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Department of Energy
Office of Legacy Management

May 18, 2009

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Dear Mr. Fischer, Mr. Schneider, and Mr. Devault:

Subject: **Transmittal of the 2009 Comprehensive Legacy Management and Institutional Controls Plan, Revision 3 Change Pages**

References: 1) Letter, T. Fischer to J. Powell, "Re: Legacy Management and Institutional Controls Plan," dated December 11, 2008

2) Letter, T. Schneider to J. Powell, "Re: RTCs – 2009 Comprehensive Legacy Management and Institutional Controls Plan, Revision 3, Final," dated March 11, 2009

The United States Department of Energy (DOE) has been implementing the January 2009 Fernald Preserve Comprehensive Legacy Management and Institutional Controls Plan (LMICP), Revision 3, Final, based on United States Environmental Protection Agency's (EPA) approval (Reference 1). Subsequently, DOE received additional comments from the Ohio Environmental Protection Agency (OEPA) (Reference 2). Based on one comment received from OEPA and the recent issuance of the renewed NPDES Permit, it has become necessary to issue revisions to Sections 4.0 and 5.0 of Attachment D (Integrated Environmental Monitoring Plan) of the 2009 LMICP. Please replace the previous version of Section 4.0 Surface Water, Treated Effluent, and Sediment Monitoring Program and Section 5.0 Dose Assessment Program.

Section 4.0 was revised to incorporate the changes to the Fernald Preserve's National Pollution Discharge Elimination System (NPDES) Permit. A new NPDES Permit was issued by OEPA and became effective on April 1, 2009. The new NPDES Permit significantly reduced the number of monitored parameters and made adjustments in regulated monitoring points. Table 4-3 of Section 4.0 reflects these changes. Minor editorial changes throughout Section 4.0 as a result if these changes necessitated revision.

Section 5.0 was revised to reincorporate the requirements of National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR 61 Subpart H that had been removed from the 2009 LMICP. DOE apparently misunderstood the position of EPA Office of Air and Radiation guidance which resulted in the proposed elimination of the air particulate monitoring program. Based on the comment from OEPA and further consultation with EPA, DOE has reinstated the air particulate monitoring program as described in the May 2008 version of the LMICP. DOE is in consultation with EPA Office of Air and Radiation as to the appropriate end date of this program.

Although the NESHAP requirements had initially been removed from the 2009 LMICP and approved by EPA (Reference 1), the monthly air samples for total particulate and total uranium, and the quarterly composite air samples for isotopic radium, thorium, and uranium have been continuously monitored at the Fernald Preserve during 2009.

The 2009 LMICP including the revised sections of Attachment D is available to all stakeholders through the Public Environmental Information Center which is located at 10995 Hamilton-Cleves Highway Cincinnati, OH 45030; (513) 648-5051 (open Monday through Thursday, 9:00 a.m. to 4:00 p.m., or by appointment) and on the Department of Energy Office of Legacy Management's internet site (http://www.lm.doe.gov) under the Legacy Management Sites icon.

If you have any questions regarding this matter, please call me at (513) 648-3148.

Sincerely,

Jane Powell

Jane Powell
Fernald Preserve Manager
DOE-LM-20.1

Enclosure

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Legacy Management and Institutional Controls Plan
Document History

Version No./Revision No.	Date	Description of Revision
3.1	05/29/2009	Based on one comment received from the Ohio Environmental Protection Agency (OEPA) and the recent issuance of the renewed National Pollution Discharge Elimination System Permit (NPDES), it has become necessary to issue revisions to Sections 4.0 and 5.0 of Attachment D (Integrated Environmental Monitoring Plan) of the 2009 LMICP. Section 4.0 was revised to incorporate the changes to the Fernald Preserve's NPDES Permit. A new NPDES Permit was issued by OEPA and became effective on April 1, 2009. Section 5.0 was revised to reincorporate the requirements of National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR 61 Subpart H, that had been removed from the 2009 LMICP.
3.0	01/19/2009	This document was previously issued under U.S. Department of Energy (DOE) Technical Assistance Contract DE-AC01-02GJ79491 as document number **DOE-LM/1526-2008**. As the initial issue under DOE Legacy Management Support (LMS) contract DE-AM01-07LM00060, it has been renumbered as **LMS/FER/S03496-3.0**. Please refer to the "Significant Changes Summary" on the following pages for details of the changes incorporated in this revision.

Approved:

Jane Powell — 6-01-09

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Appendix

Appendix A Natural Resource Monitoring Plan

4.0 Surface Water, Treated Effluent, and Sediment Monitoring Program

Section 4.0 discusses the monitoring strategy for assessing site-wide surface water, treated effluent, and sediment. The strategy includes compliance-based monitoring and reporting obligations, a medium-specific plan, sampling design, and data evaluation.

4.1 Integration Objectives for Surface Water, Treated Effluent, and Sediment

The IEMP is the designated mechanism for conducting the site-wide surface water, treated effluent, and sediment surveillance and compliance monitoring. In this role, the IEMP serves to integrate several compliance based monitoring and reporting programs currently in existence for the Fernald Preserve:

- The discharge monitoring and reporting program related to the site's NPDES Permit.
- The radiological monitoring of and reporting for the treated effluent mandated by the OU5 ROD.
- The IEMP Characterization Program, which combines portions of the former Environmental Monitoring Program (EMP) that has been ongoing at the Fernald Preserve since the 1950s and was updated in Revision 0 of the IEMP (DOE 1997d), to accommodate surface water monitoring during post-closure.
- The radiological monitoring of and reporting for off-property sediment mandated by the OU5 ROD.

4.2 Analysis of Regulatory Drivers, DOE Policies, and Other Fernald Preserve Site-Specific Agreements

This section presents a summary evaluation of the regulatory drivers governing the monitoring of the Fernald Preserve's point and non-point source discharges to Paddys Run and the Great Miami River, and also includes post-closure sediment monitoring. The intent of this section is to identify the pertinent regulatory requirements for the scope and design of the surface water, treated effluent, and sediment monitoring program. These requirements will be used to confirm that the program satisfies the regulatory obligations for monitoring that have been activated by the RODs and will achieve the intentions of other pertinent criteria, such as DOE Orders and the Fernald Preserve's existing agreements and permits, as appropriate, that have a bearing on the scope of surface water, treated effluent, and sediment monitoring.

4.2.1 Approach

The analysis of the regulatory drivers and policies for surface water, treated effluent, and sediment monitoring was conducted by examining the ARARs and CERCLA RODs to identify subsets with specific environmental monitoring requirements. The Fernald Preserve's existing compliance agreements issued outside the CERCLA process were also reviewed.

4.2.2 Results

The surface water, treated effluent, and sediment monitoring program described in this IEMP has been developed with full consideration of the regulatory drivers and policies. Table 4–1 lists each of these IEMP drivers and the associated actions conducted to comply with them. A brief summary of regulatory drivers and policies has been provided in previous IEMPs. Sections 4.5 and 6.0 provide the Fernald Preserve's current and long-range plan for complying with the reporting requirements invoked by these drivers.

Table 4–1. Fernald Preserve Surface Water, Treated Effluent, and Sediment Monitoring Program Regulatory Drivers and Actions

	Driver	Action
IEMP	DOE Order 450.1A, environmental monitoring plan for all media	The IEMP describes treated effluent and surveillance monitoring as required by DOE Order 450.1A.
	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 radiological constituents.
	CERCLA Remedial Design Work Plan (DOE 1996c)	The IEMP specifies describes treated effluent and surveillance monitoring as required by DOE Order 450.1A.
	OU5 ROD	The IEMP will be modified toward completion of the remedial action to include surface water sampling to certify FRL achievement. IEMP includes monitoring for performance based uranium discharge limits.
	OU5 Feasibility Study/OU5 ROD	The IEMP will be modified toward completion of the remedial actions to include sediment sampling to verify FRL achievement.
	NPDES Permit	The IEMP describes routine sampling of permit-designated treated 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) for radiological constituents.

Note: Soil and sediment at the Fernald Preserve have been certified, with the exception of those areas identified in Figures 2–1 and 2–2. Therefore, it is not expected that FRL exceedances will occur in association with uncontrolled runoff.

4.3 Program Expectations and Design Considerations

4.3.1 Program Expectations

The expectations for the surface water and treated effluent monitoring program are to:

- Provide an ongoing assessment of the potential for cross-medium 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 in various site drainages (noted in IEMP reports) continue to occur at key on-site locations, at the property boundary on Paddys Run, and in the Great Miami River outside the mixing zone, and determine if monitoring can be reduced based on surface water data results.
- Provide an assessment of impacts to surface water due to uncontrolled runoff.

- Provide additional data at background locations on Paddys Run and the Great Miami River to refine the ability to distinguish site impacts from background.
- 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 OU5 ROD.
- Continue to fulfill DOE Order 450.1A requirements to maintain an environmental monitoring plan for surface water.
- Continue to address the concerns of the community regarding the magnitude of the Fernald Preserve's discharges to surface water (i.e., to Paddys Run and the Great Miami River).

The expectations for the sediment monitoring program are to:

- Continue monitoring sediment in the Great Miami River to confirm that the river is not being impacted by Fernald Preserve effluent discharges.
- Confirm that remediation of sediment in the Great Miami River is unnecessary and fulfill the OU5 Feasibility Study conclusion/recommendation.

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

4.3.2 Design Considerations

This section provides the IEMP surface water, treated effluent, and sediment monitoring program design considerations. 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 OU5 ROD has been incorporated into the IEMP.

4.3.2.1 Constituents of Concern

A comprehensive listing of surface water COCs is presented in Table 4–2. The following is a description of information provided in Table 4–2.

- Column 1, Constituent: This column represents the constituents for which an FRL was established in the OU5 ROD.
- Column 2, Final Remediation Levels: This column represents the human/health protective remediation levels for surface water that were established in the OU5 ROD.
- Column 3, FRL Basis: This column is the basis for establishment of the FRL as defined in the OU5 Feasibility Study.
- Column 4, Background Values in Surface Water: This column represents updated background values for Paddys Run and the Great Miami River based on data collected for the IEMP through 2006. The IEMP provides this information for purposes of comparison.

Sediment samples will be collected from the two locations on the Great Miami River: one downstream from the outfall line and one background location, and analyzed for uranium as identified in Table 4–2. Samples will be collected in 2009 and then will be collected every 5 years thereafter. The sediment FRL for uranium is 210 mg/kg.

Table 4–2. Surface Water Selection Criteria Summary

Constituent	FRL[a]	FRL Basis[a]	95th Percentile Background Level in Surface Water[b,c]			
			Paddys Run		Great Miami River	
			Original	Revised	Original	Revised
General Chemistry (mg/L)						
Fluoride	2.0	A	0.22	0.091	0.9	0.504
Nitrate/Nitrite	2400	R	1.7	4.90	6.6	7.87
Inorganics (mg/L)						
Antimony	0.19	A	ND	0.0012	ND	0.00175
Arsenic	0.049	R	ND	0.00616	0.0036	0.0139
Barium	100	R	0.053	0.0545	0.1	0.100
Beryllium	0.0012	A	ND	0.0003	ND	0.0009
Cadmium	0.0098	B	ND	0.00075	0.01	0.00375
Chromium (VI)[d]	0.010	D	ND	0.00943	ND	0.00991
Copper	0.012	A	ND	0.00652	0.012	0.0141
Cyanide	0.012	A	ND	0.00367	0.005	0.00412
Lead	0.010	B	ND	0.00568	0.010	0.00958
Manganese	1.5	R	0.035	0.229	0.08	0.113
Mercury	0.00020	D	ND	0.000126	ND	0.000175
Molybdenum	1.5	R	ND	0.00328	0.02	0.00902
Nickel	0.17	A	ND	0.00792	0.023	0.0116
Selenium	0.0050	A	ND	0.00254	ND	0.00293
Silver	0.0050	D	ND	0.000706	ND	0.000348
Vanadium	3.1	R	ND	0.0188	ND	0.00671
Zinc	0.11	A	ND	0.0361	0.045	0.0463

Table 4–2 (continued). Surface Water Selection Criteria Summary

Constituent	FRL[a]	FRL Basis[a]	95th Percentile Background Level in Surface Water[b,c]			
			Paddys Run		Great Miami River	
			Original	Revised	Original	Revised
Radionuclides (pCi/L)						
Cesium-137	10	R	3.1	4.74	ND	3.16
Neptunium-237	210	R	-	0.054	ND	0.083
Lead-210	11	R	-	2.97	-	2.45
Plutonium-238	210	R	ND	ND	ND	0.038
Plutonium-239/240	200	R	0.09	0.093	ND	0.01
Radium-226	38	R	0.35	0.844	0.41	0.728
Radium-228	47	R	2.1	1.98	2.2	3.85
Strontium-90	41	R	0.96	1.09	ND	1.14
Technetium-99	150	R	ND	4.65	ND	7.65
Thorium-228	830	R	ND	0.238	0.62	0.234
Thorium-230	3500	R	ND	0.543	0.36	0.789
Thorium-232	270	R	ND	0.213	ND	0.231
Uranium, Total (µg/L)	530	R	1.0	1.29	1.0	2.13
Pesticide/PCBs (µg/L)						
Alpha-Chlordane	0.31	R	-	ND	-	0.003
Aroclor-1254	0.20	D	-	ND	-	ND
Aroclor-1260	0.20	D	-	ND	-	ND
Dieldrin	0.020	D	-	ND	-	0.0095
Semi-Volatiles (µg/L)						
Benzo(a)anthracene	1.0	D	-	ND	-	ND
Benzo(a)pyrene	1.0	D	-	ND	-	ND
bis(2-Chloroisopropyl)ether	280	R	-	ND	-	ND
bis(2-Ethylhexyl)phthalate	8.4	A	-	2	-	2.5
Dibenzo(a,h)anthracene	1.0	D	-	ND	-	1.9
3,3'-Dichlorobenzidine	7.7	R	-	ND	-	ND

Table 4–2 (continued). Surface Water Selection Criteria Summary

Constituent	FRL[a]	FRL Basis[a]	95th Percentile Background Level in Surface Water[b,c]			
			Paddys Run		Great Miami River	
			Original	Revised	Original	Revised
Semi-Volatiles (µg/L) (Cont.)						
Di-n-butylphthalate	6000	R	-	5.09	-	5.5
Di-n-octylphthalate	5.0	D	-	1.75	-	ND
p-Methylphenol	2200	R	-	ND	-	0.6
4-Nitrophenol	7,400,000	R	-	ND	-	ND
Volatiles (µg/L)						
Benzene	280	R	-	ND	-	0.35
Bromodichloromethane	240	R	-	ND	-	ND
Bromomethane	1300	R	-	ND	-	ND
Chloroform	79	A	-	0.782	-	0.3
1,1-Dichloroethene	15	R	-	ND	-	ND
Methylene chloride	430	A	-	1	-	ND
Tetrachloroethene	45	R	-	0.367	-	ND
1,1,1-Tricholoroethane	1.0	D	-	ND	-	ND
1,1,2-Tricholoroethane	230	R	-	ND	-	ND
Other Constituents						
Ammonia	-	-	-	0.14	-	0.176
Carbon disulfide	-	-	-	ND	-	0.35
Cobalt	-	-	-	-	-	0.00799
Trichloroethene	-	-	-	0.2	-	ND

[a]Derived from OU5 ROD, Table 9–5.
A = ARAR values
B = background concentrations
D = analytical detection limit
R = human health risk
[b]ND = non-detected result
- = not applicable/not available
[c]For small data sets (less than or equal to seven samples), the maximum detected concentration is used as the 95th percentile.
[d]FRL based on chromium (VI); however, the analytical results are for total chromium.

4.3.2.2 Surface Water Cross-Medium Impact

To assess the cross-medium 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 (Figure 4–1). At these locations (i.e., STRM 4005, SWP-02, SWD-02, SWD-03, SWD-04, SWD-05, SWD-07, and SWD-08) a direct pathway exists for surface water and associated contaminants to reach the underlying sand and gravel Great Miami Aquifer.
- During remediation and restoration efforts, new wetlands and ponds were created within the site perimeter. Some of these water bodies have little or no underlying glacial overburden. Therefore, five additional surface water locations (i.e., SWD-04, SWD-05, SWD-06, SWD-07, and SWD-08) were selected to assess the possible impacts of surface water infiltrating into the aquifer. Sampling at these locations will occur semiannually for uranium for 2 years to evaluate potential impacts. Data will be evaluated to determine the need for further sampling following the initial 2-year period. Location SWD-05 was selected specifically to monitor any impact on the underlying groundwater from surface water where elevated uranium concentrations have been discovered. This area is a small watershed draining south to this location where surface water then dissipates via infiltration or evaporation. It appears from a study conducted in March 2007 that the soil leachability characteristics in this area differ from the surrounding area. A maintenance activity was implemented in the summer of 2007 to remove a limited amount of soil from the area. To monitor how the area has responded to this maintenance activity, another location (SWD-09) upgradient of SWD-05 is also being monitored.
- Constituents analyzed should represent those area-specific COCs identified in the OU5 Feasibility Study and subsequent fate and transport modeling as having the potential for cross-medium impact to groundwater via the surface water pathway.

4.3.2.3 Sporadic Exceedances of FRLs

Sample locations should be located (1) on property locations downstream of historical FRL exceedances, (2) at the point where Paddys Run flows off the Fernald Preserve property, and (3) at the Parshall Flume (PF 4001), where treated effluent is discharged from the Fernald Preserve to the Great Miami River. (Refer to Figure 4–2 for IEMP surface water and treated effluent sample locations).

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.

To assist in the development of the scope and focus of the IEMP surface water, treated effluent, and sediment program, a review of the IEMP monitoring data is conducted periodically. The last such review was based on data collected under the IEMP program from August 1997 through December 2007. The recommended parameters and locations for monitoring are indicated in Table 4–3 (i.e., IEMP Characterization). To provide surveillance monitoring for FRL exceedances, samples will be collected and analyzed for those constituents and associated monitoring frequencies identified in Table 4–3.

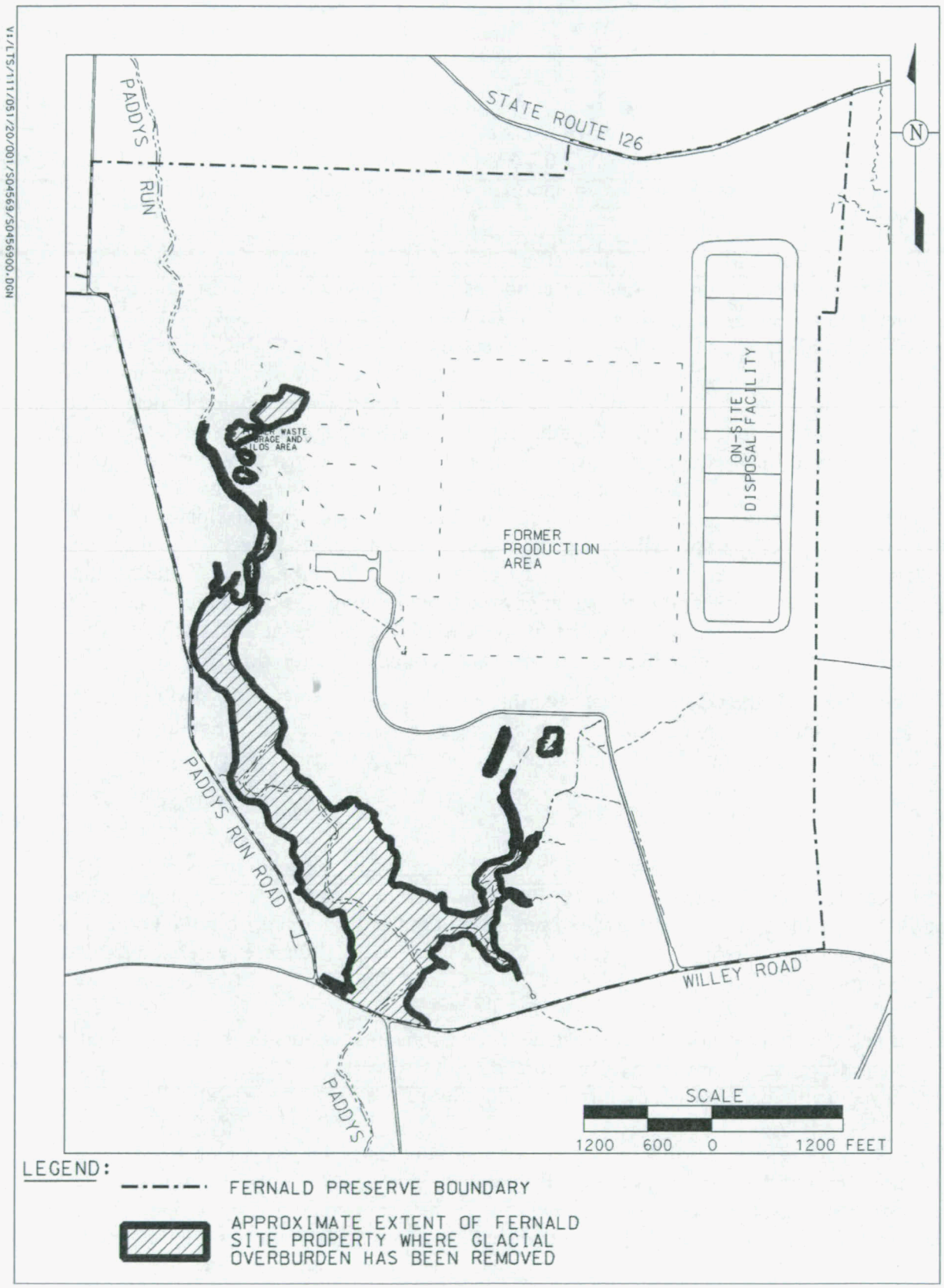

Figure 4–1. Area where Glacial Overburden Has Been Removed

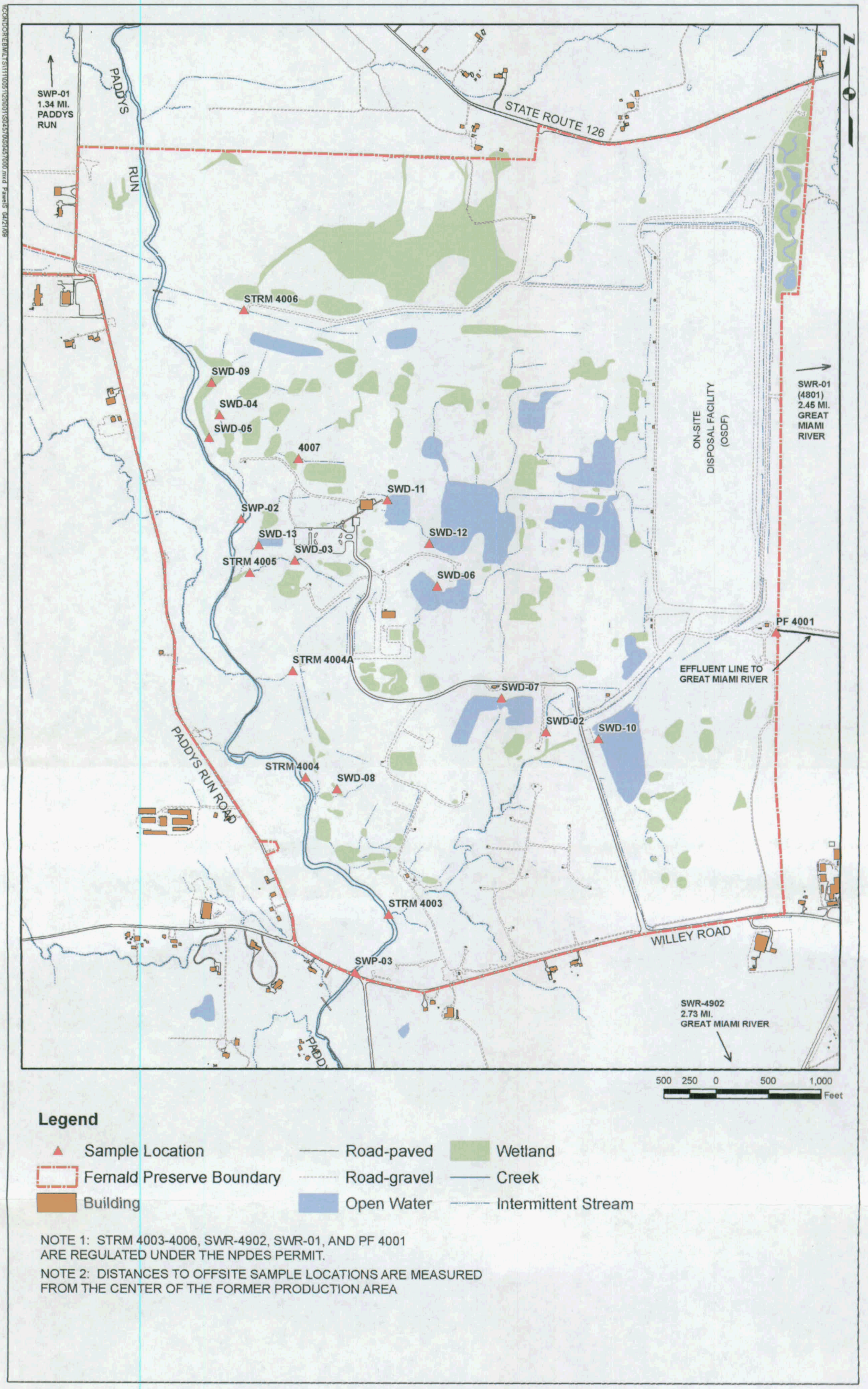

Figure 4–2. IEMP Surface Water, NPDES, and Treated Effluent Sample Locations

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Table 4–3. Summary of Surface Water, Treated Effluent, and Sediment Sampling Requirements by Location

Location	Constituent[a]	IEMP Characterization Requirements (reason for selection)[b,c]	NPDES Requirements[c] (Jan – Mar)	NPDES Requirements[c] (Apr – Dec)
SWR-01 (SWR-4801) (Great Miami River Background)	**General Chemistry:**			
	Ammonia	-	Quarterly	-
	Total hardness	-	Quarterly	Quarterly
	Inorganics:			
	Beryllium	Semiannually (B)	-	-
	Cadmium	Semiannually (B)	Quarterly	-
	Chromium, Total	Semiannually (B)	Quarterly	-
	Cobalt	-	Quarterly	-
	Copper	Semiannually (B)	Quarterly	-
	Cyanide, Total	Semiannually (B)	-	-
	Lead	-	Quarterly	-
	Manganese	Semiannually (B)	Quarterly	Quarterly
	Mercury (low level)	-	Quarterly	-
	Mercury	Semiannually (B)	-	Quarterly
	Nickel	-	Quarterly	-
	Silver	Semiannually (B)	Quarterly	-
	Zinc	Semiannually (B)	Quarterly	-
	Radionuclides:			
	Uranium, Total	Semiannually(B)	-	-
SWP-01 (Paddys Run Background)	**Inorganics:**			
	Beryllium	Semiannually (B)	-	-
	Cadmium	Semiannually (B)	-	-
	Chromium, Total	Semiannually (B)	-	-
	Copper	Semiannually (B)	-	-
	Cyanide, Total	Semiannually (B)	-	-
	Manganese	Semiannually (B)	-	-
	Mercury	Semiannually (B)	-	-
	Silver	Semiannually (B)	-	-
	Zinc	Semiannually (B)	-	-
	Radionuclides:			
	Uranium, Total	Semiannually (B)	-	-
SWP-02 (Paddys Run)	**Radionuclides:**			
	Radium-226	Annual	-	-
	Radium-228	Annual	-	-
	Technetium-99	Annual	-	-
	Thorium-228	Annual	-	-
	Thorium-230	Annual	-	-
	Thorium-232	Annual	-	-
	Uranium, Total	Semiannually (PC)	-	-
SWP-03 (Paddys Run at Downstream Property Boundary) continued on next page	**Inorganics:**			
	Beryllium	Semiannually (S)	-	-
	Cadmium	Semiannually (S)	-	-
	Chromium, Total	Semiannually (S)	-	-
	Copper	Semiannually (S)	-	-
	Cyanide	Semiannually (M)	-	-
	Manganese	Semiannually (S)	-	-
	Mercury	Semiannually (M)	-	-
	Silver	Semiannually (M)	-	-
	Zinc	Semiannually (M)	-	-

Table 4–3 (continued). 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] (Jan – Mar)	NPDES Requirements[c] (Apr – Dec)
SWP-03 continued	**Radionuclides:**			
	Radium-226	Annual	-	-
	Radium-228	Annual	-	-
	Technetium-99	Annual	-	-
	Thorium-228	Annual	-	-
	Thorium-230	Annual	-	-
	Thorium-232	Annual	-	-
	Uranium, Total	Semiannually (PC)	-	-
SWD-02 (Storm Sewer Outfall Ditch)	**Radionuclides:**			
	Uranium, Total	Semiannually (PC)	-	-
SWD-03 (Waste Storage Area)	**Radionuclides:**			
	Radium-226	Annually	-	-
	Radium-228	Annually	-	-
	Technetium-99	Annually	-	-
	Thorium-228	Annually	-	-
	Thorium-230	Annually	-	-
	Thorium-232	Annually	-	-
	Uranium, Total	Semiannually (PC)	-	-
PF 4001 (Parshall Flume - Treated Effluent) continued on next page	**General Chemistry:**			
	Ammonia	-	3/Week[d]	-
	Carbonaceous biochemical oxygen demand	-	2/Week	2/Week
	Fluoride	-	Monthly	Monthly
	Nitrate/Nitrite	-	Monthly	Monthly
	Oil and grease	-	2/Week	2/Week
	Total dissolved solids	-	Monthly	Monthly
	Total phosphorus - P	-	-	Weekly
	Total residual chlorine	-	2/Week[e]	-
	Total suspended solids	-	Daily	Daily
	Inorganics:			
	Antimony	-	Monthly	-
	Arsenic	-	Monthly	-
	Barium	-	3/Week	-
	Beryllium	-	Monthly	-
	Boron	-	Monthly	-
	Cadmium	-	3/Week	-
	Chromium, Total	-	3/Week	-
	Cobalt	-	2/Week	-
	Copper	-	3/Week	-
	Cyanide, Free	-	Monthly	Monthly
	Lead	-	3/Week	-
	Manganese	-	2/Week	2/Week
	Mercury (low level)	-	Monthly	Monthly
	Molybdenum	-	3/Week	-
	Nickel	-	3/Week	-
	Selenium	-	3/Week	-
	Silver	-	3/Week	-
	Zinc	-	3/Week	-
	Radionuclides:			
	Radium-226	Semiannually (M)	-	-
	Radium-228	Semiannually	-	-
	Technetium-99	Semiannually (M)	-	-
	Uranium, Total	Semiannually(PC)	Daily[f]	Daily[f]

Table 4–3 (continued). Summary of Surface Water, Treated Effluent, and Sampling Requirements by Location

Location	Constituent[a]	IEMP Characterization Requirements (reason for selection)[b,c]	NPDES Requirements[c] (Jan – Mar)	NPDES Requirements[c] (Apr – Dec)
PF 4001 continued	**Semi-Volatiles:**			
	Bis (2-ethylhexyl) phthalate	-	Quarterly	Quarterly
	Volatiles:			
	Chloroform	-	Quarterly	-
	1,1-Dichloroethane	-	Quarterly	-
	Trichloroethene	-	Quarterly	-
	Other:			
	Flow Rate	-	Daily	Daily
STRM 4003 (Drainage to Paddys Run)	**General Chemistry:**			
	Total suspended solids	-	Semiannually	Semiannually
	Inorganics:			
	Copper	-	Semiannually	-
	Mercury (low level)	-	Semiannually	Semiannually
	Radionuclides:			
	Uranium, Total	Semiannually (PC)	-	-
	Other:			
	Fecal coliform	-	Semiannually	-
	Flow Rate	-	Semiannually	Semiannually
STRM 4004[g] (Drainage to Paddys Run)	**General Chemistry:**			
	Total suspended solids	-	Semiannually	-
	Inorganics:			
	Copper	-	Semiannually	-
	Lead	-	Semiannually	-
	Mercury (low level)	-	Semiannually	-
	Silver	-	Semiannually	-
	Radionuclides:			
	Uranium, Total	Semiannually (PC)	-	-
	Other:			
	Fecal coliform	-	Semiannually	-
	Flow Rate	-	Semiannually	-
STRM 4005 (Drainage to Paddys Run)	**General Chemistry:**			
	Total suspended solids	-	Semiannually	-
	Inorganics:			
	Lead	-	Semiannually	-
	Mercury (low level)	-	Semiannually	-
	Radionuclides:			
	Uranium, Total	Semiannually (PC)	-	-
	Other:			
	Fecal coliform	-	Semiannually	-
	Flow Rate	-	Semiannually	-
STRM 4006 (Drainage to Paddys Run)	**General Chemistry:**			
	Total suspended solids	-	Semiannually	-
	Inorganics:			
	Copper	-	Semiannually	-
	Lead	-	Semiannually	-
	Mercury (low level)	-	Semiannually	-
	Silver	-	Semiannually	-
	Radionuclides:			
	Uranium, Total	Semiannually (PC)	-	-
	Other:			
	Fecal coliform	-	Semiannually	-
	Flow Rate	-	Semiannually	-

Table 4–3 (continued). 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] (Jan – Mar)	NPDES Requirements[c] (Apr – Dec)
4007 (Biowetland Emergency Overflow to Paddys Run)	Flow Rate	-	-	Daily during overflow
SWD-04[h], SWD-05[h], SWD-06[h], SWD-07[h], SWD-08[h]	**Radionuclides:**			
	Radium-226	Annually	-	-
	Radium-228	Annually	-	-
	Technetium-99	Annually	-	-
	Thorium-228	Annually	-	-
	Thorium-230	Annually	-	-
	Thorium-232	Annually	-	-
	Uranium, Total	Semiannually	-	-
SWD-09	**Radionuclides:**			
	Uranium, Total	Semiannually	-	-
SWD-10, SWD-11, SWD-12, SWD-13	**Radionuclides:**			
	Uranium, Total	Annually	-	-
SWR-4902 (Downstream of Fernald Preserve Effluent)	**General Chemistry:**			
	Ammonia	-	Quarterly	-
	Total Hardness	-	Quarterly	Quarterly
	Inorganics			
	Cadmium	-	Quarterly	-
	Chromium	-	Quarterly	-
	Cobalt	-	Quarterly	-
	Copper	-	Quarterly	-
	Lead	-	Quarterly	-
	Manganese	-	Quarterly	Quarterly
	Mercury (low level)	-	Quarterly	-
	Mercury	-	-	Quarterly
	Nickel	-	Quarterly	-
	Silver	-	Quarterly	-
	Zinc	-	Quarterly	-
G4 (Great Miami River-downstream sediment)	Uranium	Annually	-	-
G2 (Great Miami River-sediment background)	Uranium	Annually	-	-

[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; WP = Waste Pits Excavation Monitoring
[c]"-" indicates the constituent is not included in the sample program.
[d]Sampled twice a week in winter (November 1 through April 30) and three times a week in summer (May 1 through October 31).
[e]Constituent not sampled from November through April.
[f]This constituent is sampled under the OU5 ROD.
[g]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.
[h]Sampling will be conducted for 2 years to determine if sampling should continue. Locations are based on sampling from Residual Risk Assessment Analysis and lack of glacial overburden.

Constituents are monitored at SWP-03 because it is the last location that surface water is monitored on Paddys Run prior to leaving the site and all non-radiological area specific constituents and uranium are monitored at this location in order to be conservative. Appendix B in previous years' IEMPs provided maps detailing surface water locations with historical FRL exceedances including those exceedances at background locations.

4.3.2.4 Impacts to Surface Water Due to Storm Water Runoff

With remediation completed, there are no areas where storm water runoff is controlled, with the exception of the footprint of the CAWWT tanks located on a controlled pad. However, IEMP surface water monitoring will continue at points of storm water runoff entry into receiving waters or within main site drainage ditches (in addition to ambient monitoring for background quantification purposes). Figure 4–3 shows the Comparison of Average Total Uranium Concentrations at Paddys Run at Sample Location SWP-03. Important distinctions regarding uranium in storm water runoff from the site to Paddys Run, based on the data in Figure 4–3, include:

- Average concentrations have been far below the human/health protective surface water FRL concentration (530 µg/L) in each year since 1981. (This includes 9 years while the site was in production.)
- Annual average monthly concentrations have been consistently below the human/health protective groundwater FRL (30 µg/L) in each year since 1986.

4.3.2.5 Ongoing Background Evaluation

Because the RI/FS 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, Monitoring for surface water background has been performed from the initiation of the IEMP through 2004 for all 55 surface water FRL constituents identified in Table 4–2. Although there are only 17 area-specific surface water constituents (i.e., constituents identified as being FRL concerns and monitored under the IEMP characterization program), the extensive list of 55 constituents was monitored at background in order to establish a robust data set. The more extensive list was monitored at background so that if soil sampling indicated the need to expand the list of 17 area-specific surface water constituents, there would be corresponding background data.

Since soil sampling did not indicate a need to add constituents to the list of 17 area-specific surface water constituents and due to the abundance of background data, the list of surface water constituents monitored at the background locations was reduced to coincide with the 17 area-specific constituents monitored for surface water FRLs beginning in 2005. In 2008, the list was reduced from 17 to 10 based on monitoring data results and agencies' approvals.

In 2007, the background values were recalculated using data from August 1997 through 2006. The revised values are provided in Table 4–2. Refer to Table 4–3 for background monitoring requirements; refer to Figure 4–2 for background surface water sample locations.

4.3.2.6 Fulfill National Pollutant Discharge Elimination System Requirements

As noted in Section 4.2.2, treated effluent and storm water discharges from the Fernald Preserve are regulated under the state-administered NPDES program. OEPA Permit 1IO00004*GD was issued on June 1, 2003; became effective on July 1, 2003; and expired on June 30, 2008. A new permit application was filed in December 2007. The site continued to discharge under the OEPA Permit 1IO00004*GD until a new permit is issued by OEPA. The new permit (OEPA 1IO00004*HD) took effect on April 1, 2009, and will remain in effect until March 31, 2014. Figure 4–2 identifies the NPDES Permit sample locations.

4.3.2.7 Fulfill Federal Facilities Compliance Agreement and OU5 ROD Requirements

The design considerations provided in Section 4.3.2, are sufficient to meet or exceed the current FFCA sampling and reporting requirements as summarized in Section 4.2.2. The sampling requirements include sampling at the Parshall Flume (PF 4001) 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. Section 3.2.2 discusses sampling of the South Plume extraction wells. As discussed in Section 6.0, monitoring data required by the FFCA have been incorporated into the comprehensive IEMP reporting structure.

4.3.2.8 Fulfill DOE Order 450.1A Requirements

The design considerations provided in Section 4.3.2, are sufficient to meet or exceed the requirements of DOE Order 450.1A as summarized in Section 4.2.2.

4.3.2.9 Address Concerns of the Community

In addition to the monitoring derived from Section 4.3.2.4, four new surface water sampling locations (SWD-10, SWD-11, SWD-12, and SWD-13) have been indentified for annual total uranium analysis. This sampling will be sufficient to address the concerns of the community. These concerns focus on limiting the amount of Fernald Preserve-related contamination entering Paddys Run and the Great Miami River, and to demonstrate to the public that there is no need for apprehension with the on-site water bodies relative to contamination. This monitoring will provide a comprehensive monitoring program, in bodies of water near public access areas, in Paddys Run at the site boundary, and in the treated effluent destined for the Great Miami River.

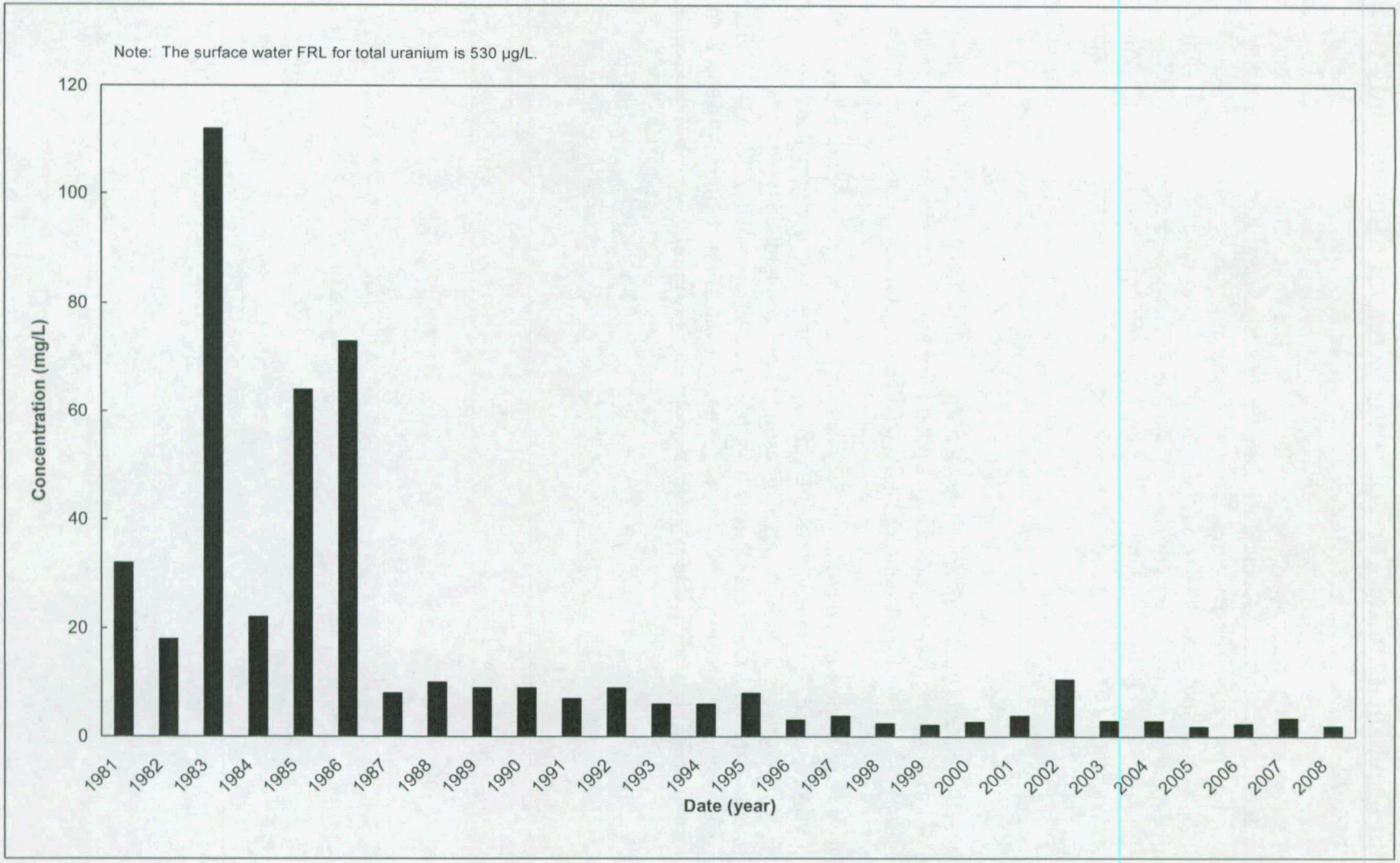

Figure 4–3. Comparison of Average Total Uranium Concentrations in Paddys Run at Willey Road Sample Location SWP-03

4.4 Medium-Specific Plan for Surface Water, Treated Effluent, and Sediment Sampling

This section serves as the medium-specific plan for implementation of the sampling, analytical, and data management activities associated with the IEMP surface water, treated effluent, and sediment sampling program. The activities described in this medium-specific plan were designed to provide data of sufficient quality to meet the program expectations as stated in Section 4.3.1. The program expectations, along with the design considerations presented in Section 4.3.2, 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 LM QAPP.

4.4.1 Sampling

To fulfill the requirements of the integrated surface water, treated effluent, and sediment monitoring program, surface water and treated effluent samples shall be collected from locations shown in Figure 4–2 and sediment samples shall be collected from locations shown in Figure 4–4.

Sample analysis will be performed either on site or at off-site contract laboratories, depending on specific analyses required, laboratory capacity, turnaround time, and performance of the laboratory. The laboratories used for analytical testing have been audited to ensure that DOECAP or equivalent process requirements have been met as specified in LM QAPP. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program.

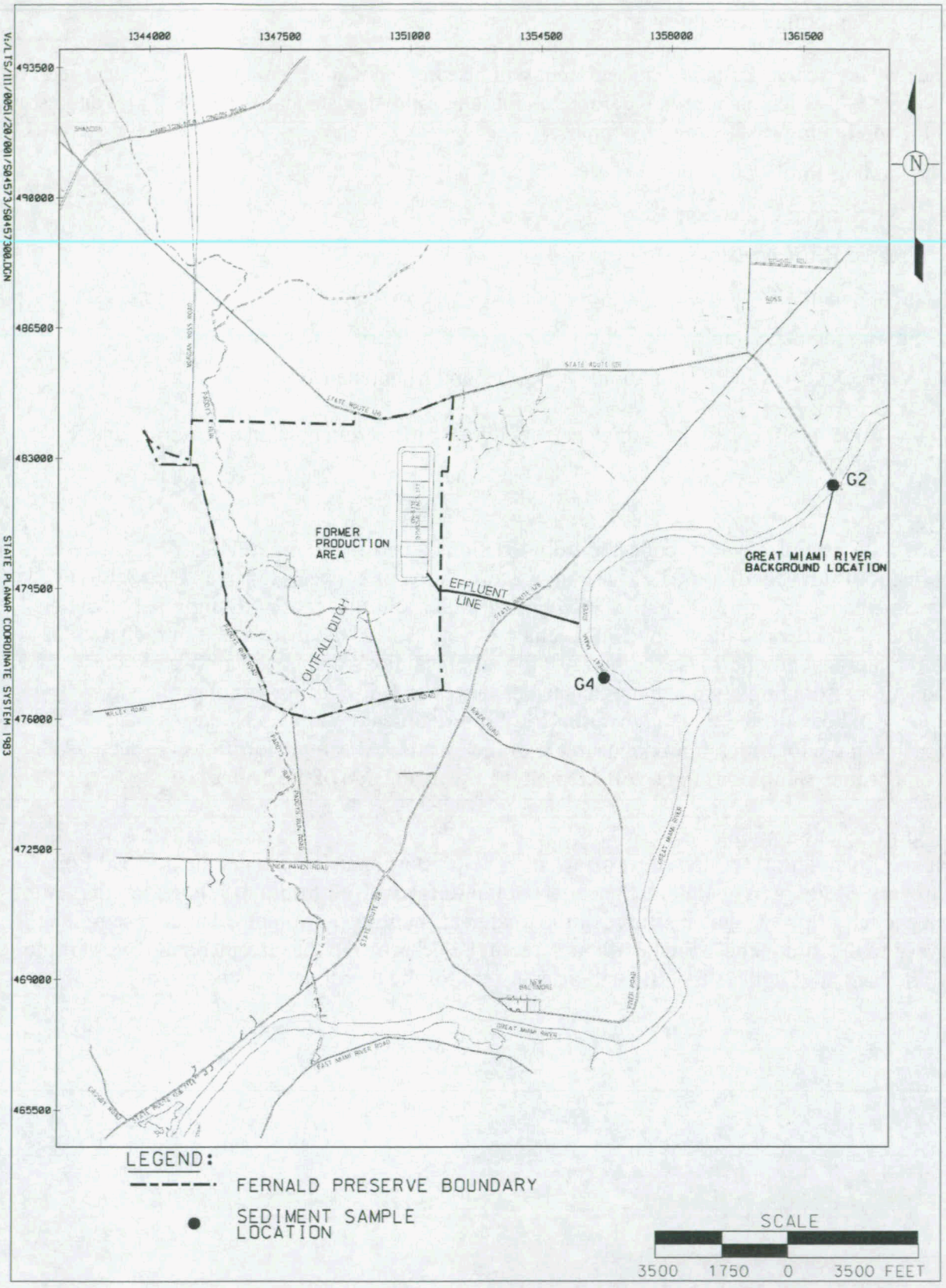

Figure 4–4. Sediment Sample Locations

4.4.1.1 Sampling Procedures

Surface water, treated effluent, and sediment will be sampled using the requirements specified in the LM QAPP, which have been incorporated into the following standard operating procedures used for conducting surface water sampling:

- Liquids Sample Collection
- Solid Sample Collection
- Treated Effluent Sample Collection
- Field Quality Control Sample Collection
- Environmental Sample Shipment
- Water Quality Meter Calibration, Operation, and Maintenance

Tables 4–4 and 4–5 identify the sample preservative, volume, and container requirements for each constituent.

Surface Water Sampling

Surface water samples will be collected from locations identified in Figure 4–2. 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.

Treated Effluent Sampling

Treated effluent will be collected by means of flow-proportional samplers at the Parshall Flume. 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 (PF 4001) will be analyzed for the constituents listed in Table 4–3.

Table 4–4. Surface Water Analytical Requirements for Constituents at Sample Locations[a] SWD-02, SWD-03, SWD-04, SWD-05, SWD-06, SWD-07, SWD-08, SWD-09, SWD-10, SWD-11, SWD-12, SWD-13, SWP-01, SWP-02, SWP-03, and SWR-01

Constituent	Analytical Method	ASL	Holding Time	Preservative	Container
Inorganics:					
Beryllium Cadmium Chromium, Total Copper Manganese Silver Zinc	7000A[b], 3500[c], 6020[b], 6010B[b] or 200.2,7,8[d]	D	6 months	HNO_3 to pH <2	Plastic or glass
Mercury	7470A[b]	D	28 days	HNO_3 to pH <2	Plastic or glass
Cyanide, Total	9010B[b], 9012[b], 335.2[d], or 335.3[d]	D	14 days	Cool 4°C, NaOH to pH >12	Plastic or glass
Radionuclides and Uranium:					
Radium-226 Radium-228 Technetium-99 Thorium-228 Thorium-230 Thorium-232 Uranium, Total	EML HASL 300[e] 6020[b]	D	6 months	HNO_3 to pH <2	Plastic or glass
Field Parameters[f]:	LM QAPP[g]	A	NA[h]	NA[h]	NA[h]

Note: The analytical site-specific contract identifies the specific method.

[a]Sample locations are analyzed for a subset of these constituents (summarized in Table 4–3).
[b]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
[c]Standard Methods for the Examination of Water and Wastewater
[d]Methods for Chemical Analysis of Water and Wastes
[e]Procedures Manual of the Environmental Measurements Laboratory .
[f]Field parameters include temperature, specific conductance, pH, and dissolved oxygen.
[g]The LM QAPP provides field methods.
[h]NA = not applicable

Table 4–5. Surface Water, Treated Effluent, and Sediment Analytical Requirements for Constituents at Sample Locations PF 4001, STRM 4003, STRM 4004, STRM 4005, STRM 4006, SWR-4801, SWR-4902, G2, and G4

Constituent[a]	Analytical Method	Sample Type	ASL	Holding Time	Preservative	Container
General Chemistry:						
Ammonia	350.1[d], 350.3[d], 4500C[e], or 4500F[e]	Composite or Grab[f]	D	28 days	Cool 4°C, H_2SO_4 to pH <2	Plastic or glass
Carbonaceous biochemical oxygen demand	5210B[e]	Composite	D	48 hours	Cool 4°C	Plastic or glass
Chlorine, residual	4500[e]	Grab	D	Analyze immediately	None	Plastic or glass
Fluoride	300.0[d], 340.2[d], 4500C[e]	Composite	D	28 days	None	Plastic or glass
Nitrate/Nitrite	353.1[d], 353.2[d], 353.3[d], 4500D[e], or 4500E[e]	Composite	D	28 days	Cool 4°C, H_2SO_4 to pH <2	Plastic or glass
Oil and grease	1664A[g] or 5520B[e]	Grab	D	28 days	Cool 4°C, H_2SO_4 to pH <2	Glass
Total dissolved solids	160.1[d] or 2540C[e]	Grab	D	7 days	Cool 4°C	Plastic or glass
Total hardness	2340C[e]	Grab	D	28 days	Cool 4°C, H_2SO_4 to pH <2	Plastic
Total phosphorus	365.1[d], 365.2[d], 365.3[d], or 4500B[e]	Composite	D	28 days	Cool 4°C, H_2SO_4 to pH <2	Plastic
Total suspended solids	160.2[d] or 2540D[e]	Composite	D	7 days	Cool 4°C	Plastic or glass
Inorganics:						
Antimony Arsenic Barium Beryllium Boron Cadmium Chromium, Total Cobalt Copper Lead Manganese Molybdenum Nickel Selenium Silver Zinc	6020[h], 7000A[h], 3500[e], 6010B[h], 200.8[i], 220.2[d], or 272.2[d]	Composite or Grab[f]	D	6 months	HNO_3 to pH <2	Plastic or glass
Mercury	7470A[h]	Grab	D	28 days	HNO_3 to pH <2	Plastic or glass
Mercury (low level)	1631[d]	Grab	D	14 days	None	Amber glass
Cyanide, Free	335.1[d] or 4500-G[e]	Grab	D	14 days	Cool 4°C, NaOH to pH >12	Plastic or glass

Table 4–5 (continued). Surface Water, Treated Effluent, and Sediment Analytical Requirements for Constituents at Sample Locations PF 4001, STRM 4003, STRM 4004, STRM 4005, STRM 4006, SWR-4801, SWR-4902, G2, and G4

Constituent[a]	Analytical Method	Sample Type[c]	ASL	Holding Time	Preservative	Container
Radionuclides:						
Radium-226 Radium-228 Technetium-99 Thorium-228 Thorium-230 Thorium-232	EML HASL 300[j]	Grab	D	6 months	HNO_3 to pH <2	Plastic or glass
Uranium, Total	6020[h], D5174-91[k]	Composite[l]	D		HNO_3 to pH <2	Plastic or glass
Uranium, Total[q]	6020[h]	Grab[p]	D	6 months	None	500 ml Plastic or glass
Semi-Volatiles:						
Bis(2-ethylhexyl)phthalate	625[m]	Grab	D	7 days to extraction 40 days from extraction to analysis	Cool 4°C	Glass (amber with Teflon-lined cap)
Volatiles:						
Trichloroethene Chloroform 1,1-Dichloroethane	624[m]	Grab	D	14 days	H_2S0_4 pH <2 Cool 4°C	Glass (with Teflon-lined septum cap)
Other:						
Fecal coliform	9222D[e]	Grab	D	6 hours	Cool 4°C	Plastic or glass (sterile)
Flow rate	NA	24 hour total	NA[b]	NA[b]	NA[b]	NA[b]
Field Parameters[n]	LM QAPP[o]	Grab	A	NA[b]	NA[b]	NA[b]

Note: The analytical site-specific contract identifies the specific method.
[a]This represents a comprehensive list of constituents taken from the indicated list of surface water and treated effluent monitoring locations. Each location will be analyzed for a subset of these constituents (summarized in Table 4–3).
[b]NA = not applicable
[c]For composite samples at PF 4001, a flow-weighted composite sample collected over a 24-hour period; for 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 2 hours.
[d]Methods for Chemical Analysis of Water and Wastes
[e]Standard Methods for the Examination of Water and Wastewater
[f]Grab samples are collected at locations SWR-4801 and SWR-4902 for this constituent.
[g]Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM; Non-Polar material) by Extraction and Gravimetry.
[h]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
[i]Methods for the Determination of Metals in Environmental Samples
[j]Procedures Manual of the Environmental Measurements Laboratory.
[k]American Society for Testing and Materials (ASTM)
[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]40 CFR 136, Appendix A
[n]Field parameters include dissolved oxygen, pH, specific conductance, and temperature.
[o]The LM QAPP provide field analytical methods.
[p] Grab sample for sediment is collected at location G4 for this constituent.
[q]Covers sediment only.

Sediment Sampling

Sampling is typically performed in summer or fall in order to take advantage of the abundance of fresh sediment deposited during flood conditions that commonly occur after winter and spring seasons. Only recently deposited surface sediment shall be collected, typically from deposition locations such as areas with a slow flow rate (e.g., obstructions in the stream bed that allow sediment to be deposited).

The exact locations of the sediment sample points are approximate and may change based on where stream flow has deposited sufficient material for sampling. Samples shall be collected from the top 2 inches and consist of fine-grained material. Any non-sediment materials shall be discarded from the sample, any free water drained from the non-sediment material, and the sediment material placed in the sample container.

4.4.1.2 Quality Control Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the LM QAPP. 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 follows:

- One field duplicate sample shall be collected each quarter at a randomly selected surface water sample location.
- One field duplicate will be collected from the G4 sediment location in the Great Miami River.
- 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.

For low-level mercury, all field sampling equipment will be sent to the off-site laboratory for decontamination and certification of cleanliness via rinsate analysis (equipment blank analysis) before reuse. In addition, trip blanks and field blanks will be supplied by the off-site laboratory and shall accompany the samples from collection to receipt at the laboratory.

4.4.1.3 Decontamination

In general, decontamination of equipment is minimized because reusable equipment is not used during sample collection. However, if decontamination is required, then it will be performed between sample locations to prevent the introduction of contaminants or cross contamination into the sampling process. The decontamination is identified in the LM QAPP. Sampling bailers used in sampling for mercury at NPDES Permit locations will be decontaminated at a contract laboratory.

4.4.1.4 Waste Disposition

Contact waste that is generated by the field technicians during field sampling activities are collected, maintained, and dispositioned, as necessary.

4.5 IEMP Surface Water, Treated Effluent, and Sediment Monitoring Data Evaluation and Reporting

This section provides the methods for analyzing the data generated by the IEMP surface water, treated effluent, and sediment monitoring program. This section summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated surface water, treated effluent, and sediment data, including specific information to be reported in the annual SER, is also provided.

4.5.1 Data Evaluation

Data resulting from the IEMP surface water, treated effluent, and sediment program will be evaluated to meet the program expectations identified in Section 4.3.1. Based on these expectations, the following questions will be answered through the surface water, treated effluent, and sediment data evaluation process, as indicated:

- Are surface water contaminant concentrations such that cross-medium 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 yearly. 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 4–6 will be implemented.

  The personnel responsible for the restoration of the Great Miami Aquifer will be informed so that any potential adverse cross-medium impacts can be factored into the site groundwater remedy. Decision-making process described in Figure 4–5 can be implemented as necessary.

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

  Data evaluation will consist of direct comparison of data to FRLs. It is anticipated that it will be possible to reduce the list of constituents monitored with respect to FRLS (i.e. IEMP Characterization Monitoring).

- Has storm water runoff caused an undue adverse impact to the surface water or treated effluent?

  Trend analyses of data will be used to identify trends that may require further investigation of activities occurring within the drainage basin (or basins).

- 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 noncompliance's to OEPA is necessary, and to determine the appropriate corrective actions to address the noncompliance.

- Are the FFCA and OU5 ROD reporting requirements being fulfilled?

  Radiological discharges to the Great Miami River and Paddys Run are regulated by the FFCA and OU5 ROD. Reporting for these requirements have been incorporated into the IEMP reporting structure and include a cumulative summary of pounds of total uranium discharged and the monthly average total uranium concentration discharged to the Great Miami River.

- Have changes in the residual contaminant concentrations occurred in sediments found in the Great Miami River as a result of runoff and treated effluent from the site?

  Data evaluation will consist of comparison to historical data, background levels, and FRLs. This evaluation will identify long-tern trends of targeted radiological constituents in sediment to determine if the potential exists for an FRL exceedance in the future.

- Should the sediment program be refined in scope?

  Data evaluation to determine if the IEMP sediment program should be revised will be based on the comparison to historic ranges and the sediment FRLs. Data evaluation to address any remaining expectations identified in Section 4.3.1 is encompassed in the data evaluation techniques described above.

- Are the program and reporting requirements of DOE Order 450.1A being met?

  DOE Order 450.1A requires that DOE implement and report on an environmental protection program for the Fernald Preserve. The surface water and treated effluent monitoring program is one component of the site-wide IEMP monitoring program. This IEMP and the annual SER fulfill the requirements of this DOE Order.

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

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

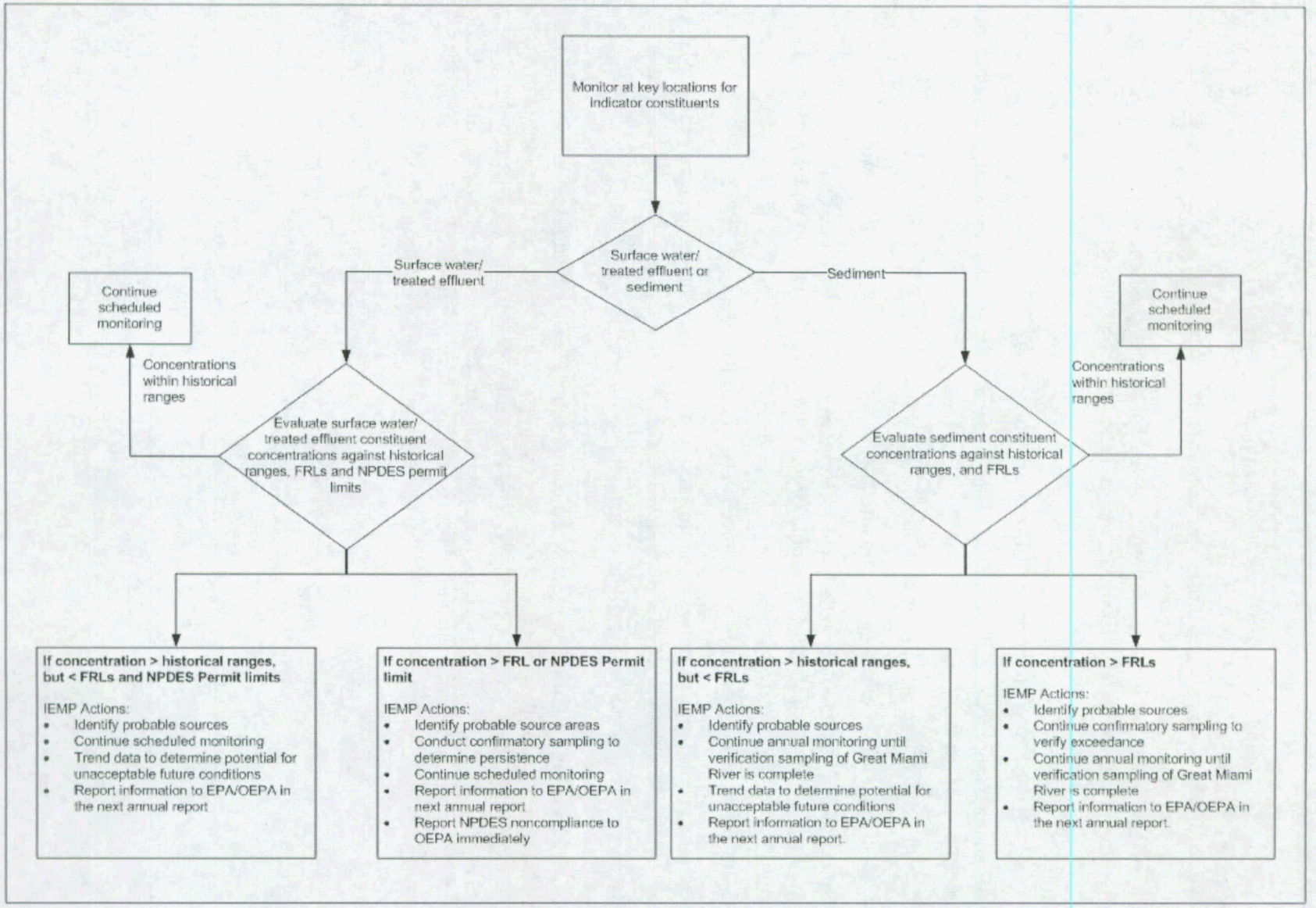

Figure 4–5. IEMP Surface Water and Sediment Data Evaluation and Associated Actions

4.5.2 Reporting

The IEMP surface water, treated effluent, sediment, and quarterly FFCA data will be reported in the annual SER and on the LM website at http://www.lm.doe.gov/land/sites/oh/fernald/fernald.htm.

Data on the LM website will be in the format of searchable data sets and/or downloadable data files. Additional information on IEMP data reporting is provided in Section 6.0.

The annual SER will be issued each June. This comprehensive report will discuss a year of IEMP data previously reported on the LM website. The annual SER will include the following:

- An annual summary of data from the IEMP surface water, treated effluent, and sediment monitoring program.
- Constituent concentrations for each sample location.
- Statistical analysis summary for constituents, as warranted by data evaluation.
- Status of FFCA and OU5 ROD Great Miami River effluent limits, to be presented graphically showing status of compliance with the 30-µg/L and 600-pound total uranium limits.
- Status of regulatory compliance of the NPDES Permit.
- 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.

Because the IEMP is a living document, a structured schedule of annual reviews and 5-year revisions has been instituted. The annual review cycle provides the mechanism for identifying and initiating any surface water, treated effluent, and sediment program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

5.0 Air Monitoring and Dose Assessment Program

The IEMP air monitoring and dose assessment program (the Program, hereinafter) for 2009 is consistent with previous IEMP revisions, with the exception of eliminating radon monitoring, discontinuing the dose assessment for native aquatic organisms, and adding the surface-water pathway to the annual dose assessment. Primary objectives include monitoring radionuclide concentrations in air particulate and surface water, measuring direct radiation levels, assessing the annual effective radiation dose to a human receptor, and demonstrating compliance with requirements in NESHAP (40 CFR 61, Subpart H), DOE Order 5400.5, and DOE Order 450.1A.

All significant radon sources were removed from the Fernald Preserve in 2006. Limited monitoring continued for two additional years (through 2008, as identified in previous IEMP versions) to ensure that all radon monitoring requirements were met and levels were acceptable from a closure standpoint. The Sitewide Environmental Report for 2007 and 2008 documents that radon levels for the site and background monitors are similar. Therefore, with agency approval, radon monitoring will cease with this revision of the LMCIP.

As the Fernald Preserve is now open to the public, there is the potential for a member of the public to illegally wade in the site ponds and accidentally ingest surface water. To account for this inadvertent exposure, the annual dose assessment will calculate the dose from ingested surface water using measured radionuclide concentrations for surface water, DOE derived concentration guidelines for drinking water (DOE 1993), and the receptor consumption volumes presented in the Interim Residual Risk Assessment (DOE 2007).

5.1 Analysis of Regulatory Drivers, DOE Policies, and Other Fernald Preserve Site-Specific Agreements

This section identifies the pertinent regulatory requirements, including ARARs and to-be-considered requirements, for the scope and design of the Program. The implementation of these requirements ensures that the Program satisfies the regulatory obligations for monitoring and dose assessment (activated by the RODs) and achieves the intentions of other pertinent criteria (such as DOE Orders and the Fernald Preserve existing agreements).

5.1.1 Approach

An analysis of regulatory drivers and policies was conducted to identify the suite of ARARs and to-be-considered requirements in the CERCLA RODs and legal agreements that contain air monitoring and dose assessment language that is applicable to the Program. This subset was further divided to identify site-specific requirements that fall under the scope of the IEMP (DOE 1997d). Reporting requirements for the IEMP, as dictated by the applicable regulatory drivers, are presented in Section 6.0.

5.1.2 Monitoring and Dose Requirements

Table 5–1 lists the regulatory drivers, the monitoring that is conducted to comply with them, and results for the path forward. For radon monitoring requirements under DOE Order 5400.5 and proposed 10 CFR 834, the results indicate that 2 years of post-remediation monitoring for radon have provided sufficient data to discontinue radon monitoring. However, NESHAP and DOE Order 5400.5 monitoring requirements must continue for air particulate and direct radiation to

Table 5–1. Air Monitoring Regulatory Drivers, Required Actions, and Results

IEMP		
Driver	**Required Action**	**Results**
• DOE Order 450.1A, Environmental Protection Program Environmental Monitoring Plan for all media	• Requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan • The previous IEMPs described effluent and surveillance monitoring as required by DOE Order 450.1A.	• The final year of soil remediation at the Fernald Preserve was 2006. By the end of October 2006, all major sources of airborne contamination were removed from the site or placed in the OSDF. In recognition of the removal of emissions sources from the site, the number of air monitoring stations was decreased from 17 to 11 in April 2006 (DOE 2006d) and from 11 to 6 in November of 2006 (DOE2006e).
• DOE Order 5400.5, Proposed 10 CFR 834 Radiation Protection of the Public and Environment	• 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 1 year, an effective dose equivalent of 100 mrem. • For radiological dose due to airborne emissions only, the DOE Order requires compliance with the 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.	• In 2008, the maximally exposed individual, standing at the eastern boundary monitor with the highest above background reading, could receive a dose of 6.0 mrem. The contributions to the estimated dose are 0.002 mrem from air inhalation and 6.0 mrem from direct radiation. This dose is 6 percent of the adopted DOE limit, which is 100 mrem/yr above background (exclusive of radon), as established by the International Commission on Radiological Protection.

Table 5–1 (continued). Air Monitoring Regulatory Drivers, Required Actions, and Results

IEMP		
Driver	**Required Action**	**Results**
• DOE Order 5400.5, Proposed 10 CFR 834 Radiation Protection of the Public and Environment (continued)	• The DOE Order also provides guidelines for radionuclide concentrations in air (known as Derived Concentration Guides) and • Provides radon concentration limits for interim storage of sources during remediation. • Previous IEMPs described on-site and off-site monitoring for radon and other radionuclides, and monitoring to determine annual dose from the air pathway.	• The final year of soil remediation at the Fernald Preserve was 2006. By the end of October 2006, all major sources of airborne contamination were removed from the site or placed in the OSDF. In recognition of the removal of emissions sources from the site, the number of air monitoring stations was decreased from 17 to 11 in April 2006 (DOE 2006d) and from 11 to 6 in November of 2006 (DOE2006e). • Present radon sources at the Fernald Preserve are limited to residual radium-226 concentrations in the soil (near background levels) and waste material disposed of in the OSDF. Waste materials in the OSDF are covered with a polyethylene liner and several feet of stone and soil, which provides an effective radon barrier. Two years of continued monitoring have shown no additional monitoring is required for radon.
• NESHAP, 40 CFR 61, Subpart H, Emission Standards for Radionuclides (excluding radon)	• Requires emission measurements at point sources with a potential to discharge radionuclides into the air in quantities that could cause an effective dose equivalent in excess of 1 percent of the standard (10 mrem/year). • Provides an assessment of the annual dose to the public from the air pathway.	• The largest historical source at the site was the waste materials stored in the silos. This and all other significant airborne contamination and direct radiation sources were removed from the site or placed in the on-site disposal facility in 2006. Present emissions are restricted to wind erosion of soil particles that contain residual contaminants at concentrations below the OU5 ROD final remediation levels.

Table 5–1 (continued). Air Monitoring Regulatory Drivers, Required Actions, and Results

IEMP		
Driver	**Required Action**	**Results**
• Federal Facility Agreement Control and Abatement of Radon-222 Emissions	• Ensures that DOE takes all necessary actions to control and abate radon-222 emissions at the Fernald Preserve • Previous IEMPs included radon monitoring. With agency approval, radon monitoring will cease with this revision of the LMCIP.	• Waste material generated from uranium extraction processes performed decades ago contained radium-226, which produces radon. This waste material no longer serves as a source for radon at the site because the last of this material was shipped off site in 2006. Present radon sources at the Fernald Preserve are limited to residual radium-226 concentrations in the soil (near background levels) and waste material disposed of in the OSDF. Waste materials in the OSDF are covered with a polyethylene liner and several feet of stone and soil, which provides an effective radon barrier. Two years of continued monitoring have shown no additional monitoring is required for radon.
• DOE Order 435.1, Radioactive Waste Management	• RODs are filed with HQs • Be in compliance with DOE 5400.5 Radiation Protection of the Public and Environment. • Requires low-level radioactive waste disposal facilities to perform environmental monitoring. • Provide boundary monitoring downwind from the OSDF.	• Waste materials in the OSDF are covered with a polyethylene liner and several feet of stone and soil, which provides an effective radon barrier. Two years of continued monitoring have shown no additional radon monitoring is required. Monitoring for air particulate will continue.
• CERCLA Remedial Design Work Plan (DOE 1996c)	• Monitoring will be conducted as required following the completion of cleanup to assess the continued protectiveness of the remedial actions.	• Two years of continued radon monitoring have shown the protectiveness of the remedial actions and thus no additional radon monitoring is required. Monitoring for air particulate will continue.

assess the radiation dose to a human receptor from residual contamination in soil at the Fernald Preserve. Additionally, radionuclide levels in the ponds will be monitored to ensure that visitors who trespass into the ponds and receive an internal dose from incidental ingestion of surface water do not exceed the annual dose limit established in DOE Order 5400.5. The radiological dose assessment is required to demonstrate compliance with NESHAP and DOE Order 5400.5 (DOE 1993).

An evaluation of the ARARs that consider protection of human health and the environment (Table 5–1) indicates that the NESHAP 10-mrem/year above-background dose limit for air emissions from point sources (excluding radon) is the most stringent emission limit, and it will be used to ensure compliance with annual dose limits. DOE Order 5400.5 requires that radiation exposure to members of the public from ingestion of a DOE drinking-water source must not exceed 4 mrem/yr, and the dose from all pathways must not exceed an effective dose equivalent of 100-mrem/year above background. The applicable pathways for the human dose assessment are direct radiation, inhalation of air particulate and incidental ingestion of surface water. Table 5–2 lists the site-wide dose tracking and annual assessment tasks.

Table 5–2. Sitewide Monitoring and Annual Dose Assessment Tasks

IEMP	Tasks
Evaluate planned activities and conditions at the beginning of the year	Annual Sitewide Planning
Conduct direct-radiation monitoring at background, trail and site boundary locations; conduct monitoring for air particulate at boundary and background locations; collect surface-water samples	Routine Site Monitoring
Directly compare routine monitoring results to annual dose benchmarks; report and evaluate any exceedance	Preventive Tracking/Feedback
Based on monitoring data, calculate annual dose for a receptor at monitoring locations.	NESHAP and DOE 5400.5 Compliance Demonstration
Prepare summaries and the annual dose assessment report	Reporting

Exposure to direct radiation (gamma, x-ray and beta) is assessed quarterly using optically stimulated luminescence (OSL) dosimeters placed along the site trails and boundary (Figure 5.1). Previous monitoring for direct radiation was performed using thermoluminescent dosimeters (TLDs), which had a nominal energy response of 0.03 to 1.25 million electron volts (MeV). OSL dosimeters have a wider energy-response range (0.005 to 20 MeV). DOE Order 5400.5 is not prescriptive on the monitoring devices that must be used to assess the direct radiation dose, but analytical integrity must be maintained and the yearly dose to members of the public, from all pathways, must be less than 100 mrem above background.

For the air pathway, public exposure to radioactive particulate (excluding radon and its daughters) released to the atmosphere from activities at a DOE site shall not result in an effective dose equivalent greater than 10 mrem/yr (NESHAP requirement) above background. Compliance will be demonstrated using monitoring data obtained from the six AMS locations on Figure 5–1. Because radium-226 waste products were removed from the site, there is no significant source for radon-222, and doses caused by radon-222 and its decay products are no longer included in the air assessment.

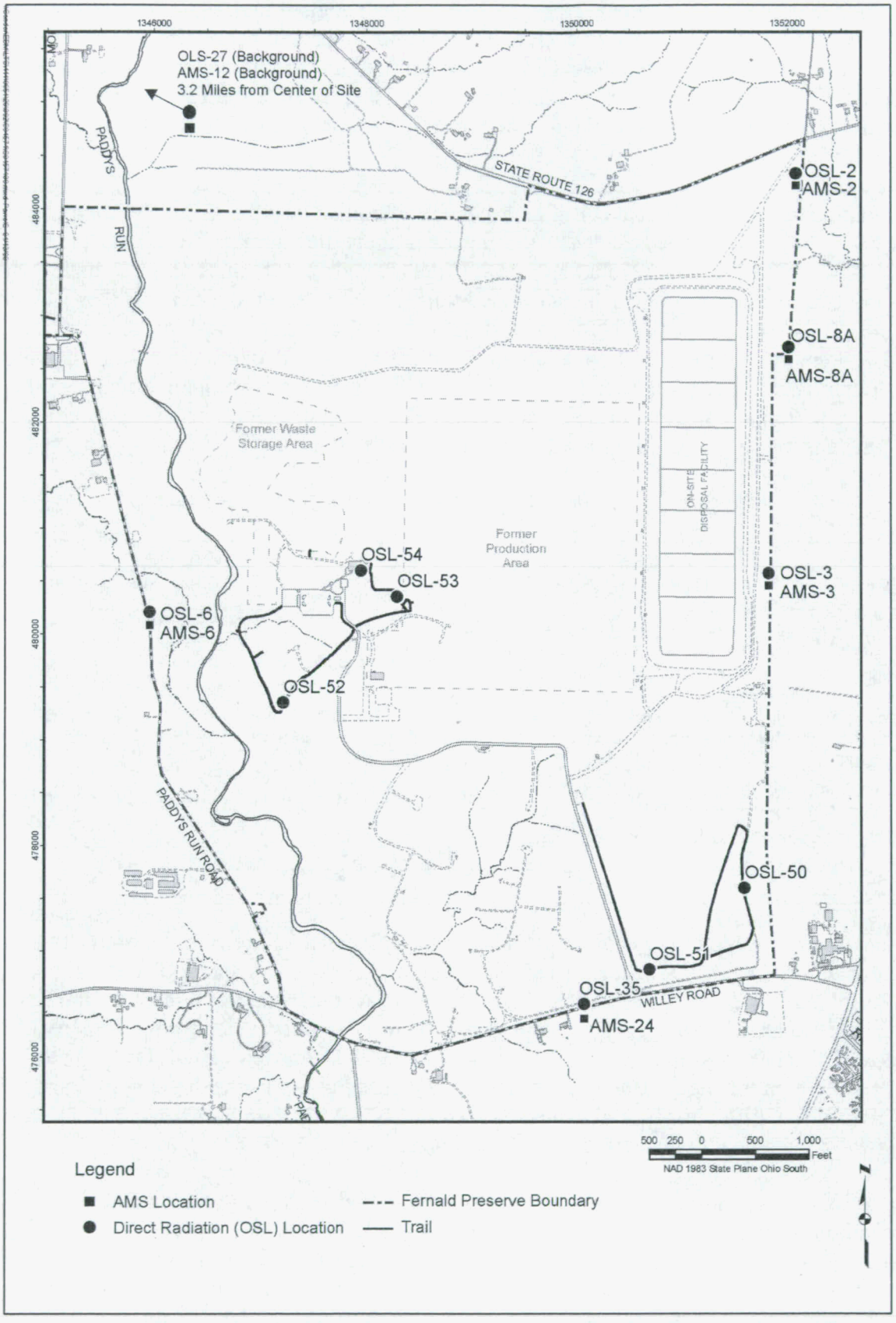

Figure 5–1. Location of Air Monitoring Stations and OSL Devices

Public exposure due to the ingestion of a DOE drinking water source shall not result in an effective dose equivalent greater than 4 mrem/yr. Although there is no DOE drinking water source at the Fernald Preserve, an on-site visitor may illegally wade in the ponds and incidentally ingest the surface water. This scenario will be treated as a member of the public ingesting a DOE drinking water supply.

DOE Order 5400.5 states that the absorbed dose to native aquatic organisms from exposure to the radioactive material in liquid wastes discharged to natural waterways shall not exceed 1 rad per day. DOE has issued a technical standard entitled, "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota" (DOE 2002a), and supporting software (RAD-BCG) for use in the evaluation and reporting of biota dose limits. A biota dose assessment divides the radionulcide concentration in surface water by a biota concentration guide (BCG) and sums the BCGs for all radionuclides. If the resulting sum is less than 1.0, compliance with the biota dose limit is achieved. Since 1999, the sum has been below 0.06, and in 2007 and 2008 (the first and second years of post-closure) the sum dropped to 0.009 (DOE 2008b) and 0.010 (DOE 2009). Therefore, it is reasonable to assume that post-closure discharges in future years will not exceed the 0.06 sum observed during active remediation, and dose calculations for aquatic organisms will be discontinued in 2009.

5.2 Program Expectations and Design Considerations

5.2.1 Program Expectations

The 2009 activities for the Program are:

- Measure public exposure to direct radiation (gamma ray, x-ray and beta) with OSL devices placed along the site trails and boundary.
- Monitor the air pathway to demonstrate that the inhaled dose from radionuclide levels in particulate results in an annual effective dose to any member of the public of less than 10 mrem/yr (NESHAP, 40 CFR 61 Subpart H) above background.
- Analyze surface-water samples to demonstrate that dose due to incidental ingestion of pond water is less than 4 mrem/yr above background, per DOE Order 5400.5.
- Doses from the air, surface-water and direct-radiation pathways will be used to show that the annual dose from all pathways is less than 100 mrem/yr above background (DOE Order 5400.5), and that dose to the public is as low as is reasonably achievable (ALARA).
- Provide a program that promotes the continued confidence of the public and is responsive to concerns raised by stakeholders.

5.2.2 Design Considerations

The Program is comprised of three monitoring components:

- Evaluate internal dose from radionuclide concentrations in suspended particulate that is inhaled via the air pathway.
- Evaluate internal dose from radionuclide concentrations in pond water that is incidentally ingested via the surface-water pathway.
- Measure direct radiation (gamma, x-ray and beta) to assess external dose.

Each component of the Program is designed to address a unique aspect of the annual dose assessment requirements in NESHAP and DOE Order 5400.5. The following sections provide a detailed discussion on the distinct sampling methodologies and analytical procedures used to obtain the data needed to demonstrate compliance with the requirements.

5.2.2.1 Air Pathway

The air-monitoring activities for 2009 are:

- Operate six air-monitoring stations to obtain data on particulate mass and radionuclide concentrations (Figure 5–1).
- Use the data to demonstrate compliance with the requirement in NESHAP (40 CFR 61 Subpart H) that states no member of the public will receive an annual effective dose equivalent greater than 10 mrem above background.

To meet these expectations during 2009, the Program will operate and maintain six high-volume air monitoring stations (Figure 5-1). Five air monitoring stations will be along the site boundary, with three of the five stations located in the prevailing downwind direction (refer to wind rose diagram, Figure 5–2). In addition, there is one background monitor (AMS-12) located approximately 3 miles northwest of the site boundary.

The sampling and analysis plan for air-particulate samples is designed to meet the following two criteria:

- Provide routine analysis that supports a quarterly evaluation of potential dose to the public.
- Account for the site-specific radionuclide contaminants that contribute to dose.

Based on these criteria, the sampling and analysis frequency for the air-particulate component consists of the following:

- Monthly Uranium and Total Particulate Samples

  Filters will be exchanged monthly at all air monitoring stations and will be analyzed for total uranium and total particulate. Monthly frequency is acceptable because the only source for contaminants is soil that has been certified to meet the final remediation limits of the OU5 ROD.

- Quarterly Composite Sampling

  A portion of each monthly sample will be used to form a quarterly composite sample for each station. The quarterly composite samples will be analyzed at an off-site laboratory for uranium-238, uranium-235/236, uranium-234, thorium-232, thorium-230, thorium-228, and radium-226. The selected isotopes represent nuclides that were stored, handled and/or processed during the remediation effort. Results from the quarterly composite samples will be used to track compliance against the NESHAP and DOE Order 5400.5 requirements.

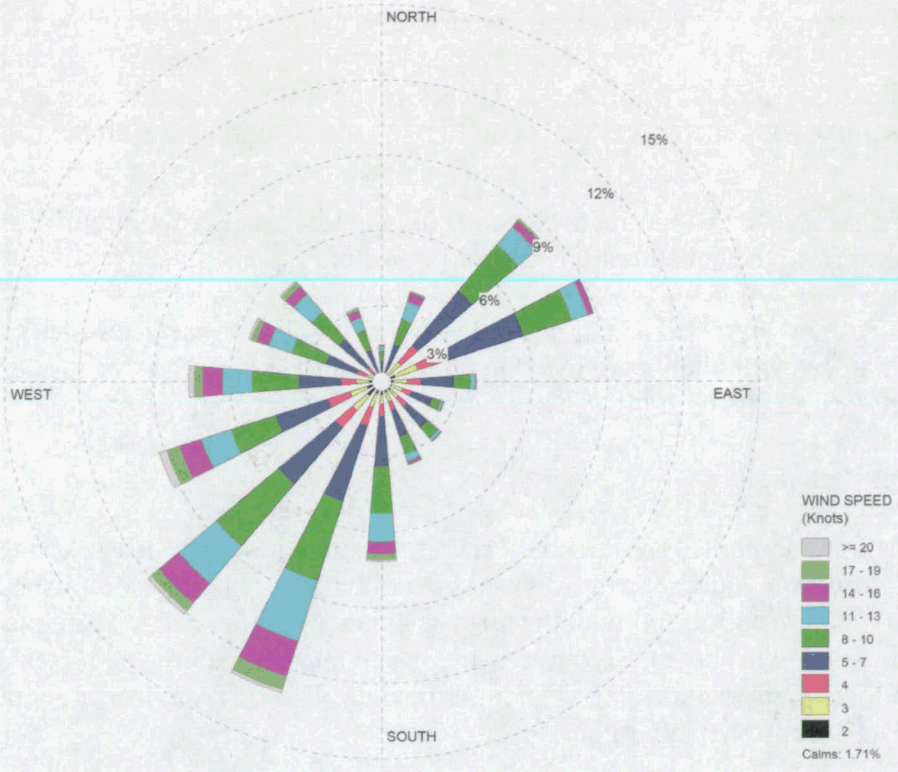

Figure 5–2. Fernald Site 2002–2006 Wind Rose, 197-ft (60-m) Height

Table 5–3 presents a summary of the sampling and analytical information.

Table 5–3. Sampling and Analytical Summary for Air Particulate Samples

Constituent	Sample Matrix	Sample Frequency	ASL	Container
Total Uranium	Air	Monthly	D	20 cm × 25 cm polypropylene 0.3-µm filter
Total Particulate	Air	Monthly	A	20 cm × 25 cm polypropylene 0.3 µm filter
Uranium-234 Uranium-235/236 Uranium-238 Thorium-228 Thorium-230 Thorium-232 Radium-226	Air	Quarterly composite	D	NA[a]

[a]NA = not applicable

5.2.2.2 Surface-Water Pathway

Monitoring activities and sample locations for surface water are discussed in Section 4.4. The incidental ingestion of surface water will be evaluated using the derived concentration guidelines (DCGs) for drinking water, as established in DOE Order 5400.5. Concentration data from surface-water samples and the DCGs will be used to assess compliance with the following DOE limit:

- No person shall receive an effective dose equivalent in excess of 4 mrem/yr above background from the consumption of drinking water.

The receptor is defined in Section 5.5.2 and the volume of ingested surface water will be set to 0.6 L/yr, which agrees with the intake listed in the Interim Residual Risk Assessment for the Fernald Closure Project (DOE 2007).

5.2.2.3 Direct Radiation

The direct-radiation component of the monitoring program is designed to assess the external environmental dose from gamma ray, x-ray and beta radiation. This is accomplished using 11 OSL devices: six are collocated with the air-particulate monitors and five are placed along the hiking trails (Figure 5–1). Three OSL devices are placed approximately one meter above the ground at each location to assess the precision of the data. The OSL devices are processed quarterly at a DOE–approved laboratory.

The OSL devices deployed in 2009 replace the TLDs used in previous years. OSL dosimeters have a superior energy-response range (0.005 to 20 MeV), relative to TLDs (0.03 to 1.25 MeV), and the stored energy can be measured many times (without losing the exposure record) because the radiation dose is measured using a light emitting diode, rather than the thermal annealing process used to read TLDs. Thermal annealing erases the exposure record held in the TLD.

The monitoring plan meets the following criteria:

- Provide quarterly analysis to evaluate direct radiation levels.
- Account for the annual dose from direct radiation to support the annual dose assessment required by DOE Order 5400.5.

Table 5–4 summarizes the sampling and analysis plan for the direct radiation monitoring program.

Table 5–4. Analytical Summary for Direct Radiation

Analyte	Sample Matrix	Sample Frequency	ASL	Detection Level
Gamma and Beta Radiation	OSL	Quarterly	B	5 mrem

5.2.2.4 Meteorological Monitoring

Meteorological monitoring is no longer performed at the Fernald Preserve. Data on wind speed and direction, obtained from the former Fernald station over the 2001 to 2006 time period, are combined with meteorological data on temperature and precipitation, obtained annually from the Butler County airport, to assess the influence of atmospheric conditions on the transport and dispersion of particulate suspended in the air pathway.

5.3 Plan for Implementation of the Monitoring Program

Implementation of the sampling, analytical, and data-management activities associated with monitoring internal and external exposure pathways are described herein to demonstrate that environmental data of sufficient quality are collected to meet the intended data use. All sampling procedures and analytical protocols described or referenced in this plan are consistent with the requirements of the LM QAPP.

5.3.1 Sampling Program

Sample analysis will be performed at off-site contract laboratories. Laboratories will be selected based on specific analyses required, laboratory capacity, turnaround time, and performance of the laboratory. The laboratories used for analytical testing will meet DOECAP requirements, as specified in LM QAPP. These criteria include performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program.

5.3.1.1 Sampling Procedures

Sampling procedures associated with the Program will be performed in accordance with the LM QAPP, and these procedures have been incorporated into the standard operating procedure *Fernald Preserve Environmental Monitoring Procedures Manual* (DOE 2008c).

Air Particulate

Table 5–3 summarizes the sampling frequency and isotopes of interest for the particulate samples. Sample collection is accomplished by using high-volume air monitors that continuously collect samples of airborne particulate (Table 5–5). Changes in flow rate are accounted for by the automatic flow controller in the monitor and are documented on a flow chart recorder that continuously records flow data.

Table 5–5. Technical Specifications for Particulate Monitors

Monitor Type	Flow Rate	Filter Type	Gauge/Meters	Indicator
High-volume continuous	45 cfm	Multi-ply polypropylene	Hours Flow Rate Set Point	Low Flow Warning Light

Per DOE guidance and industry practice, air monitoring equipment must meet the following criteria:

- 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. Flow calibration shall be at least as often as recommended by the manufacturer.

All units placed in the field have a field tracking log that indicates when calibrations were last completed and the date of the next scheduled calibration. Boundary monitors are checked daily to ensure continuous operation.

Direct Radiation

Table 5–4 provides a sample and analytical summary for the external-radiation monitoring program. Environmental monitoring of direct radiation must meet the following criteria, per DOE guidance:

- Environmental dosimeters shall be mounted at 1 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.
- Calibration, readout, storage, and exposure periods used should be consistent with the recommendations of the American National Standard Institute.

All dosimeters placed in the field have a field-tracking log that indicates deployment and collection dates.

5.3.1.2 Quality Control Sampling Requirements

Air Particulate

One blank sample is submitted with each set of monthly samples, and these blanks are used to form the quarterly composite blank. The monthly blank is analyzed for total uranium, and the quarterly blank is evaluated for isotopes listed in Table 5–3. The laboratory also analyzes method blanks, matrix spikes, and laboratory control samples as required by the LM QAPP for the corresponding ASL and analytical method.

Direct Radiation

Three dosimeters will be placed at each location to evaluate precision in the external-radiation measurement. The dosimeters will be collected and analyzed each quarter. Measurements

recorded for the three dosimeters at each location must agree within 15 percent or the results will be considered suspect and invalid.

5.3.1.3 Decontamination

Sampling equipment is not needed to recover the air filters and dosimeters. For the surface-water samples, decontamination of sampling equipment will be performed between sample locations to prevent the introduction of contaminants or cross contamination into the sampling process. Additional details are identified in the LM QAPP.

5.3.1.4 Waste Disposition

Contact wastes that are generated by the field technicians during sampling activities are collected and managed in accordance with site requirements.

5.4 Data Evaluation and Reporting

This section discusses the data evaluation process and actions associated with the monitoring systems and the reporting requirements that must be met to comply with NESHAP, DOE Orders, and the Federal Facility Agreement.

5.4.1 Data Evaluation

Data produced from the Program monitoring activities will be evaluated to ensure consistency with the expectations identified in Section 5.2.1. Based on these expectations, the following questions will be answered:

- Do the results of quarterly composite radionuclide concentrations indicate the potential to exceed the 10 mrem/yr above-background dose limit of NESHAP Subpart H?

  The quarterly composite results will be compared to the NESHAP Appendix E, Table 2 values. If this comparison indicates that the annual limit may be exceeded, sampling and analytical protocols will be evaluated to identify the problem. If needed, modifications to the Program will be proposed to mitigate future problems.

- Do results for radionuclide concentrations in surface water indicate the potential to exceed the 4 mrem/yr above-background dose limit for drinking water (DOE Order 5400.5)? The data from surface-water samples is used to assess the drinking-water dose to a member of the public who illegally wades in a pond and accidentally ingests the water. If annual results indicate that the dose limit may be exceeded, site conditions and analytical protocols will be evaluated to identify the problem. If needed, modifications to the Program will be proposed to mitigate future problems.

- Do quarterly direct radiation levels indicate the potential to exceed the all pathway dose limit (100 mrem/yr above background) of DOE Order 5400.5?

  The data generated from individual dosimeter locations will be compared to historic data to assess the validity of the results. If quarterly results are inconsistent with historic data,

site conditions and analytical protocols will be evaluated to identify the problem. If needed, modifications to the Program will be proposed to mitigate future problems.

- Are the program and reporting requirements of DOE Order 450.1A being met?

  DOE Order 450.1A requires that DOE implement and report on an environmental protection program for the Fernald Preserve. Monitoring for air particulate, surface water and external radiation are components of the site-wide IEMP monitoring program. This IEMP and the annual SER fulfill the requirements of this DOE Order.

- Are the program goals in line with ALARA?

  External radiation is the largest component of the annual dose (greater than 90 percent), and monitoring provides a quarterly assessment of this exposure to ensure the dose to a member of the public remains ALARA.

- Are community concerns being met through the present monitoring program?

  The IEMP fulfills the needs of the Fernald community by presenting monitoring results in the annual SER.

5.4.2 Reporting

The 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 the annual site environmental report.
- The quarterly FFA reporting is being fulfilled via the LM website.

The annual SER is issued each June for the previous year and contains the following, as well as additional, information:

- An annual summary of data from the IEMP monitoring program.
- Constituent concentrations for each sample location.
- Statistical analysis summary for each constituent, as warranted by data evaluation.
- A summary of the annual dose assessment and the status of regulatory compliance with NESHAP Subpart H and DOE Orders.
- Information that indicates achievement of ARAR goals.

Program data posted on the LM website is in the form of searchable data sets and/or downloadable data files. This site will be updated routinely after data are reported, validated and released for posting.

A complete discussion of reporting information is provided in Section 6.0.

5.5 Dose Assessment

This section presents the general technical approach for performing the annual dose assessment, including a description of exposure pathways, potential receptors for these pathways, sampling frequency, radionuclides evaluated in the dose assessment, and the dose calculation procedure.

5.5.1 Exposure Pathways

According to past dose assessments at the Fernald Preserve, human receptors are exposed through two primary pathways: the air pathway, which includes inhalation and ingestion of soil particulate suspended by the wind; and the external radiation pathway. The radioactive source for the external radiation is also the soil, which contains radionuclide concentrations below the final remediation levels established in the OU5 ROD. Additionally, because the site is now open to the public and unescorted hiking is permitted on designated trails, a surface-water exposure pathway is present. Although wading and swimming are prohibited in the site ponds, incidental ingestion of surface water is a viable exposure pathway for visitors that do not follow the rules.

5.5.2 Potential Receptor

A hypothetical receptor that represents the maximally exposed individual (MEI) is used for the annual dose assessment. The MEI is an off-property resident that is assumed to spend 24 hours a day, 365 days a year living at the fence line and visiting the site. Under this worse-case exposure scenario, the MEI inhales fugitive dust and receives external radiation from the site soil while living next to or visiting the site and consumes surface water when illegally wading or swimming in the site ponds. The inhalation and external radiation dose received by the MEI corresponds to the maximum measured values obtained from the air monitoring and dosimeter stations along the site boundary. Dose from the incidental ingestion of surface water is calculated using the highest radionuclide concentrations reported for pond samples.

5.5.3 Routine Surveillance of Pathways

Residual radionuclide levels in soil serve as the exposure source for the air and external radiation pathways, while radionuclide concentrations in ponds serve as the source for the surface-water pathway. These pathways are monitored throughout the year to collect the data needed for the annual dose assessment.

Radionuclide concentrations in air particulate obtained from fence-line samples (Figure 5–2) will be used to assess the NESHAP 10 mrem/yr above-background limit. Samples will be collected monthly and analyzed for uranium and particulate mass. A quarterly composite will be created from the monthly samples and this composite will be analyzed for the isotopes in Table 5–3. The location that corresponds to the highest radionuclide concentrations will be selected to perform the NESHAP analysis. This result will also be used to assess the all pathway dose, which must be less than 100 mrem/yr above background (DOE Order 5400.5).

External radiation is monitored via dosimeters placed at the fence line, the visitor museum, and along hiking trails (Figure 5–1). Dosimeters are collected and analyzed quarterly (Table 5–5). The station that corresponds to the highest direct-radiation measurement will be selected to

perform the all pathway dose, which must be less than 100 mrem/yr above background (DOE Order 5400.5).

Samples collected from ponds and wetlands (Figure 4–2) will be used to assess the internal dose to a visitor that illegally wades in the pond and incidentally ingests surface water. Samples are collected annually for radionuclides (semi-annually for uranium) from two ponds and three wetland locations (Table 4–3). The sample with the highest radionuclide concentrations will be selected to evaluate DOE Order 5400.5, which requires that the dose due to ingestion of water be less than 4 mrem/yr above background. This result will also be used to assess the all pathway dose, which must be less than 100 mrem/yr above background (DOE Order 5400.5).

5.6 Analytes and Analytical Results

The list of radionuclides contributing to the annual dose must reflect past site contaminants, and laboratory quality assurance/quality control (QA/QC) must be sufficient to maintain program integrity and confidence in the assessment of the 100 mrem/yr above-background dose limit. Therefore, contract laboratories that perform work for the Fernald Preserve must meet the QA/QC requirements of the LM QAPP.

5.6.1 Parent and Daughter Nuclides

Uranium-238, thorium-232, and uranium-235 are parent nuclides in the uranium, thorium, and actinide decay chains, respectively (Table 5–6). These isotopes, along with thorium-230 and thorium-228, are measured and reported by the laboratory. Although most uranium and thorium processed at the former Fernald Feed Materials Production Center did not contain daughter nuclides, decades of post-production time have passed and some daughters have achieved secular equilibrium with the parent nuclide. Therefore, decay-chain daughters with a half-life less than six years that are not reported by the laboratory (thorium-234, protactinium-234, radium-228, actinium-228, radium-224, and thorium-231) are assumed to be present at an activity equal to that of the parent, and this activity will be used in the dose assessment. Exceptions to this rule are daughters below radon-220 and radon-222. These daughters are excluded from the calculation because radon diffuses out of the soil and the present radon levels are similar to background levels.

5.6.2 Analytical Results

Laboratory data validation will consist of verifying that, at a minimum, 10 percent of the data are in compliance with the criteria associated with ASL E for the quarterly samples used for the NESHAP analysis and 10 percent with ASL B for the samples used to assess external radiation and surface-water dose. The analysis of environmental samples may result in reported contaminant concentrations that are at or below the minimum detectable concentration (MDC). Contaminant concentrations that are at or below the MDC are statistically indistinguishable from concentrations found in a blank sample, and results below the MDC will be set to zero for the dose assessment. Detectable contaminant concentrations will be converted to net concentrations by subtracting the blank concentration (if detected) and background concentration from the measured result prior to performing the dose assessment. All laboratory QA/QC measures and MDCs must meet the requirements established in the LM QAPP.

Table 5–6. Uranium, Thorium, and Actinide Decay Chains

Uranium	Half-Life	Thorium	Half-Life	Actinide	Half-Life
Uranium-238 [a]	4.5×10^{9} years	Thorium-232 [a]	1.4×10^{10} years	Uranium-235 [a]	7.1×10^{8} years
Thorium-234 [b]	24 days	Radium-228 [b]	5.7 years	Thorium-231 [b]	25.64 hours
Protactinium-234 [b]	1.2 minutes &				
(2 isomeric states)	6.7 hours	Actinium-228 [b]	6.13 hours	Protactinium-231	3.25×10^{4} years
Uranium-234 [a]	2.5×10^{5} years	Thorium-228 [a]	1.9 years	Actinium-227	21.6 years
Thorium-230 [a]	8.0×10^{4} years	Radium-224 [b]	3.64 days	Thorium-227	18.2 days
Radium-226 [a]	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	1.77×10^{-3} seconds
Bismuth-214	19.7 minutes	Polonium-212	3.04×10^{-7} seconds	Lead-211	36.1 minutes
Polonium-214	1.6×10^{-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				

[a] Analytical measurement
[b] Activity assumed to be equal to parent nuclide
Remaining nuclides are omitted from dose calculation

5.7 All-Pathway Dose Calculations

This section describes the calculations for compliance with the 100-mrem/yr below-background dose limit in DOE Order 5400.5 (DOE 1993). Estimates of annual dose are based on the background-corrected concentration of a contaminant in each environmental medium.

The general form of the dose assessment equation is:

$$D = C_{i,m} * I_m * DCF_i$$

where:

D = Dose (mrem/year)

$C_{i,m}$ = Blank and background-corrected concentration of radionuclide "i" in medium "m" (pCi/kg or pCi/L)

I_m = Intake (ingestion) rate for medium (kg/year or L/year)

DCF_i = Dose conversion factor for radionuclide "i" (mrem/pCi)

The detailed calculation of dose from various environmental media follows the LM SAP (DOE 2006b) and the discussion in this section. External-radiation, air-inhalation, and surface-water doses will be calculated separately and then combined into the DOE all-pathway annual dose. Additionally, air-inhalation and surface-water doses must meet annual dose limits that are specific for the air (NESHAP Subpart H) and drinking-water (DOE Order 5400.5) pathways.

Quarterly dosimeter results are reported as mrem per quarter, and the 4 quarters will be added together to obtain the yearly dose for external radiation. This dose is added to the air and surface-water doses to obtain the all-pathway dose.

The air dose will be calculated with the particulate samples from the monitoring location that yields the highest radionuclide concentrations. NESHAP Subpart H, Appendix E values will be used to calculate the dose for each nuclide. Nuclides identified in Table 5–6 will be summed to obtain the total air dose, and this sum will be compared to the 10 mrem/yr limit to assess compliance. The NESHAP air dose result is added to the direct-radiation and surface-water doses to evaluate the DOE Order 5400.5 all-pathway dose.

DOE Order 5400.5 states that DOE sources of drinking water must maintain EPA drinking water standards, and radionuclide concentrations must be low enough to ensure that an internal dose is less than 4 mrem/yr above background. Although the 4 mrem/yr standard applies to drinking water, it will be used to assess the dose to an on-site visitor that illegally enters the ponds and incidentally ingests the surface water. Surface-water samples will be screened to obtain the sample with the highest radionuclide values, and the volume of surface water ingested will be set to the value used for the Fernald Preserve visitor in the *Interim Residual Risk Assessment for the Fernald Closure Project* (DOE 2007), which is 0.6 liters per year.

The derived concentration guidelines (DCGs) for water (Chapter III of DOE Order 5400.5) are based on an internal exposure of 100 mrem/yr and a person consuming drinking water at a rate of 730 liters per year. Therefore, the DCGs must be adjusted to account for the 4 mrem/yr limit and much lower intake (0.6 L) attributed to incidental ingestion of surface water (adjusted DCG = original DCG * 4/100 * 730/0.6). The dose from each isotope in Table 4–4 will be summed to obtain the total surface-water dose, and this sum will be compared to the 4 mrem/yr criterion to evaluate compliance with the Order. The surface-water dose is added to the air and direct-radiation doses to evaluate the all-pathway dose.