

FERNALD PRESERVE

2008 Site Environmental Report



U.S. Department of Energy
Office of Legacy Management
Issued May 2009 (S05082)

Fernald Preserve

This page intentionally left blank

Fernald Preserve
2008 Site Environmental Report

May 2009

This page intentionally left blank

Contents

| | |
|---|------|
| Abbreviations..... | v |
| Measurement Abbreviations..... | vii |
| Units (Abbreviations) and Conversion Table..... | ix |
| Executive Summary..... | xi |
| 1.0 Site Background..... | 1-1 |
| 1.1 The Path to Site Closure..... | 1-3 |
| 1.2 Environmental Monitoring Program..... | 1-5 |
| 1.3 Characteristics of the Site and Surrounding Area..... | 1-6 |
| 1.3.1 Land Use and Demography..... | 1-6 |
| 1.3.2 Geography..... | 1-6 |
| 1.3.3 Geology..... | 1-11 |
| 1.3.4 Surface Hydrology..... | 1-11 |
| 1.3.5 Meteorology..... | 1-12 |
| 1.3.6 Natural Resources..... | 1-15 |
| 2.0 Remediation Status and Compliance Summary..... | 2-1 |
| 2.1 CERCLA Remediation Status..... | 2-1 |
| 2.2 Summary of Compliance with Other Requirements..... | 2-6 |
| 2.2.1 RCRA..... | 2-6 |
| 2.2.1.1 RCRA Property Boundary Groundwater Monitoring..... | 2-6 |
| 2.2.1.2 Waste Management..... | 2-7 |
| 2.2.2 Clean Water Act..... | 2-7 |
| 2.2.3 Clean Air Act..... | 2-7 |
| 2.2.4 Superfund Amendments and Reauthorization Act of 1986..... | 2-7 |
| 2.2.5 Other Environmental Regulations..... | 2-8 |
| 2.2.6 Other Permits..... | 2-8 |
| 2.2.7 Pollution Prevention and Source Reduction..... | 2-8 |
| 2.2.8 Site-Specific Regulatory Agreement..... | 2-11 |
| 2.2.8.1 Federal Facility Compliance Agreement..... | 2-11 |
| 2.2.8.2 Federal Facility Agreement, Control, and Abatement of Radon-222 Emissions..... | 2-11 |
| 2.2.9 Environmental Management Systems Requirement..... | 2-11 |
| 2.3 Split Sampling Program..... | 2-12 |
| 3.0 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 2008..... | 3-6 |
| 3.3.1 Restoration Monitoring..... | 3-12 |
| 3.3.1.1 Operational Summary..... | 3-12 |
| 3.3.1.2 South Plume/South Plume Optimization Module Operational Summary..... | 3-14 |
| 3.3.1.3 South Field Module Operational Summary..... | 3-14 |
| 3.3.1.4 Waste Storage Area Module Operational Summary..... | 3-16 |
| 3.3.1.5 Monitoring Results for Total Uranium..... | 3-17 |
| 3.3.1.6 Monitoring Results for Non-Uranium Constituents..... | 3-18 |
| 3.3.2 Other Monitoring Commitments..... | 3-20 |
| 3.4 OSDF Monitoring..... | 3-21 |

| | | |
|---------|---|------|
| 4.0 | 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 the Surface Water Pathway..... | 4-3 |
| 4.3 | Surface Water, Treated Effluent, and Sediment Monitoring Program for 2008.... | 4-3 |
| 4.3.1 | Surveillance Monitoring | 4-8 |
| 4.3.2 | Compliance Monitoring..... | 4-10 |
| 4.3.2.1 | FFCA and OU5 ROD Compliance | 4-10 |
| 4.3.2.2 | NPDES Permit Compliance..... | 4-13 |
| 4.3.3 | Uranium Discharges in Surface Water and Treated Effluent | 4-13 |
| 4.4 | Sediment Monitoring | 4-13 |
| 5.0 | Air Pathway | 5-1 |
| 5.1 | Activities Affecting the Air Pathway..... | 5-1 |
| 5.2 | Air Monitoring Program Summary for 2008..... | 5-3 |
| 5.3 | Radiological Air Particulate Sampling Results..... | 5-3 |
| 5.4 | Radon Monitoring..... | 5-6 |
| 5.5 | Monitoring for Direct Radiation | 5-9 |
| 6.0 | Radiation Dose..... | 6-1 |
| 6.1 | Estimated Dose from Airborne Emissions..... | 6-1 |
| 6.2 | Direct Radiation Dose..... | 6-2 |
| 6.3 | Total of Doses to the Maximally Exposed Individual | 6-4 |
| 6.4 | Significance of Estimated Radiation Doses for 2008 | 6-6 |
| 6.5 | Estimated Dose from Radon | 6-6 |
| 6.6 | Estimated Dose to Biota..... | 6-8 |
| 7.0 | Natural Resources | 7-1 |
| 7.1 | Ecological Restoration Activities | 7-1 |
| 7.1.1 | Trails and Overlooks Construction | 7-3 |
| 7.1.2 | Restored Area Maintenance Activities | 7-3 |
| 7.1.3 | Ecological Restoration Monitoring..... | 7-4 |
| 7.2 | Fernald Preserve Site and OSDF Inspections | 7-7 |
| 7.3 | Affected Habitat and Inspection Findings | 7-8 |
| 7.4 | Threatened and Endangered Species and Species Inventories | 7-8 |
| 7.5 | Cultural Resources | 7-9 |
| 8.0 | References..... | 8-1 |
| 9.0 | Glossary | 9-1 |

Figures

| | | |
|--------------|--|------|
| Figure 1-1. | Fernald Preserve and Vicinity..... | 1-7 |
| Figure 1-2. | Major Communities in Southwestern Ohio | 1-8 |
| Figure 1-3. | Fernald Preserve Perspective | 1-9 |
| Figure 1-4. | Cross Section of the New Haven Trough, Looking North..... | 1-12 |
| Figure 1-5. | Regional Groundwater Flow in the Great Miami Aquifer..... | 1-13 |
| Figure 1-6. | Great Miami River Drainage Basin | 1-14 |
| Figure 1-7. | 2002-2006 Wind Rose, 33-ft (10-m) Height..... | 1-16 |
| Figure 1-8. | 2002-2006 Wind Rose, 197-ft (60-m) Height..... | 1-16 |
| Figure 1-9. | Annual Precipitation, 1994-2008 | 1-17 |
| Figure 1-10. | Monthly Precipitation for 2008 Compared to Average Monthly Precipitation for 1951-2008..... | 1-18 |

| | | |
|--------------|---|------|
| Figure 2–1. | Uncertified Areas and Subgrade Utility Corridors | 2–3 |
| Figure 2–2. | 2008 DOE and OEPA Groundwater Split Sample Locations..... | 2–13 |
| Figure 3–1. | Extraction Wells Active in 2008..... | 3–3 |
| Figure 3–2. | Diagram of a Typical Groundwater Monitoring Well | 3–7 |
| Figure 3–3. | Monitoring Well Relative Depths and Screen Locations | 3–8 |
| Figure 3–4. | Locations for Semiannual Total Uranium Monitoring | 3–9 |
| Figure 3–5. | Locations for Semiannual Non-Uranium Monitoring..... | 3–10 |
| Figure 3–6. | IEMP Groundwater Elevation Monitoring Wells | 3–11 |
| Figure 3–7. | Net Mass of Uranium Removed from the Great Miami Aquifer, 1993–2008.... | 3–13 |
| Figure 3–8. | Total Uranium Plume in the Aquifer with Concentrations Greater Than 30 µg/L at the End of 2008 | 3–15 |
| Figure 3–9. | Non-Uranium Constituents with 2008 Results Above FRLs..... | 3–19 |
| Figure 3–10. | OSDF Footprint and Monitoring Well Locations..... | 3–22 |
| Figure 4–1. | Controlled Surface Water Areas and Uncontrolled Runoff Flow Directions | 4–2 |
| Figure 4–2. | IEMP/NPDES Surface Water and Treated Effluent Sample Locations | 4–5 |
| Figure 4–3. | IEMP Background Surface Water Sample Locations..... | 4–7 |
| Figure 4–4. | Annual Average Total Uranium Concentrations in Paddys Run at Willey Road (SWP-03) Sample Location, 1985–2008..... | 4–9 |
| Figure 4–5. | Pounds of Uranium Discharged to the Great Miami River through the Parshall Flume (PF 4001) in 2008 | 4–11 |
| Figure 4–6. | 2008 Monthly Average Total Uranium Concentration in Water Discharged Through the Parshall Flume (PF 4001) to the Great Miami River | 4–12 |
| Figure 4–7. | Uranium Discharged via the Surface Water Pathway, 1993–2008 | 4–14 |
| Figure 4–8. | 2008 Sediment Sample Locations..... | 4–15 |
| Figure 5–1. | Radiological AMS Locations..... | 5–2 |
| Figure 5–2. | Monthly Results and Measurement Error for Uranium in Collected Air Particulate | 5–5 |
| Figure 5–3. | Annual Activity and Uncertainty for Isotopes Used in NESHAP Analysis | 5–7 |
| Figure 5–4. | 2008 Average Radon Results Compared to Historical Levels (no background correction)..... | 5–10 |
| Figure 5–5. | Direct Radiation (TLD) Monitoring Locations..... | 5–11 |
| Figure 5–6. | Quarterly Results and Measurement Error for TLD Monitoring Locations | 5–13 |
| Figure 6–1. | Comparison of 2008 Air-Pathway Doses and Allowable Limits..... | 6–3 |
| Figure 6–2. | Comparison of 2008 All-Pathway Doses and Allowable Limits..... | 6–5 |
| Figure 7–1. | Restoration Project Areas | 7–2 |
| Figure 7–2. | Herbaceous Cover Monitoring Sub-Areas..... | 7–5 |
| Figure 7–3. | Threatened and Endangered Species Habitat Areas | 7–10 |
| Figure 7–4. | Cultural Resource Survey Areas..... | 7–12 |

Tables

| | | |
|------------|--|------|
| Table 1–1. | Operable Unit Remedies | 1–4 |
| Table 2–1. | Compliance with Other Environmental Regulations | 2–9 |
| Table 2–2. | 2008 DOE/OEPA Groundwater Split Sampling Comparison | 2–12 |
| Table 3–1. | Groundwater Restoration Module Status for 2008 | 3–12 |
| Table 3–2. | Non-Uranium Constituents with Results Above FRLs During 2008 | 3–20 |
| Table 3–3. | OSDF Groundwater, Leachate, and LDS Monitoring Summary..... | 3–23 |
| Table 4–1. | 2008 Summary Statistics for the Sediment Monitoring Program..... | 4–16 |

| | |
|---|------|
| Table 5–1. Summary of Total Uranium and Particulate Concentrations in Air | 5–4 |
| Table 5–2. Annual Summary for Monthly Average Radon Concentrations..... | 5–9 |
| Table 5–3. Direct Radiation (TLD) Measurement Summary | 5–12 |
| Table 6–1. Dose to MEI..... | 6–4 |
| Table 6–2. 2008 Radon Dose Estimate..... | 6–8 |
| Table 7–1. Data Summary for Herbaceous Cover Sampling..... | 7–6 |

Appendixes

| | |
|------------|--|
| Appendix A | Supplemental Groundwater Information |
| Appendix B | Supplemental Surface Water, Treated Effluent, and Sediment Information |
| Appendix C | Supplemental Air Information |
| Appendix D | 2008 National Emissions Standards for Hazardous Air Pollutants (NESHAP) Annual Report |
| Appendix E | Ecological Restoration Monitoring |