

Table of Contents

List of Figures.....	iv
List of Tables.....	iii
List of Acronyms.....	v
Units (Abbreviations) and Conversion Table	vii
<hr/>	
ES 1.0 Executive Summary	ES-1
ES 1.1 Liquid Pathway Highlights.....	ES-2
ES 1.1.1 Groundwater Pathway.....	ES-2
ES 1.1.2 Surface Water and Treated Effluent Pathway.....	ES-3
ES 1.2 Air Pathway Highlights.....	ES-3
ES 1.2.1 Radiological Air Particulate Monitoring.....	ES-3
ES 1.2.2 Radon Monitoring	ES-4
ES 1.2.3 Direct Radiation Monitoring	ES-4
ES 1.3 Estimated Dose for 2004.....	ES-4
ES 1.4 Natural Resources.....	ES-4
<hr/>	
1.0 Chapter 1 – Site Background	1-1
1.1 The Path to Site Closure.....	1-3
1.2 Environmental Monitoring Program.....	1-3
1.3 Characteristics of the Site and Surrounding Area.....	1-6
1.3.1 Land Use and Demography	1-6
1.3.2 Geography	1-9
1.3.3 Geology	1-9
1.3.4 Surface Hydrology.....	1-9
1.3.5 Meteorological Conditions	1-16
1.3.6 Natural Resources	1-16
<hr/>	
2.0 Chapter 2 – Remediation Status and Compliance Summary	2-1
2.1 CERCLA Remediation Status	2-1
2.1.1 Waste Pits Project.....	2-5
2.1.2 Demolition, Soil, and Disposal Project	2-6
2.1.3 Silos Projects.....	2-10
2.1.4 Aquifer Restoration/Wastewater Project	2-12
2.2 Summary of Compliance with Other Requirements	2-14
2.2.1 Resource Conservation and Recovery Act (RCRA).....	2-14
2.2.2 Clean Water Act	2-16
2.2.3 Clean Air Act.....	2-16
2.2.4 Superfund Amendments and Reauthorization Act of 1986	2-17
2.2.5 Other Environmental Regulations	2-18
2.2.6 Other Permits	2-18
2.2.7 Pollution Prevention and Source Reduction	2-21
2.2.8 Site-Specific Regulatory Agreements.....	2-21
2.2.9 Environmental Management Systems Requirement.....	2-22
2.3 Split Sampling Program	2-22
<hr/>	
3.0 Chapter 3 – Groundwater Pathway	3-1
3.1 Summary of the Nature and Extent of Groundwater Contamination	3-1
3.2 Selection and Design of the Groundwater Remedy	3-2
3.3 Groundwater Monitoring Highlights for 2004.....	3-7
3.3.1 Restoration Monitoring.....	3-7
3.3.2 Other Monitoring Commitments	3-22
3.4 On-site Disposal Facility Monitoring.....	3-23

4.0 Chapter 4 – Surface Water and Treated Effluent Pathway	4-1
4.1 Summary of Surface Water and Treated Effluent Pathway.....	4-1
4.2 Remediation Activities Affecting Surface Water Pathway	4-2
4.3 Surface Water, Treated Effluent, and Sediment Monitoring Program for 2004	4-4
4.3.1 Surveillance Monitoring	4-7
4.3.2 Compliance Monitoring	4-11
4.3.3 Uranium Discharges in Surface Water and Treated Effluent	4-14
4.4 Sediment Monitoring	4-15
5.0 Chapter 5 – Air Pathway	5-1
5.1 Remediation Activities Affecting the Air Pathway.....	5-1
5.2 Air Monitoring Program Summary for 2004	5-2
5.3 Radiological Air Particulate Sampling Results	5-3
5.4 Radon Monitoring	5-8
5.4.1 Continuous Radon Monitors	5-10
5.5 Monitoring for Direct Radiation	5-12
5.6 Stack Monitoring for Radionuclide Emissions	5-17
5.7 Monitoring for Non-Radiological Pollutants	5-19
6.0 Chapter 6 – Radiation Dose	6-1
6.1 Estimated Dose from Airborne Emissions	6-1
6.2 Direct Radiation Dose.....	6-3
6.3 Total of Doses to Maximally Exposed Individual	6-3
6.4 Significance of Estimated Radiation Doses for 2004	6-4
6.5 Estimated Dose from Radon	6-5
6.6 Estimated Dose to Biota	6-7
7.0 Chapter 7 – Natural Resources	7-1
7.1 Threatened and Endangered Species	7-1
7.1.1 Sloan’s Crayfish Monitoring and Provisions for Protection	7-3
7.2 Impacted Habitat	7-3
7.3 Ecological Restoration Activities	7-3
7.4 Cultural Resources.....	7-6
References	R-1
Glossary	G-1
Appendices – 2004 Environmental Summary	
A Supplemental Groundwater Information	
B Supplemental Surface Water, Treated Effluent, and Sediment Information	
C Supplemental Air Information	
D CY 2004 National Emissions Standards for Hazardous Air Pollutants (NESHAP) Annual Report for the Fernald Closure Project	

List of Tables

Table 1-1	Operable Unit Remedies and Associated Project Responsibilities	1-4
Table 2-1	Final Remediation Levels for Groundwater, Surface Water, and Sediment.....	2-3
Table 2-2	Compliance with Other Environmental Regulations	2-19
Table 2-3	2004 DOE/OEPA Split Sampling Comparison	2-24
Table 3-1	Groundwater Restoration Module Status for 2004	3-14
Table 3-2	Non-Uranium Constituents with Results Above Final Remediation Levels During 2004	3-20
Table 3-3	On-site Disposal Facility Groundwater, Leachate, and Leak Detection System Monitoring Summary.....	3-24
Table 4-1	Constituents With Results Above Surface Water FRLs During 2004	4-7
Table 4-2	Surface Water Total Uranium Results Exceeding the Groundwater FRL at Cross-Media Impact Locations During 2004	4-10
Table 4-3	Exceedances of the NPDES Permit During 2004	4-13
Table 4-4	2004 Summary Statistics for Sediment Monitoring Program	4-16
Table 5-1	Summary of Biweekly Total Uranium, Total Particulate, and Monthly Thorium-230 Concentrations in Air	5-5
Table 5-2	Continuous Environmental Radon Monitoring Monthly Average Concentrations	5-11
Table 5-3	Direct Radiation (Thermoluminescent Dosimeter) Measurement Summary.....	5-15
Table 5-4	2004 NESHAP Stack Emissions.....	5-19
Table 5-5	Chemical Emissions from Waste Pits Project Dryers or Gas-Fired Sources.....	5-20
Table 6-1	Dose to Maximally Exposed Individual	6-4
Table 6-2	2004 Radon Dose Estimate.....	6-7

List of Figures

Figure 1-1	Fernald Site and Vicinity	1-7
Figure 1-2	Major Communities in Southwestern Ohio.....	1-8
Figure 1-3	Fernald Site Perspective	1-11
Figure 1-4	Cross Section of the New Haven Trough, Looking North.....	1-13
Figure 1-5	Regional Groundwater Flow in the Great Miami Aquifer	1-14
Figure 1-6	Great Miami River Drainage Basin	1-15
Figure 1-7	2004 Wind Rose, 33-Foot (10-Meter) Height.....	1-17
Figure 1-8	2004 Wind Rose, 197-Foot (60-Meter) Height.....	1-17
Figure 1-9	Average Annual Precipitation, 1994–2004.....	1-18
Figure 1-10	Monthly Precipitation for 2004 and Annual Average Precipitation, for 1951–2003....	1-18
Figure 2-1	Site-wide Soil Remediation Areas and Certified Areas	2-7
Figure 2-2	DOE and OEPA Groundwater Split Sample Locations	2-23
Figure 3-1	Current Extraction and Re-injection Wells Active in 2004	3-3
Figure 3-2	Current and Future Extraction and Re-injection Wells for the Enhanced Groundwater Remedy	3-6
Figure 3-3	Diagram of a Typical Groundwater Monitoring Well	3-8
Figure 3-4	Monitoring Well Relative Depths and Screen Locations	3-9
Figure 3-5	Locations for Semiannual Total Uranium Monitoring	3-10
Figure 3-6	Locations for Semiannual Non-Uranium Monitoring.....	3-11
Figure 3-7	IEMP Groundwater Elevation Monitoring Wells.....	3-12
Figure 3-8	Net Pounds of Uranium Removed from the Great Miami Aquifer, 1993–2004	3-13
Figure 3-9	Total Uranium Plume in the Aquifer with Concentrations Greater than 30 $\mu\text{g/L}$ at the End of 2004	3-16
Figure 3-10	Non-Uranium Constituents with 2004 Results Above Final Remediation Levels	3-21
Figure 3-11	On-site Disposal Facility Footprint and Monitoring Well Locations.....	3-26
Figure 4-1	Controlled Surface Water Areas and Uncontrolled Runoff Flow Directions	4-3
Figure 4-2	IEMP/NPDES Surface Water and Treated Effluent Sample Locations	4-5
Figure 4-3	IEMP Background Surface Water Sample Locations	4-6
Figure 4-4	Constituents with 2004 Results Above FRLs.....	4-8
Figure 4-5	Annual Average Total Uranium Concentrations in Paddys Run at Willey Road (SWP-03) Sample Location, 1985–2004.....	4-9
Figure 4-6	Pounds of Uranium Discharged to the Great Miami River from the Parshall Flume (PF 4001) in 2004.....	4-12
Figure 4-7	2004 Monthly Average Total Uranium Concentration in Water Discharged from the Parshall Flume (PF 4001) to the Great Miami River	4-12
Figure 4-8	Uranium Discharged Via the Surface Water Pathway, 1993–2004	4-14
Figure 4-9	2004 Sediment Sample Locations.....	4-17
Figure 5-1	Radiological Air Monitoring Locations	5-4
Figure 5-2	2004 Total Uranium Concentrations in Air at Selected East Fenceline Monitors (AMS-3, AMS-8A, and AMS-9C)	5-6
Figure 5-3	2004 Thorium-230 Concentrations in Air at Selected East Fenceline Monitors (AMS-3, AMS-8A, and AMS-9C)	5-6
Figure 5-4	Radon Monitoring Locations	5-9
Figure 5-5	Annual Average Radon Concentrations at K-65 Silos Exclusion Fence, 1987–2004	5-13
Figure 5-6	Annual Average Radon Concentrations at Selected Radon Locations, 1989–2004	5-13
Figure 5-7	Direct Radiation (TLD) Monitoring Locations.....	5-14
Figure 5-8	Direct Radiation (TLD) Measurements at K-65 Silos Boundary, 1991–2004 (K-65 Silos Fenceline Average vs. Background Average)	5-16
Figure 5-9	Direct Radiation (TLD) Measurements, 1994–2004 (Location 6 vs. Background Average)	5-16
Figure 5-10	NESHAP Stack Emission Monitoring Locations.....	5-18
Figure 6-1	Comparison of 2004 Air-Pathway Doses and Allowable Limits.....	6-2
Figure 6-2	Comparison of 2004 All-Pathway Doses and Allowable Limits	6-5
Figure 7-1	Priority Natural Resource Areas	7-2
Figure 7-2	Cultural Resource Survey Areas.....	7-7

List of Acronyms

ALARA	as low as reasonably achievable
ARARs	applicable or relevant and appropriate requirements
AWWT	advanced wastewater treatment facility
BCG	Biota Concentration Guides
BTV	benchmark toxicity value
CAWWT	converted advanced wastewater treatment facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLM/ICP	Comprehensive Legacy Management and Institutional Controls Plan
cm	centimeter
DCG	derived concentration guide
DOE	U.S. Department of Energy
EMS	Environmental Management Systems
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FCP	Fernald Closure Project
FEMP	Fernald Environmental Management Project
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Agreement
FRL	final remediation level
ft ³	cubic feet
ft ³ /sec	cubic feet per second
gpm	gallons per minute
HEPA	high-efficiency particulate air
ICRP	International Commission on Radiological Protection
IEMP	Integrated Environmental Monitoring Plan
kg	kilogram
km	kilometer
lbs	pounds
lbs/kg	pounds per kilogram
lbs/yr	pounds per year
Lpm	liters per minute
μCi	microCuries
μCi/hr	microCuries per hour
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
μg/m ³	micrograms per cubic meter

List of Acronyms (continued)

m ³	cubic meters
M gal	million gallons
M liters	million liters
mCi/yr	milliCuries per year
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mGy/day	milliGray per day
mrem	millirem
m ³ /sec	cubic meters per second
mSv	milliSievert
NCRP	National Council on Radiation Protection
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRC	National Council on Radiation Protection
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
PCB	polychlorinated biphenyl
pCi/g	picoCuries per gram
pCi/L	picoCuries per liter
pCi/m ³	picoCuries per cubic meter
pCi/m ² /sec	picoCuries per square meter per second
person-Sv	person-Sievert
PVS	pugmill ventilation system
RCRA	Resource Conservation and Recovery Act
RCS	Radon Control System
SARA	Superfund Amendment and Reauthorization Act
TLD	thermoluminescent dosimeter
TSCA	Toxic Substance Control Act
USGS	United States Geologic Survey
WPP	Waste Pits Project
yd ³	cubic yards

Units (Abbreviations) and Conversion Table

Multiply	By	To Obtain	Multiply	By	To Obtain
inches (in)	2.54	centimeters (cm)	cm	0.3937	in
feet (ft)	0.3048	meters (m)	m	3.281	ft
miles (mi)	1.609	kilometers (km)	km	0.6214	mi
pounds (lb)	0.454	kilograms (kg)	kg	2.205	lb
tons	0.9072	metric tons	metric tons	1.102	tons
gallons	3.785	liters (L)	L	0.2642	gallons
square feet (ft ²)	0.0929	square meters (m ²)	m ²	10.76	ft ²
acres	0.4047	hectares	hectares	2.471	acre
cubic yards (yd ³)	0.7646	cubic meters (m ³)	m ³	1.308	yd ³
cubic feet (ft ³)	0.02832	cubic meters (m ³)	m ³	35.31	ft ³
picocuries (pCi)	10 ⁻¹²	curies (Ci)	Ci	1012	pCi
pCi/L	10 ⁻⁶	microcuries per liter (μ Ci/L)	μ Ci/L	106	pCi/L
Ci	3.7 x 10 ¹⁰	becquerels (Bq)	Bq	2.7 x 10 ⁻¹¹	Ci
pCi	0.037	Bq	Bq	27.03	pCi
millirem (mrem)	0.001	rem	rem	1000	mrem
mrem	0.01	milliSievert (mSv)	mSv	100	mrem
rem	0.01	Sievert (Sv)	Sv	100	rem
mSv	0.001	Sv	Sv	1000	mSv
person-rem	0.01	person-Sv	person-Sv	100	person-rem
rad	0.01	Gray (Gy)	Gy	100	rad
milliGray (mGy)	0.001	Gy	Gy	1000	mGy
milligrams per liter (mg/L)	1000	micrograms per liter (μ g/L)	μ g/L	0.001	mg/L
Fahrenheit (°F)	(°F - 32) x 5/9	Celsius (°C)	°C	(°C x 9/5) + 32	°F
For Natural Uranium in Water					
pCi/L	0.0015	mg/L	mg/L	675.7	pCi/L
pCi/L	1.48	μ g/L	μ g/L	0.6757	pCi/L
μ g/L	0.6757	pCi/L	pCi/L	1.48	μ g/L
For Natural Uranium in Soil					
pCi/g	1.48	μ g/g	μ g/g	0.6757	pCi/g
mg/kg	1	μ g/g	μ g/g	1	mg/kg