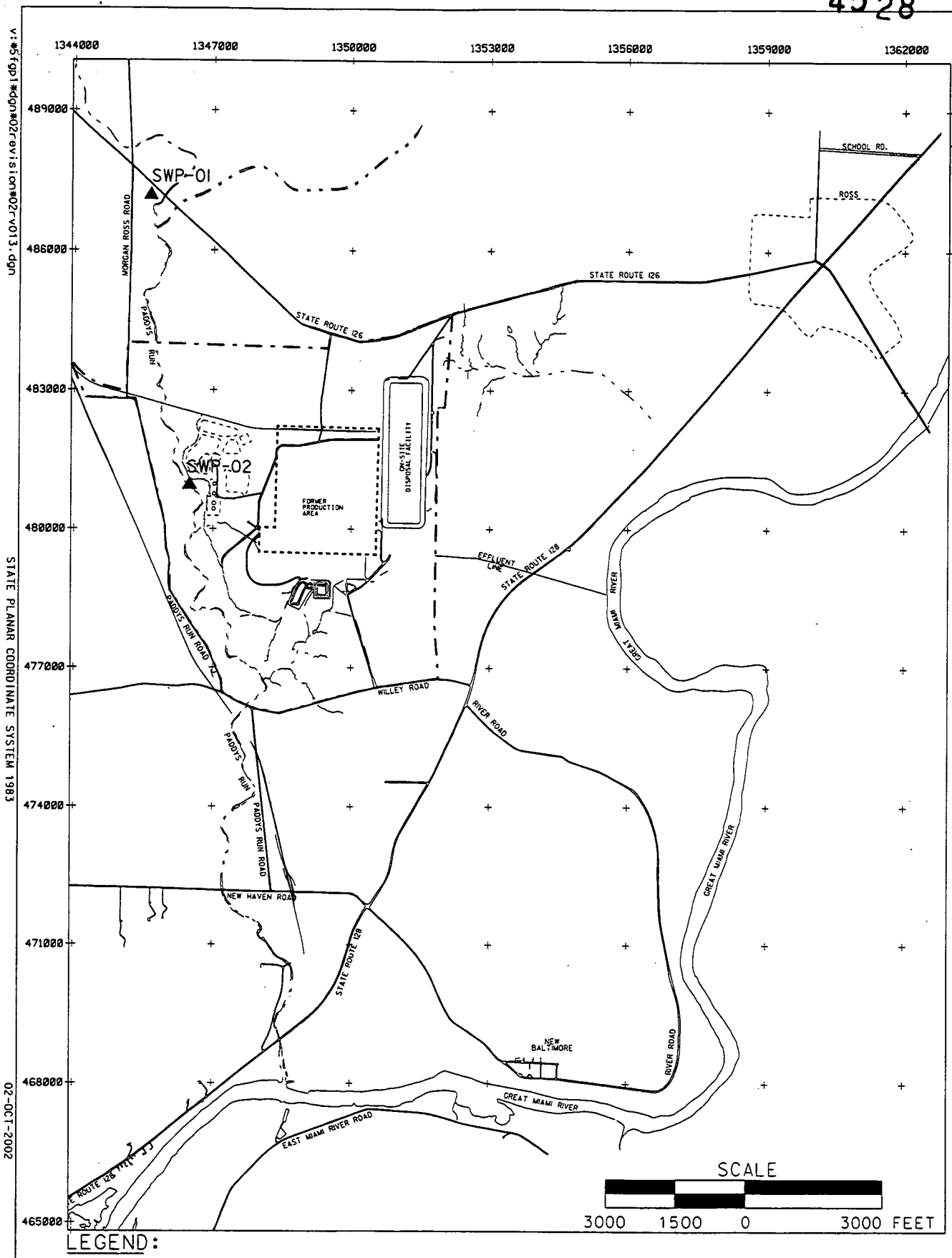
000278

v:\5fqp1\dgn\02revision\02rv012.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002

FIGURE B-5. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR LEAD




LEGEND:

FEMP BOUNDARY

▲ 1997-2001 IEMP EXCEEDANCE

DRAFT
FINAL

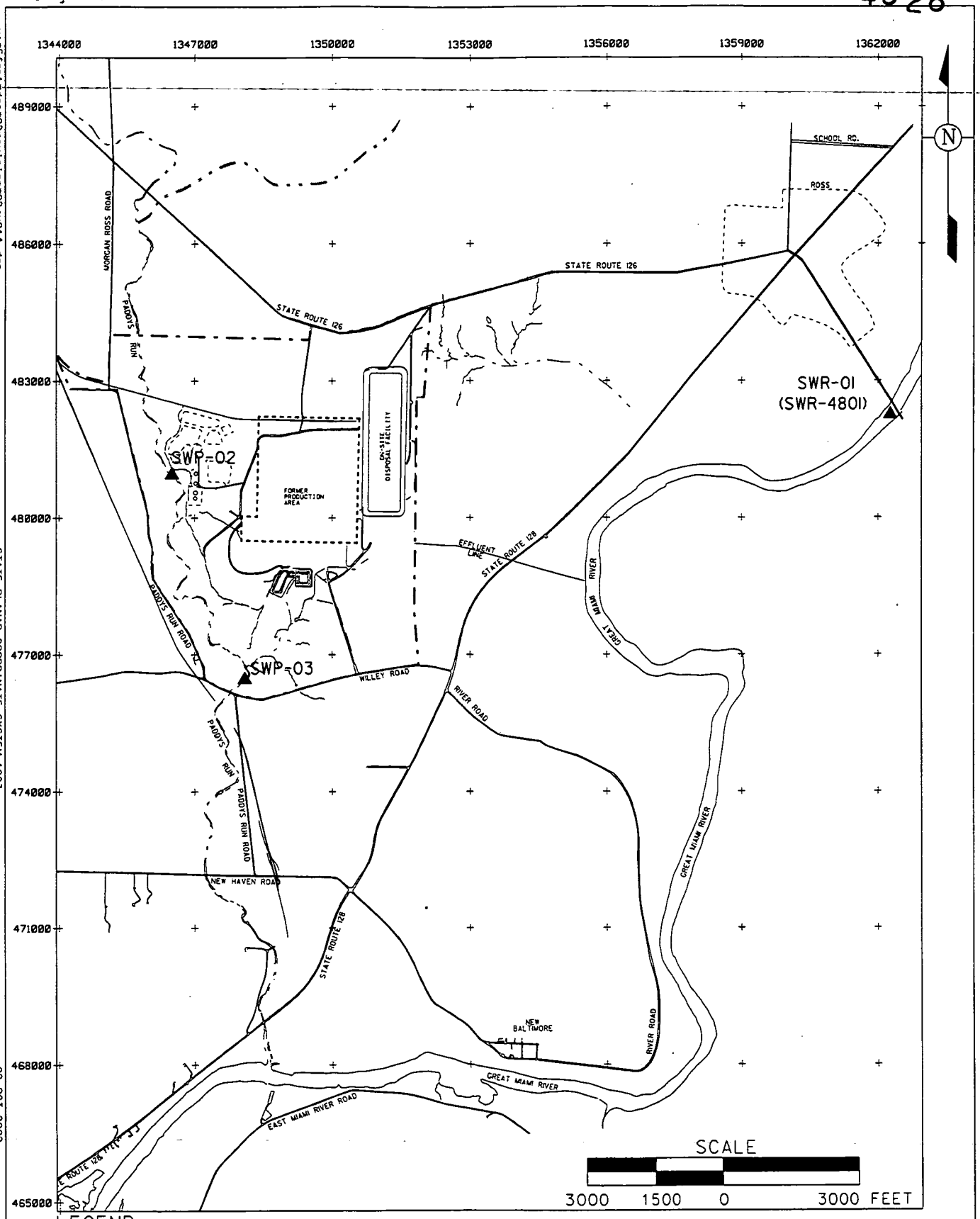
000279

FIGURE B-6. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR MANGANESE

v:\5fgp1\dgn\02revision\02rv013.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002




LEGEND:

FEMP BOUNDARY

▲ 1997-2001 IEMP EXCEEDANCE

DRAFT
FINAL

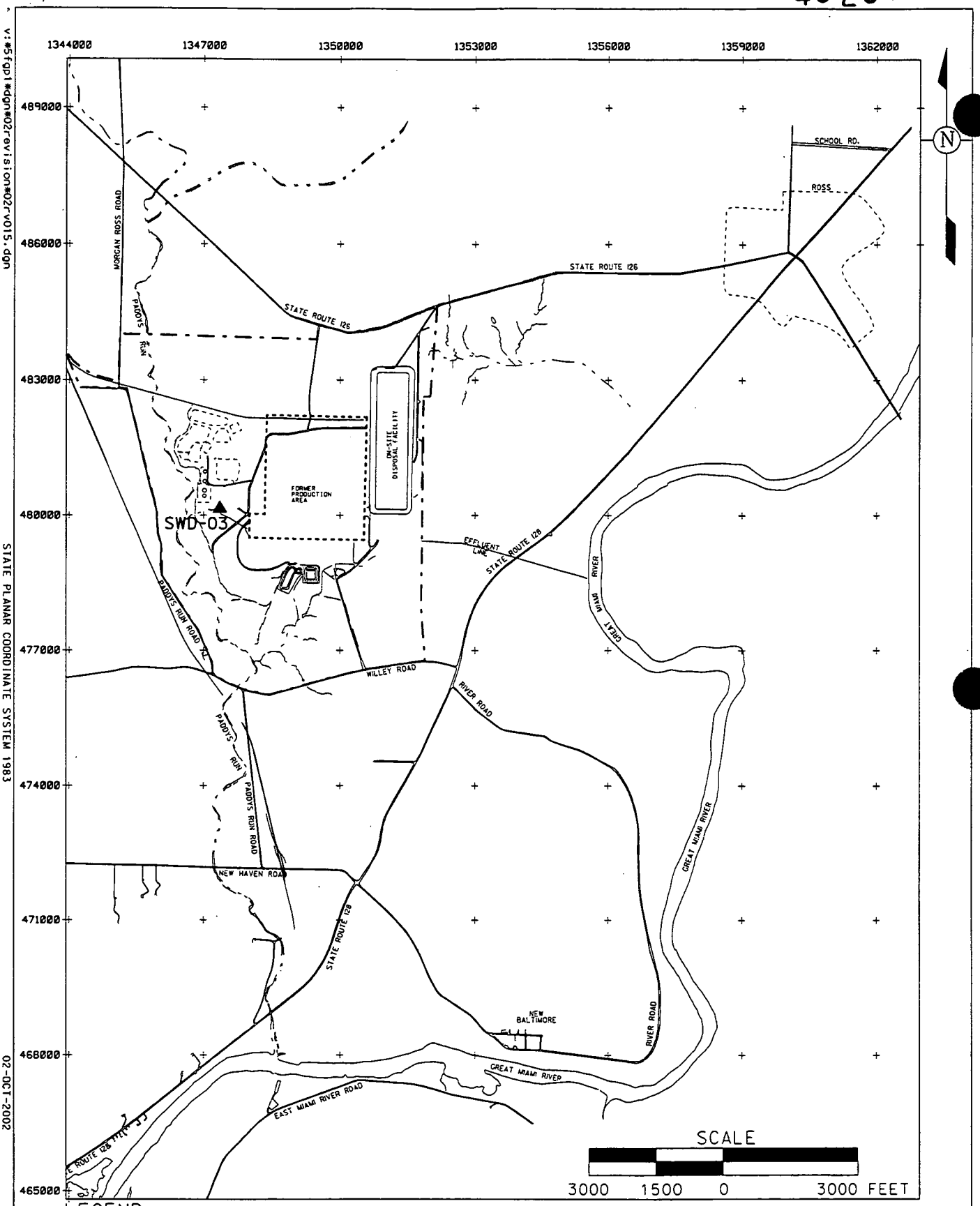
000280

FIGURE B-7. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR MERCURY

v:\5fp1\dgn\02revision\02rv014.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002




LEGEND:

— · — · — FEMP BOUNDARY

▲ 1997-2001 IEMP EXCEEDANCE

DRAFT
FINAL

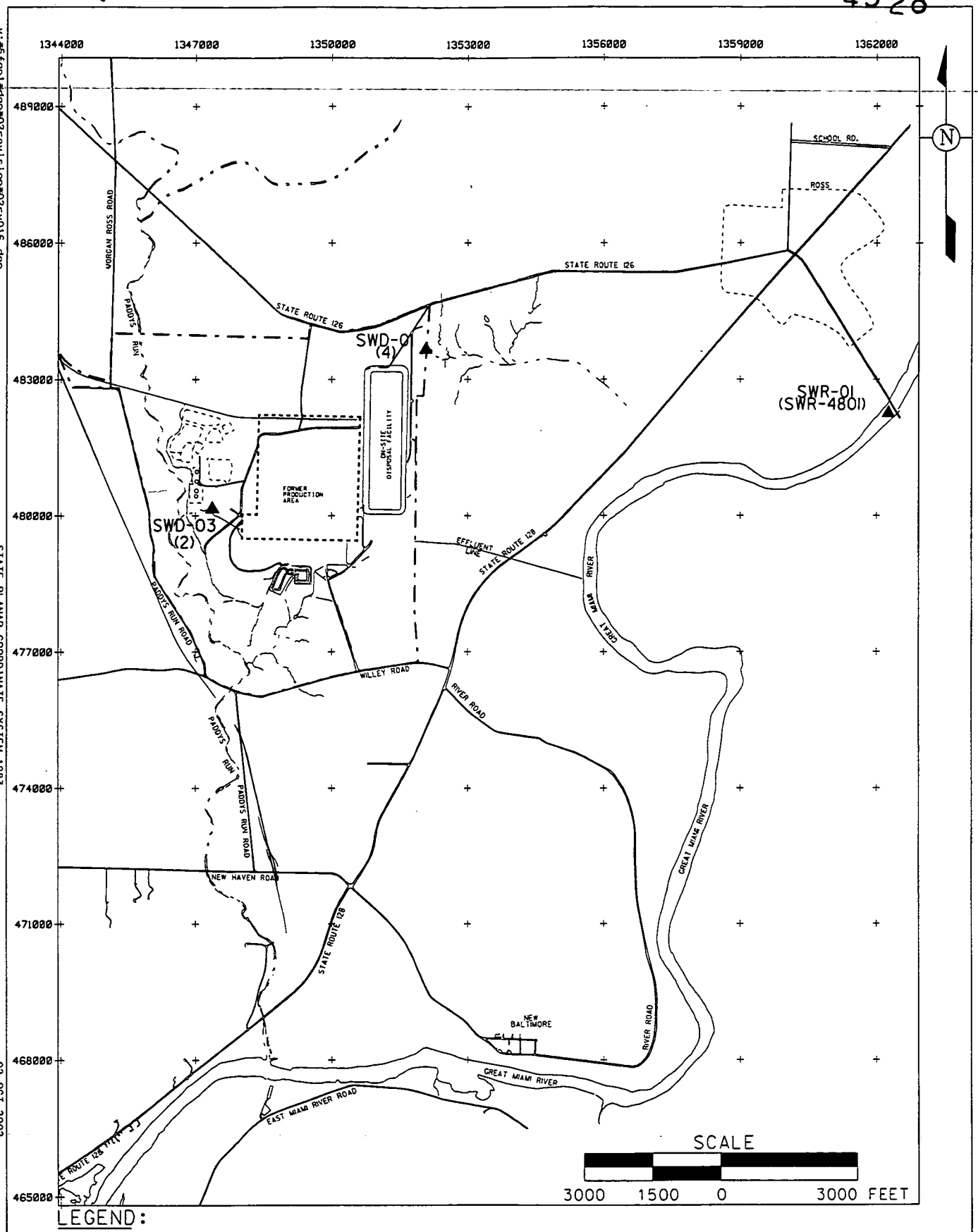
000281

FIGURE B-8. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR SILVER

v:#5fgpl#dgn#02revision#02rv015.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002




LEGEND:

FEMP BOUNDARY

(2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

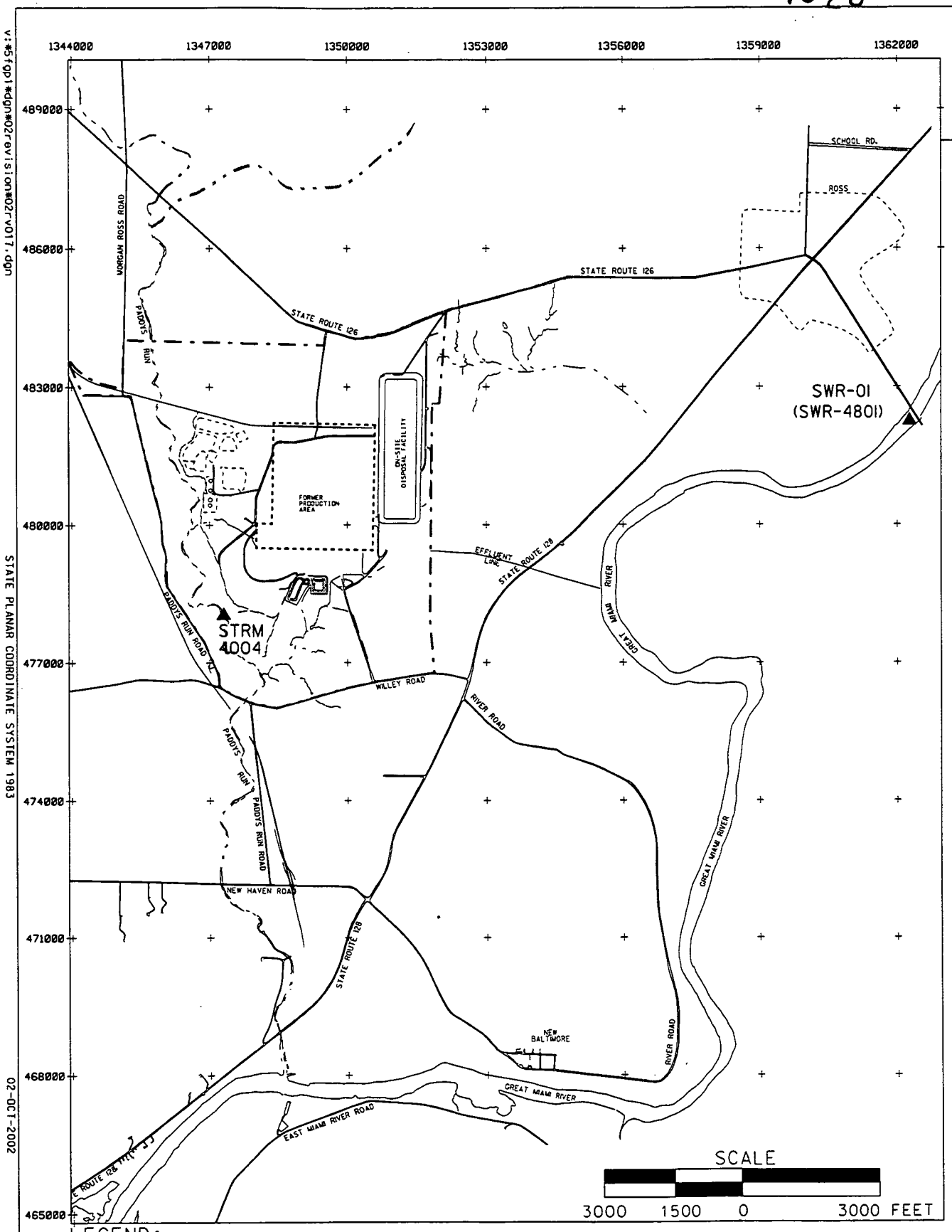
▲ 1997-2001 IEMP EXCEEDANCE

DRAFT FINAL

000282

FIGURE B-9. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR ZINC

v:\5fgp1\dgn\02revision\02rv016.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




LEGEND:

FEMP BOUNDARY

▲ 1997-2001 IEMP EXCEEDANCE

DRAFT FINAL

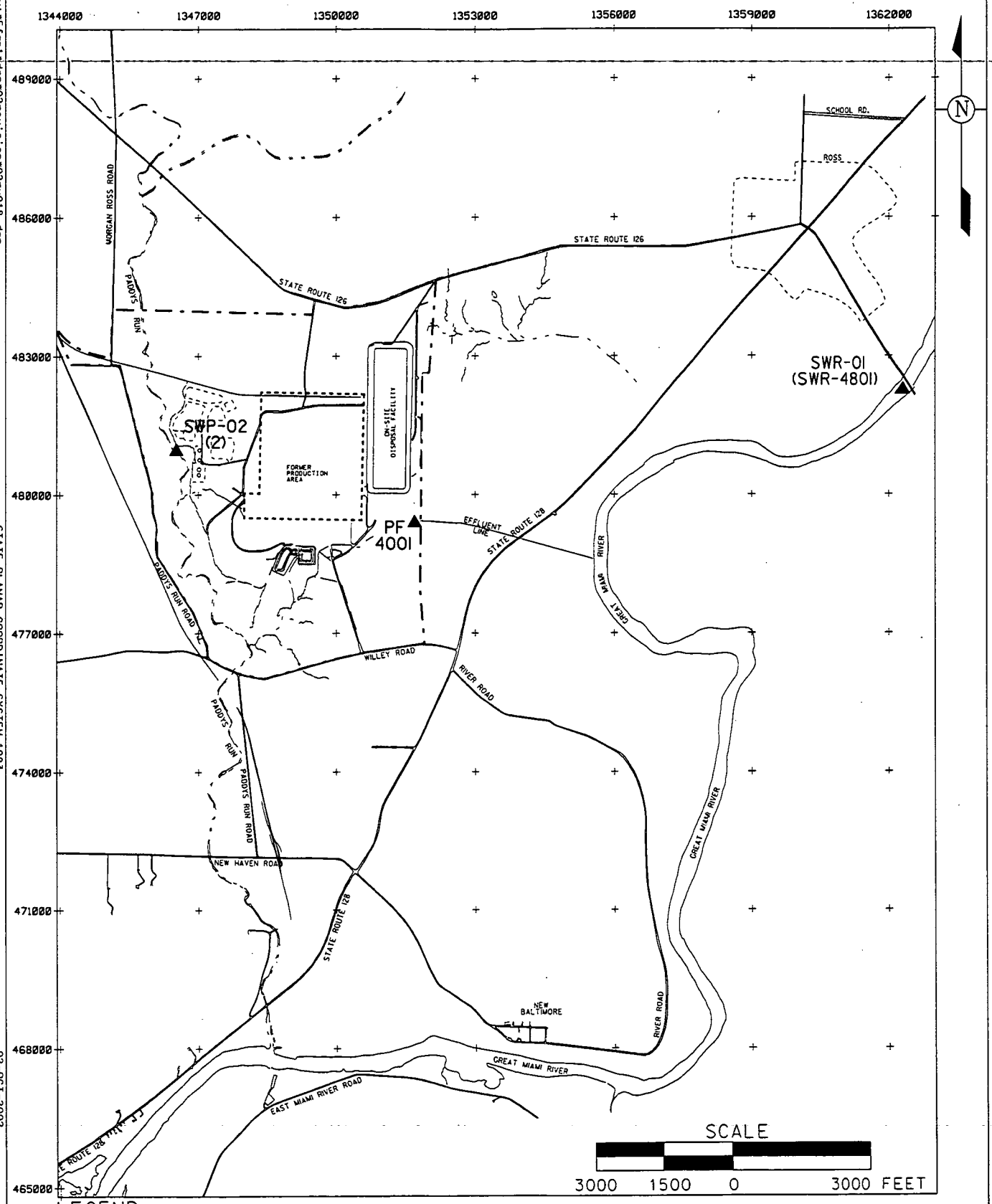
000283

FIGURE B-10. SURFACE WATER LOCATIONS WITH BTV EXCEEDANCES FOR BARIUM

v:\5fop1\dgn\02revision\02rv017.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002




LEGEND:

—·—·— FEMP BOUNDARY

(2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

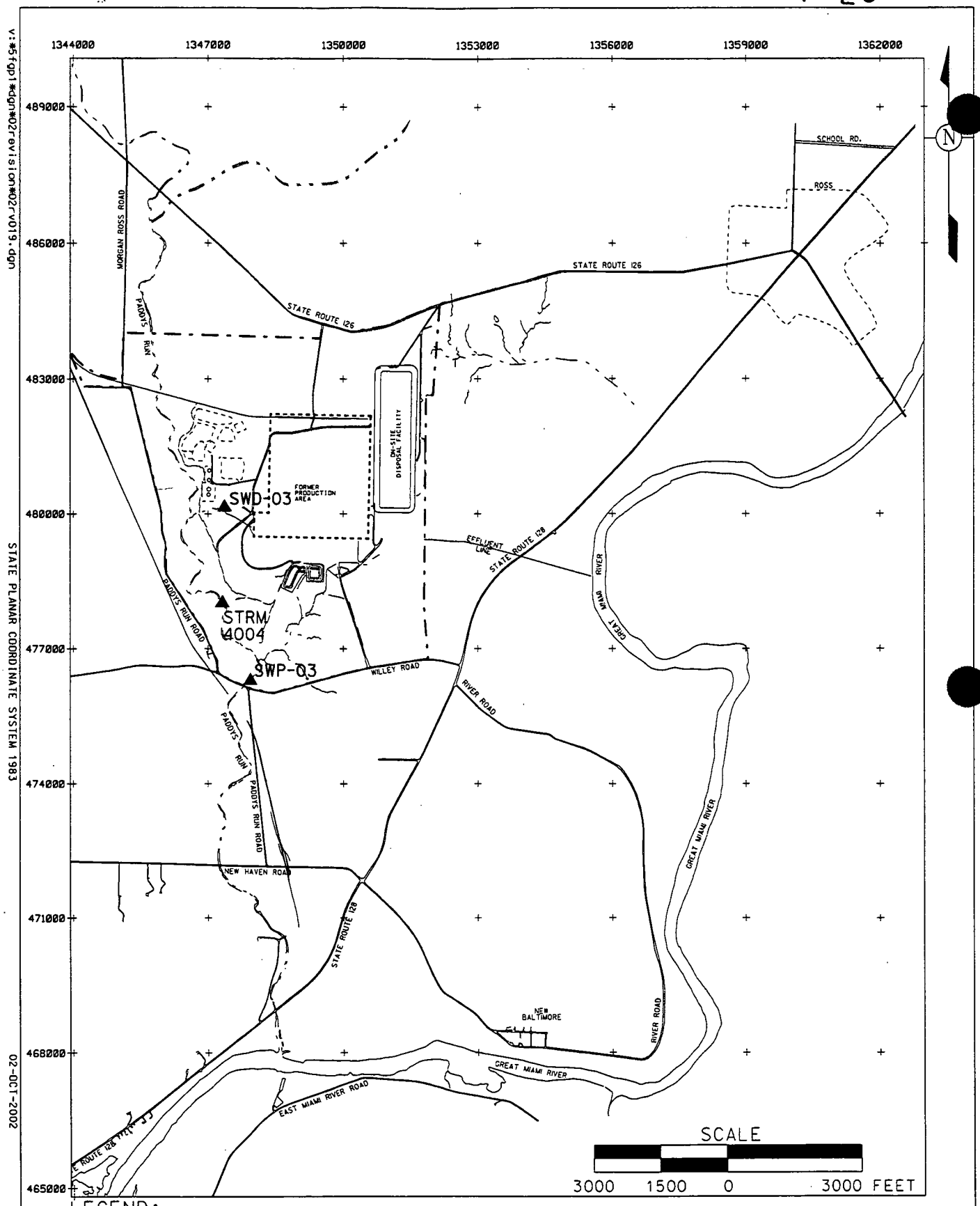
▲ 1997-2001 IEMP EXCEEDANCE

DRAFT
FINAL

000284

FIGURE B-11. SURFACE WATER LOCATIONS WITH BTV EXCEEDANCES FOR CADMIUM

v:\5fgp1\dgn\02revision\02rv018.dgn
STATE PLANAR COORDINATE SYSTEM 1983
02-OCT-2002




LEGEND:

FEMP BOUNDARY

▲ 1997-2001 IEMP EXCEEDANCE

DRAFT
FINAL

000285

FIGURE B-12. SURFACE WATER LOCATIONS WITH BTV EXCEEDANCES FOR SILVER

v:\5fdp1\dgn\02revision\02rv019.dgn

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002

# Appendix C

# APPENDIX C

# DOSE ASSESSMENT

# APPENDIX C

# DOSE ASSESSMENT

## C.1 INTRODUCTION

This appendix describes the technical approach for conducting the annual radiological dose assessment to meet the intentions of U.S. Department of Energy (DOE) Order 5400.5 and the air pathway compliance determination (for 40 Code of Federal Regulations [CFR] 61 National Emissions Standards for Hazardous Air Pollutants [NESHAP] Subpart H) during the active remediation of the Fernald Environmental Management Project (FEMP). The Integrated Environmental Monitoring Plan (IEMP) will be the vehicle for conducting and reporting the annual sitewide radiological dose assessments.

The application of effective source and emission control measures, coupled with appropriate initial planning and on-going preventive tracking, will form the cornerstone of the FEMP's environmental safeguards during remediation. The objective of the dose assessment under the IEMP is to support these safeguards during remediation and to provide appropriate feedback, when necessary. The FEMP's current compliance-based method for conducting the site's annual dose assessment (which, by definition, is performed at the end of the calendar year to report the results of past activities) will be supplemented with tracking and evaluating actual monitoring data collected at the site fenceline during the year to identify any need for improving source emission control measures to ensure that the annual NESHAP dose limit is never reached.

## C.2 REGULATORY DRIVERS AND REQUIREMENTS

Radiological dose assessments are prepared annually at the FEMP to establish that doses to the public from routine operations and emissions are in compliance with the dose limits set by the U.S. Environmental Protection Agency (EPA) and DOE regulations and orders. Before 1998 radiological dose assessments conducted at the end of the year were based on modeling results that used measured and estimated releases of airborne radioactive materials from significant sources. Before 1998 radiological dose assessments conducted at the end of the year were based on computer modeling results that used measured and estimated releases of airborne radioactive materials from significant sources. Since 1998 radiological dose assessments have been based on environmental monitoring results in order to provide a more accurate estimate of dose attributable to fugitive emissions. The various radiological dose limits and guidelines defined in the applicable or relevant and appropriate requirements (ARARs) and other regulatory requirements accompanying the FEMP's remediation activities are described in this section.

In addition to the regulatory-based drivers for the FEMP's annual dose assessment, the need for a dose tracking procedure that can be utilized as a preventive tool has been identified. Dose tracking is needed to help prevent exceedance of the annual radiological dose limits and to identify the expected significant contributors for each year's combination of remediation activities. Based on the dose tracking results, any additional source control measures or adjustment in project-specific activities can be made as necessary to ensure that the FEMP's contributions to annual dose remain within prescribed limits.

### C.2.1 ARARs and Other Regulatory Drivers

This subsection summarizes the ARARs and other regulatory drivers for the dose assessment and associated dose limits. A sitewide radiological dose assessment is needed to demonstrate compliance with the following limits and guidelines from DOE Order 5400.5, which incorporates dose assessment standards in 40 CFR 61 NESHAP, Subpart H:

- The exposure of members of the public to radiation sources as a consequence of all routine activities at a DOE site shall not cause, in a year, an effective dose equivalent greater than 100 millirem (mrem). This annual effective dose equivalent is defined as the sum of direct external exposure for the year, plus the committed effective dose equivalent for intakes experienced during the year.

- The guideline includes doses from remediation activities and naturally occurring radionuclides released by DOE processes, but not radon and its decay products. All pathways that could significantly contribute to the exposure are to be included in the calculations. Significant exposures are considered to be one percent of the 100 mrem (one mrem) dose limit or greater.

- The exposure of members of the public to radioactive materials released to the atmosphere as a consequence of all activities at a DOE site shall not cause, in a year, an effective dose equivalent greater than 10 mrem. Because this guideline implements the dose limits of 40 CFR 61 Subpart H, doses caused by radon-222 and its decay products are not included. The same annual effective dose equivalent definition applies as above.

- Note: The radon effluent guidelines of DOE Order 5400.5 also implement the EPA flux regulations of 40 CFR 61, Subpart Q, which apply to radon-producing wastes during storage or disposal. These guidelines are expressed in terms of radon concentrations in air and radon flux at the surface of radon-producing wastes, not in terms of dose to humans or other organisms.

- The liquid effluents from DOE activities shall not cause private or public drinking water systems to exceed the drinking water radiological limits in 40 CFR 141. That is, effluents must not cause the drinking water to exceed any of the following independent limits: man-made beta/gamma-emitting radionuclides at an annual average concentration that would cause an annual dose equivalent of 4 mrem to the total body or any internal organ, combined radium-226 and radium-228 at any time totaling 5 picoCuries per liter (pCi/L), or gross alpha activity (including radium but excluding radon and uranium) of 15 pCi/L at any time.

- The absorbed dose to native aquatic organisms shall not exceed one rad per day from exposure to the radioactive material in liquid wastes discharged to natural waterways. For the purposes of satisfying this requirement, the term "native aquatic organisms" (which is not otherwise defined by DOE) is interpreted to mean insects, macro-invertebrates (i.e., crayfish, shellfish, etc.), finned fish or mammals.

C.2.2 Remediation Support Requirements

During FEMP remediation, routine dose assessments using actual monitoring data will also be conducted more frequently to verify the effectiveness of the source control measures implemented by individual remediation projects and to prevent exceedance of the annual dose limits.

During the year, actual monitoring data at fenceline monitoring locations as defined in Section 6.0 will be evaluated at least quarterly. When determined necessary, the source emission control measures for selected remediation projects will be revised to reduce the chance of exceeding the annual dose limit. At the end of the year, the actual air monitoring data will also be directly used to determine the annual dose for the 40 CFR 61 NESHAP Subpart H compliance demonstration.

## C.3 GENERAL TECHNICAL APPROACH

This section presents a discussion of the general technical approach to be followed for performing the dose tracking and actual annual dose assessment. The discussion includes an explanation of exposure pathways and media important to the dose assessment, surveillance and characterization of these pathways, and the dose calculation procedure.

### C.3.1 Exposure Pathways During Remediation

Establishment of representative exposure pathways is important for performing the dose assessment. A typical exposure pathway consists of a specific source, medium of transport, and a defined receptor. During the course of remediation, conditions at the FEMP's contaminant sources may be altered both temporarily (during the action) and permanently (as a result of the action). Therefore, representative definitions of remediation-specific exposure pathways are needed to support accurate projections of radiological dose. Because contaminant source conditions can vary each year due to the mix of remediation activities in a given year, representative definitions of remediation-specific exposure pathways will be reevaluated each year during the initial annual sitewide planning and dose projection.

#### C.3.1.1 Remedial Project-Specific Sources

The remedial operations present new potential emissions sources in addition to the traditional sources (e.g., stack emissions) evaluated for NESHAP compliance. Following is a list of the major types of remediation operations that may have significant emissions:

- Building decontamination and dismantling
- Soil and waste pit material excavation
- Waste handling and treatment
- Construction and operation (i.e., waste placement) of the on-site disposal facility
- Waste transportation.

It is important to emphasize that the scope of the IEMP does not include the project-specific emission control monitoring (such as that fugitive dust monitoring) that will be performed by the individual projects. The individual projects will also be responsible for applying the appropriate emission controls within a remediation activity to achieve compliance with project-specific regulatory requirements for workers' protection and environmental emissions. As a feedback mechanism for the projects, in the event that the routine IEMP dose tracking results indicate a pending unacceptable annual cumulative impact, follow-up project-specific analyses will be conducted to determine the possible causes. Then, the results of the analysis will be provided to the specific remedial projects and they will be responsible for further adjusting their control measures or activities to bring cumulative projections within acceptable limits.

C.3.1.2 Media-Specific Pathways

Effective source control measures for each remedial action will be implemented and maintained during FEMP remediation. (The IEMP monitoring and dose tracking activities are designed to appraise the cumulative effectiveness of these control measures.) As a result of the FEMP's continuing obligation to apply such measures and the maturity of several remediation projects, the potential impacts resulting from remediation activities are not expected to appreciably increase in any of the media-specific pathways from historical levels. Therefore, the historical monitoring results summarized in the past annual site environmental reports can be used to select the FEMP's significant exposure pathways (i.e., those pathways with the potential to contribute more than one percent of the all-pathway combined dose limit of 100 mrem, as prescribed by DOE guidelines) to be routinely monitored and included in the annual dose calculation procedure under the scope of the IEMP.

According to the past five annual dose assessments and remedial investigation/feasibility studies performed at the FEMP, the potential exposure pathways to human receptors are through the air (inhalation and ingestion) and by direct radiation. These potential media-specific pathways are summarized below:

Air Pathway

Significant exposure (i.e., above one percent of the all-pathway combined dose limit of 100 mrem) to humans through the air pathway during remediation may result from:

- Inhalation of contaminated fugitive dust from soil excavation, building decontamination and dismantling, temporary soil storage piles, on-site disposal facility construction and waste pits (dose attributable to airborne emissions is subject to 40 CFR 61, Subpart H limit of 10 mrem per year)
- Inhalation of stack and vent releases

- Ingestion of foodstuff contaminated by direct deposition onto crops
- Ingestion of foodstuff contaminated indirectly by deposition onto soil where crops are grown.

Note: Exposure through consumption of meats and milk from animals that consumed contaminated feed (assuming all contaminated by air deposition instead of irrigation using contaminated water) has been shown to be consistently insignificant according to existing monitoring data.

Direct Radiation Pathway

Exposure from direct radiation may result from:

- Direct radiation from materials stored at the FEMP, especially materials in the K-65 Silos
- Direct radiation from contaminated soil and sediment.

C.3.1.3 Potential Receptors

Potential receptors to be considered in the radiological dose assessment during the FEMP remediation will include actual and hypothetical off-property residents. The hypothetical receptors are usually selected to demonstrate the worst possible dose at locations of the measured or calculated maximum air concentrations even when there is no actual receptor at those locations. The NESHAP compliance demonstration will be based on fenceline measurements although there are no actual receptors on the fenceline. The IEMP air monitoring network focuses on monitoring at the fenceline to ensure limits are not exceeded, thereby ensuring the levels at the actual off-property residents are also below the limits. The exposure scenarios and parameters (i.e., duration of exposure and potential food sources) will be generally conservative as used in the previous dose assessments.

C.3.2 Routine Surveillance of Pathways

The environmental media that have the potential to lead to a significant annual dose (greater than one percent of the DOE all-pathway combined dose limit of 100 mrem) at the site boundary and representative potential receptor locations will be routinely sampled and analyzed for the constituents contributing to the dose. Sections 3.0 through 7.0 of the main text describe the media-specific monitoring programs under the IEMP. All the significant pathways listed in Section C.3.1.2 will be monitored under the IEMP.

In general, the routine surveillance under the IEMP will include both environmental sampling/analysis and dose assessment/feedback to the remediation projects. The frequency of monitoring and evaluation will be selected to satisfy the regulatory drivers, as well as, remediation support requirements.

The data for the dose assessment will be based on measurements of radionuclide concentrations in environmental media at on-property and boundary/receptor monitoring locations (as presented in Sections 3.0 through 7.0), rather than in effluent samples obtained at specific sources (i.e., stacks), for the following reasons:

- Dose assessments based on measured radionuclide concentrations in environmental media are less uncertain than those based on effluent measurements. Assessments based on environmental monitoring avoid the use of the transport and bioaccumulation models required by effluent-based calculations, thereby reducing the overall uncertainty in the results.

- The potential exists for unmonitored releases from the FEMP, and the impact of all releases must be accounted for. Examples of potential unmonitored releases include releases from open waste pits, fugitive releases from remediation activities, and any releases from demolition projects in the former production area. In an effluent-based method, releases from such pathways must be conservatively estimated, which again contributes to the uncertainty of the results and over-estimates the impact.

- Calculations based on environmental measurements directly account for impact from multiple sources. Using environmental monitoring results as input for the dose assessment accounts for all sources of environmental contaminants, without the need for assumptions regarding the impacts of multiple facilities.

- Despite the lower concentrations in environmental media compared to effluent samples, adequate dose sensitivity can be achieved. Environmental sampling frequencies, sample sizes, and analytical methods have been selected to obtain sufficient sensitivity in order to support the required dose calculations.

The air pathway dose calculation, which is required to demonstrate compliance with EPA's NESHAP Subpart H standards, will also be based on environmental monitoring data instead of stack emissions measurements and subsequent air dispersion modeling.

As part of its integration responsibilities, the IEMP serves to consolidate the FEMP's environmental monitoring, preventive tracking/feedback, and reporting requirements required to assess the air exposure pathway.

C.3.3 Dose Assessment Approach

C.3.3.1 Air Monitoring for NESHAP Subpart H Compliance

This section describes the technical approach for demonstrating compliance with NESHAP Subpart H using environmental measurements of radionuclide air concentrations at the FEMP fenceline. The section addresses each of the criteria for environmental measurement compliance programs as described in 40 CFR 61.93 (b)(5) and the basic requirements issued by EPA for NESHAP Subpart H environmental measurements at the FEMP.

*Criterion (I):* *The air at the point of measurement shall be continuously sampled for collection of radionuclides.*

Seventeen out of a network of 18 (16 fenceline, one background, and one for thorium tracking) continuously operating high volume air monitoring stations will be used for the collection of radionuclides. The air monitoring stations sample air at approximately 1.3 $m^3$/minute using a 0.3 micron filter. The air monitoring stations contain a flow rate chart recorder and an hour-meter that provides a record of the monitors operation over the sampling period. The air monitoring stations are routinely checked to ensure normal operation. Figure 6-1 identifies the location of the air monitoring stations. Monitoring locations have been selected based on wind rose sectors and potential receptor locations.

*Criterion (II):* *Those radionuclides released from the facility, which are the major contributors to the effective dose equivalent, must be collected and measured as part of the environmental measurement program.*

The IEMP air monitoring program consists of the following sampling and analytical regime.

- Table C-1 identifies the analysis regime for samples collected from each air monitoring station.

**TABLE C-1**

**ANALYSIS REGIME**

| Constituent | Frequency | Method | HAMDC[a] (pCi/$m^3$) |
|---|---|---|---|
| Total Particulate | Biweekly | Gravimetric | - |
| Total Uranium | Biweekly | Laser Phosphorescence/ICPMS | 3E-05 |
| Thorium-228 | Monthly | Alpha Spec. | 7E-06 |
| Thorium-230 | Monthly | Alpha Spec. | 7E-06 |
| Thorium-232 | Monthly | Alpha Spec. | 7E-06 |

- Quarterly composite samples will be prepared from the biweekly samples for each monitor. The composite samples will be analyzed at ASL E by an off-site laboratory for the following constituents of concern. Table C-2 provides the basis for the frequency of analysis and selection of constituents.

**TABLE C-2**

**QUARTERLY ANALYSIS REGIME**

| Constituent | Method[a] | HAMDC[b] ($pCi/m^3$) | HAMDC as Percent of Appendix E, Table 2 Values |
|---|---|---|---|
| Uranium-238 | Alpha Spec. | 9E-05 | 1.1 |
| Uranium-234 | Alpha Spec. | 9E-05 | 1.3 |
| Uranium-235/236 | Alpha Spec. | 9E-05 | 1.2 |
| Thorium-228 | Alpha Spec. | 7E-06 | 0.2 |
| Thorium-230 | Alpha Spec. | 7E-06 | 0.2 |
| Thorium-232 | Alpha Spec. | 7E-06 | 1.1 |
| Radium-226 | Gamma Spec./Alpha Spec. Analysis | 2E-04 | 6.1 |

[a]Or other EPA-approved methods
[b]HAMDC = Highest Allowable Minimum Detectable Concentration as specified in the Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 2002) or as specified in analytical contracts with off-site laboratories. The HAMDCs required by the FEMP provide adequate sensitivity to detect below 10 percent of the corresponding NESHAP standard for each radionuclide of interest.

Frequency of Analysis

Quarterly analysis of composite samples is performed in order to meet the following needs of the IEMP air monitoring program:

- Sufficient air sample volumes to detect the low concentrations of contaminants in the air
- Periodic confirmation that contaminant concentrations are below the levels which would cause a dose of 10 mrem/year.

At low concentrations, large volumes of air must be sampled in order to readily detect and distinguish the presence of a contaminant from both the background and blank concentrations. Because filter loading limits the volume of air that can be sampled with a single filter, quarterly composite sampling is used to create a sample that represents a large volume of air.

Quarterly measurements provide a means to check the concentrations of contaminants several times during the year. Activities or work practices will be adjusted if quarterly measurements indicate that the 10 mrem/year limit might be exceeded.

Basis for Quarterly Composite Analytical Suite

The isotopes selected for quarterly analysis represent the major contributors to dose based on the following considerations:

- Radionuclides which are stored in large quantities at the FEMP and which will be handled or processed during the remediation effort (uranium, thorium-232, thorium-230, and radium-226)
- Radionuclides which have been the major contributors to dose based on recent environmental filter measurements (uranium and thorium-230)
- Radionuclides, which due to their concentration in waste and contaminated soil, will be the major contributors to dose if the waste or soil is released in the form of fugitive dust (uranium, thorium-228, and thorium-230).

The large quantities of uranium compounds stored at the FEMP combined with the potential for release during the remediation effort are the basis for including them as major contributors to dose. The waste products from the chemical processes used to produce uranium metal at the FEMP contain comparatively high levels of thorium-230 and radium-226. These wastes were either stored in the K-65 Silos (historically with the intent of recovering the radium-226) or disposed of in the waste pits. The high concentrations of thorium-230 in the waste pit material are documented in the Remedial Investigation Report for Operable Unit 1 (DOE 1994). The K-65 Silos contents and the high levels of radium-226 and thorium-230 are characterized in the Remedial Investigation Report for Operable Unit 4 (DOE 1993). The inclusion of radium-226 and thorium-230 as major contributors is based, in part, on the quantity of wastes that contain high levels of these radionuclides.

Based on planned activities and the radiological characteristics of materials (soil and waste) to be processed, uranium and thorium-230 are expected to continue to be the major contributors to the air pathway dose during the near term (2003 and 2004). However, DOE recognizes that as the remediation progresses, new sources of emissions may change the mix of major contributors. The potential to change the list of major contributors exists through the excavation of the waste pits, demolition of buildings within the former production area, and to a lesser extent, the removal and handling of the silo's contents.

The major contributors from the waste pits were estimated by calculating the radionuclides relative contributions to dose assuming resuspension of the pit material in the form of fugitive dusts. Average concentrations of pit materials (DOE 1994) were used to represent the radiological characteristics of the fugitive dusts. The radiological characteristics of the K-65 Silos were not used because the process to remove the silo contents is not expected to generate emissions in the form of fugitive dusts. Table C-3 lists the expected major contributors to dose during waste pit excavation.

Thorium-228 was added to the list of major contributors based on its greater than five percentage contribution from Pits 1, 2, and 4. Based on process knowledge, small quantities of transuranics (e.g., neptunium-237 and plutonium-239/240) and fission products (strontium-90, technetium-99, and cesium-137) shown in Table C-3 were introduced into the waste pits from recycled uranium and not from irradiated fuel. These radionuclides have been well characterized in the FEMP wastes and will not be major contributors to air inhalation dose.

**TABLE C-3**

**ESTIMATED PERCENTAGE CONTRIBUTION TO INHALATION DOSE ASSUMING RESUSPENSION OF WASTE PIT MATERIAL**

| Constituent | Pit 1 | Pit 2 | Pit 3 | Pit 4 | Pit 5 | Pit 6 |
|---|---|---|---|---|---|---|
| Cesium-137 | 0 | 0 | 0 | 0 | 0.2 | 0 |
| Neptunium-237 | 0 | 0 | 0 | 0 | 3.4 | 0 |
| Plutonium-238 | 0 | 0 | 0 | 0 | 0.1 | 0 |
| Plutonium-239/240 | 0 | 0 | 0 | 0 | 0.3 | 0.1 |
| Radium-226 | 1.1 | 4.8 | 2.9 | 0.3 | 3.4 | 0 |
| Radium-228 | 0.2 | 1.1 | 1.2 | 0.4 | 0.5 | 0.2 |
| Ruthenium-106 | 0 | 0 | 0 | 0 | 0 | 0 |
| Strontium-90 | 0 | 2.0 | 0 | 0.1 | 0 | 0 |
| Technetium-99 | 0 | 0 | 0.1 | 0 | 1.2 | 0 |
| Thorium-228 | 5.2 | 6.1 | 2.8 | 7.4 | 0.7 | 0 |
| Thorium-230 | 47.1 | 40.0 | 77.3 | 9.8 | 66.6 | 0.2 |
| Thorium-232 | 16.2 | 9.1 | 8.4 | 9.5 | 2.5 | 0 |
| Uranium-234 | 5.1 | 14.3 | 2.6 | 9.1 | 10 | 8.8 |
| Uranium-235/236 | 0.7 | 6.6 | .2 | 1.6 | 0.4 | 1.7 |
| Uranium-238 | 24.4 | 16.1 | 4.6 | 61.7 | 10.7 | 88.9 |

DOE will monitor the changing mix of contributors by comparing the quarterly composite results to the NESHAP Appendix E, Table 2 values. If the fractions of the measured concentration to the corresponding NESHAP limit indicates a contaminant other than uranium is contributing the largest percentage of dose, then DOE will propose changes to the IEMP air monitoring and analytical schedule in order to better monitor the mix of major contributors.

Consideration of Decay Chain Daughter Products

Uranium-238, thorium-232, and uranium-235 are initial radionuclides in the uranium, thorium, and actinide decay chains, respectively. Table C-4 shows the decay chains and the half-lives of the daughter products.

Note: Doses caused by radon-222 and its respective decay products formed after the radon is released from the facility are not included in the NESHAP dose limit of 10 mrem/year and will not be measured as part of the NESHAP Subpart H compliance demonstration. A description of the FEMP radon monitoring program is included in Section 6.0.

**TABLE C-4**

**URANIUM, THORIUM, AND ACTINIDE DECAY CHAINS**

| Isotope | Half-Life | Isotope | Half-Life | Isotope | Half-Life |
|---|---|---|---|---|---|
| Uranium-238 | $4.5 \times 10^{9}$ years | Thorium-232 | $1.4 \times 10^{10}$ years | Uranium-235 | $7.1 \times 10^{8}$ years |
| Thorium-234 | 24 days | Radium-228 | 5.7 years | Thorium-231 | 25.64 hours |
| Protactinium-234m | 1.2 minutes | Actinium-228 | 6.13 hours | Protactinium-231 | $3.25 \times 10^{4}$ years |
| Uranium-234 | $2.5 \times 10^{5}$ years | Thorium-228 | 1.9 years | Actinium-227 | 21.6 years |
| Thorium-230 | $8.0 \times 10^{4}$ years | Radium-224 | 3.64 days | Thorium-227 | 18.2 days |
| Radium-226 | 1622 years | Radon-220 | 55 seconds | Francium-223 | 22 minutes |
| Radon-222 | 3.8 days | Polonium-216 | 0.16 second | Radium-223 | 11.4 days |
| Polonium-218 | 3.05 minutes | Lead-212 | 10.6 hours | Radon-219 | 4.0 seconds |
| Lead-214 | 26.8 minutes | Bismuth-212 | 60.5 minutes | Polonium-215 | $1.77 \times 10^{-3}$ seconds |
| Bismuth-214 | 19.7 minutes | Polonium-212 | $3.04 \times 10^{-7}$ seconds | Lead-211 | 36.1 minutes |
| Polonium-214 | $1.6 \times 10^{-4}$ sec. | Lead-208 | Stable | Bismuth-211 | 2.16 minutes |
| Thallium-210 | 1.3 minutes | | | Thallium-207 | 4.79 minutes |
| Lead-210 | 22 years | | | Lead-207 | Stable |
| Bismuth-210 | 5 days | | | | |
| Polonium-210 | 138 days | | | | |
| Lead-206 | Stable | | | | |

The majority of uranium and thorium received and processed during the production era of the FEMP had been separated from its decay chain daughters prior to shipment to the FEMP. As a result, decay chain daughter products were not in equilibrium (the condition where the daughter concentration [in Curies per gram (Ci/g)] is equal to the parents' concentration [in Ci/g]) with the parent concentrations in the bulk of the materials received on site for processing.

Radioactive decay laws govern the ingrowth of the daughters from the purified parent. Daughter product ingrowth is based on the length of time the parent bearing material has been stored on site. As a general rule, the daughter of a long-lived parent (e.g., uranium-238, thorium-232, or uranium-235) grows into equilibrium with the parent in about 10 daughter half-lives. For example, using data from the above table, thorium-234 would reach equilibrium with uranium-238 in about 240 days (10 x 24 days).

Considering the half-lives in the table above and the 40-year production history of the FEMP, a number of daughters can conservatively be considered to be present in equilibrium concentrations with their parents. These radionuclides (thorium-234, radium-228, actinium-228, radium-224, and thorium-231) will be considered to be in equilibrium with their parent concentrations measured in the quarterly composite. The equilibrium based concentration for these radionuclides will be compared to the corresponding 40 CFR 61 Subpart H, Appendix E, Table 2 value as described in *Criterion IV*. Other radionuclides (protactinium-231, actinium-227, and their decay products) have not had sufficient time to reach equilibrium with their parent. In fact, due to the 32,500 year half-life of protactinium-231, none of the decay chain daughters have had time for significant ingrowth. Therefore, concentrations of decay chain daughters in the uranium-235 chain below thorium-231 will be considered to be zero in the quarterly composite samples.

*Criterion (III): Radionuclide concentrations that would cause an effective dose equivalent of 10 percent of the standard shall be readily detectable and distinguishable from background.*

As indicated in Table C-2, the detection limits for the major contributors to dose are less than 10 percent of NESHAP Appendix E, Table 2 values and will therefore be readily detectable, if present. The analysis of samples from the background monitor(s) will provide the data to distinguish fenceline and potential receptor monitoring results from background.

*Criterion (IV): Net measured radionuclide concentrations shall be compared to the concentration levels in Table 2 of Appendix E to determine compliance with the standard. In the case of multiple radionuclides being released from the facility, compliance shall be demonstrated if the value for all radionuclides is less than the concentration level in Table 2, and the sum of the fractions that result when each measured concentration value is divided by the value in Table 2 for each radionuclide is less than one.*

Annual average radionuclide concentrations at each monitoring location will be determined for each radionuclide by dividing the sum of the radionuclide mass values, obtained via quarterly laboratory analysis, by the total volume of air drawn through the filter. As described above, decay chain daughter products will be assumed to be in equilibrium with the measured parent concentration. Concentrations will be corrected for background to obtain the net measured concentration. The resulting net annual average concentrations will be divided by the corresponding 40 CFR 61 Subpart H, Appendix E, Table 2 values. The resulting fractions will be summed per monitoring location to demonstrate compliance. Compliance with the Subpart H standard will be documented in a summary that will be submitted as part of the annual site environmental reports.

Managing Analytical Results

The analysis of environmental air samples may result in contaminant concentrations being reported at levels that are at or below the minimum detectable concentration (MDC). Contaminant concentrations, which are at or below MDC, are statistically indistinguishable from concentrations found in a blank sample. Air sample results which are reported at or below the MDC will therefore be considered non-detects (zero) for the purposes of demonstrating compliance with the NESHAP dose limit.

Detectable contaminant concentrations will be corrected to net detectable concentrations using the average background concentration measured during the same sampling period. Average background concentrations will be determined using the average detected concentrations. Background air monitoring results that are at or below MDCs will not be averaged, only measured concentrations will be used.

*Criterion (V): A quality assurance program shall be conducted that meets the performance requirements described in Appendix B, Method 114.*

All environmental sample collection and analysis conducted in support of the remediation effort at the FEMP are subject to the quality assurance requirements of the SCQ. This EPA approved plan and its incorporation into the IEMP sampling plan meets the quality assurance program requirements of Appendix B, Method 114.

*Criterion (VI): Use of environmental measurements to demonstrate compliance with the standard is subject to prior approval by EPA. Applications for approval shall include a detailed description of the sampling and analytical methodology and show how the above criteria will be met.*

The IEMP and its appendices provide a description of the sampling and analytical methodology and explains how the criteria will be met. DOE submitted an application to use environmental measurements to demonstrate compliance with the NESHAP Subpart H standard to EPA in May of 1997. EPA approved the application in August of 1997.

C.3.3.2 All -Pathway Dose Calculations

This section describes the technical approach for demonstrating compliance with the 100 mrem/year all-pathway dose limit in DOE Order 5400.5. Estimates of annual dose are based on the measured, background-corrected concentration of a contaminant in each environmental media (i.e., air and foodstuff). A modified reference diet (Nuclear Regulatory Commission Reg. Guide 1.109) is used for the consumption of food. Dose conversion factors (DCF) (which are radionuclide specific factors used to convert a unit of ingested radioactivity [pCi] to dose [mrem]) are taken from DOE publications (Internal/External Dose Conversion Factors for Calculation of Dose to the Public DOE/EH-0070 and DOE/EH-0071).

The general form of the dose assessment equation is

$$D = C_{i,m} * I_m * DCF_i$$

where,

$D$ = Dose (mrem/year)

$C_{i,m}$ = Background-corrected concentration of radionuclide "i" in media "m" (pCi/kg or pCi/L)

$I_m$ = Intake (ingestion) rate for media (kg/year)

$DCF_i$ = Dose conversion factor for radionuclide "i" (mrem/year*pCi)

The detailed calculation of doses from the various environmental media is governed by FEMP procedure ADM-08, Estimating Radiological Pathway Dose. Doses from all the media monitored under the IEMP also will be calculated according to relevant sections in this procedure. In general, foodstuff ingestion dose, air inhalation dose, and direct radiation dose will be separately calculated and then combined into the DOE all-pathway annual dose.

## C.4 REPORTING

The types, frequency, and procedure of dose assessment reporting during FEMP remediation are summarized in this section. Based on the objective of the dose assessment described in Section C.1, there will be three interfacing and reporting mechanisms in which the dose assessment results will need to be presented. Each of these three reporting processes is described in the following subsections.

### C.4.1 Project-Specific Interfaces

Project-specific emission monitoring results collected by remediation projects for workers' health and safety concerns will be used to determine significant contributors among the on-going remedial actions. Therefore, an interface between the IEMP and ongoing remediation projects will be maintained in order to gather project-specific data and to provide feedback for adjusting/implementing source control measures. Data review and evaluation will generally follow the receipt of each set of project-specific monitoring results.

### C.4.2 Regulatory Interfaces

The IEMP air monitoring data will be posted to the IEMP Data Information Site. When the monitoring data indicates a need for adjusting or implementing project-specific source control measures, the regulatory agencies will be notified by the specific remediation projects. The modifications and the effectiveness of the improved source control measures will also be documented.

### C.4.3 Annual Reporting

The NESHAP Subpart H Annual Report will be issued as part of the annual site environmental report, according to reporting schedule in Section 8.0 of the IEMP. Annual summaries of the monitoring results, calculated doses from airborne emissions, calculated dose from eating foodstuffs produced near the FEMP (every three years), and calculated direct radiation dose will be included in the report. Comparisons of the pathway-specific and the combined annual radiological doses to the regulatory dose limits will also be presented.

## C.5 SUMMARY

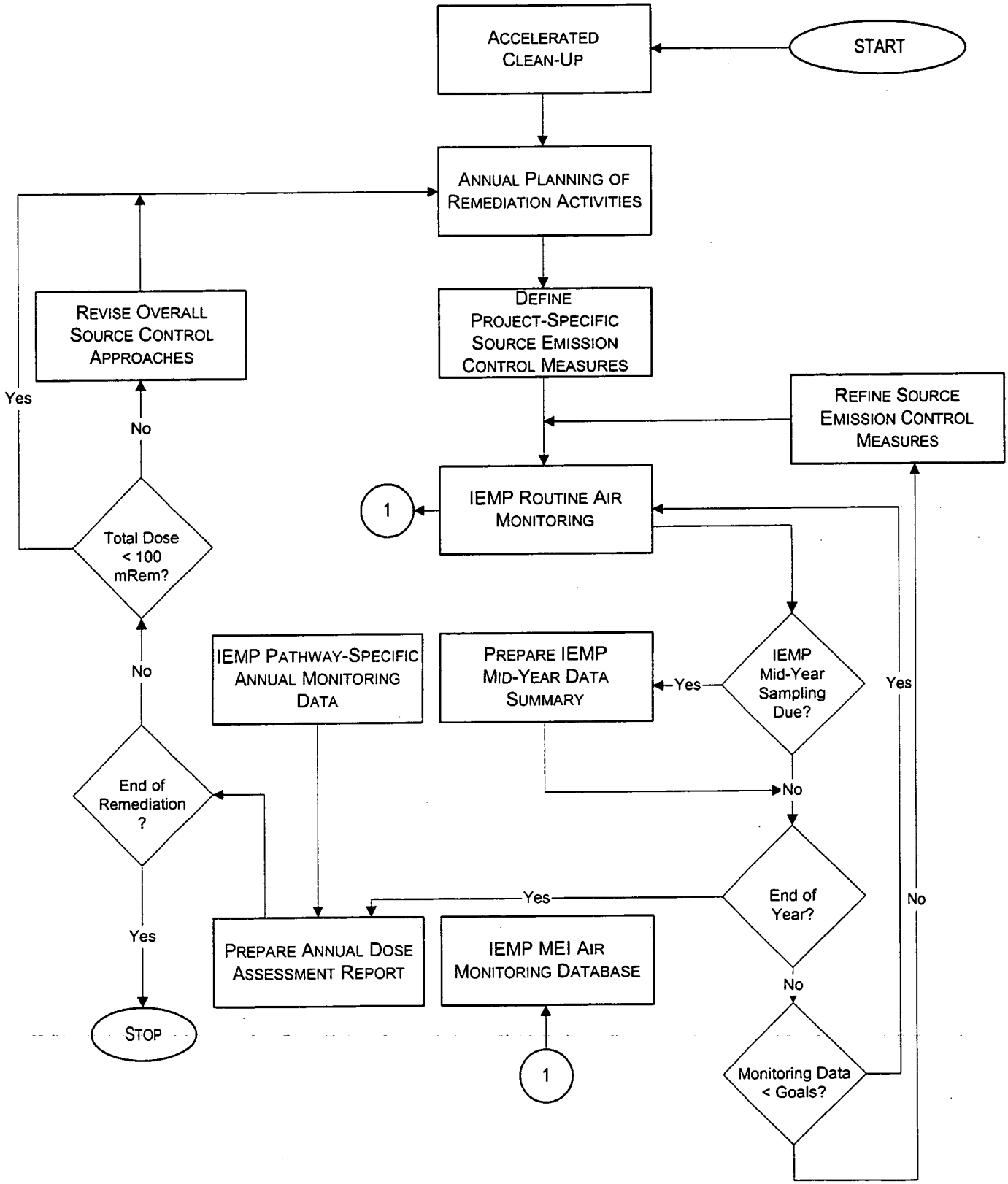
Figure C-1 shows the major tasks in the sitewide dose tracking and annual dose assessment processes during the FEMP remediation described in this Appendix. Table C-5 further summarizes the responsibilities of the IEMP and specific remediation projects to fully implement the sitewide air-pathway dose tracking and annual dose assessment processes.

## TABLE C-5

## SITEWIDE DOSE TRACKING AND ANNUAL ASSESSMENT TASKS

| Tasks | Project Responsibilities |
|---|---|
| | IEMP |
| • Annual Sitewide Planning | Evaluate planned remediation activities and source conditions at beginning of the year |
| • Routine Fenceline Monitoring | Conduct routine air monitoring at background and fenceline locations |
| • Preventive Tracking/Feedback | Directly compare routine monitoring results to annual dose benchmarks; report and evaluate any exceedances |
| • NESHAP Compliance Demonstration | Based on actual monitoring data, calculate annual doses at monitoring locations |
| • Reporting | Prepare summaries and the annual NESHAP report |
| | Remediation Project |
| • Annual Planning | Specify project-specific remedial schedule and activities at beginning of the year |
| • Maintain Fugitive Dust and/or Emission Source Control | Maintain/improve effective fugitive dust and emission source control measures within the project boundary |
| • Health and Safety Monitoring | Conduct routine remedial worker health and safety monitoring |

# FIGURE C-1
## SITEWIDE IEMP/DOSE TRACKING AND ASSESSMENT ROAD MAP




000303

## REFERENCES

U.S. Dept. of Energy, 2002, "Sitewide CERCLA Quality Assurance Project Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1994, "Remedial Investigation Report for Operable Unit 1," Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1993, "Remedial Investigation Report for Operable Unit 4," Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

Appendix D

# APPENDIX D

# NATURAL RESOURCE MONITORING PLAN

# APPENDIX D

# NATURAL RESOURCE MONITORING PLAN

## D.1 INTRODUCTION AND OBJECTIVES

The purpose of the Natural Resource Monitoring Plan (NRMP) is to monitor the status of impacts to natural resources at the Fernald Environmental Management Project (FEMP) during remediation. In addition, the plan will outline an approach to monitor the status of several priority natural resource areas in order to remain in compliance with the appropriate regulations. The results of this monitoring will be used to inform the U.S. Environmental Protection Agency (EPA), Ohio Environmental Protection Agency(OEPA), and the Fernald Natural Resource Trustees as to the status of Fernald's natural resources. Reporting of the monitoring results will be included in the annual Integrated Environmental Monitoring Plan (IEMP) reporting schedule. The IEMP annual site environmental reports will also summarize the results of monitoring ecological restoration efforts required through project-specific Natural Resource Restoration Design Plans.

## D.2 ANALYSIS OF REGULATORY DRIVERS

As shown in Table D-1, regulatory drivers for the management of natural resources and associated impact monitoring include five areas: endangered species protection; wetlands/floodplain regulations; cultural resource management; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) natural resource trusteeship process; and the National Environmental Policy Act (NEPA).

**TABLE D-1**

**FEMP NATURAL RESOURCE MONITORING**

| DRIVER | ACTION |
|---|---|
| Endangered Species Act<br>Ohio Endangered Species Regulations | The IEMP describes management of existing habitat and future follow-up surveys. |
| Clean Water Act - Section 404 | The IEMP describes the monitoring of mitigated wetlands. |
| National Historic Preservation Act<br><br>Native American Graves Protection and Repatriation Act<br><br>Archaeological Resources Protection Act | The IEMP describes the monitoring of cultural resources. |
| CERCLA<br><br>Executive Order 12580<br><br>National Contingency Plan | The IEMP describes the CERCLA Natural Resources Trusteeship process. |
| NEPA | The IEMP discusses the substantive requirements of NEPA for protecting sensitive environmental resources. |

000306

D.2.1 Threatened and Endangered Species

The federal laws and regulations listed below mandate that any action authorized, funded, or carried out by the U.S. Department of Energy (DOE) cannot jeopardize the continued existence of any listed species or result in the destruction or adverse modification of the constituent elements essential to the conservation of a listed species within a defined critical habitat. Additional requirements may apply if it is determined that a proposed activity could adversely affect these species or their habitat. These laws and regulations include the Endangered Species Act (16 United States Code [U.S.C.] §1531, et seq.) and its associated regulations (50 Code of Federal Regulations [CFR] 17 and 50 CFR 402).

State law also protects endangered species by prohibiting the taking or destruction of any state-listed endangered species. These laws are found in Ohio Revised Code §1518 and §1531, as well as in Ohio Administrative Code §1501.

D.2.2 Wetlands/Floodplains

Executive Order 11990 (Protection of Wetlands) and Executive Order 11988 (Protection of Floodplains), which are implemented by DOE Regulation 10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements," specify the requirement for a Floodplain/Wetland Assessment in cases where DOE is responsible for providing federally undertaken, financed, or assisted construction and improvements that may impact floodplains or wetlands. This regulation further requires that DOE exercise leadership to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands.

Pursuant to Section 404 of the Clean Water Act and 33 CFR § 323.3, any activity that results in the discharge of dredged or fill material out of or into a wetland or water of the United States requires permit authorization by the Army Corps of Engineers. These permits can be in the form of either nationwide permits (33 CFR Part 330) or individual permits (33 CFR Part 323) depending on the nature of the activity.

Section 401 of the Clean Water Act and 33 CFR §325.2(b)(1)(ii), also require that a Section 401 State Water Quality Certification be obtained to authorize discharges of dredged and fill material under a Section 401 permit. In Ohio, the Section 401 State Water Quality Certification program is administered by OEPA pursuant to Chapter 3745-32 of the Ohio Administrative Code.

D.2.3 Cultural Resource Management

Management of cultural resources, particularly archeological sites, is mandated by the National Historic Preservation Act (16 U.S.C. §470), the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001, et seq.), and the Archeological Resources Protection Act (16 U.S.C. §470aa-470ll). The associated regulations for the above laws are found in 36 CFR 800, 43 CFR 10, and 43 CFR 7, respectively. These laws and associated regulations ensure that archeological resources on federal land are appropriately managed. Section 106 of National Historic Preservation Act ensures that DOE takes into consideration the effect of its undertakings on properties eligible for listing on the National Register of Historic Places. Native American Graves Protection and Repatriation Act and 43 CFR 10 require that the rightful control of Native American cultural items that are discovered on federal land be relinquished to the appropriate, culturally affiliated tribe(s). Federal land is defined as "land that is owned or controlled by a federal agency" (e.g., the FEMP). Cultural items are defined as "human remains, associated funerary objects, unassociated funerary objects, sacred objects, and objects of cultural patrimony." Archeological Resources Protection Act and 43 CFR 7 ensure that competent individuals carry out archeological excavations in a scientific manner.

DOE has finalized a Programmatic Agreement with the Advisory Council on Historic Preservation and the Ohio Historic Preservation Office that streamlines the National Historic Preservation Act Section 106 consultation process. Monitoring provisions will be included as part of this agreement to ensure that appropriate management is implemented for any eligible properties at the FEMP.

D.2.4 The CERCLA Natural Resource Trusteeship Process

CERCLA, Executive Order 12580, and the National Contingency Plan collectively require certain federal and state officials to act on behalf of the public as trustees for natural resources. Trustees for the FEMP are the Secretary of DOE; the Secretary of the U.S. Department of the Interior; and officials of the OEPA, appointed by the Governor of Ohio.

The trustees' role is to act as guardians for public natural resources at or near the FEMP. The trustees are responsible for determining if natural resources have been injured as a result of a release of a hazardous substance or oil spill from the site and if so, how to restore, replace, or acquire the equivalent natural resources to compensate for the injury. DOE, as the responsible party, is potentially liable for costs related to natural resource injury, in addition to costs associated with remediation of the site.

The Fernald Natural Resource Trustees have been meeting since June of 1994 to evaluate and determine the feasibility of integrating the trustees' concerns with future remediation activities. The trustees have identified their desire to resolve DOE's liability by integrating restoration activities with remediation.

The Fernald Natural Resource Trustees have chosen to focus on a restoration-based approach to resolve DOE's liability for natural resource impacts. To accomplish this, the Fernald Natural Resource Trustees have signed a Memorandum of Understanding that establishes implementation of a Natural Resource Restoration Plan (NRRP) as the primary means of settlement for an existing natural resource damage claim against DOE by OEPA. The NRRP sets forth a conceptual design for a series of ecological restoration projects that will eventually encompass approximately 850 acres of the FEMP site. Detailed designs will be generated through Natural Resource Restoration Design Plans. Results of NRMP monitoring will be taken into consideration during the design of these area-specific restoration projects. Natural Resource Restoration Design Plans will have project-specific monitoring requirements to determine the success of the restoration project. As stated in Section D.1, this monitoring will be summarized in the site environmental reports. Detailed results of restoration monitoring will be reported annually through the Consolidated Monitoring Report for Restored Areas at the FEMP.

In April 1998 the Fernald Natural Resource Trustees (including OEPA) tentatively agreed that reporting associated with natural resources would be provided in annual IEMP integrated site environmental reports and through correspondence between DOE and the Fernald Natural Resource Trustees. It was also agreed that quantitative monitoring of impacted habitats associated with natural resources will not be necessary because the proposed settlement identifies that natural resource restoration will be performed for all on-property areas outside the on-site disposal facility, the Operable Unit 4 supplemental projects, and the area under consideration by the Community Reuse Organization for economic development.

D.2.5 National Environmental Policy Act

In addition to the specific regulatory drivers summarized above, aspects of natural resource management and monitoring are mandated through the incorporation of substantive NEPA requirements into remedial action planning. In June 1994 DOE issued a revised secretarial policy on NEPA compliance. This policy called for the integration of NEPA requirements into the CERCLA decision-making process. Therefore, requirements for the protection of sensitive environmental resources including threatened and endangered species and cultural resources are to be considered throughout remediation activities.

## D.3 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

The expectations of the monitoring and reporting as outlined in the NRMP are as follows:

- Provide a mechanism to monitor the status of Fernald's natural resources to remain in compliance with applicable laws and regulations
- Support the design of area-specific restoration projects as conceptually described in the NRRP.

The results of the monitoring outlined in this NRMP may have an impact on design issues associated with the NRRP. If the amount of impact to natural resources during remediation activities is substantially more or less than anticipated in the Natural Resource Impact Assessment, then adjustments to the amount of natural resource restoration activities as outlined in the NRRP may be warranted. In addition, if impacts to a sensitive area were to occur during remediation that was not anticipated (i.e., the northern-forested wetland), then additional activities (e.g., wetland mitigation) may be required. It is not anticipated that results of the NRMP will impact any other aspect of remedial design.

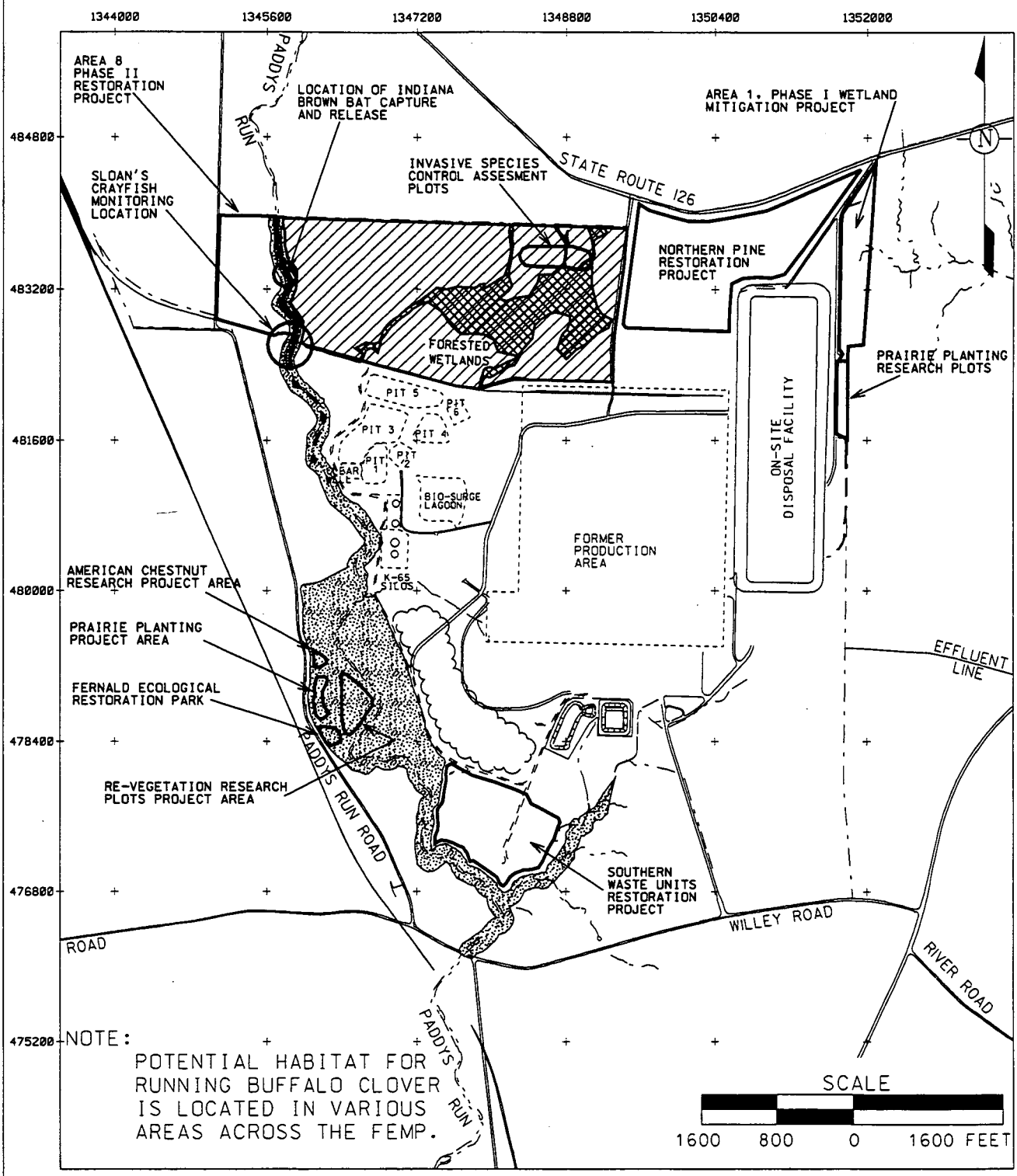
## D.4 NATURAL RESOURCE MONITORING PLAN

Monitoring will be implemented during remediation activities to identify impacts to natural resources at the FEMP with particular emphasis placed on meeting regulatory requirements for NEPA, threatened and endangered species, wetlands/floodplains, and cultural resources. To accommodate natural resource monitoring, priority natural resource areas have been established across the FEMP (Figure D-1). FEMP personnel will carry out all natural resource monitoring, with oversight from DOE-Fernald.

Outside expertise may be used in limited circumstances depending on the type of monitoring to be conducted. A description of the monitoring strategies to be implemented at the FEMP is provided below.

### D.4.1 Threatened and Endangered Species

The state-listed threatened Sloan's crayfish (*Orconectes sloanii*) and the federally endangered Indiana brown bat (*Myotis sodalis*) are the only threatened or endangered species to have a known population at the FEMP. However, there is the potential for other state- and federally listed threatened and endangered species to have habitat ranges that encompass and/or occupy the FEMP. Therefore, monitoring will continue to track the status of the Sloan's crayfish and Indiana brown bat populations and their habitats as well as several other listed species that potentially could use the FEMP.




V:/SFGPI/DGN/02REVISION/02RV004.DGN

STATE PLANAR COORDINATE SYSTEM 1983

02-OCT-2002

FIGURE D-1. PRIORITY NATURAL RESOURCE AREAS

000311

D.4.1.1 Sloan's Crayfish

The state-listed threatened Sloan's crayfish is a small crayfish found in the streams of southwest Ohio and southeast Indiana. It prefers streams with constant (though not necessarily fast) current flowing over rocky bottoms. A large, well-established population of Sloan's crayfish is found at the FEMP in the northern reaches of Paddys Run. In dry periods, the crayfish retreat to deeper pools that remains both downstream and upstream of the train trestle. A significant population of Sloan's crayfish also resides in an off-property section of Paddys Run at New Haven Road. The Sloan's Crayfish Management Plan, which is included as Attachment D.1 to this appendix, provides additional information on the FEMP Sloan's crayfish population.

This species resides with one other competing species of crayfish (*Orconectes rusticus*) that is generally considered more aggressive. In addition, the Sloan's crayfish is sensitive to siltation in streams.

Impacts to Sloan's crayfish are similar to impacts to other aquatic organisms in Paddys Run. Impacts of concern would include excavation and alteration of the streambed along with increased siltation and runoff into Paddys Run. Visual field observations after every storm event were conducted from August of 1996 through December of 1997 to identify any impact of sediment loading on the Sloan's crayfish population in Paddys Run from FEMP activities. Visual observations of Sloan's crayfish populations were resumed in September 1998, when construction activities began in the vicinity of the waste storage area. In general, site activities have not impacted the Paddys Run crayfish population. However, on several occasions an elevated amount of sediment runoff was observed in the northern drainage ditch following rain events. Because the instances were of short duration (less than 24 hours), no impacts to the Sloan's crayfish occurred. The source of the elevated sediment has been traced to the rail yard sedimentation basin. Several corrective measures were implemented, including repair of eroding fill around an inlet pipe and seeding of exposed soil. As a result of these corrective actions, incidents of increased turbidity into Paddys Run were reduced to one or two times a year. Because of this, OEPA agreed to suspend visual observations until remediation activities in the immediate vicinity of the northern drainage ditch have the potential to adversely impact turbidity.

Additionally, as a condition of the FEMP National Pollutant Discharge Elimination System Permit, visual observations of sediment controls must be carried out pursuant to the FEMP's Storm Water Pollution Prevention Plan on a weekly basis and after any storm event. A storm event is defined as being "any event in which more than 0.5 inch of rainfall occurs in a 24-hour period." An inspection form is completed after each visual observation to ensure that sediment controls are properly functioning. FEMP natural resource personnel will interface with the personnel conducting the visual observations of sediment controls on a regular basis to ensure controls remain in place.

The Sloan's crayfish population in Paddys Run will be surveyed every three years to monitor trends in the long-term status of the population. A survey in the summer of 2001 revealed a significant population of Sloan's crayfish in Paddys Run. The survey involved the use of nets to capture and identify species in Paddys Run. The next survey will be conducted in 2004.

The attached Sloan's Crayfish Management Plan describes in greater detail the requirements listed above. A contingency plan is also included which calls for the upstream relocation of affected crayfish populations, if necessary. Relocation of crayfish populations is not anticipated. However, relocation is an option if remedial activities would result in severe degradation of existing habitat in Paddys Run.

D.4.1.2 Indiana Brown Bat

Good to excellent habitat for the federally listed endangered Indiana brown bat (*Myotis sodalis*) has been identified north of the train trestle in Paddys Run. The habitat provides an extensive mature canopy from older trees and the presence of water throughout the year. In 1999, one adult female was captured and released along Paddys Run. Potential impacts to Indiana brown bat habitat include soil excavation and tree removal associated with soil and/or stream remediation and alteration along riparian areas in the northern on-property sections of Paddys Run. Because the bats use loose-bark trees for their maternal colonies, removal of trees would impact this species by eliminating its summer habitat.

Remediation activities are not currently planned within the area of concern for the Indiana brown bat. The habitat of the Indiana brown bat will be monitored during remediation activities as part of the program outlined in Section 4.4 to identify any unanticipated impacts during remediation. However, if remediation activities are proposed as a result of certification sampling identifying unanticipated hot spots of contamination in the Paddys Run area north of the train trestle, then a follow-up survey for the Indiana brown bat will be initiated prior to initiation of remediation activities. A follow-up survey was conducted in the summer of 2002 as a result of remediation activities north of the train trestle along Paddys Run. No Indiana brown bats were found during this survey. In addition, a survey will be conducted before ecological restoration activities are conducted. Follow-up surveys may also be proposed as part of success monitoring in the NRRP if that area is considered for enhancement of the Indiana brown bat population.

If monitoring is determined appropriate, then monitoring methods for the Indiana brown bat would consist of mistnetting in areas suitable as bat flyways and where canopy occurs. Mistnetting would occur between May 15 and August 15, since some bats begin to disperse for winter shelter in late August. Data recorded at each sampling site would include type of habitat, water depth and permanence, type of bottom, tree species and size, and presence of hollow trees or trees with loose bark in the vicinity.

In addition to mistnets, bat detectors would be used during all sampling to detect echolocation calls near the net, which indicate bat activity. The number of calls on the detector would be recorded to indicate the effectiveness of the nets in relation to bat activity. Bat detectors can also be used to sample areas of marginal habitat to determine if netting should be attempted.

D.4.1.3 Running Buffalo Clover

The federally listed endangered running buffalo clover (*Trifolium stoloniferum*) surveys conducted in 1994 found no individuals of this species at the FEMP. However, because running buffalo clover is found nearby in the Miami Whitewater Forest, the potential exists for this species to establish at the FEMP. The running buffalo clover prefers habitat with well-drained soil, filtered sunlight, limited competition from other plants, and periodic disturbance. Therefore, surveys will be conducted in future years, as needed, prior to remediation activities within areas of concern for running buffalo clover. Areas of concern at the FEMP are limited, but would include partially shaded and sparsely vegetated areas along Paddys Run and the Storm Sewer Outfall Ditch. Follow-up surveys would optimally be conducted between May and June, which is the time frame for blooms. An appropriate number of transects would be walked in suspect areas to identify the running buffalo clover. This plant is a perennial that forms long stolons, rooting at the nodes. The plant is also characterized by erect flowering stems, typically three to six inches tall, with two leaves near the summit topped by a round flower head. If populations are discovered, then best management practices would be utilized to minimize impacts and the NRRP would be adjusted accordingly.

The U.S. Fish and Wildlife Service announced plans to delist running buffalo clover from its endangered status. However, the plant would still require monitoring because of its status as an endangered species in the State of Ohio.

D.4.1.4 Spring Coral Root

The state-listed threatened spring coral root (*Corallorhiza wisteriana*) is a white and red orchid which blooms in April and May and grows in partially shaded areas of mesic deciduous woods, such as forested wetlands and wooded ravines. Although surveys conducted in 1994 and 1995 indicated no individuals were present, suitable habitat exists in portions of the northern woodlot.

A floristic analysis for the northern woodlot and associated northern-forested wetland was conducted in 1998. This analysis showed that no spring coral root was present in the northern woodlot.

D.4.2 Floodplains/Wetlands

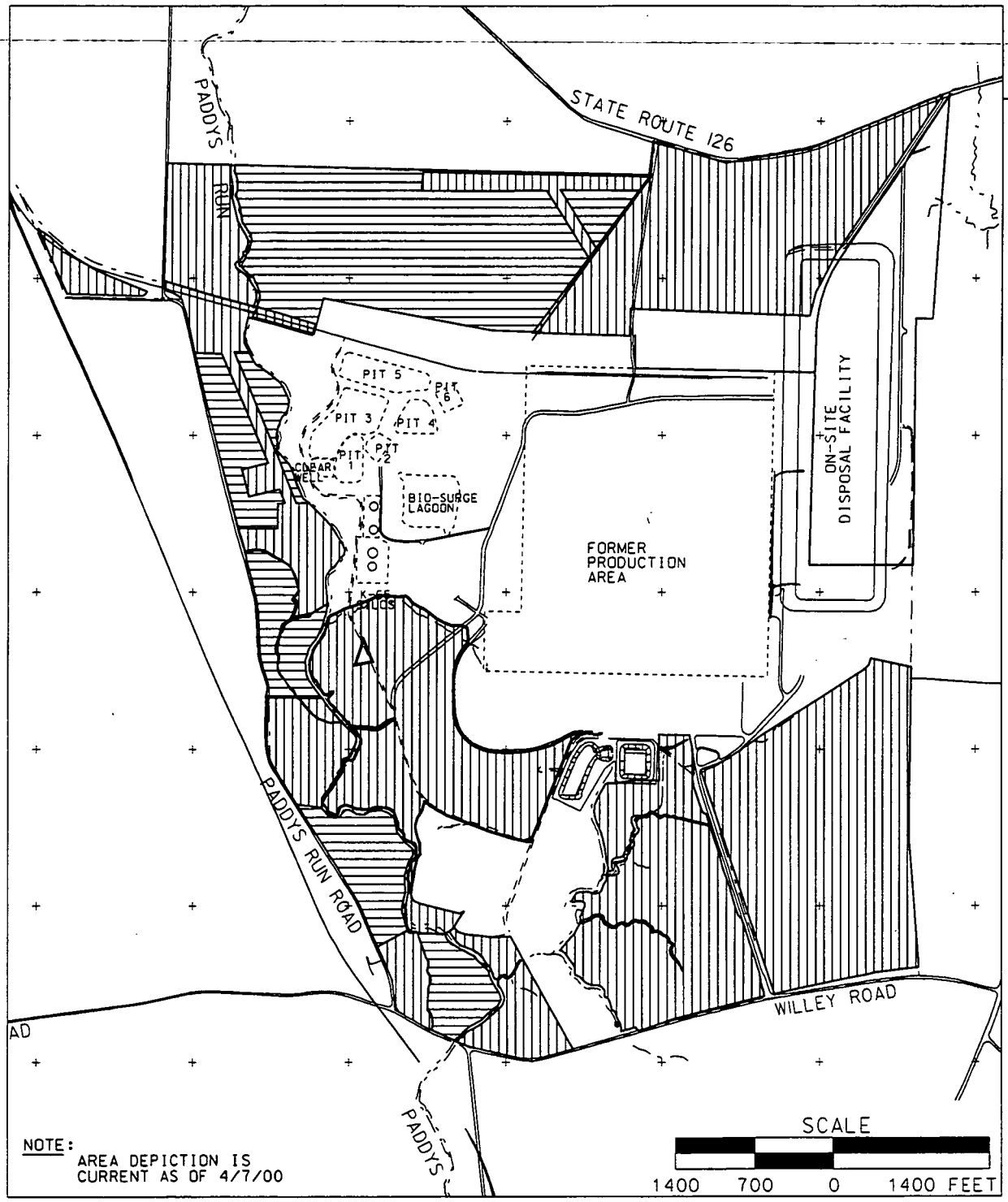
Approximately 11 acres of on-property wetlands adjacent to the former production area will be impacted as a result of contaminated soil excavation. The 26-acre northern-forested wetland area and associated drainage characteristics will be avoided and protected during remediation activities. A mitigation ratio of 1.5:1 (1.5 acres of wetlands will be replaced for every one acre of wetland disturbance) was negotiated between DOE and the appropriate agencies (EPA, OEPA, U.S. Fish and Wildlife Service, and Ohio Department of Natural Resources). As a result of this agreement, 16.5 acres of wetlands must be established to compensate for the impacts during remediation.

All naturally created wetlands on the site have been identified. It is possible that as a result of remediation activities, areas of poor drainage will be created and some wetland vegetation may emerge. These wetlands formed incidental to construction will be reviewed on a case-by-case basis to allow for consideration of alternatives to destruction, options for re-establishment, and a determination of the need for mitigation. In most instances, these types of wetlands will not require mitigation.

Wetland mitigation was initiated at the FEMP in 1999. Approximately six acres of wetlands were constructed within a 12-acre ecological restoration project along the North Access Road. Details of mitigation monitoring will be reported in the annual consolidated monitoring report. Narrative summaries will be provided in IEMP annual site environmental reports.

D.4.3 Cultural Resource Management

All field personnel must comply with procedure EP-0003, Unexpected Discovery of Cultural Resources, if cultural resources are uncovered during ground disturbing activities. Monitoring will occur on a limited basis in all areas that have been surveyed to identify any unexpected discoveries of human remains (Figure D-2). More intensive field monitoring will only take place in areas known to have a high potential for archaeological sites as determined by previously conducted investigations. In most instances, discovery of human remains will require data recovery work in previously surveyed areas. Any disturbance of previously unsurveyed areas will require at least Phase I investigations. An annual summary of all cultural resource field activities is separately provided from the IEMP under the Programmatic Agreement for Archeological Activities at the Fernald Site.




LEGEND:

AREA SURVEYED

AREAS NOT SURVEYED DUE TO CONTAMINATION/DISTURBANCE

AREA TO BE SURVEYED

DRAFT FINAL

000316

FIGURE D-2. CULTURAL RESOURCE SURVEY AREAS



v:#5fgp1#dgn#02revision#02r-v027.dgn
STATE PLANAR COORDINATE SYSTEM 1927
02-OCT-2002

D.4.4 Habitat Monitoring

As stated in Section D.2.4, the Natural Resource Trustees have tentatively agreed that habitat impact monitoring is not necessary. If renegotiations with the trustees become necessary, then quantitative quarterly habitat impact tracking may be resumed. A narrative summary of habitat impacts will be provided in IEMP annual site environmental reports.

D.4.5 Natural Resource Data Evaluation and Reporting

The results of natural resource monitoring will be integrated with the annual reporting committed to in the IEMP. Table D-2 provides a summary of the monitoring activities to be carried out until the end of 2004 (i.e., the life of this version of the IEMP). IEMP annual isite environmental reports will provide appropriate updates on unexpected impacts to natural resources and the results of specific natural resource monitoring that has been implemented (e.g., crayfish, cultural resources, etc.). Due to the effort to streamline the quarterly reporting, Natural Resources monitoring will not be included in the quarterly summaries. However, significant findings will still be communicated to the regulatory agencies on an as-needed basis by the Natural Resources Project.

**TABLE D-2**

**SUMMARY OF MONITORING ACTIVITIES FOR 2003 AND 2004**

| Monitoring Activity | Implementation |
|---|---|
| Sloan's crayfish population summary | 2004 |
| Cultural resources | 2003 and 2004 |
| Delineation of additional wetlands | As required |
| Follow-Up Threatened and Endangered Species Surveys | As required |

Attachment D.1

**ATTACHMENT D.1**

**SLOAN'S CRAYFISH MANAGEMENT PLAN**

## TABLE OF CONTENTS

D.1 Sloan's Crayfish Management Plan D.1-1
D.1.1 Introduction D.1-1
D.1.2 Background D.1-1
D.1.3 Management Objectives D.1-3
D.2 Management Plan D.1-3
D.2.1 Sedimentation Controls D.1-5
D.2.2 Refuge Preservation D.1-5
D.2.3 Restoration Commitment D.1-6
D.3 Field Monitoring D.1-6
D.4 Contingency Plan D.1-8
D.4.1 Relocation D.1-8
D.4.2 Frequency D.1-8
D.4.3 Methods D.1-8
D.5 Reporting D.1-8

## LIST OF FIGURES

Figure D.1-1 - Survey Results for Sloan's Crayfish D.1-2
Figure D.1-2 - Refuge Area for Sloan's Crayfish D.1-4
Figure D.1-3 - Area of Influence for Paddys Run D.1-7

# ATTACHMENT D.1
# SLOAN'S CRAYFISH MANAGEMENT PLAN

## D.1.1 Introduction

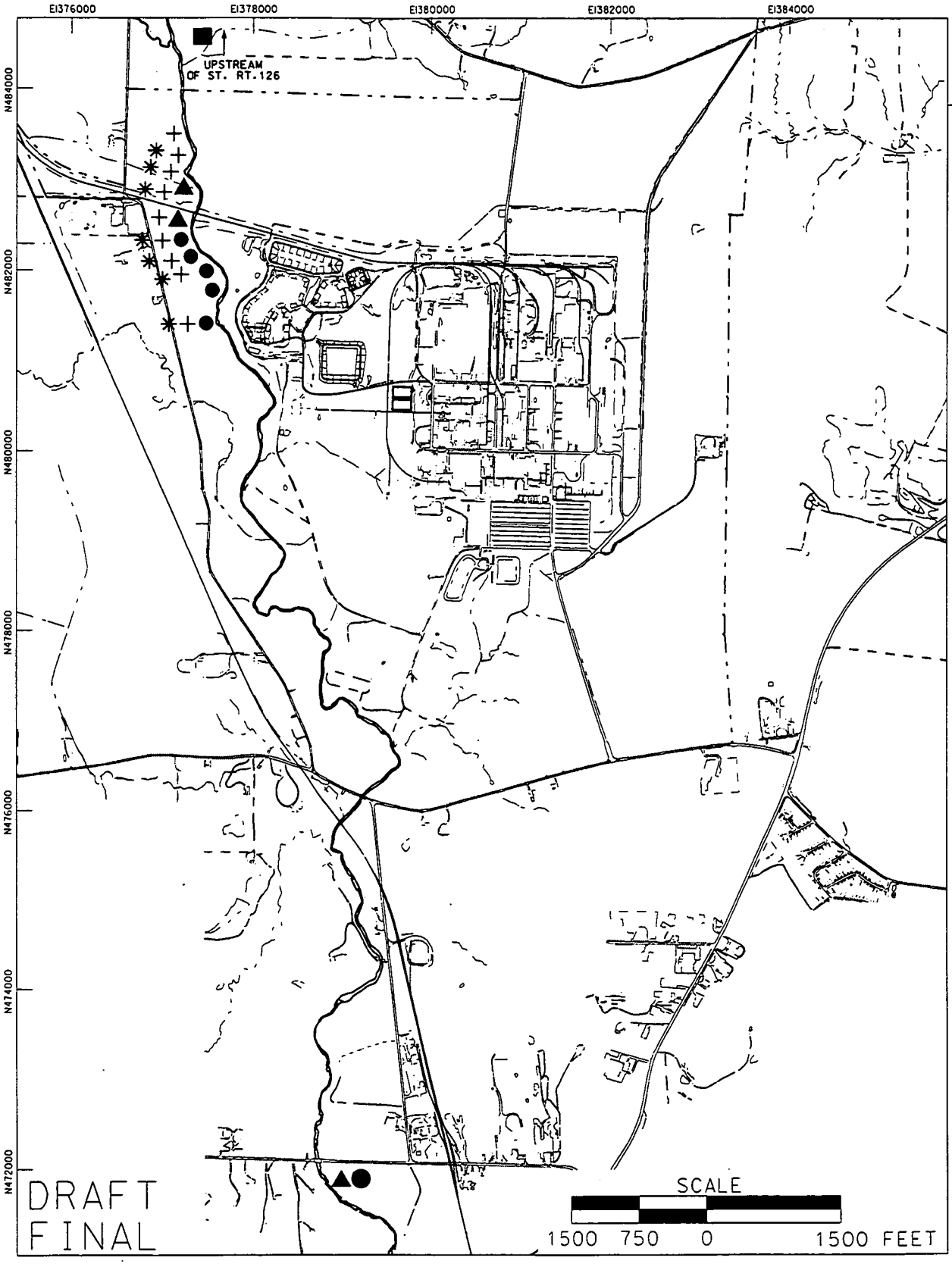
The purpose of this plan is to provide a management strategy for the state-threatened Sloan's crayfish *(Orconectes sloanii)* and its associated habitat at the Fernald Environmental Management Project (FEMP). Remedial work at the FEMP has the potential to result in increased sediment loading to Paddys Run in the area inhabited by the Sloan's crayfish. Therefore, the U.S. Department of Energy (DOE) has prepared a management plan to meet the intent of state and federal regulations governing the management of threatened and endangered species and to fulfill the DOE's role as a Natural Resource Trustee.

## D.1.2 Background

The Sloan's crayfish has been listed as threatened in the state of Ohio. Populations of the Sloan's crayfish are known to reside only in southeastern Indiana and southwestern Ohio (St. John 1993). The Sloan's crayfish resides in streams with constant flow and flat, rocky bottoms covered with broken or rounded stones. A decline in the species has been noted in streams that have been effected by urbanization, construction, and other forms of human stress. Crayfish breathe through gills; therefore, increases in sediment loading in streams they inhabit will decrease their chances for survival.

The species was discovered in the northern portion of Paddys Run at the FEMP (Figure D.1-1) during surveys conducted by Dr. F. Lee St. John in September 1993 and May 1994. The surveys for the crayfish were amongst several conducted at the site during that time frame. Remediation of the FEMP is being undertaken pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and will involve the excavation of large portions of the site and the construction of new treatment and disposal facilities. The Sloan's crayfish has been identified as a species that requires special consideration during the planning and implementation of remediation activities at the FEMP.

FILE NAME /res3016/crayfish1.dgn 8x11 cru5 6-25-96 GES STATE PLANAR COORDINATE SYSTEM 1927




LEGEND:

- FEMP BOUNDARY
- ▲ SLOAN'S CRAYFISH POPULATIONS IN 1993
- ● SLOAN'S CRAYFISH POPULATIONS IN 1994
- ■ SLOAN'S CRAYFISH POPULATIONS IN 1995
- + SLOAN'S CRAYFISH POPULATIONS IN 1996
- ✱ SLOAN'S CRAYFISH POPULATIONS IN 1999

FIGURE D.1-1. SURVEY RESULTS FOR SLOAN'S CRAYFISH

D.1.3 Management Objectives

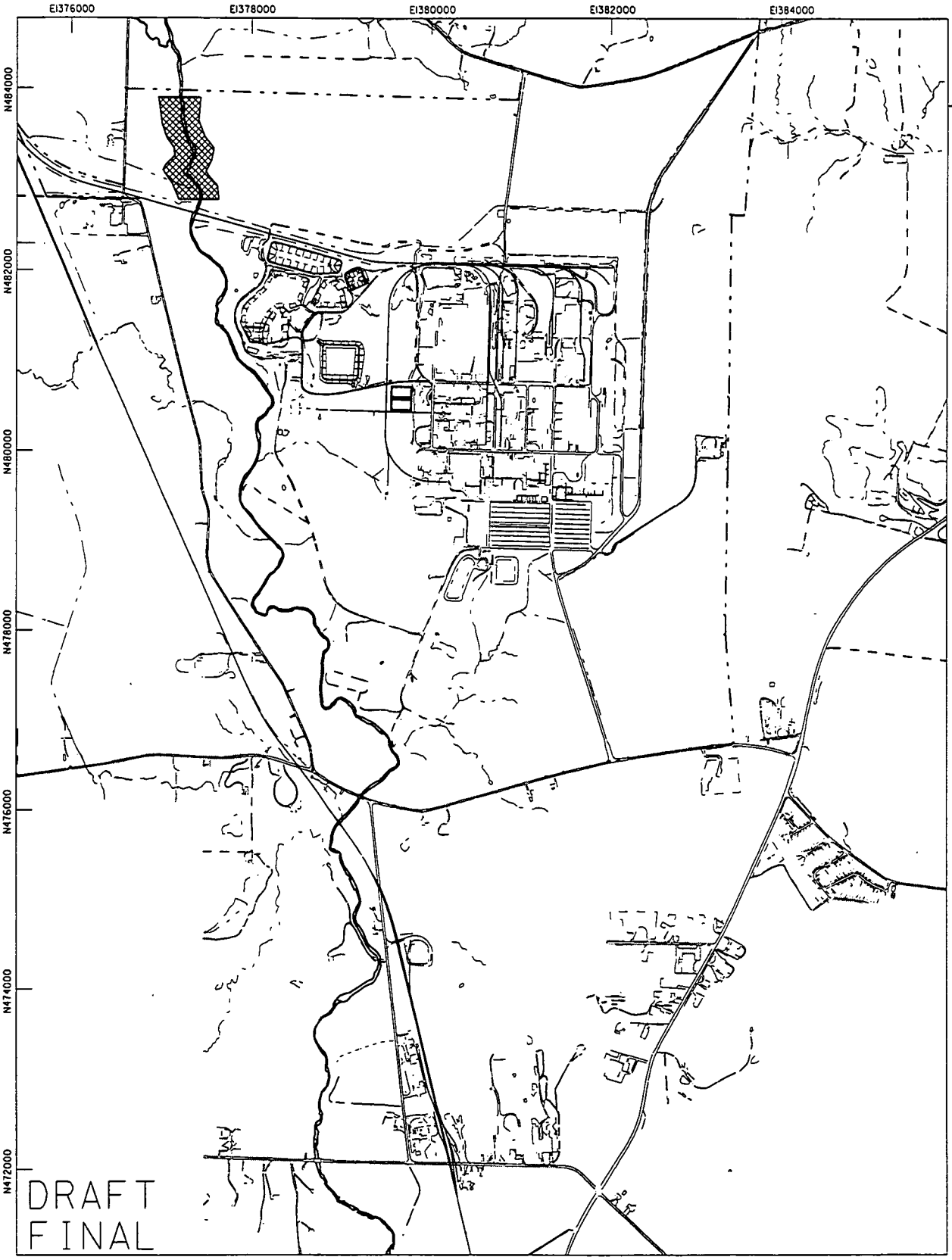
The primary objective in managing the Sloan's crayfish population at the FEMP is to ensure that adequate habitat is available within Paddys Run for the continued existence of the population upon completion of remediation. This will be accomplished through preservation and/or post-remedial restoration. In addition, efforts to protect the current population from degradation during remediation activities will also be employed to the extent practicable. As discussed in greater detail below, the combination of adequate controls to minimize sediment loading remediation activities, coupled with the availability of a "refuge area" for the crayfish population upstream, will minimize short-term degradation to the crayfish population. In addition, field monitoring will be initiated to identify potential impacts to the portions of Paddys Run containing the population. If it is determined that impacts to the stream may result in the long-term degradation of the population, then DOE will notify the appropriate agencies and relocate individual crayfish.

The objectives of this management plan are to undertake all measures practicable to protect the species within Paddys Run and to minimize stress to the species by relocating only if necessary. DOE feels the most important aspect of the management plan is to ensure that an optimal habitat exists for the crayfish in the long-term (i.e., postremediation). This would be accomplished either through preserving and/or enhancing existing habitat or restoring habitat if the existing habitat is impacted during remediation. Future FEMP remediation activities may also involve excavation activities that will potentially impact the population. Therefore, this plan of action may be incorporated by reference into future work plans.

D.2 MANAGEMENT PLAN

There are three phases to the protection of the Sloan's crayfish and its associated habitat within Paddys Run. The first two phases are avoidance measures while the last phase is a mitigation effort. First, several controls will be installed to prevent excessive sedimentation into Paddys Run. Second, the area of Paddys Run upstream of the train trestle and the confluence of the northern drainage ditch will be preserved as a refuge for Sloan's crayfish to the maximum extent practicable (Figure D.1-2). The third aspect of protection is the mitigation of appropriate habitat, if required, after remediation activities have been completed. All three phases of Sloan's crayfish protection are discussed in more detail below.

FILE NAME /res3016/crayfish2.dgn 8x11 crs5 6-25-96 GES STATE PLANAR COORDINATE SYSTEM 1927




LEGEND:

— - - — FEMP BOUNDARY

REFUGE AREA FOR SLOAN'S CRAYFISH

SCALE

1500 750 0 1500 FEET

FIGURE D.1-2. REFUGE AREA FOR SLOAN'S CRAYFISH

D.2.1 Sedimentation Controls

The primary source of surface water runoff from the FEMP to the Sloan's crayfish habitat in Paddys Run is from the westerly flowing drainage area directly located north of the railroad tracks on the northern side of the former production area. The confluence of this drainage area and Paddys Run is a National Pollutant Discharge Elimination System (NPDES) permitted storm water outfall (STRM 4006) and is subject to semiannual monitoring under the terms and conditions of the new site NPDES Permit (Ohio Environmental Protection Agency [OEPA] Permit No. 1IO00004*FD). This ditch was also identified as a jurisdictional wetland during the 1993 delineation of the site.

Large scale earthmoving activities associated with the Operable Unit 1, Operable Unit 2, and Operable Unit 5 Remedial Actions are planned within several watershed basins in the northern and eastern portions of the site that ultimately drain to Paddys Run through the northern drainage ditch described above. Erosion control devices will conform to the requirements of the site NPDES Permit, the FEMP Storm Water Pollution Prevention Plan (PL-3083), and various applicable or relevant and appropriate requirements identified in the Operable Unit 1, Operable Unit 2, and Operable Unit 5 Records of Decision. Specifications for sedimentation and erosion control devices are being incorporated into the remedial design packages for these activities in an effort to avoid and/or minimize erosion and sedimentation to the northern drainage ditch and Paddys Run. As part of CERCLA Remedial Design packages for Operable Unit 1, Operable Unit 2, and Operable Unit 5, these erosion and sedimentation designs are subject to review and approval by the U.S. Environmental Protection Agency (EPA) and OEPA. Once established in the field, DOE will inspect these controls, at a minimum, on a weekly basis to ensure their effectiveness in accordance with the requirements of the Storm Water Pollution Prevention Pan. Given that the extensive erosion and sedimentation controls described above will be established, adverse impacts to Sloan's crayfish habitat in Paddys Run will be avoided and minimized to the maximum extent practicable.

D.2.2 Refuge Preservation

The area of Paddys Run immediately north of the train trestle and the confluence of the northern drainage ditch to the FEMP property line will be preserved as a refuge for Sloan's crayfish to the maximum extent practicable (Figure D.1-2). Appropriate habitat exists in this area, as evidenced by several studies that have identified Sloan's crayfish upstream of the northern drainage ditch (St. John 1993, 1996, and 1999).

St. John reported in the Addendum to the Report on the Status of the Sloan's Crayfish (St. John 1994) that Sloan's crayfish repopulation within Paddys Run is governed by downstream migration rather than upstream migration or repopulation in situ.

The preservation of the upstream portion of Paddys Run is also the primary protection effort for the Indiana brown bat (*Myotis sodalis*), a federally listed endangered species for which suitable habitat exists within the riparian areas north of the train trestle. This area will be considered a priority natural resource area, and a maximum effort will be made to preserve the stream and its associated habitat in its present state.

### D.2.3 Restoration Commitment

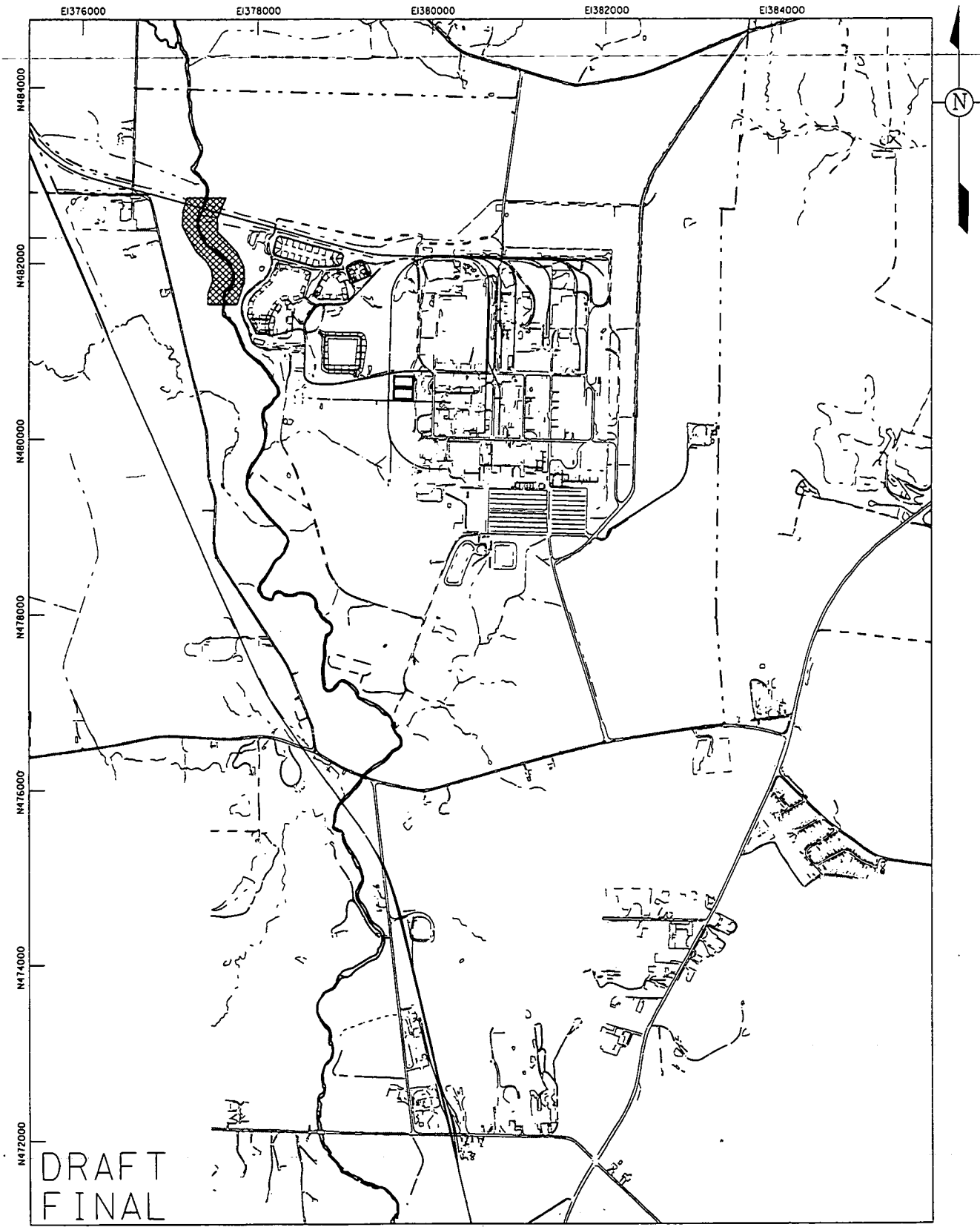
Once remediation activities have been completed within the area of influence for Paddys Run, the stream will be restored to suitable Sloan's crayfish habitat, if necessary (Figure D.1-3). This stream restoration will take place in accordance with the sitewide Natural Resource Restoration Plan, as agreed to by the FEMP Natural Resource Trustees. It is expected the upstream refuge will act as the catalyst for the repopulation of impacted sections of Paddys Run, where pools and riffles will be reestablished.

## D.3 FIELD MONITORING

Field monitoring will be conducted to determine the effectiveness of the sedimentation controls discussed above. Sedimentation controls will be inspected at least weekly in accordance with the FEMP Storm Water Pollution Prevention Plan. Based on visual observations of sediment loading into Paddys Run in 1996 and 1997, DOE determined that the current sedimentation control program adequately protected the Sloan's crayfish. Visual observations resumed in 1998 as a result of construction activities in the vicinity of the waste storage area. Following corrective actions to the rail yard sediment basin, which reduced incidents of increased turbidity to one or two times a year, OEPA agreed to suspend visual observations until remediation activities in the immediate vicinity of the northern drainage ditch have the potential to adversely impact turbidity.

The Sloan's crayfish population of Paddys Run will be surveyed every three years in order to monitor trends in the long-term status of the population. This information will not be used as an indicator of remediation impacts, but rather as assistance in restoration planning.

FILE NAME /res3016/crayfish3.dgn 8x11 cru5 6-25-96 GES STATE PLANAR COORDINATE SYSTEM 1927




LEGEND:

— · · — FEMP BOUNDARY

AREA OF INFLUENCE FOR PADDYS RUN

000326

SCALE

1500 750 0 1500 FEET

FIGURE D.1-3. AREA OF INFLUENCE FOR PADDYS RUN

## D.4 CONTINGENCY PLAN

This contingency plan includes provisions for relocating individual Sloan's crayfish. Relocation will be dependant upon field observations of Paddys Run as discussed above. These relocation provisions include the establishment of locations within Paddys Run, along with the frequency and methodology for relocation.

Relocation is an unproven technique that may result in harm to individuals. Problems associated with relocation include alteration of stream habitat from netting and species removal activity and loss of individuals from the stress of relocation. In addition, an otherwise healthy community could be impacted by the introduction of relocated species.

### D.4.1 Relocation

The crayfish will be relocated further upstream within Paddys Run. Optimal habitat for the crayfish is a stream with constant current flowing over a rocky bottom, which occurs upstream of the train trestle in Paddys Run and within the refuge area illustrated in Figure D.1-2.

### D.4.2 Frequency

Crayfish will be relocated as appropriate, up to a frequency of every two months, depending on stream conditions. If visual observations of the Paddys Run tributary indicate increased turbidity into Paddys Run for several consecutive days, then the crayfish will be relocated. If turbid tributary conditions persist two months after the initial relocation, then the crayfish will be relocated again.

### D.4.3 Methods

Crayfish will be obtained by seining Paddys Run with a minnow seine (1.2 x 1.8 meters; 0.64 centimeter mesh). Pools and riffles will be seined several times in an effort to capture as many individuals as possible. Upon capture, crayfish will be placed in a plastic container containing existing stream water and transported upstream for free release. The location selected for release will be pre-determined based on the suitability of habitat.

## D.5 REPORTING

Sloan's crayfish monitoring activities will be reported through the Integrated Environmental Monitoring Plan annual site environmental reports which will provide an update on Sloan's crayfish population surveys and contingency actions.

## REFERENCES

St. John, F.L., 1999, Fernald Site Crayfish Survey at Paddys Run, June 9, 1999.

St. John, F.L., 1996, Fernald Site Crayfish Survey at Paddys Run, September 18, 1996.

St. John, F.L., 1994, Addendum to the Report on the Status of the Sloan's Crayfish, *Orconectes sloanii* (Bundy, 1876) at the Fernald Environmental Management Project.

St. John, F. L., 1993, Report on the Sloan's Crayfish (*Orconectes sloanii* Bundy) at the Fernald Environmental Management Project.