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Department of Energy  
Office of Legacy Management

March 26, 2009

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Chicago, IL 60604-3590

Mr. Thomas Schneider, Project Manager  
Ohio Environmental Protection Agency  
Southwest District Office  
401 East Fifth Street  
Dayton, Ohio 45402-2911

**Subject: Transmittal of Fernald Preserve Quality Assurance Project Plan**

References: 1) Letter, T. Schneider to J. Powell, "Re: Comments – Fernald Preserve Quality Assurance Project Plan," dated February 6, 2009

2) Email, T. Fischer to J. Powell, "FP QAPP," dated March 10, 2009

Dear Mr. Fischer and Mr. Schneider:

This letter transmits the Fernald Preserve Quality Assurance Project Plan (FPQAPP), Revision 4, Final, and the responses to Ohio Environmental Protection Agency (OEPA) comments on the FPQAPP to the United States Environmental Protection Agency and Ohio Environmental Protection Agency.

The FPQAPP has been revised to incorporate the responses to OEPA comments (Reference 1). EPA approved the draft FPQAPP without comment (Reference 2).

If you have any questions regarding this matter, please call me at (513) 648-3334.

Sincerely,

Jane Powell  
Fernald Preserve Manager  
DOE-LM-20.1

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REPLY TO: Harrison Office		

Mr. Timothy Fischer  
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Enclosure

cc w/enclosure:

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## RESPONSES TO OHIO EPA COMMENTS ON THE FERNALD PRESERVE QUALITY ASSURANCE PROJECT PLAN

### General Comment:

1. Commenting Organization: Ohio EPA

Section #: na Pg #: na Line #: na Code: C

Comment: The document appears to be inconsistent with the level of detail for different aspects of the QAPP. Some sections only receive a "high-level" summary while other sections add detail that may be more appropriately incorporated into a procedure.

Response: In general the FPQAPP was prepared following the EPA QAPP preparation guidance document (EPA QA/G-5, "Guidance for Quality Assurance Project Plans," EPA/240/R-02/009, December 2002). In order to facilitate usability and programmatic implementation, references to SOPs were minimized and the detail provided in the FPQAPP.

Action: None.

### Comments:

2. Commenting Organization: Ohio EPA

Section: 1.0/Figure 1-1 Pg #: 1-1 Line #: Code: E

Comment: Please spell out the acronym "LMS" on the Organizational chart or record it on the Acronym list.

Response: Agreed.

Action: Figure 1-1 and the acronym list will be updated in the final version of the document.

3. Commenting Organization: Ohio EPA

Section #: 2.1.2 Pg #: 2-4 Line #: na Code: C

Comment: Change the last sentence in the last paragraph from, "It is also suspected that air emissions contributed to both on-site and off-site deposition of soils," to, "Also, air emissions contributed to both on-site and off-site deposition of soils." [emphasis added] It is a fact that air emissions contaminated surface soils both on and off site.

Response: Agreed.

Action: The affected sentence will be updated in the final version of the document.

4. Commenting Organization: Ohio EPA

Section #: 2.1.3 Pg #: 2-5 Line #: na Code: C

Comment: The sentence, "Soil certification processes were performed to ensure that excavation had removed all impacted material," is not accurate. Change the wording to reflect that soil certification was performed to ensure that excavation had removed all detected materials above FRLs.

Response: Agreed.

Action: The affected sentence will be updated in the final version of the document.

5. Commenting Organization: Ohio EPA

Section #: 2.1.4 Pg #: 2-6 Line #: na Code: C

Comment: The statement, "All contaminated soils have been excavated..." is not accurate. Change the wording to reflect that all soils detected above FRLs have been excavated.

Response: Agreed.

Action: The affected sentence will be updated in the final version of the document.

6. Commenting Organization: Ohio EPA

Section: 3.2.1 Pg #: 3-2 Line #: 2<sup>nd</sup> Para/fourth bullet Code: C

Comment: The fourth bullet is a critical project point for cleanup levels and groundwater remediation, the remaining uncertified soils and closing of the OU5 area. These specifics need to be mentioned here or provide a reference where they are discussed in the document or other documents. In addition, any sampling done now ensures the protection of the remedy. This point seems to be left out of the document and needs to be made clear here, as well as throughout.

Response: Agreed.

Action: The fourth bullet will be revised to read "Assess whether the completed remedy remains protective of human health and the environment as well assessing the progress of the on-going groundwater remediation and the eventual certification that final remediation levels stipulated in the OU5 ROD have been met for groundwater, surface water, and the remaining soils associated with the groundwater infrastructure as the infrastructure is removed."

7. Commenting Organization: Ohio EPA

Section #: 3.3.1 Pg #: 3-3 Line #: na Code: C

Comment: A bullet should be added to this section that adds an objective for data use that includes compliance with NESHAP Subpart H requirements.

Response: Agreed.

Action: The fourth bullet will be revised to read "Compliance with NESHAPS Subpart H requirements, as applicable."

8. Commenting Organization: Ohio EPA

Section: 3.3.2 Pg #: 3-4 Line #: last Para/last line Code: C

Comment: Please write out the title of the annual report in the last sentence. The above text refers to other documents which are tied to the QUAAP. Referencing the SER completes the information.

Response: Agreed.

Action: The annual Fernald Preserve Site Environmental Report will be referenced in the final version of the document.

9. Commenting Organization: Ohio EPA

Section: 3.3.4 Pg #: 3-9 Line #: third Para Code: C

Comment: What are the "seven guiding safety management principles" and the "five core ISMS functions?" In addition, where are they discussed within the document? Please clarify the text.

Response: Agreed

Action: Text will be added to this section listing the seven guiding principles and the five core functions.

10. Commenting Organization: Ohio EPA

Section: 3.3.7 Pg #: 3-10 Line #: Code: C

Comment: Before post closure of the site, variances were handled somewhat differently. However, the text does not specifically say whether the variances will follow the same protocol regarding "significant and non-significant" or whether there will be just one type of variance. Please clarify. Lastly, will variances be reviewed by the Agencies?

Response: Section 3.3.7 will be updated to include a protocol regarding significant and non-significant variance. A significant variance will require approval from the regulatory agencies.

Action: An additional paragraph will be inserted between the second and third paragraphs of Section 3.3.7 to read as follows:

Variances to sampling plans that have been approved by the regulatory agencies shall be considered either significant or non-significant (i.e., informational). A significant variance is required when activity changes the scope of the project and that change must be reviewed by the regulatory agencies. Informational variances are used to provide clarification, incorporate additional information, correct errors in the original sampling plan, document re-sampling activities, etc.

In addition, Item 5 in Section 3.3.7 will end with the following sentence:

For significant variances, the regulatory agencies shall be included in the review process.

11. Commenting Organization: Ohio EPA

Section #: 8.0 (Table 8-1) Pg #: 8-2 to 8-6 Line #: na Code: C

Comment: It appears that detail provided in Table 8-1 exceeds the detail that is appropriate for a Quality Assurance Project Plan. This type of detail may be more appropriate in a sampling procedure. Listing media and method would seem to be the appropriate level of detail for this table.

Response: The contents of this table are consistent with that provided in EPA QA/G-5, "Guidance for Quality Assurance Project Plans," EPA/240/R-02/009, December 2002.

Action: No action required.

12. Commenting Organization: Ohio EPA

Section #: 8.0 (Table 8-1) Pg #: 8-6 Line #: na Code: E

Comment: The units for the radionuclide air particulates are incorrect. Each of the radionuclides has liters (L) in the denominator. These samples are typically reported as pCi/sample from the laboratory. Air concentrations are then reported in units of pCi/m<sup>3</sup> after the flow rates through each filter are evaluated. The same is true for total uranium except the sample is reported as µg instead of pCi.

Response: The contract for the offsite laboratory specifies the process for acid digestion of the air filters, including acid volumes. The laboratory is required to report the results in µg/L for total uranium and pCi/L for isotopic analysis. All of the calculations regarding how the concentrations relate to flow rates are performed by Fernald Preserve personnel and not the contract laboratory.

Action: No action required.

13. Commenting Organization: Ohio EPA

Section #: 8.5.1 Pg #: 8-7 Line #: na Code: E

Comment: A couple of the parameters of precision, RPD and RER, should be spelled out before the acronyms are used.

Response: Agreed.

Action: RPD and RER will be spelled in the text upon first use.

14. Commenting Organization: Ohio EPA

Section #: 8.5.2 Pg #: 8-7 Line #: na Code: E

Comment: The acronyms LCS and MS should be spelled out before they are used in the text.

Response: Agreed.

Action: LCS and MS will be spelled in the text upon first use.

15. Commenting Organization: Ohio EPA

Section #: 8.5.4 Pg #: 8-8 Line #: na Code: E

Comment: The acronyms MDL and MDC should be spelled out before they are used in the text.

Response: Agreed.

Action: MDL and MDC will be spelled in the text upon first use.

16. Commenting Organization: Ohio EPA

Section #: 13.1.1 Pg #: 13-1 Line #: na Code: C

Comment: The text states, "All calculations and results, including field measurements, shall be independently reviewed." This statement does not define what "review" means, nor do the referenced Sections 5.2 and 6.2. Are the calculations reviewed for completeness or accuracy? What are the qualifications of the reviewer?

Response: Agreed.

Action: Additional text will be added to Section 13.1.1 in the final version of the document.

17. Commenting Organization: Ohio EPA

Section #: 13.5 Pg #: 13-6 Line #: na Code: E

Comment: Add the word, "uses," to the last sentence of the first paragraph of this section.

Response: Agreed.

Action: The affected sentence will be updated in the final version of the document.

# Fernald Preserve Quality Assurance Project Plan

March 2009



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
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**Fernald Preserve Quality Assurance Project Plan**

**Fernald, Ohio**

**March 2009**

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## Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
amsl	above mean sea level
ACA	Amended Consent Agreement
ANSI	American National Standards Institute
ARARs	applicable or relevant and appropriate requirements
ASL	Analytical Support Level
ASTM	American Society for Testing and Materials
CAA	Clean Air Act
CAWWT	Converted Advanced Wastewater Treatment Facility
CCB	continuing calibration blank
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	<i>Code of Federal Regulations</i>
CLP	Contract Laboratory Program
CMT	continuous multi-channel tubing
COC	chain of custody
CWA	Clean Water Act
DLC	decision level concentration
DO	dissolved oxygen
DOE	U.S. Department of Energy
DOE-CAP	DOE Consolidated Audit Program
DOT	U.S. Department of Transportation
DQOs	Data Quality Objectives
EPA	U.S. Environmental Protection Agency
FFCA	Federal Facilities Compliance Agreement
FPQAPP	Fernald Preserve Quality Assurance Project Plan
FRLs	final remediation levels
ft	foot (feet)
GC	gas chromatography
GMA	Great Miami Aquifer
ICB	initial calibration blank
ICP	inductively coupled plasma
ICPT BOA	Integrated Contractor Purchasing Team Basic Ordering Agreement
ICS	interference check sample
ICV	initial calibration verification
IEMP	Integrated Environmental Monitoring Plan
ISMS	Integrated Safety Management System
ISO	International Organization for Standardization
lb/gal	pound(s) per gallon
LCS	laboratory control samples
LM	U.S. Department of Energy Office of Legacy Management
LMS	Legacy Management Support
LSA	low specific activity materials
MDA	minimum detectable activity
MDC	minimum detectable concentration

MDL	method detection limit
mg/L	milligram(s) per liter
mL	milliliter(s)
mrem	millirem(s)
MS	matrix spike
MSD	matrix spike duplicate
MVS	Mining Visualization System
NELAC	National Environmental Laboratory Accreditation Conference
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTU	nephelometric turbidity unit
OAC	<i>Ohio Administrative Code</i>
OEPA	Ohio Environmental Protection Agency
OJT	on-the-job training
ORP	oxidation-reduction potential
OSDF	on-site disposal facility
OU	operable unit
PB	preparation blank
PCBs	polychlorinated biphenyls
PDF	portable document format
ppb	part(s) per billion
PQL	practical quantitation limit
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
QSAS	Quality Systems for Analytical Services
RA	remedial action
RAB	Registrar Accreditation Board
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RER	relative error ratio
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RPD	relative percent difference
RPM	remedial project manager
SEEP <sub>Pro</sub>	Site Environmental Evaluation for Projects (database)
SMS	sample management system
SOPs	standard operating procedures
SOWs	statements of work
SQL	structure query language
SSOD	storm sewer outfall ditch
SVOCs	semi-volatile organic compounds
TSCA	Toxic Substances Control Act
USCS	Unified Soil Classification System
VAM3D	Variably Saturated Analysis Modeling in 3-Dimensions Model

VOCs      volatile organic compounds  
WAC      waste acceptance criteria

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# 1.0 Project Organization and Responsibilities

## 1.1 Project Management

Remediation activities are conducted by the U.S. Department of Energy (DOE) Office of Legacy Management (LM) and regulated by the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA). The responsibilities of each group are defined in the Amended Consent Agreement (ACA) (EPA 1991), the Federal Facilities Compliance Agreement (FFCA) (EPA 1996a), the Consent Decree with the State of Ohio (1988), and other agreements between DOE and the regulatory agencies. Organizational and management structures showing the relationships among regulatory agencies and Fernald Preserve are provided in Figure 1-1.

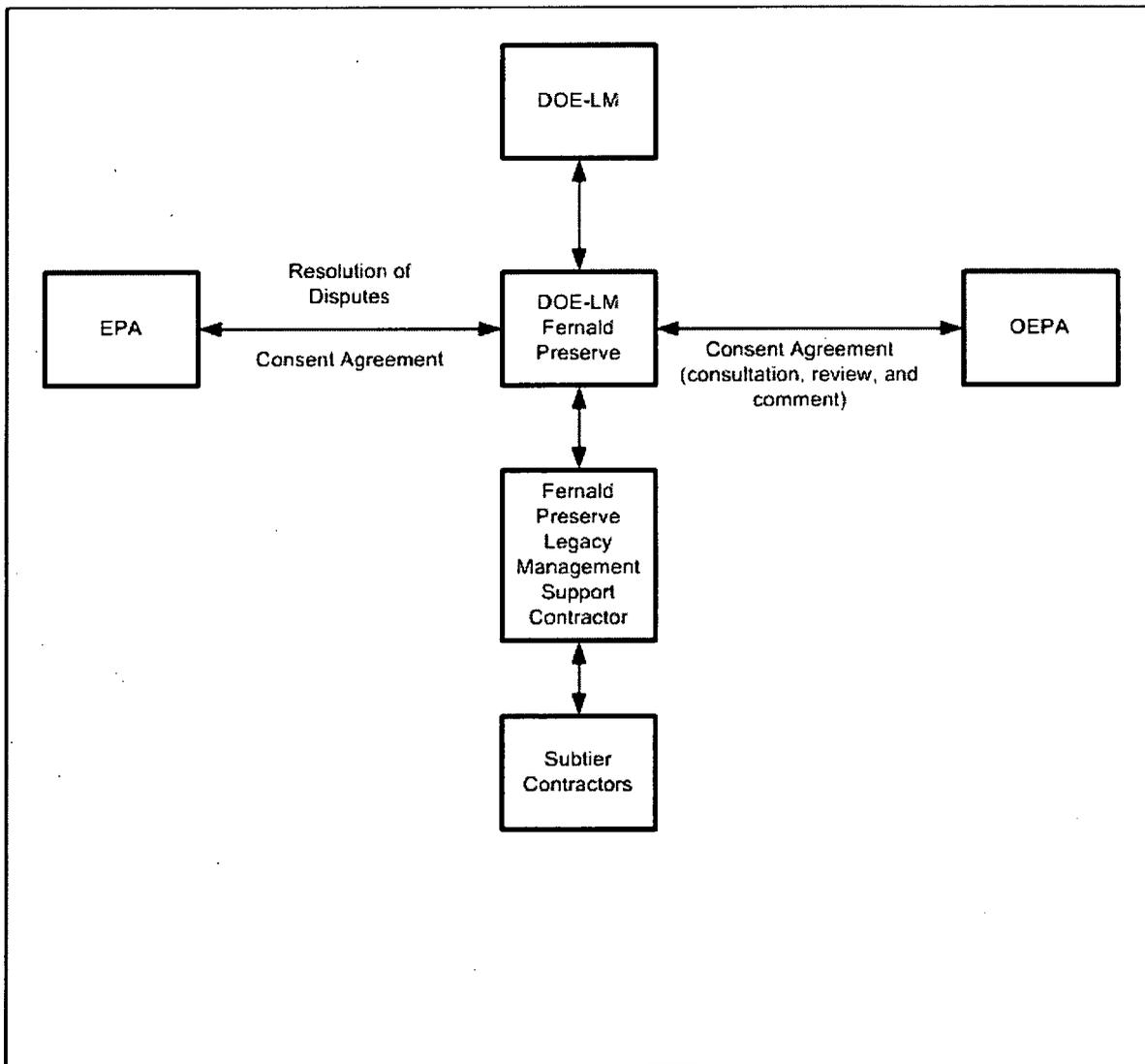


Figure 1-1. Fernald Preserve Project Organization

### **1.1.1 U.S. Environmental Protection Agency**

EPA has review and comment responsibility for Comprehensive Environmental Response Compensation and Liability Act (CERCLA) documents. The EPA Remedial Project Manager (RPM) is responsible for project oversight, reviewing documents, and interacting with Fernald Preserve personnel. The EPA RPM is also responsible for distributing deliverables to appropriate reviewers within EPA, and transmitting comments to—and resolving them with—DOE. Additional responsibilities are outlined in the ACA. The EPA Administrator is ultimately responsible for resolving disputes as specified in the ACA. At the Fernald Preserve, EPA also has regulatory authority through the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. §6901); Clean Water Act (CWA) (33 U.S.C. 1251); Clean Air Act (CAA) (42 U.S.C. § 7401); Toxic Substances Control Act (TSCA) (15 U.S.C § 2601–2692); the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136); and the Atomic Energy Act (42 U.S.C. 23).

EPA is responsible for the review and approval of the Fernald Preserve Quality Assurance Project Plan (FPQAPP). Requests to modify the FPQAPP or other EPA-approved documents shall be transmitted by DOE to the EPA RPM, who is responsible for distributing change requests to appropriate reviewers. Work plans prepared as part of the ACA activities shall be reviewed and approved by EPA prior to implementation.

The following EPA organizations have quality assurance (QA) responsibilities as indicated:

- The EPA RPM and/or the Regional QA Reviewer is responsible for the approval of the FPQAPP.
- The EPA RPM is responsible for the approval of all plans required by the ACA and for the coordination of communications between EPA and DOE.

### **1.1.2 Ohio Environmental Protection Agency**

OEPA has review and comment responsibility for CERCLA documents as stated in the ACA. OEPA also evaluates and comments on the FPQAPP for completeness relative to tasks for which the state has primacy, including RCRA, CAA, and CWA. State involvement and concurrence is vital to achieving the goal of an integrated environmental monitoring program at the Fernald Preserve.

### **1.1.3 U.S. Department of Energy Office of Legacy Management**

LM is responsible for day-to-day site management, program decisions, interpretation of DOE orders, interaction with regulatory agencies, milestone compliance, and transmission of deliverables. Procedures for site operations are outlined at headquarters level through DOE orders and guidance, and are interpreted and implemented at the LM level. The LM Site Manager is responsible for sampling plan approval. LM has delegated independent QA assessment duties to the Legacy Management Support (LMS) contractor QA organization.

#### **1.1.4 LMS Contractor**

The LMS contractor is responsible for the day-to-day operation of the site, including the operation of all facilities, services, and utilities. DOE has assigned radiological and industrial health and safety duties to the LMS contractor. The LMS contractor's safety and health organization may utilize expertise and resources of other subcontractors to fulfill its duties.

The LMS contractor is responsible for the day-to-day execution of the Fernald Preserve environmental programs, including the collection and evaluation of data pertaining to those programs. Additional duties include the preparation of reports specified in the ACA.

The designated QA organization is independent of direct job involvement and day-to-day operations and has direct access to LMS contractor management to resolve QA disputes (independent assessment). The QA organization is responsible for the following QA management functions:

- Conducting assessments and surveillances to verify that the QA program is implemented in compliance with sitewide and project-specific requirements, DOE orders and guidance, and regulatory requirements.
- Verifying that appropriate corrective actions have been completed.
- Assessing compliance with procedures.

Each project manager is responsible for QA within the project scope (self-assessment). The QA organization may be made responsible for verifying training, conducting assessments and surveillances, performing data validation, and verifying compliance with requirements.

### **1.2 Field Responsibilities**

Field responsibilities for Fernald Preserve personnel and subcontractors shall be defined in sampling plans and SOWs. These responsibilities shall include project management responsibilities, field personnel qualifications, sample-handling specifications, and data management and interpretation requirements.

Field responsibilities for environmental activities are assigned as follows:

- The project manager is responsible for project planning, for providing personnel and subcontractors to conduct the work, and for overseeing each phase of work.
- The project manager also ensures support for identifying utilities, health and safety assistance, environmental compliance, and coordinates with other Fernald Preserve field teams.
- The drilling subcontractor shall perform drilling, soil sampling, well construction, development, and completion, as directed.
- The QA organization provides assessments and field inspections of sampling activities.

The project manager is supported in field activities by field activity leaders, including but not limited to the geologist in charge of field investigations for the project and sampling team leaders. Each of these field activity leaders supervises other members of his or her team and is responsible for coordinating that field team in a specific activity for a specific project.

Field team members may include members of sampling teams or other teams organized for the completion of field activities. Field team members implement the sampling plans.

Training and proficiency requirements for team members shall be fulfilled as specified in Section 4, in procedures, and in the sampling plans, as applicable. Documentation of training and qualifications shall be readily retrievable by the project manager.

The Fernald Preserve analytical project contact's responsibilities include coordinating with the project manager regarding the types of analyses that will be required for the project; arranging for analytical services; and arranging for sample containers, labels, and custody record forms to be provided to the sampling teams.

The analytical project contact acts as the liaison between the individual project manager and the laboratories used to support his or her project. The analytical project contact also ensures that the laboratory analyzes the samples and provides reports consistent with a prearranged schedule.

## 2.0 Problem Definition/Background

The Fernald Preserve is owned by DOE and was formerly a uranium-processing facility.

### 2.1 Setting and Site History

#### 2.1.1 Setting

The Fernald Preserve is located in a rural area of southwestern Ohio, approximately 17 miles northwest of downtown Cincinnati, Ohio, and 8 miles southwest of Hamilton, Ohio. The villages of Fernald, New Baltimore, Ross, New Haven, and Shandon are located within a few miles of the site. The Fernald Preserve comprises 1,050 acres bounded by State Highway 126 to the north, Willey Road to the south, Paddys Run Road and the Chesapeake and Ohio Railroad to the west, and a power transmission line right-of-way to the east. The former production area occupies approximately 136 acres in the center of the DOE property.

Ground elevations at the Fernald Preserve range from approximately 700 feet (ft) above mean sea level (amsl) along the northern boundary to approximately 550 ft amsl where Paddys Run leaves the property near the southwest corner. Natural surface runoff at the site is generally east to west into Paddys Run, which flows south to the Great Miami River. Runoff from the northeast corner of the Fernald Preserve drains into a small, intermittent tributary of the Great Miami River.

Groundwater extracted from strategic locations with the uranium plumes both on the Fernald Preserve property and on private property south of the site is treated at the Converted Advanced Wastewater Treatment Facility (CAWWT) along with leachate collected from the on-site disposal facility (OSDF). The combined CAWWT-treated effluent is discharged to the Great Miami River through an effluent line permitted under National Pollutant Discharge Elimination System (NPDES) provisions of the CWA.

A glacial overburden, ranging from 0 to approximately 50 ft thick, underlies most of the Fernald Preserve. The overburden is composed primarily of poorly sorted, clay-rich till with various interbedded glaciofluvial (glacial stream), lacustrine (lake), and loess (wind blown) deposits of lenticular geometry.

Extensive valley-fill outwash deposits of medium- to well-sorted sands and gravels, averaging about 150 ft thick, underlie the glacial overburden deposits. The outwash overlies well-indurated shale and limestone bedrock. The outwash under the former production area is separated into an upper and lower unit by a clay-rich lacustrine deposit, locally referred to as blue clay, which ranges from 0 to approximately 20 ft thick. A generalized cross section of the subsurface in the Fernald Preserve area is included in Figure 2-1.

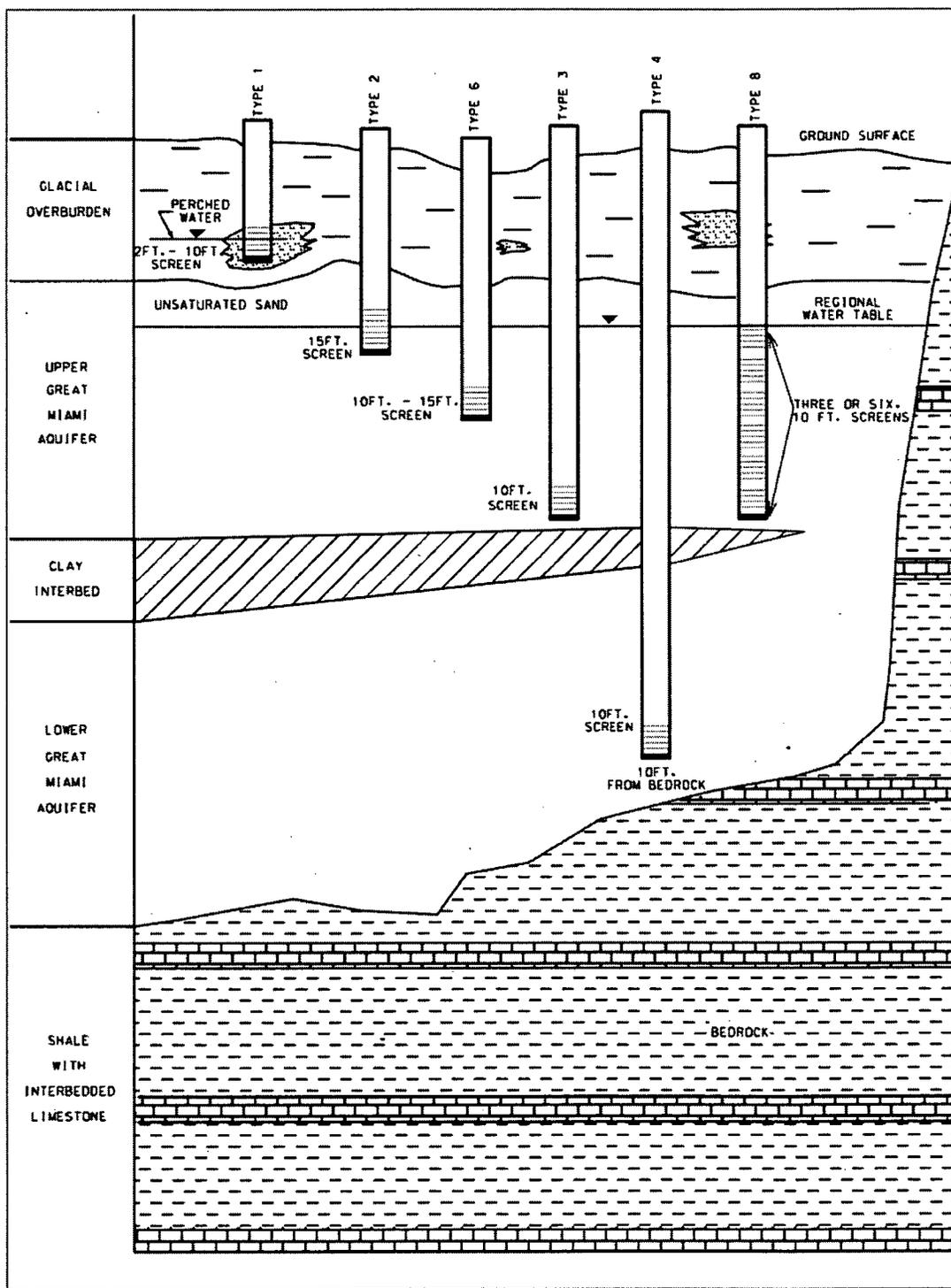


Figure 2-1. Generalized Cross Section of Site Hydrogeology and Monitoring Well Placement

Perched groundwater is present in hydrologic zones composed of coarser, better-sorted lenses within the glacial overburden and in coarse fill below buildings and along utility lines. Groundwater flow within the overburden is discontinuous and may be subject to extreme seasonal fluctuation. The upper 20 to 30 ft within the outwash is unsaturated. The remainder forms the Great Miami Aquifer (GMA), which has been designated a sole source aquifer by EPA. Under the former production area, the GMA is separated into an upper and lower unit by the blue clay. The upper portion is unconfined and receives recharge from Paddys Run (a losing stream) and the Storm Sewer Outfall Ditch (SSOD), as well as the overburden. The lower portion is semi-confined and, probably, is primarily recharged by leakage through the blue clay (DOE 1990).

Groundwater quality and water levels are monitored in the glacial overburden and at different levels in the GMA. A simple numeric system is used to identify wells at the Fernald Preserve. The first digit designates the hydrogeologic zone in which the well is screened; the last digits are sequentially assigned numbers. Clusters of wells of different types, at the same geographic location, are assigned the same sequential number. Thus, wells with one as the first digit of the identification number (Type 1) are screened in the glacial overburden. Wells with two as the first digit of the identification number (Type 2) are screened across the top of the GMA. Wells with three as the first digit of the identification number (Type 3) monitor the approximate middle of the GMA at a depth above, and equivalent to, a discontinuous clay lens in the Fernald Preserve area. Wells with four as the first digit of the identification number (Type 4) are installed to monitor the base of the GMA. Wells with six as the first digit of the identification number (Type 6) are installed at a depth between that of a Type 2 well and a Type 3 well to effectively monitor movement of the contaminant plume. Wells with eight as the first digit of the identification number (Type 8) are continuous multi-channel tubing (CMT) wells; instead of having one screen, they have three or six individual screens in order to discretely monitor the entire vertical thickness of the plume.

Groundwater users in the area surrounding the Fernald Preserve draw primarily from the GMA. The most significant usage is by the Southwest Ohio Water Company, which operates a series of radial collector wells east of the Fernald Preserve. Groundwater is also produced from extraction wells or from other wells for non-potable uses. Other groundwater users include production facilities to the south of the Fernald Preserve, residents around the site, and other private and commercial users.

In the area around the Fernald Preserve, the portion of the Great Miami River that is not affected by the Southwest Ohio Water Company collector wells is a discharge area under normal hydrologic conditions. The lower portion of Paddys Run between New Haven Road and the Great Miami River is a gaining stream during part of the year and a losing stream at other times. Paddys Run is also a gaining stream where its bed is on the clay-rich glacial overburden (north of the former silos area), as evidenced by small seeps and springs along its banks and tributaries.

The Great Miami River is a losing stream where drawdown induced through the pumping of Southwest Ohio Water Company collector wells reduces the aquifer head below the stream level. Paddys Run is a losing stream between the former silos area and approximately New Haven Road. It loses flow to the aquifer along other stretches during periods of low flow.

### **2.1.2 Production History**

The U.S. Atomic Energy Commission, predecessor to DOE, began construction of the Feed Materials Production Center (now the Fernald Preserve) in 1951 and began operations there in 1952. Operations consisted of foundry and other processes to convert natural uranium ore concentrates and recoverable, recyclable residues into uranium metal and compounds. The primary function of the plant was the production of metallic uranium fuel cores and uranium compounds for use in U.S. defense programs.

In addition to the primary uranium products, small amounts of thorium were produced. The site once served as the thorium repository for DOE, where various thorium materials were kept in long-term storage facilities. These materials were shipped to the Nevada Test Site for disposal. During the 1950s, pitchblende ores containing uranium, radium-226/228, and daughter products were processed at the site.

A variety of chemicals (e.g., nitric acid, anhydrous hydrogen fluoride, tributyl phosphate, magnesium metal, metal cleaning solvents, coolants, lubricating oils) were used in the production processes. As a result of these operations, various types of liquid and solid matrix wastes were generated. These wastes were broadly categorized as hazardous, solid, radioactive, and mixed (hazardous wastes with radioactive material).

Many solid and liquid wastes were stored or disposed of on site. Radium-bearing wastes from pitchblende processing were stored in two concrete silos in a waste storage area west of the former production area. Metal oxide wastes were stored in a third silo. A fourth silo was constructed but went unused. Uranium-metal-production wastes were placed in pits in the waste storage area, and an on-site landfill was operated for the disposal of solid waste. Construction debris was disposed of on site separately from the waste storage area, as was flyash from the boiler plant.

Releases of contaminants from the Fernald Preserve to environmental media have been noted during past investigations. These releases included runoff to the SSOD and Paddys Run; discharges of uranium to the Great Miami River; and releases and spills of uranium-bearing materials, solvents, and other material to soils on the site property. Affected media include perched groundwater (radionuclides and volatile organic materials), groundwater in the GMA (radionuclides and volatile organic compounds [VOCs]), surface water and sediments in Paddys Run and the Great Miami River (radionuclides). Air emissions also contributed to both on-site and off-site deposition of radionuclides.

### **2.1.3 Summary of Remediation Efforts**

CERCLA is the primary driver for the environmental remediation of the Fernald Preserve. Although Operable Unit (OU) 5 is the only OU that is currently active, the site was divided into five OUs for remedial action. The five OUs were defined as follows:

- OU1—Waste Pits Area
- OU2—Other Waste Units
- OU3—Production Area

- OÚ4—Silos 1 through 4
- OU5—Environmental Media

A remedial investigation/feasibility study (RI/FS) was conducted for each of the five OUs listed above. Based on the results of the RI/FS, records of decision (RODs) outlining the selected remedy for each OU were issued. A summary of the remedies follows.

**ROD for OU1, Waste Pits Area**—The remedy for OU1 included removing all material from the waste pits, stabilizing the material by drying it, and shipping it off site for disposal. OU1 field activities were completed in June 2005.

**ROD for OU2, Other Waste Units**—The remedy for OU2 included removing material from the various units, disposing of material that meets the on site waste acceptance criteria (WAC) in the OSDF, and shipping all other material off site for disposal. The WAC were developed by DOE and regulators, with input from the stakeholders and the public, to strictly control the type of waste disposed on site. OU2 field activities were completed in November 2003.

**ROD for OU3, Production Area**—The OU3 remedy included decontaminating and decommissioning all contaminated structures and buildings, recycling waste materials whenever possible, disposing of material that meets the on site WAC in the OSDF, and shipping all other material off site for disposal. OU3 field activities were completed in October 2006.

**ROD for OU4, Silos 1–4**—The OU4 remedy included removing and treating all material from the silos, dismantling the silos, and shipping the waste materials and silo debris off site for disposal. OU4 field activities were completed in May 2006 (field activities relate to the final shipment of OU4 waste off of the Fernald Site). The Silo 1 and 2 waste was shipped to a Waste Control Specialists LLC (WCS) in facility in Andrews, Texas. The waste has been held in interim storage at WCS since it was shipped off site.

On May 29, 2008, the State of Texas granted a byproduct license to WCS. This will allow 3,766 canisters of Silos 1 and 2 waste to be permanently disposed of at WCS. There is an ROD milestone of October 31, 2009 for "initiation" of permanent disposal. It will take WCS 6 months to construct the disposal cell, allowing disposal to "commence" in fiscal year 2009.

**ROD for OU5, Environmental Media**—OU5 includes all environmental media, such as soil, sediment, surface water, groundwater, and vegetation. Soils and sediments that exceeded final remediation levels (FRLs) but were below the OSDF WAC were excavated and placed in the OSDF. Soil certification processes were performed to ensure that all soils identified as exceeding FRLs were removed. Several sub-grade utility corridors that are being used to support the continuing groundwater remediation were not certified at closure, but they will be certified following the completion of groundwater remediation and their discontinued use.

The OU5 ROD (DOE 1996) describes the approved groundwater remediation method of pump and treat. The primary constituent of concern for groundwater is uranium. Other constituents have been identified and are being removed during the remediation of the aquifer. A complete list of all of the constituents identified in groundwater including their associated FRLs can be found in the OU5 ROD (DOE 1996). The FRL for uranium in groundwater is 30 parts per billion

(ppb). In the original ROD, the FRL for uranium in groundwater was 20 ppb. After EPA changed the drinking water standard, and after EPA and OEPA approved of the Explanation of Significant Differences for OU5 (DOE 2001), the FRL was raised to 30 ppb. DOE and regulators based the target cleanup levels for groundwater on the use of the aquifer as a potable water supply and incorporated Safe Drinking Water Act standards for all constituents for which these standards were available.

#### **2.1.4 Declaration of Physical Completion**

The Declaration of Physical Completion occurred on October 29, 2006. LM assumed responsibility for the Fernald Preserve from DOE Office of Environmental Management. All soils identified as exceeding FRLs have been excavated and certified to meet final remediation levels (with the exception of the ongoing actions necessary to achieve the final cleanup of the Great Miami Aquifer [GMA]); the OSDF is complete; all required groundwater infrastructure is installed, operational, and secured; and restoration activities have been completed within all excavated areas, including achieving final grade and completing the necessary restoration activities. Once the aquifer is restored, the CAWWT and associated infrastructure will be decommissioned and dismantled, and the utility corridors and the CAWWT footprint will be remediated.

#### **2.1.5 Site Conditions at Closure**

The following is an overview of the site conditions after remediation. It is clear that some remediation (e.g., continuing groundwater remediation) will be ongoing during legacy management.

##### **2.1.5.1 On-Site Disposal Facility**

Based on a pre-design investigation, the most suitable location for the OSDF was determined to be on the eastern side of the Fernald Preserve. This location was considered the best because of the thickness of the gray clay layer that overlies the GMA.

Construction on Cell 1 of the OSDF was initiated in December 1997 and the permanent cap for Cell 1 was complete in late 2001. The OSDF consists of eight individual cells covered by a continuous permanent cap. The design includes a liner system, impacted-material placement, a final cover system, a leachate management system, a surface water management system, and other ancillary features. The final dimensions are approximately 950 ft east to west and 3,600 ft north to south, with a maximum height of 65 ft. Approximately 2.5 million cubic yards of impacted materials were placed in the facility. Approximately 80 percent of the material is impacted soil and the remaining 20 percent consists of building demolition rubble, flyash, lime sludge, and small amounts of miscellaneous materials.

##### **2.1.5.2 Restored Areas**

Approximately 900 acres of the Fernald Preserve were ecologically restored. Restored areas are those parts of the site that have been graded following remedial excavation, amended, planted, or enhanced to create the early stages of ecosystems comparable to native pre-settlement southwestern Ohio. The specific habitats restored include upland forest, riparian forest, tallgrass

prairie and savanna, and wetlands and open water. In addition, previously existing habitats (such as pine plantations) were enhanced.

#### 2.1.5.3 Groundwater

Groundwater remediation and monitoring of the GMA will continue until the FRL of 30 ppb for uranium has been achieved. Groundwater monitoring will be required following the completion of remediation to ensure continued protectiveness of the remedy and to support the CERCLA 5-year reviews. Long-term monitoring of groundwater will be required around the OSDF.

#### 2.1.5.4 Uncertified Soil Areas

Two facilities remain on site below which the soils have yet to be certified: the CAWWT and the South Field Valve House. There are also sub-grade utility corridors that were not certified at closure. These facilities and utilities primarily support the ongoing groundwater remedy and are located below certified areas.

The 60-inch main drainage corridor culvert and an adjacent 18-inch culvert were left in place even though there is fixed contamination within the culverts. Both culverts are located directly below the OSDF leachate conveyance system and the main effluent line running between the CAWWT and the Great Miami River. Due to their location, these culverts could not have been removed without potentially impacting ongoing CAWWT and OSDF operations. The 18-inch culvert is completely buried and grating was installed on the ends of the 60-inch culvert to prevent access.

The certification of the sub-grade utility corridors will occur following the completion of groundwater remediation, when these systems are no longer needed and are removed. Certification of the soils within the footprints of the CAWWT and South Field Valve House will occur when these facilities are no longer needed, are removed from service, and are decommissioned and dismantled. Due to the uncertainty of the groundwater remediation end date, no firm schedule for soil certification in the corridors can be established at this time.

#### 2.1.5.5 Existing Infrastructure and Facilities

A few facilities remain on site including the CAWWT and supporting infrastructure, South Field Valve House, former Communications Building, former Dissolved Oxygen Building, Parshall Flume Building, Restoration Storage Shed, electrical substation, Water Meter House, and the Visitors Center.

### 2.1.6 Other Regulatory Issues

In addition to compliance with CERCLA, the Fernald Preserve shall also comply with DOE orders and other regulatory requirements, including RCRA, CAA, CWA, NPDES, National Environmental Policy Act (NEPA) (42 U.S.C. §4332), TSCA, and the Pollution Prevention Act of 1990. The LMS contractor intends to meet or exceed the substantive requirements of each of these regulations. Compliance with other requirements that are fully applicable (both administratively and substantively) to the Fernald Preserve (i.e., RCRA and CWA) is discussed below.

Water discharges from the Fernald Preserve to the Great Miami River through the CA WWT effluent line fall under CWA (via the Fernald Preserve NPDES permit), DOE Order 5400.5, DOE Order 450.1A, and the FFCA. Discharges shall be maintained within limits specified in the site NPDES permit and the OUS ROD.

## 3.0 Project Description

Fernald Preserve requirements include maintaining the remedies, continuing the groundwater remedy, and ensuring the protectiveness of human health and the environment. Other post-closure activities include monitoring and maintaining the Fernald Preserve property, facilities, and structures that remain.

### 3.1 Purpose

The FPQAPP was developed for Fernald Preserve environmental sampling and analysis with a twofold purpose: (1) establish minimum standards of performance for operational and analytical activities and (2) ensure that those standards are followed by parties covered by the plan (as defined in Section 1).

This document is a revision of the Sitewide CERCLA Quality Assurance Project Plan, which fulfills requirements of the FFCA between DOE and EPA. The FPQAPP integrates CERCLA requirements into applicable sampling activities at the Fernald Preserve.

### 3.2 Scope

The FPQAPP was developed to direct environmental sampling and analysis to support the ultimate remediation of the site. To this end, ongoing and future environmental projects at the Fernald Preserve shall comply with QA/Quality Control (QC) requirements specified herein. The following projects are included in the Fernald Preserve activities:

- Remedial design (RD)—Engineering phase, which follows the ROD, when technical drawings and specifications are developed for subsequent remedial action.
- Remedial action (RA)—Construction or implementation phase that follows the RD of a selected cleanup alternative.
- OU completion.
- Closeout/NPL deletion.
- Operation and maintenance.

Other programs and activities at the Fernald Preserve (many of which are also incorporated into the RD and RA activities) that require collection and analysis of samples under FPQAPP criteria include the following:

- RCRA groundwater monitoring
- CWA
- NEPA
- TSCA
- DOE Orders 450.1A, 5400.5, 435.1

The FPQAPP is designed to ensure that work performed for environmental programs and supporting activities at the Fernald Preserve is of adequate quality to fulfill environmental sampling project objectives. The organization, objectives, functional activities, and specific QA/QC activities associated with the CERCLA program at the Fernald Preserve are presented. Minimum requirements for sampling, sample handling and storage, chain of custody (COC) records, and laboratory and field analyses are specified in the FPQAPP.

### 3.2.1 Use of Data

Data generated in accordance with the requirements of the FPQAPP are intended to fulfill defined needs of DOE, EPA, OEPA, and the public. Sampling efforts implemented under the FPQAPP are designed to accomplish the following:

- Assess environmental conditions in air, groundwater, sediment, soil, and surface water.
- Assess variability in the measurement process, along with sources and magnitude of variation in results generated.
- Provide a means of determining whether a sampling program meets Data Quality Objectives (DQOs).
- Assess whether the completed remedy remains protective of human health and the environment.
- Assess the progress of the ongoing groundwater remediation and the eventual certification that final remediation levels stipulated in the OU5 ROD have been met for groundwater, surface water, and the remaining soils associated with the groundwater infrastructure as the infrastructure is removed.

### 3.2.2 FPQAPP Development

QA procedures in the FPQAPP were developed in accordance with applicable EPA guidelines, DOE orders, professional technical standards, and regulatory requirements. The following documents were considered:

- *EPA Guidance for Quality Assurance Project Plans* (EPA 2002a).
- *Superfund Remedial Design and Remedial Action Guidance* (EPA 1986b).
- DOE Order 414.1C, *Quality Assurance*.
- Title 10, *Code of Federal Regulations*, Part 830.120 (10 CFR 830.120), "Quality Assurance Requirements."
- DOE Order 241.1A, *Managing the Department of Energy's Scientific and Technical Information*.
- DOE Order 2321.1B, *Auditing of Programs and Operations*.
- *Guidance for Data Useability in Risk Assessment*, April 1992 (EPA 1992a).
- *EPA Requirements for Quality Assurance Project Plans* (EPA 2001a).
- *EPA Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA 2006).
- *EPA Requirements for Quality Management Plans, Final* (EPA 2001b).

In addition, FPQAPP requirements are consistent with the intent of other DOE orders and EPA guidance documents that pertain to environmental sampling and analysis.

### **3.3 Use of the FPQAPP**

The FPQAPP provides overall QA planning for sampling and analysis activities planned or ongoing at the Fernald Preserve and was developed to fulfill two primary purposes:

- To establish minimum standards of performance for operational and analytical activities.
- To ensure that those standards are followed by all parties covered by the document.

The FPQAPP is a cross between a QA program plan and a QA project plan. Requirements for planning, implementing plans, and assessing activities are included in the FPQAPP so that it may be used like a QA program plan. The FPQAPP also fulfills the requirements of a QA project plan.

Historical data has been collected at the Fernald Preserve under numerous revisions of the FPQAPP; therefore, historical sampling data may require special consideration. The scope of work for these projects is included in previously approved documents and may include certain details that differ from the current version of this document. These differences shall be identified and evaluated for each project to determine the effect of changes on data comparability and confidence.

#### **3.3.1 Data Quality Objective Process**

DQOs are quantitative and qualitative statements that specify the quality of data required to support decision making. Intended use of the data is the driving consideration in the formulation of DQOs. The DQO process results in project-specific QA objectives. These objectives (precision, accuracy, representativeness, comparability, and completeness) should be reflected in the DQO. EPA guidance has been used to develop a process for defining DQOs for projects at the Fernald Preserve (EPA 2006). The process results in the preparation of a logic flow statement (including a decision rule or potential subsequent actions) that shall be kept as part of the permanent record. All potential uses of data shall be considered when preparing DQOs. For example, samples collected from domestic drinking-water wells may also be used in a planned risk assessment. This could result in choosing a different laboratory analytical method than if the data were used only for DOE environmental monitoring.

Preparation of the sampling plan can be started simultaneously with preparation of DQOs, but the DQO process must be completed before the sampling plan can be completed. A copy of the approved DQO must be attached to the sampling plan and incorporated as a reference.

The preparation of a DQO is required for sampling projects at the Fernald Preserve where data could be used for the following objectives:

- Final certification in the CERCLA process regulatory citation (or another process).

- Detection, assessment, and corrective action monitoring as established in Ohio Administrative Code (OAC) 3745 (i.e., OSDF monitoring).
- Formal risk assessment to be submitted to the regulatory agencies.
- Compliance with NESHAPS Subpart H requirements, as applicable.

Sampling projects that support surveillance monitoring or are driven by permit requirements (e.g., NPDES), do not require formal DQO. Using this graded approach, the Fernald Preserve LMS Site Manager, with assistance from the DQO Coordinator, is responsible for determining when a DQO is required. Documentation of this decision shall be made in the sampling plan or placed in the project records. The Fernald Preserve LMS Site Manager shall also ensure that the appropriate persons or organizations, including QA, have reviewed the DQO. The completed DQO must be signed by the responsible project manager and the DQO Coordinator to note approval.

The DQO Coordinator is responsible for overall control of the DQO process at the Fernald Preserve. This includes ensuring that all required approvals have been received, distributing the approved controlled documents to appropriate project personnel, and storing the DQO files. Support documentation for DQOs is filed by the DQO Coordinator and, upon request of the project manager, may become part of project files.

### **3.3.2 Sampling Plans**

The sampling plan is designed to provide for project-specific planning and QA/QC considerations and rely directly on the FPQAPP for overall guidance and QA/QC requirements. The sampling plan provides the specific details not provided in the FPQAPP or DQO and provides documentation of exceptions or additions to the FPQAPP. Sections of the FPQAPP may be included by reference in the sampling plan. Project-specific variations to the FPQAPP requirements shall be identified and justified in the plan. Health and safety requirements are addressed in project-specific addenda or other health and safety documents, such as job safety analyses.

Detailed procedures for each field activity shall be referenced in sampling plans as a supplement to the FPQAPP. Each field procedure shall specify the scope and purpose of the activity, methods to be used, applicable material specifications, and documentation requirements specific to that activity. Minimum requirements for field activities in this section may be incorporated into sampling plans by reference to the FPQAPP.

Sampling plans shall be developed for each project that is performed at the Fernald Preserve and that includes environmental sampling and analysis. These plans include details applicable to the specific project for which they are written and shall be in a form that can be used on a day-to-day basis by project personnel.

The Comprehensive Legacy Management and Institutional Controls Plan (LMICP) (DOE 2009) contains a collection of sampling plans developed to address the regulatory environmental monitoring requirements for the Fernald Preserve. The LMICP contains the Integrated Environmental Monitoring Plan (IEMP) and the Groundwater/Leak Detection and Leachate

Monitoring Plan (GWLMP), which are discussed below. Environmental data collected for these programs are reported in the annual *Fernald Preserve Site Environmental Report*.

### 3.3.2.1 Integrated Environmental Monitoring Plan

The IEMP defines monitoring activities for environmental media, such as groundwater, surface water and treated effluent, sediment, air (including air particulate, radon, and direct radiation), and natural resources. In general, the primary exposure pathways (water and air) are monitored, and the program focuses on assessing the collective effect of sitewide emissions on the surrounding environment.

The IEMP establishes a data evaluation and decision-making process for each environmental medium. Through this process, environmental conditions at the site are continually evaluated. These evaluations sometimes affect decisions made about the implementation of remediation activities. For example, environmental data are routinely evaluated to identify any significant trends that may indicate the potential for an unacceptable future impact to the environment if action is not taken.

### 3.3.2.2 Groundwater/Leak Detection and Leachate Monitoring Plan

The GWLMP details the monitoring program for the on-site disposal facility (OSDF). The monitoring program comprises two primary components: (1) a leak detection component, which provides information to verify the ongoing performance and integrity of the OSDF and its impact on groundwater; and (2) a leachate monitoring component, which satisfies regulatory requirements for leachate collection and management.

The OSDF monitoring plan has been developed to meet the regulatory requirements for the first tier of a three-tiered monitoring strategy required for engineered disposal facilities (i.e., [1] detection, [2] assessment, and [3] corrective action monitoring strategy). Consistent with this three-tiered requirement, follow-up groundwater quality assessment and corrective action monitoring plans will be developed and implemented as necessary.

### 3.3.2.3 Sampling Plan Content

A sampling plan must, at a minimum, address seven aspects of the project for which it is prepared:

- Project background.
- Project objectives.
- Project organization.
- Sample design.
- Analytical requirements.
- Project requirements for surveillances and audits.
- Methods for data management, storage, and evaluation.

If a technology, procedure, or method is not described in the FPQAPP, the following shall be included in the sampling plan:

- Reason the technology, procedure, or method was chosen.
- References or other data confirming that the technology, procedure, or method is sufficient to support data needs.
- Procedure for implementation of technology/method by reference after EPA approval.
- Types of required preventive maintenance, if appropriate.

If the technology, procedure, or method replaces one previously used, the following shall be included in the sampling plan:

- The reason for the change.
- A means for comparing results of the old and new technologies/methods.
- Data Validation Level 3 (Section 13.2) of any new method used to calculate upper confidence limits for use in risk assessment until completeness requirements have been met for the initial stage or phase of use.

#### 3.3.2.4 Project Background

Project background shall include historical information about the activities that have previously occurred at the site that are germane to the current project. The following may be included:

- A summary of the contaminants of concern and the probable sources, potential transport routes, and environmental fate.
- A summary and evaluation of previous monitoring activities.
- A summary of previous remediation activities.

#### 3.3.2.5 Project Objectives

Development and clarification of the project's objectives are integral parts of the DQO and sampling plan process. Project objectives need to be stated with sufficient detail so that the sample design, analytical methods, and QC requirements are consistent with the goals of the project. A copy of the approved DQO must be attached to the sampling plan and incorporated by reference.

#### 3.3.2.6 Project Organization

Clearly describe the project organization and responsibilities to accomplish the goals of the specific project.

#### 3.3.2.7 Sample Design

The sample design incorporates all concerns related to the collection of environmental samples. Maximum use of reference to the FPQAPP is encouraged. Descriptions of supplemental information, site-specific details, maps, and new information shall be provided in the sampling plan. Collected samples should be representative of the media sampled and support the intended

data use. The sampling plan must specify the number of samples to be collected in order to achieve the quality objectives of the sampling plan.

The sample design within the sampling plan shall:

- Identify the method or methods used for determining sampling locations and number of samples (including background).
- Describe the location, number, and description of sample collection locations, including background stations.
- Identify field screening measurements and other field observations to be taken prior to and during sample collection.
- Identify the media to be sampled.
- Define the frequency of sampling.
- Specify QC samples to be collected and protocols to be followed.
- Specify the methods for collecting samples (Section 6) and the types of samples.
- Include detailed method descriptions if they differ from those in the FPQAPP or are not included in the FPQAPP.
- Specify the volume of samples to be collected, the types of containers to be used, and the sample preservation techniques.
- Define the roles and responsibilities of the sampling team members.
- Determine and identify equipment and materials necessary to perform required sampling activities and field analyses.
- Identify appropriate field collection sampling reports pertinent to the particular sampling activity.
- Specify holding times, packaging, storage, and shipping requirements in accordance with the FPQAPP.
- Specify the sample labels and COC documentation (Section 7) to be used by reference, providing any project-specific variations in detail.
- Specify decontamination procedures for sampling activities (in accordance with decontamination requirements in Section 6) by specific reference, describing in detail any project-specific variations.

#### 3.3.2.8 Analytical Methods

The description of the analytical methods to be used shall incorporate the target parameters, required detection limits, and the required ASL. Maximum use of reference to the FPQAPP is encouraged. Supplemental information, site-specific details, and new information shall be included in the sampling plan. This information should include the following:

- Specify analytes of interest, detection limits, and performance requirements.
- Specify analytical methods and ASL (Section 13).
- Identify the types of field analyses.

- Identify any additional QC checks.
- Define data validation requirements for ASLs B, C, D, and E data.
- Specify data validation and data reporting requirements that differ from FPQAPP requirements.
- Specify calibration requirements for field equipment (Section 11).
- Specify field measurements, including replicate measurements.

#### 3.3.2.9 Project Requirements for Surveillances and Audits

Project-specific surveillance and assessment requirements shall be included in the sampling plan. Surveillance and assessment information shall include the number and frequency, the scope, and the organizations responsible for conducting the surveillances or assessments.

#### 3.3.2.10 Data Management, Evaluation, and Storage

Requirements for managing, evaluating, and storing data shall be included in the sampling plan. The sampling plan must specify requirements for field-generated data documentation and analytical data, including both electronic and hard-copy data. Responsibilities for each requirement must be stated. Additional requirements for data management are provided in Section 13.

### 3.3.3 Sampling Plan Review and Approval

After a draft sampling plan is prepared, it shall be reviewed by the project manager, the Fernald Preserve QA organization, environmental compliance, and groups having implementation responsibility (Section 1). The review serves the following purposes:

- Provides a detailed technical review to ensure that accepted scientific and engineering practices, and standardized or approved approaches are specified.
- Ensures integration and coordination of individual activities of each sampling plan with overall Fernald Preserve monitoring and sampling goals.
- Improves the use of data for multiple purposes.
- Makes sample collection consistent.

Sampling plans shall receive technical and quality reviews and approvals. The designated project manager is responsible for developing sampling plans in accordance with requirements of the FPQAPP and the appropriate DQOs, and for ensuring that all appropriate organizations review the sampling plan prior to implementation.

Sampling plans required as part of the ACA or the Consent Decree with the State of Ohio shall be reviewed by LM and approved by the appropriate agency prior to implementation unless other arrangements are made for certain time-critical sampling plans. For normal sampling plans, the regulatory comment resolutions will be incorporated in the final sampling plans before implementation.

Upon comment resolution, the sampling plan will be approved (at a minimum) by the project manager, the implementing organization, and LMS contractor QA and environmental compliance organizations for controlled distribution to appropriate project personnel.

### 3.3.4 Additional Project Concerns

Apart from technical requirements, these additional factors shall be addressed in project scoping, as applicable.

**Personnel Protection**—Safety is the top priority at the Fernald Preserve. Each employee is expected to consider how his or her work tasks may be performed more safely. Methods for performing work shall minimize the probability of an accident and keep hazard exposure to an acceptable level in accordance with EPA and Occupational Safety and Health Administration requirements through the use of personal protective equipment and safe work practices. Exposure to potentially harmful ionizing radiation shall be as low as reasonably achievable.

The LMS contractor has developed and implemented an Integrated Safety Management System (ISMS) to comply with 10 CFR 851, “Worker Safety and Health Program.” It establishes the framework for a worker protection program that will reduce or prevent occupational injuries, illnesses, and accidental losses by requiring DOE contractors to provide their employees with safe and healthful workplaces. This program also establishes procedures for investigating whether a requirement has been violated, for determining the nature and extent of such violation, and for imposing an appropriate remedy.

The following key ISMS principles are included in work processes at the Fernald Preserve:

- Line management is responsible for environment, safety, and health.
- Roles and responsibilities are clear.
- Competence is commensurate with responsibilities.
- Priorities are balanced.
- Environment, safety, and health standards and requirements are identified.
- Hazard controls are tailored to the work being performed.
- Authorizations for operation are identified.

Work processes are also designed to include the following five core functions of ISM:

- Define the scope of work.
- Analyze the hazards.
- Develop and implement hazard controls.
- Perform work within controls.
- Provide feedback and continuous improvements.

**Protection of the General Public and the Environment**—The Fernald Preserve’s commitment to safety, which includes the minimization of accidental exposure to hazards, is extended to protection of the general public and the environment. Activities at the site shall be performed with primary consideration given to protection of human health and the environment.

**Waste Minimization**—Activities shall be planned to prevent the unnecessary generation of waste, including consideration of sample location selection, sample collection methods, parameters to be analyzed, use of screening analyses where applicable, and prudent use of materials. Generated wastes shall be handled in an environmentally sound and safe manner, in compliance with all applicable requirements.

**Timeliness**—Every attempt shall be made to meet schedule commitments, perform activities safely, and produce useable data within a reasonable timeframe.

**Cost Effectiveness**—Activities shall be performed to maximize production of useful, valid information and minimize expenditures.

### **3.3.5 Sampling Plan Implementation**

Sampling plans or work plans required as part of the ACA activities shall be reviewed by OEPA and reviewed and approved by EPA prior to implementation. Sampling plans generated in response to requirements of the Consent Decree with the State of Ohio shall be reviewed by OEPA and EPA. Draft sampling plans may be revised internally until approved by LM for outside agency review. Based on agency review comments, sampling plans may be revised until approved, with revisions being submitted to the reviewing agencies. Upon receipt of agency approval, the sampling plan shall be implemented according to the schedule in the plan.

Implementation of the sampling plan shall consist of the following major steps:

- [1] Sample collection and fieldwork.
- [2] Laboratory analysis.
- [3] Data validation, if required.
- [4] Data management.
- [5] Data interpretation and analysis.
- [6] Reporting results.
- [7] Decision for action on problem or compliance with requirement.

Feedback loops shall be provided in the execution of the project between data validation and laboratory analysis and between data interpretation/analysis and DQO preparation. Data validation can result in a requirement for the laboratory to reanalyze a sample because of failure to comply with QC requirements. In extreme cases, resampling may be required. These feedback loops may require revisions to the DQOs and sampling plan.

Data analysis and interpretation may result in the realization that data may be used for a purpose different than originally intended. The DQO process shall then be reviewed to determine if the data are suitable for the new purpose.

### **3.3.6 Project Schedules**

A schedule for completion or for conducting routine, ongoing projects shall be included in each sampling plan as applicable. It shall consist of the anticipated start date and the duration of each project phase (including fieldwork, laboratory analysis, data validation, data assessment and interpretation, and submittal of interim and final reports). For sampling plans related to Consent Agreement (EPA 1990) items, 30 calendar days shall be allowed for each phase of regulatory review, and 30 days shall be allowed for comment resolution and re-submittal of documentation by the Fernald Preserve.

### **3.3.7 Variance**

A variance is a pre-approved action performed in a manner different from the one specified by the requirements of an approved sampling plan. How changes impact the quality of work performed shall be evaluated, documented, and approved by the Fernald Preserve organizations that approved the original document prior to implementation.

A variance is not a nonconformance. A variance is a means of accomplishing changes to sampling plans. The variance is a change approved only for the specific activity described in the variance documentation. Proposed changes must be in accordance with the approved DQO. Any changes outside the scope of the DQO must be accomplished through a revision of the sampling plan and DQO.

Variances to sampling plans that have been approved by the regulatory agencies shall be considered either significant or non-significant (i.e., informational). A significant variance is required when activity changes the scope of the project and that change must be reviewed by the regulatory agencies. Informational variances are used to provide clarification, incorporate additional information, correct errors in the original sampling plan, document re-sampling activities, etc.

The person identifying the need for the variance (the initiator) shall process a variance request as follows:

- [1] Notify the project manager of the need to vary from the plan and determine the appropriate action.
- [2] Initiate a variance (Figure 3-1). The original sampling plan for which the variance is being sought must be identified.
- [3] Describe the variance in writing, including the justification for the variance, and the potential impact on the project.
- [4] Indicate the intended time and date of variance implementation and the time allotted for comments and resolution (if applicable).

<b>VARIANCE</b>		Significant? (Yes or No):	Variance No.		
DOCUMENT NO:		Page of		Date:	
DOCUMENT TITLE:					
<b>VARIANCE (Include justification)</b>					
Requirement:					
Variance:					
Justification:					
Requested By:				Date:	
<input checked="" type="checkbox"/> IF REQD	VARIANCE APPROVAL	DATE	<input checked="" type="checkbox"/> IF REQD	VARIANCE APPROVAL	DATE
	Quality Assurance			Hydrology	
	Laboratory Technical Rep.			Geosciences	
	Environmental Compliance			Environmental Monitoring	
	Other			Site Systems Operations	
REVISION REQUIRED (Document No. & Title): <input type="checkbox"/> YES <input type="checkbox"/> NO					
DISTRIBUTION: Records Management, EPA, & OEPA					

Figure 3-1. Variance Form

- [5] Distribute the variance request to all organizations affected by the variance for their review. For significant variances, the regulatory agencies shall be included in the review process.

The reviewers shall proceed as follows:

- [1] Evaluate the variance request and approve or disapprove the document.
- [2] If the document is approved, sign and date it (including time approval was granted).
- [3] If the document is disapproved, return it to the initiator, and indicate the reason for disapproval.

If approval was not obtained, the initiator shall evaluate reasons for disapproval and the need for a revision to the requested variance. Revisions to the variance shall be processed as indicated above.

When approvals have been obtained, project personnel shall implement the described variance. Under no condition shall an unapproved variance be implemented. The original variance shall become part of the project file as described in Section 4.3. Approved variances shall be incorporated into subsequent revisions of the sampling plan. Controlled copies of the approved variance shall be distributed to appropriate project personnel.

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## **4.0 Training, Document Control, and Records**

### **4.1 Training**

The LMS contractor and subcontractors shall use personnel that have appropriate education, training, and experience to perform an assigned task. To accomplish this, the managers will ensure compliance with training requirements of federal and state laws and regulations, DOE orders and policies, and other procedures needed by personnel in order to successfully perform tasks related to the collection and analysis of environmental samples. The manager will ensure that continuing training requirements for employees are addressed. Documentation of personnel training shall be readily retrievable.

Managers will identify and document personnel qualifications and training needs, including continuing training requirements. Before an individual is considered to be trained and allowed to perform a task unsupervised, the following requirements, at a minimum, shall be completed:

- Documented reading of the applicable procedure or work instruction for the task or duty and understanding it sufficiently to pass a written test if required.
- Observing the task being done by a trained and qualified worker.
- Performing the task under supervision of a trained and qualified individual until completion of formal training.

Training shall be performed in accordance with formally planned, executed, and documented training activities. The following training types will be used to provide training for Fernald Preserve personnel.

#### **4.1.1 Formal Training**

Formal training is performance based and is a systematic program of instruction designed around specific tasks, related knowledge, skills, and the abilities required for competent job performance. Formal training instructors shall be technically qualified with the appropriate required combination of experience and training to present the topic of instruction. This instructor authorization will be documented by the LMS contractor. Formal instruction performed by authorized instructors focuses on specific technical or administrative principles essential to the performance of assigned duties. The purpose of formal instruction is to qualify individuals to perform current or potential jobs and enhance qualifications set forth in laws, regulations, position descriptions, or program or project plans. Formal training is conducted in accordance with approved course materials and an established course description. This training is mandated by laws, regulations, company policies, procedures, or plans and may be a prerequisite for qualification or certification.

Documentation of formal training shall be maintained by the LMS contractor training organization. Personnel training records shall include the following at a minimum, the trainee's name, the date of training completion, the course title, and if an exam is required, the training results (i.e., pass or fail).

For web-based training, authentication of the trainee shall be completed through user name and password. The training database shall be updated with the following minimum personnel training documentation: trainee's name, completion date, course title, and training results (i.e., pass or fail) if an exam is required.

#### **4.1.2 On-the-Job Training**

On-the-job training (OJT) that is conducted and evaluated in the normal work environment by a qualified OJT instructor. Additional job-specific training shall be conducted when required or deemed necessary to ensure that work is performed by thoroughly knowledgeable and capable personnel. OJT requires:

- An evaluation of the employee's work experience.
- An explanation of proper work/task procedures.
- A demonstration of the work/task, performed by the trainer and the trainee.
- An evaluation of the work/task, performed by the trainee.
- Documentation of the OJT process.

OJT instructors shall be technically qualified with the appropriate required combination of experience and training to present the topic of instruction. This instructor authorization will be documented by the LMS contractor. Documentation of OJT shall be maintained by the manager or a designee.

#### **4.1.3 Informal Training**

Informal training is a routine practice for all Fernald Preserve activities as an integral part of ensuring safe and adequate work performance. Informal training is supplemental instruction provided by managers or their designees to address emerging issues or procedural changes. Documentation of informal training shall be maintained by the project manager or a designee. Employee pre-job briefings and personal instruction sessions are examples of informal training. Professional certifications and registrations that are not prerequisites for employment may also be tracked as informal training.

#### **4.1.4 Required Reading**

Project managers may require personnel to read documents that are important to the performance of their assigned tasks. Documentation of the required reading shall be maintained by the project manager or a designee. Examples of items that may be used as required reading include company manuals, revisions, occurrence reports relating to the facility, and DOE orders.

## **4.2 Document Control**

For the purposes of this FPQAPP, a controlled document is any document for which distribution and status are to be kept current by the issuer to ensure that users of the document have access to the most up-to-date version for accomplishment of work under the scope of the FPQAPP.

Controlled documents shall be prepared, reviewed, approved, revised, and distributed by the appropriate project manager. Controlled document listings shall be maintained by the LMS contractor and any subcontractor for quality-related documents, project-specific documents, drawings, computer graphics, and maps.

### **4.2.1 Preparation, Review, and Approval of Documents and Drawings**

Prior to implementation or use, documents and drawings shall be reviewed and approved. Each approved document or drawing shall be signed and dated. Documents and drawings requiring DOE approval shall be reviewed and approved by designated LMS personnel before submittal to DOE. Copies of documents or drawings released for any purpose before they have gone through the complete review and approval process shall be dated and marked (e.g. "PRELIMINARY" or "DRAFT") for documents.

Fernald Preserve subcontractors shall have a documented process for preparation, review, and approval of documents and drawings for which they are responsible or adopt the LMS contractor process. This process shall include the following:

- Standardized document and drawing format.
- Identification of required reviewers.
- Review process, including documented resolution of reviewer comments, to include concurring signature for comments submitted as significant.
- Procedure for obtaining required approvals and authorization to issue.
- Periodic review.

### **4.2.2 Changes to Documents and Drawings**

Changes to approved plans and procedures may be necessary during the course of project performance. Review and approval of changes to documents shall be in accordance with requirements of the original document. Organizations approving the original document shall also approve changes. Changes shall be approved prior to implementation. Revisions shall be submitted for review and approval with approval sheets, as appropriate.

### **4.2.3 FPQAPP Review/Revision**

The FPQAPP shall be reviewed annually and revised as necessary. When a substantive change is required, the FPQAPP shall be revised and submitted to the original reviewers (or their designee) for review and approval.

#### **4.2.4 FPQAPP Distribution**

The FPQAPP shall be made available electronically to appropriate project personnel, including appropriate regulatory agencies. Appropriate project personnel shall be provided notification of the current approved FPQAPP and any subsequent revisions.

### **4.3 Records Administration**

A records management system in accordance with the requirements of this section; DOE Order 200.1; and 36 CFR 12, Subchapter B, "Federal Records Management," has been established to cover preparation, control, and retention of project-related records. Records control includes receipt from sources, transmittals, and transfer to storage. Retention includes receipt at the storage areas, indexing and filing, storage and maintenance, and retrieval from storage.

The CERCLA Administrative Record and the Post-ROD files are part of the official Fernald Preserve CERCLA record and contain information and reports used to support CERCLA decision making. Copies of their contents are available to the public. Evidence files (Section 7) are maintained to support all reports and information officially entered into the CERCLA Administrative Record and Post-ROD files. The Administrative Record Coordinator is responsible for maintaining the analytical evidence files to support the CERCLA Administrative Record and Post-ROD files and for maintaining files of all other environmental sampling and analysis files that could be used to support future decisions.

#### **4.3.1 Record Preparation**

Hard-copy records shall be legible, accurate, and complete; indexed to permit quick and accurate identification of items or activities to which they apply; and authenticated by the preparer's signature and completion date. Each diskette, tape, or other data medium shall be identified by a unique identifier. A hard-copy index of contents shall be maintained in project files.

When appropriate, corrections may be made to records by authorized personnel (e.g., originating personnel or organization, QA personnel). Corrections shall be made by drawing a single line through the incorrect information on hard copies, making the correct entry, and initialing and dating the revised entry. Electronic files in the archives shall be write-protected. If changes to an electronic file are required, both the original and the backup copies shall be replaced entirely.

#### **4.3.2 Records Retention**

All validated data supporting Fernald Preserve CERCLA decisions shall be submitted to the Administrative Record Coordinator. Copies of all other environmental sampling and analysis files shall be submitted to the Administrative Record Coordinator for inclusion in the Administrative Record. Following the receipt of information from external sources and the issuance of reports, associated records (including those generated by subcontractors) shall be placed in the CERCLA Administrative Record or the Post-ROD files as required.

Files shall also include correspondence, data, and references supporting entries into the CERCLA Administrative Record and the Post-ROD files; supporting documentation for

CERCLA-driven programs; and supporting documentation for CERCLA-covered programs. Documents exempt from the Freedom of Information Act (e.g., personal dosimetry, urinalysis, and medical records) are specifically excluded from these requirements. Each Fernald Preserve contractor and subcontractor shall maintain project files as required.

Records shall be identified by source and date of receipt. Files shall be identified by project, subject, and task and by keywords in a central file database management system. Files shall be maintained for the length of time specified in DOE and/or EPA records management guidelines.

#### **4.3.3 Records Facility**

Files shall be located in an area that, at a minimum, provides the following:

- Suitable environment to prevent record deterioration, damage, and loss.
- Controlled access.
- Steel file cabinets.
- Protection against excess moisture and temperature extremes.
- A record review area, if practical.

#### **4.3.4 Records Handling**

Files and records contained in project files shall be maintained by designated personnel who are responsible for the following:

- Review of incoming records for original receipt date prior to filing.
- Indexing.
- Filing in labeled folders or binders as applicable.
- Maintaining sign-out sheet.

#### **4.3.5 Records Index**

A numbered index for each project file shall be prepared and maintained in the project records storage area. The index shall list individual file numbers and identify records therein and may be part of an electronic database management system with appropriate backup.

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## **5.0 Field Activities**

Requirements provided in this section pertain to recordkeeping and actions that are distinct from the actual act of physically collecting a sample. Sample collection requirements are detailed in Section 6, and COC requirements are listed in Section 7. All field activities must be performed in accordance with the Applicable or Relevant and Appropriate Requirements (ARARs) for the Fernald Preserve.

### **5.1 Responsibilities**

#### **5.1.1 Project Manager**

The project manager shall also be responsible for ensuring that all activities are conducted in accordance with the ARARs for the project under his or her control. The project manager is responsible for securing all permits per state, local, and site requirements. The project manager shall determine the need for either a geologist or a field technician with applicable experience based on the activity being performed, the technical specifications required, and the potential for subsurface cross-contamination. The project manager is responsible for defining, documenting, and communicating the project objectives to the geologist and field activity team members.

#### **5.1.2 Geologist**

A geologist (geologist, hydrogeologist, or geological engineer) is responsible for the technical oversight and proper documentation of field activities described in this section. The geologist shall be responsible for the safe and prompt completion of project activities. A geologist must be present for oversight responsibility of all the following activities:

- Well installation.
- Well abandonment.
- Drilling, when lithologic description is required.

#### **5.1.3 Field Activity Team Leader**

The sampling team leader is responsible for implementing the requirements of the sampling plan, including the following:

- Ensure that team members follow specified procedures.
- Ensure that work is completed in a safe and efficient manner.
- Ensure that documentation is maintained and completed as specified in this document and in procedures identified in the sampling plan.
- Ensure communication with the project manager or designee concerning progress.

#### **5.1.4 Field Activity Team Members**

Members of the sampling team are responsible for performing field or sampling activities under the supervision of the team leader and as specified in sampling plans and procedures. If sampling

plan or procedure requirements cannot be performed as specified, field activity team members shall notify the project manager and modification will be addressed as a variance.

Team members shall ensure that documentation is maintained and completed as specified in this document and in procedures identified in the sampling plans. They shall observe health and safety and environmental requirements, ensuring that work is completed in a safe and efficient manner and is protective of the environment. Team member shall inform the team leader of progress and concerns.

## **5.2 Field Documentation**

Field documentation consists of written or electronic records of activities and measurements conducted in the field on a given date. Documentation shall be completed in the field and compiled as a package following the completion of the day's activities. The pages contained in the field documentation package shall be sequentially numbered. Field documentation shall be stored in a secure area when not in use and shall be maintained as a record as described in Section 4.

Field documentation (hard-copy or electronically generated field data) includes, but is not limited to, the following:

- All logs generated during the installation, development, or abandonment of monitoring wells and boreholes.
- Test data forms.
- Field activity logs.
- Sample collection logs (Section 6).
- COC records (Section 7).

The following shall be performed for all hard-copy field forms.

- Record all field measurements and comments using indelible black or blue ink in the appropriate field logs as specified by the sampling plan.
- If the information requested on a form is not applicable or is not known, insert an "NA" (not applicable) or "NK" (not known) as appropriate.
- Line out any unused portions of the page or form by drawing a line across the empty area, and initial and date the line.
- If requirements cannot be performed as described in the sampling plan, a variance must be approved (Section 3).
- Identify photographs with the project name, date and time taken (using 24-hour time), and a brief description on the back of each photograph.
- Ensure that field documentation is subjected to peer review.
- Original field documentation shall be maintained as records.

### **5.2.1 Field Activity Log**

A field activity log is a narrative record of events occurring during the field activity and shall be written in a sequential manner that sufficiently describes the event so that the sampling team may reconstruct that event without reliance on memory. Entries should be objective, factual and free of personal feelings or other terminology that might prove inappropriate. The geologist or team member supervising the activities shall be responsible for entries in the daily log.

The field activity log shall include, but not be limited to, the following information:

- Subject of field activity.
- General work activity.
- Unusual events.
- Visitors at the site.
- Calibration checks.
- Subcontractor progress and specifications.
- Communication with regulatory agencies or others.
- Weather conditions.

### **5.2.2 Subsurface Borehole Log**

The geologist is responsible for preparing subsurface borehole logs in the field. At a minimum, the log shall provide the following information:

- Location identifier.
- Coordinates and surface elevation as surveyed by a licensed surveyor.
- Drilling start and completed dates.
- Geologist.
- Drilling rig make/model.
- Drilling contractor.
- Standard penetration test (if applicable).
- Footage drilled.
- Materials penetrated.
- Depth to significant changes in lithology.
- Samples collected, if applicable (identified by depth, time, sample number, and collection method).
- Amount of sample recovery.
- Qualitative degree of saturation of each sample.
- Qualitative degree of plasticity of each sample.
- Depth to saturated zones and potential confining beds.

- Unified Soil Classification System (USCS) symbol for each sample.
- Fluid losses, if applicable.
- Color of sample (using Munsell color chart).

### **5.2.3 Borehole Abandonment Record**

The geologist or team member is responsible for completing the borehole abandonment record. At a minimum, the borehole abandonment record shall provide the following information:

- Borehole identifier.
- Geologist.
- Date.
- Water level.
- Drilling method.
- Borehole diameter.
- Borehole depth.
- Type and amount of materials used.
- Depths at which materials were placed.

### **5.2.4 Well Completion Log**

The geologist is responsible for completing a well completion log. The well completion log shall illustrate a cross section of the screen, filter packs, and seals. At a minimum, the well completion log shall provide the following information:

- Well identifier.
- Geologist.
- Date.
- Drilling rig make/model.
- Drilling contractor.
- Installation start and completion dates.
- Drilling method.
- Coordinates, surface elevation, and reference point on top of protective casing as surveyed by a licensed surveyor.
- Water level.
- Volume of water lost during drilling (if used).
- Borehole depth.
- Well depth.
- Well screen material, wall thickness, slot size, type, depth (top and bottom), length, diameter.

- Well riser material, wall thickness, diameter.
- Volume, type, thickness, and depth to top of filter pack.
- Volume, type, thickness and depth to top of bentonite seal.
- Volume, type, and depth to top of grout.
- Dimensions of concrete surface pad and thickness of concrete seal.
- Height of riser above ground surface.
- Height of protective casing above ground surface.

### **5.2.5 Plugging and Abandonment Record**

The geologist or team member is responsible for completing a plugging and abandonment record. At a minimum, the plugging and abandonment record shall provide the following information:

- Borehole identifier.
- Geologist.
- Date.
- Drilling subcontractor.
- Plugging and abandonment start and completion dates.
- Water level.
- Reason for plugging and abandonment of well.
- Method of plugging and abandonment.
- Types and volumes of materials used for plugging.
- Depths at which materials were placed.
- Condition of well materials.
- Differences in well from information recorded on well installation records.

### **5.2.6 Monitoring Well Development Form**

The geologist or team member is responsible for completing a monitoring well development form. At a minimum, the monitoring well development form shall provide the following information:

- Well identifier.
- Geologist.
- Date.
- Development start and completion dates and times.
- Water level before and after development.
- Total depth of well before and after development.

- Total volume of water to be removed.
- Type of development equipment used.
- Description of development method.
- Total volume of water removed and time of removal.
- Water quality field parameter data taken at regular intervals during development.
- Description of water/sediment removed.

### **5.3 Field Activity Requirements**

The following general requirements for field activities are supplemented by specific requirements listed in sampling plans. The field activity team leader shall ensure that underground and aboveground utilities are located and avoided to protect field personnel.

#### **5.3.1 Drilling**

The nature, arrangement, thickness, and extent of subsurface strata can be determined by implementing a well-designed drilling program. Number, location, and depth of borings and type of sampling and testing required depend on the intended use of the data generated. The type of drilling method selected for a particular project at the Fernald Preserve depends on project objectives. Factors to be considered in selecting a drilling method include the ability to acquire data of sufficient quality for the intended use, the need to maintain environmental integrity (preventing the possible spread of contaminants during drilling operations), and personnel health and safety. The particular drilling method shall be specified in the sampling plan.

Descriptions of various drilling methods are presented in Driscoll (1986), Aller et al. (1989), and OEPA (2008). Drilling methods that may be considered for use at the Fernald Preserve mainly include rotasonic, cable tool, and hollow-stem auger. Although direct-push technology is not generally considered a drilling method, this technique may be used to obtain soil samples by using coring methods, to collect groundwater samples by using temporary screen points, and install small diameter wells.

Drilling operations shall be conducted to minimize, to the maximum extent possible, the introduction of contaminants into the environment or their spread between subsurface zones. Surface casing shall be set when a potentially contaminated zone is penetrated prior to reaching the target zone.

Consistent with the Fernald Preserve policy of waste minimization, the chosen drilling method shall require the minimization of drilling fluid use and generate the fewest possible cuttings and the least waste. The sampling plan shall specify how drilling wastes shall be contained. In general, cuttings may be spread on the ground at the drilling locations.

Potable water from a public water system shall be used for drilling operations. If extenuating circumstances dictate that another source must be used, the quality of the other water source used shall be documented through water certification or analysis prior to use. Water shall be transported from the source to the drill site in a clean, approved container.

The project manager shall approve additives used in drilling fluids prior to use. Before an additive is approved, a sample shall be analyzed for parameters of interest and the results reviewed for potential impact on the objectives of the data collection program. Use of additives is discouraged.

As specified in Section 6, drilling equipment shall be decontaminated before each use to prevent contamination of the boring. Following project completion, the drilling equipment shall be decontaminated to prevent transport of contaminants out of the project area.

A geologist shall be responsible for operations at each drilling site and shall be at the field site during selected drilling activities as specified in Section 5.1.2. The geologist assigned to this project role is also responsible for logging activities at the work site, including, but not limited to, drilling and sampling activities, footage drilled, materials used, sample descriptions, well installation activities, and unusual occurrences. Subsurface borehole logs shall be generated for each boring. Requirements for soil and groundwater samples collected during drilling are specified in Section 6.

Underground and aboveground utilities hazards shall be identified and mitigated to protect personnel involved in drilling operations. Copies of the appropriate health and safety documentation shall be available at the work site when drilling operations are conducted.

### **5.3.2 Well Design and Construction**

For clarity, the term “well” shall include groundwater monitoring points such as monitoring wells, CMT wells, lysimeters, extraction wells, injection wells, and production wells. Monitoring well types are defined in Section 2.

#### **5.3.2.1 Well Construction Materials**

Schedule-40 polyvinyl chloride (PVC) or 316 stainless-steel casing with flush-thread joints shall be used for well construction. The casing type selected depends on the presence of known or suspected contaminants, the proposed depth, and the purpose of the well. If conditions are highly corrosive, then PVC should be used in place of stainless steel. Commercial wire-wound stainless-steel or PVC screens with flush-thread joints compatible with the well casing shall be used. The size of screen openings shall be based on effective grain size of monitored zone and filter pack size, or by using data obtained from previous wells that are screened in similar geologic formations and located adjacent to the well being placed. Use of glues or solvents is prohibited.

CMT wells are made of 3- or 7-channel, continuous polyethylene tubing. Screen shall be made of stainless-steel mesh and clamped to tubing with stainless-steel clamps.

Screen openings shall be capable of catching between 85 and 100 percent of the filter pack material to allow accurate measurement of hydraulic properties, minimize turbulence during sample collection, and optimize capacity to develop the well completely and efficiently. Slotted or wound PVC screens with flush-thread joints compatible with the well casing may be used in wells.

Filter pack material shall be well-sorted quartz sand, or the aquifer shall be allowed to naturally collapse during retrieval of the drill rods as specified in the sampling plan. In general, historical data is used for filter pack grain size determination; sieve analysis (Driscoll 1986) of the natural formation can also be used. Prior to the use of any filter pack material, the materials used must be inspected by the geologist to ensure that they have not been compromised and that sampling plan requirements are met.

Bentonite pellets shall be used as a seal above the sand filter pack prior to placement of grout slurry. Annular grout must consist of a slurry of high-solids bentonite mixed to manufacturer specifications. Bentonite mixtures used to seal the annular space must conform to the density standard of 9.4 pounds per gallon (lb/gal). Grout density will be verified by mud balance measurements prior to and during placement of the grout. If grout density in the annulus is less than required, then the grout shall be pumped from the annulus until the 9.4 lb/gal standard is reached. Grout purged from the borehole cannot be reused. Cuttings from the borehole shall never be used as an annular seal.

The top 30 inches of annular space shall be sealed with concrete. The protective casing will be placed in the concrete seal before the concrete sets up.

The use of flush mount completions is discouraged because the design increases the potential for surface water infiltration. Additional precautions must be taken if the use of flush mount completions is inevitable; these design modifications shall be detailed in the sampling plan.

#### 5.3.2.2 Well Construction

The geologist will inspect the physical installation of wells by utilizing the following criteria:

- Borehole depth and diameter are consistent with sampling plan specifications.
- Materials used for construction of each monitoring well must meet applicable sampling plan specifications (e.g., filter pack material, screen length and slot size, casing length). This will include verification of volume calculations and actual volumes used.
- Materials are installed in accordance with FPQAPP requirements.
- Bentonite grout entering the borehole has been density tested using a mud balance and is consistent with manufacturer's specifications.

After drilling is complete and the borehole has been cleaned of cuttings, the well will be constructed. Drill casings shall be removed gradually and backfill materials shall be installed so that the bottom of the temporary casing or augers is kept below the top of the backfill materials. Depths of filter pack, bentonite seal, and grout shall be recorded. The well cap shall be placed on the well casing prior to bentonite grout placement to prevent bentonite grout from entering the well.

Wells screened in the glacial overburden and wells screened across the GMA water table (Type 1 and Type 2 wells) shall be installed as follows:

- Place required length of screen and riser inside the open borehole, temporary casing, or hollow-stem augers.
- Make periodic measurements to check uniform placement of the filter pack.
- Install a filter pack to a height of 2 to 5 ft above the screen in Type 1 wells and a minimum of 5 ft above the screen in Type 2 wells.
- Install a 2- to 5-ft bentonite seal on top of the filter pack for Type 1 wells and a minimum of 5 ft above the filter pack centered at the glacial overburden/aquifer contact in Type 2 wells.
- Hydrate the bentonite seal material with sufficient volume of water.
- Install grout from the top of the bentonite seal to within 30 inches of the ground surface by side-discharge tremie line method.

Install wells screened in the middle of the GMA (Type 3 and Type 6 wells) as follows:

- Place required length of screen and riser inside the open borehole, temporary casing, or hollow-stem augers.
- Install a filter pack to a minimum height of 5 ft above the screen.
- Allow native material to collapse and fill the annulus from the top of the filter pack.
- Install a 5-ft bentonite seal on top of the native material centered at the glacial overburden/aquifer contact.
- Install grout from the bentonite seal to within 30 inches of the ground surface by side-discharge tremie line method.

Install wells screened at the base of the GMA (Type 4 wells) as follows:

- Place required length of screen and riser inside the open borehole, temporary casing, or hollow-stem augers.
- Install a filter pack to a minimum height of 5 ft above the screen.
- If the interbedded clay layer is present, allow native material to collapse and fill the annulus from the top of the filter pack to within 5 ft of the base of the interbedded clay layer. Install a bentonite seal from 5 ft below the base of the clay to 5 ft above the top of the interbedded clay layer.
- Allow native material to collapse and fill the annulus.
- Install a 5-ft bentonite seal centered at the glacial overburden/aquifer contact.
- Install grout from the bentonite seal to within 30 inches of the ground surface by side-discharge tremie line method.

Install CMT (Type 8) using the following requirements and per the sampling plan:

- Place required length of constructed CMT inside drilling rods.
- Remove drilling rods, allowing formation to collapse around the CMT to top of the water table.
- Install artificial filter pack to approximately 2.5 ft below the glacial overburden. If glacial overburden is not present, then install sand to 5 ft above the highest screened interval.
- Place a minimum of 5 ft of bentonite pellet/chip seal centered at the glacial overburden/aquifer contact.
- Install grout with a side-discharge hose to within 30 inches of ground surface.

The geologist shall inspect the borehole 24 hours after completion of grouting to ensure that the grout level has not settled. If the grout has settled below 30 inches from the ground surface, additional grout shall be added, as necessary.

The riser shall be cut off to measure 24 to 30 inches above ground surface, and a vented well cap shall be placed on the well. A 5-ft-long carbon steel pipe, minimum ¼-inch thick, and at least 4 inches greater in diameter than the well riser, shall be used as a protective casing. The protective casing shall have a hinged cap, hasp, and lock. The protective casing shall be primed and painted with high-visibility orange paint. The ambient temperature must be within manufacturer's specifications before applying paint and primer. After painting, the well location identification number shall be marked on the inside of cover and welded, stamped, engraved, or permanently painted on top of locking cover.

The top 30 inches of the annular borehole space shall be sealed with concrete. The protective casing shall be a minimum of 2 inches larger in diameter than the well and shall be placed so that it is within 4 inches of top of the well casing. The height of the concrete inside the protective casing shall be higher than the surrounding concrete pad. Drain holes, a minimum of ¼-inch in diameter, shall be drilled in the protective casing just above the inner concrete surface. To discourage insects, sand can be placed in the annular space above the concrete so that the drain hole is covered.

The concrete pad shall have a minimum height of 2 inches above the ground surface and 2 inches below grade, and shall extend a minimum 12 inches from the protective casing. The concrete pad shall be sloped sufficiently to drain water away from the well. The surrounding ground surface shall be re-graded so that water drains away from well head; disturbed areas around the well shall be restored to as close to original conditions as possible.

Special precautions shall be taken if it is necessary to install concrete when temperatures are below 45 °F. The use of salts and chemicals to affect cold weather placement shall not be permitted. All ice, snow, and frost shall be completely removed from surfaces that will be in contact with concrete before the concrete is placed. Concrete shall not be placed on a frozen subgrade or on a subgrade that contains frozen materials. If placements are to be made during freezing weather (32 °F or less), the ground on which the concrete is to be placed shall be heated for 12 hours at a minimum before any concrete is placed. Concrete shall be protected from freezing by adequate covering for seven days. Field activities and measurements shall be documented on the applicable forms as described in Section 5.2.

### 5.3.3 Well Development

Wells must be properly developed to yield accurate aquifer test results and groundwater samples representative of aquifer conditions. Well development may be conducted using bailers, submersible, bladder, inertial or peristaltic pumps. Surging techniques using surgeblocks are recommended in relatively high-yield aquifers. Excessive drawdown must be avoided. To avoid pumping/bailing a well dry and to prevent damage to the pumps by allowing them to pump air, reduce the purge rate if necessary. Dispersing agents, disinfectants, or acids shall not be used during the well development process. Equipment and materials used for well development shall be decontaminated as specified in Section 6 prior to use at each well location.

Wells shall be developed as soon as possible after well installation, but no sooner than 48 hours after grouting is completed. Development shall continue until the water is visually clear and turbidity, temperature, pH, and specific conductance have stabilized (i.e., turbidity  $\pm 10$  percent, temperature  $\pm 10^{\circ}\text{C}$ , pH  $\pm 0.1$  standard unit, specific conductance  $\pm 3$  percent) over at least 3 consecutive well volumes.

A minimum of five times the standing water volume in the well (water in well screen and casing plus saturated filter pack) shall be removed during well development. During development, an attempt shall be made to remove standing water from over the entire length of the screen and from the entire water column. If recharge is so slow that the required amount of water cannot be removed in a reasonable amount of time, or if the water contains visible particulates after the five-volume removal, contact the project manager for direction to use an alternate procedure. If it appears necessary to add water to the well to assist development, obtain written approval from the project manager before proceeding.

If the boring was made or enlarged using drilling fluid (water), five times the measured amount of total fluids lost during drilling in addition to the five times the amount of standing water volume shall be removed. If slow recharge, discoloration, or particulate-laden water is a problem, then contact the project manager.

Field measurements and comments shall be recorded on the applicable monitoring well development form as described in Section 5.2.6.

### 5.3.4 Well Maintenance

Well maintenance is required to ensure that the monitoring well is protective of the environment, to ensure the collection of representative samples, and to extend the life of the monitoring well. The LMS contractor shall conduct an inspection of groundwater wells and evaluate structural integrity and wellhead protection. If problems are noted, existing groundwater wells shall be evaluated prior to use to assess whether the status will allow for collection of representative groundwater samples. Maintenance shall be performed on a case-by-case basis pursuant to the results of the inspection. The project manager shall be notified of the results of the routine inspections if problems are noted.

Routine inspections of monitoring wells include the following at a minimum:

- Inspection of the ground around the monitoring well for depressions or channels that allow surface water to collect or flow towards the well. The surface must be regraded so that water flows away from the well on all sides.
- Inspection of the integrity of the locking mechanism and well cap. The locking mechanism and/or well cap must be replaced if they have been tampered with or may compromise the security of the well.
- Inspection of concrete surface seals inside and outside of the protective casing for settling and cracking. Concrete surface seals must be completely removed and replaced if settling or cracking has occurred.
- Ensure the well is visible in high traffic areas. To protect the well from vehicular damage, it may be necessary to install protective posts. Additional protective measures include installing construction fence around well and ensuring vegetative growth is cut, as appropriate.

For wells that are sampled routinely, inspections also include the following:

- Inspection of the well cap to ensure that it is free of debris and fits securely and the vent hole is clear. Well caps must be replaced as necessary.
- Measurement of the bottom of the well to determine if sediment is accumulating in the well. If the sediment covers 20 percent of the screened area, then the sediment must be removed by either pumping the accumulated sediment from the well or completely redeveloping the well, as appropriate. If defects or damage to well screens or casing are suspected, downhole camera surveys may be conducted to determine the condition of the monitoring well.
- Evaluation of the turbidity of the sample. Historical field documentation will be reviewed to determine whether the turbidity is increasing with each sampling event. Increasing turbidity measurements may indicate the need for redevelopment of the monitoring well or, if redevelopment is unsuccessful, the well may require plugging and abandoning. As with accumulation of sediment, downhole camera surveys may be necessary to determine the condition of the monitoring well.

If well maintenance or inspection activities indicate a problem with the well, then the project manager must determine whether the well should be repaired or abandoned in accordance with the FPQAPP. If a monitoring well has been damaged beyond repair so that it is no longer protective of the environment, then the well must be plugged and abandoned. If it is determined that the well does not yield representative samples and rehabilitation efforts are not effective in improving the condition of the monitoring well, the monitoring well must be abandoned. Well abandonment and repair shall be performed and documented in compliance with applicable EPA and OEPA regulations and the FPQAPP.

### **5.3.5 Borehole and Well Abandonment**

Proper abandonment is necessary to maintain a credible monitoring program. Improperly abandoned wells or boreholes can serve as a pathway for pollutants to migrate from one zone to another. Objectives of proper well and borehole abandonment include the following:

- Eliminate physical hazards.
- Prevent groundwater contamination.
- Conserve aquifer yield and hydrostatic head.
- Prevent intermixing of subsurface waters (Aller et al. 1989).
- Comply with reasonable requests from property owners.
- Remove a well that is no longer necessary to support Fernald Preserve project activities.
- Remove a well that does not yield groundwater data representative of conditions in the monitored hydrogeologic zone.
- Comply with OU5 ARARs for abandoning test holes and wells, as specified in OAC 3745-9-10.

Boreholes that are not converted into monitoring wells must be properly sealed following completion of sampling activities. Borehole abandonment shall be completed as soon as possible following the completion of sampling objectives. Prior to permanent abandonment, precautions will be taken to mechanically secure the borehole during work stoppages of more than 2 hours.

#### 5.3.5.1 Hand-Augered Borehole Abandonment

Hand-augered boreholes will generally be limited to 4 inches or less in diameter and 8 ft or less below the ground surface, depending on geologic materials present in the subsurface.

For borings no greater than 1 ft deep, the borehole shall be abandoned by backfilling with the excavated soil, and the surface shall be regraded.

For hand-augered borings greater than 1 ft in depth, hydrated bentonite pellets, bentonite grout, cement, or other material as specified in the sampling plan shall be used to plug and abandon the hole to within 30 inches of the ground surface. The materials will be placed into the boring in increments of approximately 2 ft. For bentonite pellets, a sufficient volume of potable water will be poured over each increment of bentonite, allowing several minutes between increments for adequate hydration of the pellets to occur. The top 30 inches will then be backfilled, compacted, and graded with surrounding top soil or excess cuttings. Field activities and measurements shall be documented on the applicable forms as described in Section 5.2.

#### 5.3.5.2 Drilled Boreholes

Drilled boreholes shall be abandoned using bentonite grout unless otherwise specified in the sampling plan. For boreholes completed in dry, stable materials, augers and casings may be removed and grout inserted from the bottom of the hole using a side-discharge tremie line. For boreholes completed in unstable materials, the augers or casing shall be used to prevent the collapse of the borehole as the grout is inserted. The grout level shall be maintained above the bottom of the augers or casing as the grout is inserted and the augers or casing is removed.

Boreholes completed in the GMA shall be allowed to collapse to 5 ft beneath the top of the GMA or to 5 ft beneath the clay interbed, if present, prior to installation of plugging material. If a borehole will not collapse, use sand as a plugging material to a depth of 5 ft beneath the top of

the GMA or the clay interbed, if present. The depth to the top of the seal shall be measured periodically throughout the process to ensure that bridging has not occurred. A minimum of five feet of bentonite pellets shall be placed on top of the sand and the pellets shall be hydrated. Pellets shall be poured into the borehole in 2-ft increments and a sufficient volume of potable water shall cover each increment of bentonite, allowing a minimum of 5 minutes between increments for adequate hydration of the pellets to occur. Bentonite grout shall be placed to 30 inches below the surface using a side-discharge tremie hose.

The borehole shall be inspected 24 hours after completion to ensure that the grout level has not settled. If the grout has settled below 30 inches from the ground surface, additional grout shall be added as needed. The top 30 inches will then be backfilled, compacted, and graded with surrounding top soil or excess cuttings.

Field measurements and comments shall be recorded on the applicable form as described in Section 5.2.

#### 5.3.5.3 Direct-Push Boreholes

Bentonite grout shall be used for plugging direct-push boreholes unless otherwise specified in the sampling plan. If the borehole does not extend into the GMA, then grout may be emplaced to the surface through probe rods. If the borehole extends into the GMA, then the end of the probe rods shall be placed 5 ft above the groundwater table and the GMA allowed to collapse. If the GMA does not collapse more than 5 ft above the water table, then at least 2 ft of 20/40 sand shall be tremied through the probe rods. Bentonite grout shall be placed to the surface through the probe rods; the probe rods shall be removed from the borehole slowly, ensuring that the grout level stays inside the probe rods as the rods are removed.

Boreholes shall be inspected 24 hours after grouting to ensure that the grout level has not settled. If the grout has settled, more grout shall be added until it is flush with the surface. If the borehole is located on a paved surface, concrete shall be used to seal the top 6 inches of the borehole.

Field measurements and comments shall be recorded on the applicable form as described in Section 5.2.

#### 5.3.5.4 Well Abandonment

No single method of plugging and abandonment is suitable for all wells. When selecting the appropriate method for plugging and abandonment, each well must be evaluated individually, and all aspects of the well's construction, location, and hydrogeologic environment must be considered. Detailed instructions for plugging and abandoning a specific well are provided in the sampling plans for each plugging and abandonment project.

The concrete pad and protective casing shall be removed from around the well. The protective casing may be removed with the well riser, if pulled as a single unit. During the material placement process, depths of materials shall be measured in the borehole and recorded on the well abandonment form.

If the well riser and screen are to be completely removed, the following requirements apply to Type 1 PVC wells:

- If possible, push the bottom out of the well.
- Place grout into the borehole through the well riser while pulling well riser and screen, using a side-discharge tremie hose from the bottom to the top. Maintain a grout level approximately 5 ft inside the well screen while removing the well riser and screen from the borehole.
- Pull well riser and screen slowly from the ground.

If the well riser and screen are to be completely removed, the following requirements apply to Type 1 stainless-steel and all Type 2, 3, 4, and 6 wells:

- Pull well riser and screen slowly from the ground.
- Allow the native material to collapse to a depth of 5 ft below the glacial overburden/aquifer contact. If the sands do not collapse, fill the aquifer interval with sand before grouting.
- After complete removal of the well riser and screen, measure the borehole depth to ensure the borehole walls above the aquifer did not collapse.
- Place a minimum of 5 ft of bentonite pellets centered on the glacial overburden/aquifer contact and hydrate the pellets, if necessary.
- Place grout in the borehole, using a side-discharge tremie hose from the bentonite seal to the top.
- If required, install a concrete plug from 30 inches below the surface, flush to the surface.

If the well is to be overdrilled, the following requirements apply:

- Ensure the outside diameter of the drilling tool is at least as large as the original borehole.
- Overdrill the boring to a depth of at least 1 ft below the depth of the original borehole.
- For Type 2, 3, 4, 6, or 8 wells, allow native material to collapse to a depth of 5 ft below the till. If the native materials do not collapse, fill the borehole with sand to 5 ft below the till.
- Place a minimum of 5 ft of bentonite pellets centered on the glacial overburden/aquifer contact and hydrate the pellets, if necessary.
- Place grout in the borehole, using a side-discharge tremie hose from the bentonite seal to the top.
- If required, install a concrete plug from 30 inches below the surface, flush to the surface.

If the well is to be partially removed, the following requirements apply:

- Place sand in the screened interval to a minimum of 2 ft above the top of the screen.
- Place sand to 5 ft below the base of the glacial overburden, if necessary.
- Cut the well riser a minimum of 5 ft below the base of the till.
- Insert grout, using a side-discharge tremie hose while pulling the well riser.

- Maintain a grout level approximately 5 ft inside the well riser while removing the well riser from the borehole.
- If required, install a concrete plug from 30 inches below the surface, flush to the surface.

Following grouting of the borehole, inspect the borehole after 24 hours to ensure the grout level has not settled. If the grout has settled below 30 inches from the ground surface, add additional grout as needed.

Field measurements and comments shall be recorded on the applicable form as described in Section 5.2.

## 6.0 Sampling Methods

Samples are collected at the Fernald Preserve to provide data for specific project objectives (Section 3 for the scope of projects covered by this document). All sampling activities must be performed in accordance with the ARARs for the Fernald Preserve. This section identifies the minimum requirements for the most common types of sampling performed at the site and the field storage and shipment of those samples. Additional requirements may also be described in sampling plans.

The following general requirements apply to all sampling activities covered by this document:

- Ensure that all documentation is accurate and complete.
- Ensure that sampling equipment that may contact the sample during collection is constructed of materials that will not contribute to or react with the constituents of concern.
- Wear clean, disposable nitrile gloves when handling samples; change gloves between sampling location or as the gloves become compromised.
- Do not place sampling equipment directly on the ground or on other potentially contaminated surfaces prior to sampling. Place equipment on a clean plastic sheet adjacent to the sampling point, if necessary.
- Document all field activities completely and accurately as they are performed.
- Maintain proper sample custody at all times (Section 7.0).

### 6.1 Responsibilities

#### 6.1.1 Project Manager

The project manager is responsible for scoping the project through a DQO and sampling plan (Section 3). The project manager is also responsible for ensuring that all activities are conducted in accordance with the ARARs for the project.

#### 6.1.2 Sampling Project Manager

The sampling project manager is responsible for coordinating the day-to-day activities to ensure the most efficient and effective lines of communication are established. The sampling project manager is responsible for implementing requirements of the sampling plan, including the following:

- Ensure that team members follow specified procedures.
- Ensure that work is completed in a safe and efficient manner.
- Ensure that documentation is maintained and completed as specified in this document and procedures specified in the sampling plan.
- Ensure communication with the sampling project manager or a designee concerning progress.

### 6.1.3 Sampling Team Members

Members of the sampling team are responsible for performing sampling activities under the supervision of the sampling project manager as specified in sampling plans. They shall observe health and safety requirements, ensuring that work is completed in a safe and efficient manner. Team members are responsible for informing the sampling project manager of progress and concerns.

## 6.2 Sample Collection Forms

Information in activity-specific logs (including sample collection forms) shall be written in such a manner that the sampling team may reconstruct that event without reliance on memory. Hard-copy sample collection forms and/or electronically generated field data forms shall be completed for all sampling activities throughout the performance of field activity and are considered part of the daily log (Section 5). Specific information about sampling location and collection shall be recorded on the forms, including the following minimum information:

- Project name.
- Sample identifier and/or description of sampling points (e.g., east bank of Great Miami River 500 ft upstream of confluence with Paddys Run).
- Sampling date or dates.
- Sample screen results (e.g., organic or radiological measurements), if applicable.
- Start and finish time of sampling activity and sample collection times.
- Weather conditions, including significant changes during the activity.
- Sample numbers.
- Field measurements.
- Visual description of samples.
- Unusual occurrences (e.g., “semivolatile sample could not be collected because of insufficient recovery of well” or “truck passed while sampling, stirring up significant volume of dust upwind of sample collection site”).
- Sampling team members.
- Types and identification numbers of equipment used.
- Calibration information.

Field data may also be entered electronically in the field at the time of data collection. This electronically generated field data and field data collected manually will be downloaded into a database where it is controlled, secured, and backed up in accordance with Section 13.

A groundwater sample collection form shall be completed for each sample and shall include the following information:

- Description of water level measuring point (e.g., top of well, top of protective casing).
- Depth to water.

- Measured depth of well, if applicable.
- Depth of well from well construction diagram.
- Well casing diameter from well installation records.
- Calculated well purge volume.
- Actual volume removed during purging and maximum rate of purge.
- Estimated depth (sample depth) to pump intake at start and finish of pumping.

### **6.3 Sample Container Preservation**

Certain samples must be preserved to minimize the degradation of the constituents of concern prior to analysis. Methods of preservation retard biological action, retard hydrolysis of chemical compounds and complexes, reduce volatility of constituents, and reduce absorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and freezing. The required preservatives for constituents of concern are detailed in the sampling plan. If requested, sample containers may be prepared in a sample preparation area with pre-measured amounts of appropriate chemical preservatives and sent to the field.

### **6.4 Collection of Aqueous Samples**

Aqueous samples include natural and wastewaters; groundwater and surface water are defined for the purpose of this document as natural waters. Aqueous samples collected for process control are not within the scope of this document. The following are specific types of aqueous samples collected at the Fernald Preserve:

- Groundwater from monitoring wells, extraction wells, and private wells.
- Surface water from the Great Miami River, Paddys Run, and other surface bodies of water.
- Wastewater from the treatment system collected to determine compliance with ARARs.

#### **6.4.1 Field Analytical Requirements for Natural Water Samples**

Temperature, pH, and specific conductance shall be measured in the field and documented on groundwater and surface water sample collection forms. Other measurements (including, but not limited to, dissolved oxygen [DO], turbidity, and oxidation-reduction potential [ORP]) may be specified for certain projects. These field parameters shall be measured on unpreserved samples; field measurements shall be made on both the unfiltered and filtered (if collected) portions of the sample. Surface water and wastewater measurements may be collected directly from the surface water or wastewater body. Groundwater field measurements may also be taken in situ (downhole) to avoid changes that might occur if the sample is removed from the well.

Meters shall be properly calibrated in accordance with manufacturer's recommendations and Section 11. Preparation of calibration solutions shall be documented when prepared. Calibration of pH, ORP and DO generally occur daily prior to use in the field. Meters for pH measurement shall be calibrated with a two-point calibration by using two solutions that bracket the expected pH range of the sample. Calibration of DO probes shall be completed at least once a day when in

use. A conductivity meter shall be checked with one standard solution prior to being used for measurement in the field.

Any meters that are outside of tolerance limits specified by the manufacturer or individual meter SOPs shall not be used in the field until maintenance and calibration are successfully completed. All calibration and recalibration checks shall be recorded on the appropriate field activity log.

To measure field parameters of a water sample, the calibrated probe end should first be cleaned in deionized water and then immersed in the field sample. The probe should be suspended away from the sides and bottom of the container (if used) or above the sediments if measuring directly from the surface water or wastewater body.

DO, ORP, and turbidity are especially sensitive to measurement techniques. DO sensors that consume oxygen during measurement require flow across the sensors at approximately 1 ft per second. This can be accomplished using flow cells, or if measurements are performed in natural waters, by moving the sensors through stagnant water. Other types of DO sensors may not be flow sensitive. ORP is measured in situ or using a flow cell or similar device that prevents atmospheric contamination of the water sample. Because turbidity is sensitive to a number of variables, the measurement shall be made in the field, either in situ (e.g., directly in a well or stream) or as soon as possible after sample collection.

Meters shall be given adequate response time to provide measurements based on manufacturer's recommendations. All field readings shall be documented on the appropriate field forms. Meters shall be properly stored in accordance with the manufacturer's recommendations.

#### 6.4.1.1 Temperature

Surface water and groundwater temperatures are required to normalize data from other analytical determinations such as pH, specific conductance, and DO. At a minimum, a standard thermometer or combination meter equipped with a temperature sensor, accurate to  $\pm 0.5$  °C or a metal-cased, direct-reading thermocouple with a normal range of 0 to 50 °C accurate to  $\pm 0.5$  °C is required.

#### 6.4.1.2 pH

The pH measurements shall be acquired using a standard pH meter or a combination meter that is direct-reading and temperature-compensating with an expanded scale capable of measuring pH to the nearest 0.10 standard unit over a temperature range of 0 to 40 °C; response time of the instrument shall be less than two minutes. The pH meter shall be calibrated with pH 7.0, pH 4.0, or pH 10.0 buffer, depending on expected pH range of the sample.

#### 6.4.1.3 Specific Conductance

Specific conductance is sensitive to a number of variables and the measurement shall be made in the field, either in situ (e.g., directly in a well or stream) or as soon as possible after sample collection. Conductivity meters or combination meters shall be temperature-compensating. The instrument shall be accurate to within three percent of full scale over a temperature range of 0 to +40 °C, and have a response time of less than 2 minutes. The meter shall be calibrated using a

known standard within range of the expected conductivity of the sample solution to be measured in accordance with manufacturer's recommendations.

#### 6.4.1.4 Dissolved Oxygen

The DO concentration affects ORP of water and chemical behavior of aqueous constituents. Physical, chemical, and biochemical activities in water may affect DO levels. Measurement of DO is useful in tracking contaminant plumes, determining surface water/groundwater interaction, and locating contaminant source areas. In situ measurements or the use of a flow cell is recommended for the accurate determination of DO in groundwater.

The DO is normally measured in the field by immersing a membrane electrode in the water. Oxygen gas molecules diffuse through the membrane into a measuring cell at a rate proportional to concentration of molecular oxygen in the water. Inside the sensor, oxygen reacts with an electrolyte and is reduced spontaneously or by an applied voltage, depending on the instrument. Current that is generated is directly proportional to concentration of molecular oxygen in the water outside the sensor.

The DO meters shall be direct-reading, temperature-compensating and equipped with oxygen-sensitive membrane electrode (polarographic or galvanic), which usually includes two solid metal electrodes separated from the test solution by a selective membrane (commonly polyethylene or fluorocarbon). The instrument shall be capable of responding within 0.1 milligrams per liter (mg/L) over a water temperature range of 0 to 40 °C.

#### 6.4.1.5 Oxidation-Reduction Potential

A chemical reaction in which an element undergoes a loss or a gain of electrons is referred to as oxidation or reduction, respectively. ORP is a measure of aqueous electron concentration and is controlled by reactions involving elements present in more than one oxidation state. Chemical behavior and mobility of many aqueous constituents are influenced by the ORP of surface and groundwater. Physical, chemical, and biochemical processes in water also affect ORP.

Meters shall be accurate to within 20 millivolts over a temperature range of 0 to 50 °C and the response time of the meter shall not be greater than two minutes. Reference solutions with known ORP are used to standardize and check the accuracy of the electrode system.

#### 6.4.1.6 Turbidity

Turbidity meters shall be calibrated using a minimum of two known standards that bracket the expected turbidity of the sample solution to be measured per manufacturer's recommendations.

### 6.4.2 Groundwater Sampling

Groundwater monitoring shall meet the requirements of the ACA and the OEPA's Director's findings and orders regarding integration of RCRA and CERCLA groundwater monitoring requirements. Groundwater sampling is currently being conducted at the Fernald Preserve for various projects and programs, including those listed in Section 3.

Groundwater sampling is often conducted on property owned by private entities. Permission must be obtained prior to completing any field activities. Purge water produced during the evacuation of monitoring wells shall be collected in appropriate containers and retained in appropriate containers until disposal at the on-site CAWWT.

The use of dedicated groundwater sampling equipment is encouraged. Dedicated sampling equipment is not to be removed from the well except when maintenance is to be performed on either the sampling equipment or the well. Dedicated sampling equipment, such as bailers, shall be stored in the well casing between uses. If dedicated equipment is stored outside the well, the equipment shall be sealed in clean, plastic bags identified with the well number. Equipment removed from the well shall be decontaminated in accordance with Section 6.7 prior to reinstallation.

#### 6.4.2.1 Water Level Measurements

Groundwater elevation data are used to monitor aquifer storage, estimate rate and direction of groundwater movement, define recharge/discharge relationships relative to surrounding features, estimate baseflow to streams, and calculate the volume of water in a borehole or well. Water levels shall be accurate to within 0.1 ft; however, there may be instances where the level of accuracy may need to be within 0.01 ft. These instances shall be noted in the sampling plan.

Upon arrival at the well site, determine whether the lock is secure. The well shall be inspected for signs of tampering or forced entry or for unusual occurrences such as animal burrows or recently discarded trash. Observations shall be recorded on a daily log. The lock shall be removed from the well, and the water level measuring instrument shall be checked for proper operation. The probe shall be lowered until the water is reached and the water level indicator sounds. The probe shall be raised above the water level and shaken slightly, then lowered again to recheck the measurement. If measurements do not agree to within 0.1 ft, continue to remeasure until the cause of the discrepancy has been determined or agreement of the measurements has been obtained. The water level depth shall be recorded to 0.01 ft from the measuring point, (e.g., top of protective casing). The water level measurement time shall be recorded using 24-hour format. The water level probe shall be wiped between each well, using disposal towels soaked in deionized water.

Small-diameter temporary well points or CMT wells may require measuring devices that do not meet the specifications required above. If the water level measurements are being used for sample purge requirements, water level measuring devices used in small-diameter temporary well points or CMT wells may record to  $\pm 0.1$  ft of accuracy. Care should be taken to calculate purge volume requirements conservatively if this method is used.

#### 6.4.2.2 General Groundwater Sampling Requirements

The primary technical consideration in groundwater sampling is to obtain a representative sample to fulfill the requirements of the sampling plan. Groundwater sampling at the Fernald Preserve must meet certain QA requirements in order for subsequent data to be used by the CERCLA program. To ensure that these objectives are achieved, the following minimum requirements must be met during sample collection. Additional requirements may be included in sampling plans.

Temperature changes should be avoided by preserving analytes immediately following sample collection (i.e., chemical and temperature preservation) and protecting samples from temperature extremes. Volatilization and degassing shall be minimized during sample collection by using dedicated bladder pumps and ensuring samples are collected to minimize turbulence. Photodegradation effects on organic samples and cross-contamination of airborne organic contaminants must be minimized by ensuring that samples are collected immediately into amber containers (as specified in the sampling plan) and that all sources of airborne organic contaminants (e.g., vehicle exhaust) are removed from the area. Sample vehicles and internal combustion engines shall be located downwind of the well. Any unavoidable or unexpected vehicle traffic shall be documented in the field activity log. Cross-contamination shall be eliminated by ensuring that all equipment coming into contact with the samples is properly decontaminated, that samples are collected from least-contaminated areas to most-contaminated areas, that dedicated equipment is used where feasible, and equipment and materials coming into contact with the sample is minimized.

The total depth of the monitoring well shall be measured to the nearest 0.1 ft and compared to well installation records. Dedicated equipment in the monitoring well may prevent or impede measurement of well total depth. Differences between the total depth measurement and well installation records may indicate silting into the screened portion of the well. If discrepancies are identified or silting has occurred, immediately refer the matter to the sampling project manager for resolution.

Two methods for purging monitoring wells exist. The first is a standard purging method that involves the evacuation of multiple well volumes of water from the well casing and screen. This standard purging is used when the well is not equipped with dedicated equipment and when recharge rates are such that drawdown is excessive when pumping at low rates. The second method is low flow purging, which involves the evacuation of stagnant water from the dedicated pump and discharge line. Low flow purging is used in wells where recharge rates allow minimal drawdown when pumping at low rates and where dedicated equipment is installed in the monitoring well.

Standard purging typically requires the evacuation of at least three times the amount of water in the well casing and screen with a pump or bailer. Low flow purging requires the evacuation of a pre-calculated purge volume, which is three times the volume of water contained in the dedicated pump and discharge line. The flow rate must not produce drawdown in the well, as this would produce mixing of the stagnant water column with the water in the screened interval.

#### 6.4.2.3 Standard Purging

For standard purging (removal of standard three volumes), sets of pH, temperature, turbidity, and specific conductance measurements shall be collected until the results between measurements are stabilized. Temperature, pH, and specific conductivity shall be considered stabilized over three consecutive readings if readings differ by  $\pm 0.5$  °C,  $\pm 0.1$  standard unit, and  $\pm 3$  percent, respectively. Turbidity shall be considered stable if readings differ by  $\pm 10$  percent when turbidity is greater than 10 nephelometric turbidity units (NTUs) or if turbidity is maintained at less than 10 NTUs. The pH reading may not stabilize, especially if sampling with a bailer. If, after three well volumes have been removed, the chemical parameters have not stabilized according to the

above criteria, additional well volumes may be removed. If the parameters have not stabilized within five volumes, it is at the discretion of the sampling team leader whether or not to collect a sample or to continue purging. The conditions of sampling should be noted in the field log. All field measurements shall be collected on unpreserved samples.

The pump intake shall be lowered to a depth of 5 to 10 ft below the water level in the casing but above the well screen where possible. Initially, the well will be purged from this depth so that fresh water from the screened interval will move upward through the casing and completely flush the well. The pumping rate shall be lowered enough to prevent significant agitation. If pumping of air (caused by excessive drawdown of the well water level) occurs, reduce the pumping rate. If pumping of air continues, the pump intake shall be lowered 5 to 10 ft within the well if possible and reduce the pumping rate further to prevent excessive drawdown.

A well is generally considered dry if it does not yield a complete sample within 24 hours after purging. Samples shall not be collected from wells that do not recover sufficiently unless approved by the project manager. If a well that has previously produced sufficient purge and sample volume does not recover sufficiently, evaluate the well for potential problems that may affect the integrity of the sample (e.g., well screen blocked by bacteria). Evacuate the monitoring well if it can be pumped or bailed dry and allow it to recover prior to sample collection. The evacuation rate shall be low enough to prevent excessive agitation of recharge water based on hydraulic characteristics of the well. Avoid excessive pumping that can cause samples to be nonrepresentative.

#### 6.4.2.4 Low Flow Purging

For low flow sampling (removal of a calculated low flow volume), one set of pH, temperature, turbidity, and specific conductance measurements shall be collected as an indicator of in situ conditions prior to sample collection. All field measurements shall be collected on unpreserved samples.

#### 6.4.2.5 Parameter-Specific Groundwater Sample Collection

As soon as the purging requirements are met, groundwater samples shall be collected in accordance with the stability and volatility of parameters to be tested in the following order:

- Water quality sample for determination of field measurements.
- VOCs.
- Total organic halogens.
- Total organic carbon.
- Extractable organic compounds (semivolatiles, pesticides, PCBs).
- Unfiltered metals.
- Filtered metals.
- Phenols.
- Cyanide.
- Sulfide.

- pH (laboratory analysis).
- Specific conductance (laboratory analysis).
- Alkalinity, bicarbonate, carbonate.
- Total dissolved solids, total solids, total suspended solids, and/or fluoride.
- Sulfate and chloride.
- Nitrogen compounds (ammonia, nitrate-nitrite, total Kjeldahl nitrogen, total organic nitrogen, nitrate, and/or nitrite).
- Phosphorus (all forms, excluding elemental).
- Unfiltered radionuclides.
- Filtered radionuclides.

If a well is low yielding, it may be necessary to change the order of sampling to ensure that a representative sample is collected for the priority constituents identified in the sampling plan.

If the well is purged with a submersible pump, samples shall be collected from pump discharge prior to removing the pump from the well and before the collection of bailed samples. This prevents handling the pump twice and eliminates the need for pump decontamination between well evacuation and sample collection.

Perform groundwater sample collection from monitoring wells for VOCs, semivolatile organic compounds (SVOCs), filtered and unfiltered metals, general chemistry, and radiological parameters in accordance with the requirements below.

#### **Volatile Organic Compounds**

Samples for analyses of VOCs shall be collected using a stainless-steel or Teflon bailer or stainless-steel and/or Teflon bladder pump operated at 0.2 liter per minute or less. Sample collection shall be performed in a manner to minimize turbulence and volatilization of VOCs.

Samples shall be collected into 40-milliliter (mL) screw cap vials, with Teflon-lined septa, that have been prepared with the preservative specified in the sampling plan. Sample vials shall be filled until a meniscus is present above the rim of the vial and sealed without air bubbles. Avoid excessive overfilling of pre-preserved vials. The vials shall be visually checked for air bubbles by inverting the vial and sharply tapping the vial against the hand. If air bubbles are present, top off the sample bottle and recheck it for air bubbles. When no air bubbles are present, place the sample in a cooler to obtain a temperature of 0 to 6 °C.

#### **Semivolatile Compounds and Pesticides/PCBs**

Samples for semivolatile analysis shall be collected with a stainless-steel or Teflon bailer or a stainless-steel and/or Teflon bladder pump or submersible pump. Because some semivolatiles are susceptible to photodegradation, use amber glass sample containers with Teflon-lined caps as specified in the sampling plan. Sample containers shall be filled to the neck and sealed.

### **Metals and Radionuclides**

Unfiltered samples for metals and radionuclide analysis shall be collected using a peristaltic pump, a stainless-steel or Teflon bailer, and a stainless-steel and/or Teflon bladder pump or submersible pump. If specified in sampling plan, samples shall be collected through discharge of pump used to purge monitoring well. Polyethylene sample containers shall be filled to the neck and sealed.

Filtered samples for dissolved metal and radionuclide analysis shall be collected using in-line filters that attach directly to pump discharge. Filter sizes to be used to prepare filtered metal water samples (e.g., 5.0 or 0.45 micron) shall be specified in the sampling plan. A minimum of 50 mL of sample shall be purged through the filter prior to sample collection. If water is extremely turbid, larger pore pre-filters may be used, as necessary. The use of prefilters and the final filter size shall be documented on the sample collection log and field activity log.

### **General Chemistry Parameters**

Samples for general chemistry parameters shall be collected using a peristaltic pump, a stainless-steel or Teflon bailer, a stainless-steel and/or Teflon bladder pump or submersible pump, and, if specified in the sampling plan, a submersible pump to purge the monitoring well. Appropriate sample containers shall be filled to the neck. Samples shall be preserved in accordance with the sampling plan.

#### **6.4.2.6 Sampling Groundwater from Private Wells**

Private wells near the Fernald Preserve may be sampled to meet project objectives. Property owners' access approval shall be obtained and notifications shall be made before a private well is sampled. Requirements of individual property owners' license agreements shall be reviewed prior to each sampling round and complied with during sampling. Sampling shall be conducted only at the time agreed to by the owner. If additional visits to the site are necessary, the property owner shall be notified before each visit or arrangements shall be made for continuing access. Communications with the property owner shall be documented in a daily log.

Procedures for collecting water samples from private wells shall be identified in sampling plans. The system shall be flushed before collecting the sample to remove stagnant water from the lines and well bore. The amount of flushing required depends on the frequency of well use; one minute of flushing at full capacity is the minimum required. Use sample containers and preservatives specified in the sampling plan and collect samples as near to the wellhead as possible upgradient of treatment units (e.g., water softeners). If the sample cannot be collected upgradient of treatment units or if the location of treatment units cannot be determined at the time of sampling, note conditions in field logs.

#### **6.4.3 Surface Water Sampling**

Surface water sampling is conducted at Fernald Preserve in accordance with NPDES requirements and as part of routine monitoring in accordance with the LMICP (DOE 2009). Two different techniques are used for collecting surface water samples: grab sampling and composite sampling. The following requirements are applicable to collection of water samples from streams, ponds, lakes, rivers, springs, and seeps.

#### 6.4.3.1 Grab Sampling

The surface water grab sampling location shall be chosen so that a representative sample can be collected. Clean sample containers and appropriate preservatives approved for specific parameters as specified in the sampling plan shall be used. Stream samples shall be collected beginning at the farthest downstream location and work upstream to prevent contamination during sample collection. Surface debris and artificial turbulence shall be avoided during sample collection.

Samples shall be collected at a depth of approximately 6 inches below the water surface, if possible. When sampling from a bridge, platform, or boat, it may be necessary to use a stainless-steel bailer or a peristaltic pump (for nonvolatile parameters) to collect a sample. If a bailer is used for sample collection, the material shall be compatible with the analytes of interest. A peristaltic pump cannot be used to collect samples for VOC analysis. Use unpreserved containers to collect samples directly from a body of water where water depth is sufficient and access conditions permit. If depth is not sufficient, use a Teflon or stainless-steel beaker or ladle. The grab bottle and the sample bottle shall be of the same materials or an approved equivalent.

The bottle shall be grasped securely at the base with one hand and plunged mouth-down into the water, avoiding surface debris. For rivers and streams, the bottle opening shall be positioned towards the current flow and away from the collector's hand, the shore, or the side of the sampling platform or boat. The bottle shall be tipped slightly upwards to allow air to exit and the bottle to fill. Collect a sufficient volume of sample to perform required analyses. If a sample bottle is used for collection, cap the bottle prior to removal from water. The grab bottle and the sample bottle shall be of the same materials or an approved equivalent.

When more than one grab bottle volume of sample is required to fill necessary sample containers, distribute sample portions equally among individual sample containers to provide homogeneity of collected sample. Field measurements shall be performed on unpreserved samples immediately after collection.

#### 6.4.3.2 Composite Sampling

Composite samples may be collected with automatic sampling equipment or may be collected manually as grab samples and composited. Procedures for collection of composite samples shall be included in sampling plans. Samples for unstable parameters, such as VOCs, total organic halogens, oil, and grease, shall not be composited.

#### 6.4.3.3 Parameter-Specific Surface Water Sampling

Perform surface water sample collection for VOCs, SVOCs, filtered and unfiltered metals, general chemistry parameters, and radiological parameters in accordance with the requirements below.

##### **Volatile Organic Compounds**

If possible, collect samples for VOC analysis directly into pre-preserved containers as specified in the sampling plan. If conditions do not permit the efficient collection of the surface water sample directly into the pre-preserved sample container, collect the sample in a stainless-steel,

Teflon, or glass device and transfer the sample directly to the pre-preserved container in a manner to minimize turbulence and volatilization of the VOCs. Fill sample vials with a visually apparent meniscus present above the rim of the vial and seal without air bubbles. Avoid excessive overfilling of pre-preserved vials. Visually check each vial for air bubbles by inverting the vial and sharply tapping the vial against the hand. If air bubbles are present, top off the sample vial, and recheck it for air bubbles. When no air bubbles are present, place sample in a cooler to obtain a temperature of 0 to 6 °C.

### **Semivolatile Organic Compounds**

Samples for SVOC analysis shall be collected directly into amber glass containers as specified in the sampling plan. The bottle shall be capped while still submerged; remove the bottle from the water body, pour out water in the bottle neck, and recap. If the sample cannot be collected directly into the bottle, use a stainless-steel, Teflon, or glass scoop, ladle, or bailer to collect the sample. Because some SVOCs are susceptible to photodegradation, use amber glass sample containers with Teflon-lined caps as specified in the sampling plan. Sample containers shall be filled to the neck and sealed.

### **Metals and Radionuclides**

Unfiltered samples for metals and radionuclide analysis shall be collected using a peristaltic pump, a stainless-steel or Teflon bailer, or directly using the sample container. Polyethylene sample containers shall be filled to the neck and sealed.

Filtered samples for dissolved metals and radionuclides analysis shall be collected using a peristaltic pump equipped with in-line filters that attach directly to pump discharge. Filter sizes to be used to prepare filtered metal water samples (e.g., 5.0 or 0.45 micron) shall be specified in the sampling plan. A minimum of 50 mL of sample shall be purged through the filter prior to sample collection. If water is extremely turbid, larger pore pre-filter may be used, as necessary. The use of prefilters and the final filter size shall be documented on the sample collection log and field activity log.

### **General Chemistry Parameters**

Samples for general chemistry parameters shall be collected directly into an unpreserved container specified for that parameter in the sampling plan when possible. Cap the bottle while it is still submerged, remove it from the water, and recap. If the sample cannot be collected directly into the bottle, use a stainless-steel, Teflon, or glass scoop, ladle, or bailer or a peristaltic pump with polyethylene or Teflon tubing. Samples shall be preserved as specified in the sampling plan.

#### **6.4.4 Aqueous Sample Collection Completion**

The pH of the preserved aqueous samples shall be checked using pH indicator strips; pH strips shall not be immersed in the samples. The pH indicator strip shall be taped to the sample containers. If the pH does not meet sampling plan requirements, do not adjust the pH. The sampling team leader will notify the laboratory of shortened hold times. Sample container lids shall be tightly secured, and sample containers shall be placed in coolers to obtain a temperature of 0 to 6 °C. Complete all field documentation.

#### 6.4.5 Wastewater Sampling

Wastewater sampling is regulated by OEPA under CWA. As such, data are collected in accordance with NPDES permit-specific requirements. Samples are also collected for DOE environmental monitoring purposes (DOE Order 5400.5) and to fulfill requirements of the 1986 FFCA.

NPDES is a statutory requirement under Title IV, Section 402, of the CWA. The NPDES program requires that point source discharges into the nation's waterways have a permit that stipulates the allowed limits for certain pollutants entering a particular body of water. The permit is based on the water quality goals of OEPA and the best available technology for treating wastewaters specific to an industry. Permitted discharges and required sampling locations are specified in the permit.

Test procedures for the analysis of NPDES samples shall conform to regulation 40 CFR 136, "Test Procedures for the Analysis of Pollutants" unless other test procedures have been specified in the permit. The required detection levels of the analysis and monitoring systems shall be sufficient to demonstrate compliance with all regulatory requirements consistent with the characteristics of the constituents that are present or expected to be present in the effluent. The analytical procedures to be performed by the Fernald Preserve for NPDES compliance are listed in Section 8 of this document.

The following program elements are to be reflected in Fernald Preserve site documentation as guidance or requirements in the development and use of liquid monitoring systems for compliance with DOE Order 5400.5. Facility operators shall provide monitoring of liquid waste streams adequate to demonstrate compliance with applicable requirements of DOE 5400.5, Chapter II, Appendixes 1a, 1d, 2a, and 3; quantify radionuclides released from each discharge point; and alert affected process supervisors of upsets in processes and emission controls.

Sampling systems shall be sufficient to collect representative samples that provide for an adequate record of releases from a facility, to predict trends and to satisfy needs to quantify releases. Sampling/monitoring lines and components shall be designed to be compatible with the chemical and biological nature of the liquid effluent.

As specified in Section 11, monitoring and sampling systems shall be calibrated before use and recalibrated any time they are subject to maintenance, modification, or system changes that may affect equipment calibration. They shall also be recalibrated at least annually and routinely checked with known sources to determine that they are consistently functioning properly.

Samples are collected with automatic samplers at locations specified in the NPDES permit. The automatic sampler collects composite samples by measuring the flow of the sampled media and incrementally drawing a set volume of sample. Each increment is discharged into one large sample container. The automatic sampler collects the total flow-weighted composite volume over a 24-hour period. At the end of 24 hours, samples are taken from the composited volume. Grab samples are required for specific parameters and at locations without automatic samplers. Samples for unstable parameters, such as VOCs, shall not be composited.

Automatic samplers can be programmed for either time-dependent or flow-dependent sampling. The NPDES permit requires that samples be flow-dependent. To activate the sampler, an electric signal is sent from a flow measurement device to the sampler. The program must be reset each time the sampler is reactivated. Sample bottle type, volume and preservative are specified in the sampling plan. Composite samples to support the NPDES permit shall be collected by filling sample containers from the automatic sampler after swirling the composited sample container or using a magnetic stirrer. Excess water shall be poured back into the wastewater stream. Grab samples shall be collected by lowering the sample bottle into applicable effluent stream or by using a dedicated Teflon beaker.

## **6.5 Collection of QC Samples**

Field and laboratory QC samples requirements are specified in sampling plans and are based on the project's DQOs. Field QC samples include trip blanks, equipment rinsate blanks, duplicate samples, and split samples. Laboratory QC samples include matrix spikes/matrix spike duplicates (MS/MSDs) (Section 9).

Trip blanks shall be included with each shipping container of aqueous samples to be analyzed for VOCs unless specifically omitted in the sampling plan. Trip blanks may be specified in sampling plans for other parameters. Trip blanks shall be prepared in a controlled environment and accompany the sample containers through collection, shipping, and handling. Deionized organic-free water shall be poured into 40 mL glass vials; preservative requirements are specified in the sampling plan. Vials shall be filled so that there is no headspace until a meniscus is present above the rim of the vial and sealed without air bubbles. The vials will be visually checked for air bubbles by inverting the vial and sharply tapping the vial against the hand. If air bubbles are present, top off sample bottle and recheck for air bubbles.

Equipment rinsate samples are collected after decontaminating equipment by pouring or pumping deionized organic-free water through the sample collection devices (e.g., bailer, pump) and then pouring the sample into the sample containers. Rinsate samples shall be collected and handled in the same manner as specified for the relevant analytes of concern. Rinsate samples are collected at a rate of 1 per 20 samples when non-dedicated equipment is used for collection.

Duplicate samples are collected by taking a second sample from the same source, immediately following, and in the same type of sample container as the original sample. Duplicate samples are collected at a rate of 1 per 20 samples.

Split samples are collected by taking a minimum of a double sample volume from the sample source and dividing it into two containers of the same size and type. Split sample collection rates are specified in the sampling plan.

MS/MSD samples shall be collected at triple the regular volume for VOCs and at least double the volume for extractable organics. These samples shall be collected and handled in the same manner as the other samples. Additional sample volume may be required for laboratory QC samples. The sampling plan shall specify the type of laboratory QC samples required and the frequency with which they shall be collected. QC samples are subject to the same documentation, labeling, COC, and shipping and handling requirements as all other samples.

## 6.6 Solid Matrix Environmental Samples

Solid media include soil, sediment, sludge, and residue. Solid samples are routinely collected at the Fernald Preserve for monitoring purposes. Sampling plans shall specify the type of sample to be collected (i.e., grab or composite). Composite samples are collected as grab samples and then composited. Samples shall be collected in accordance with the stability and volatility of parameters to be tested in the following order:

- VOCs.
- Total organic halogens.
- Total organic carbon.
- Extractable organic compounds (SVOCs, pesticides, PCBs).
- Metals.
- Phenols.
- Cyanide.
- Sulfate and chloride.
- Nitrate and ammonia.
- Radionuclides.

### 6.6.1 Surface Soil Sampling

Surface soil samples are collected from material that can be collected with manually operated, hand-held tools, usually within 6 inches of the surface. Specific equipment to be used shall be based on project objectives and shall be specified in the sampling plan. All equipment shall be decontaminated prior to use as described in Section 6.7.

The area to be sampled shall be prepared as specified in the sampling plan. Generally vegetation, large rocks, or trash will be collected only if required by the project objectives. Samples shall be collected at the depth and interval specified in the sampling plan. The size of the sampling tool shall be sufficient to collect the required volume within the depth interval limitation. Sufficient sample volumes shall be collected to perform required analyses as defined in the sampling plan.

Surface soil samples for VOC analysis shall be collected using a stainless-steel trowel (or similar device) or direct-push coring sampler containing a Teflon liner (e.g., Macro-Core® sampler). The soil sample shall be collected using an Encore® or equivalent sampler (an Encore® is a one-use, EPA-approved sampling device that allows the sample to be collected and transported to the laboratory without field preservation). An airtight sealing cap shall then be placed on the bottom of the sampler. Generally, multiple sample aliquots are collected for each sample depending on the analytes of interest. The devices shall be transported to the laboratory on ice. At the laboratory, the cap is opened, and the undisturbed sample is immediately placed in the appropriate preservation fluid (e.g., methanol, sodium bisulfate). The samples must be preserved at the laboratory within 48 hours of sample collection (ASTM 6418-04).

Samples for non-VOC analysis shall be collected with a trowel, scoop, coring device, or other sampling device as specified in the sampling plan. The sampling device must be constructed of a material that is inert to the materials collected and the analytes to be measured. Sample material shall be transferred to the appropriate container as specified in the sampling plan.

### **6.6.2 Soil Compositing**

Mixing or compositing requirements for solid materials are designed to ensure homogeneity within a sample and to ensure that composite samples undergo the same degree of mixing. When compositing is required, adhere to the following procedures unless specifically modified in sampling plans. Do not field composite samples to be analyzed for volatile parameters.

Samples shall be removed from the collection device and placed in a decontaminated flat-bottomed container constructed of an inert material relative to the constituents of concern. When a sufficient volume of sample has been collected, the soil pieces shall be broken into small pieces then the entire volume shall be divided into relatively even quarters. Opposite quarters shall be mixed together and the resulting halves shall be mixed together. All of the material will then be regrouped into a single volume. The process shall be repeated once and the soil sample shall be placed into the appropriate sample containers.

### **6.6.3 Sediment Sampling**

Sediments are materials that have been transported from their place of origin by fluid action and redeposited. Stream sediments are of interest at the Fernald Preserve. Sediment sampling in the Great Miami River is currently conducted for routine monitoring as described in the LMICP (DOE 2009). Other sediment samples may be collected to determine the concentration of target analytes; requirements for sediment sampling are documented in sampling plans.

Specific sampling locations shall be documented in sampling plans. Equipment used shall be selected based on project objectives and specified in sampling plans. When sampling of rivers and large streams is necessary, use a clamshell dredge, trowel, or similar device for sediment collection as specified in the sampling plan. Sediments shall be collected progressing from the downstream sampling locations towards the upstream sampling locations. Sediment samples shall be collected to the depth specified in the sampling plan in sufficient volume to perform the required analyses. In general, large rocks, twigs, or debris should not be collected unless specified in the sampling plan.

### **6.6.4 Subsurface Soil Sampling**

Subsurface soil samples for environmental constituents may be collected at the Fernald Preserve to support remedy performance monitoring. Samples shall be collected using equipment specified in the sampling plan in compliance with the drilling requirements in Section 5. Only undisturbed soil shall be collected as sample material, materials that have caved within the borehole shall not be collected. If caving materials are present in the upper part of a sampler, discard this material prior to packaging samples for shipment. Advance the boring, collecting samples at specified intervals in accordance with the sampling plan.

Subsurface split-spoon or core tube samples shall be collected by lowering the decontaminated sampling device consisting of a threaded coupling to fit a standard drill or drive rod and a replaceable split-spoon sampler or core tube sampler down the borehole. The sampling device shall be pushed or driven into undisturbed material at the bottom of the borehole. While driving the sampling device, the number of blows required to advance the sampler every 6 inches shall be recorded. The sampling device shall be removed from the boring, opened, and screened for VOCs or radionuclides if required by the sampling plan. The soil sample shall be described, removed from the sampler, and transferred to the appropriate containers. Soil samples collected for VOC analysis shall be removed from the interior of the core sample using an Encore® sampler or equivalent as described in Section 6.6.1.

## **6.7 Field Storage of Samples**

In the field, samples shall be handled in a way to preserve sample integrity and maintain COC security. As soon as samples requiring refrigeration are collected, filtered as necessary, and preserved, they shall be stored in chests packed with artificial icing material to obtain a temperature range of 0 to 6 °C if refrigerators are unavailable. Care should be exercised to avoid breakage of containers due to rapid extreme temperature changes. Field personnel shall be responsible for ensuring that sample container lids are secure before placing samples in the storage chest.

For soil samples, multiple analytical parameters may be combined in the same sample container as long as all preservation requirements are maintained, volatile organics analysis is not involved, sufficient sample weight is collected, and the parameters are analyzed by a single laboratory. For example, radionuclides and metals may be combined and stored at 0 to 6 °C (for metals preservation). The laboratory should also be consulted prior to combining parameters for soil samples.

## **6.8 Decontamination Requirements**

Equipment shall be decontaminated to prevent transfer of contaminants from equipment to sampled media, to limit cross-contamination between sampling points, and to protect worker health and safety. Decontamination procedures shall be designed to accomplish these objectives without affecting the integrity of the collected samples. The generation of hazardous waste and excessive volumes of waste solutions is discouraged. Use of improperly decontaminated equipment is prohibited. Non-dedicated sampling equipment shall be cleaned between each use and each sampling point.

Equipment shall be decontaminated at a central decontamination area where a water source and a means of containing decontamination solutions are available. Sampling equipment to be dedicated shall be decontaminated prior to installation or use.

Materials used during decontamination activities include phosphate-free laboratory detergent, potable water, and deionized organic-free water. Following are descriptions of the three levels of decontamination identified for the Fernald Preserve. The level of decontamination required for a project shall be specified in the sampling plan.

Cleaning of equipment and tools by steam cleaning or high-pressure potable water washing without the use of detergents is termed Level I decontamination. Only those items that do not come into contact with sampled media shall be decontaminated at Level I.

Most equipment is designated for Level II decontamination and shall be cleaned by rinsing with potable water; washing with a phosphate-free laboratory detergent and potable water solution, steam-cleaned, or washed with high-pressure potable water; followed by a rinse with potable water; and finally rinsed twice with deionized organic-free water. Sampling equipment may be wiped dry with clean, lint-free disposable wipes if air drying is not feasible, and immediately covered with plastic or aluminum foil. Equipment used to sample for organic parameters shall be covered with plastic *only* if organic parameters released by plastic are not analytical concerns. If aluminum foil is used, equipment shall be wrapped with the shiny side out. Aluminum foil shall not be used if aluminum contamination may be an analyte of concern.

The plastic or aluminum foil shall be labeled with the date of decontamination, the initials of the person performing the decontamination, and the level of decontamination performed. If a plastic bag is used to cover the equipment, then the bag shall be taped or sealed tightly. Decontaminated equipment must remain covered and isolated from ambient conditions until use.

Drilling equipment that contacts subsurface material (i.e., augers, drill rods, drill casings, split spoons, auger teeth, or drill bits) shall be decontaminated to Level I requirements when moving between drill sites. Drilling and sampling equipment that come in contact with chemical or radiological analytical sample media that is suspected to be contaminated shall be decontaminated at Level II. Drilling or sampling equipment that come in contact with analytical sample media that is not contaminated shall be decontaminated at Level I.

Determine decontamination level for drilling rig wheel wells, tires, mast, and other potentially contaminated items based on the next usage. If the rig is to remain in the same work area or contamination area (i.e., the contaminant levels are the same or higher based on existing data), decontamination is not required. Follow Level I requirements if the rig is moved to a cleaner area or to a different work area or contamination area.

All equipment shall be visually inspected for gross contamination (e.g., caked-on mud, grease on threads, organic odor) or screened with field instruments. If evidence of contamination is present, the equipment shall be recleaned at the appropriate decontamination level for its intended use.

Interior and exterior submersible pump and lines shall be decontaminated at Level II. For the final rinse, determine the amount of water required to fill the system and pump at least three times that amount of deionized water through the system.

## **6.9 Radiological Air Particulate Monitoring**

The Fernald Preserve radiological air particulate monitoring program was designed to demonstrate compliance with DOE Order 5400.5 and the provisions of CAA, 40 CFR 61, Subpart H (NESHAP). This program provides a continual assessment relative to the health protective NESHAP standard of 10 millirem (mrem) per year.

Environmental high-volume air monitoring shall be adequate to provide a direct measure of the environmental conditions at the Fernald Preserve and therefore provide a conservative estimate of the air inhalation to members of the public.

Air samplers shall be mounted in locked, all-weather stations with the sampler discharge located to prevent recirculation of air. The air sampling system shall have a flow rate meter. The air sampling rate shall not vary by more than 20 percent and total air flow or total running time shall be documented. Linear flow rate across air particulate filters shall be maintained between 20 and 50 meters per minute.

Air sampling systems shall be leak-tested, flow-calibrated (Section 11), tested, and inspected routinely according to a written procedure. Selection of the filter type for collection of air particulates shall be based on site-specific needs. At a minimum, collection efficiency, particle size selectivity, ease of radiochemical analyses, and cost shall be considered when selecting filters.

## **6.10 Direct-Radiation Monitoring**

The direct-radiation monitoring program is designed to measure environmental radiation levels. This is accomplished using a network of environmental dosimeters located at air monitoring stations as specified in the LMICP.

The monitoring design incorporates a network of dosimeter locations. Three dosimeters are deployed at each location and submitted to the DOE-accredited laboratory for analysis. External gamma radiation measurements are recorded from each dosimeter read.

Environmental dosimeters shall be mounted at one meter above ground. Annealing, calibration, readout, storage, and exposure periods used should be consistent with the ANSI recommendations. All dosimeters placed in the field are tracked via a field tracking log, which provides information pertaining to when and where dosimeters were deployed as well as scheduled collection dates.

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## 7.0 Sample Handling and Custody

Sample custody procedures at the Fernald Preserve are conducted in accordance with American Society for Testing and Materials (ASTM), *Standard Guide for Sample Chain of Custody Procedure*, ASTM D 4840-99; *Contract Laboratory Program Guidance for Field Samplers*, (EPA 2007a); *Technical Guidance for Ground Water Investigations* (OEPA 2006), and *SESD Operating Procedures: SESD Operating Procedures: Sample and Evidence Management* (EPA, Region 4, 2007b). Custody requirements are addressed in two parts: (1) sample custody and handling in the field, and (2) custody during laboratory receipt, analysis, and disposition.

A COC shall provide accountability for and documentation of sample integrity from the time a sample is collected until sample disposal (ASTM D 4840-99). To document COC an accurate record must be maintained to trace the possession of the sample. Compliance with the sample packaging, sample shipment, and the custody requirements in this section will provide adequate documentation of sample custody.

A sample is considered in the custody of a person if any of the following rules of custody are met:

- The person has physical possession of the sample.
- The sample is in view of the person after being in possession.
- The sample is placed in a secure location by the custody holder and then secured to prevent tampering.
- The sample is in a designated secure area.

The COC requirements for subcontract laboratories are specified in the Quality Systems for Analytical Services (QSAS). Compliance with these requirements is verified during data validation and laboratory audit.

Field sampling personnel are responsible for the implementation of sample custody procedures. The QA organization is responsible for verifying that sample custody requirements are implemented and followed.

### 7.1 Field Sample Custody Requirements

The sampling team leader is responsible for the care and custody of the samples collected until relinquished to a sample custodian, a transporter, or an analytical laboratory. All samplers involved in the sample collection shall sign the COC. The sampling team member relinquishing and the sample team member receiving the samples must sign the COC upon relinquishment and receipt. The date and time of the transfer shall be documented.

Sample labels shall be prepared for each individual sample container as specified in Section 7.1.2. Sample labels may be preprinted or handwritten using black or blue indelible ink. The label shall be permanently affixed to the sample container. Information on the label must be consistent with the information recorded on the COC. The number of persons having sample custody shall be minimized during sample collection, packaging, and transport.

Sample collection information including field data shall be recorded on a field log as specified in Sections 5 and 6. The date and time of collection shall be recorded on the COC once a sample has been collected. The total number of sample containers and required analyses for each sample must be recorded. Separate COCs shall be used for each laboratory receiving samples.

Samples shall be sealed after sample collection using custody tape around the lid of the sample container in such a manner that when the container is opened, the tape would be destroyed. Custody tape will be initialed and dated by the sampler. When sample collection has been completed, samples shall be secured from tampering and stored in a secured area or delivered directly to an analytical laboratory. Samples requiring refrigeration shall be placed immediately in a refrigerator and/or in a cooler with cooling media and kept under the rules of custody. If the samples are not transferred immediately, the COC shall contain the name of the storage area and shall state how custody was maintained (e.g., locked room or sealed cooler).

### **7.1.1 Sample Tracking and Control Documentation**

Sampling personnel shall maintain complete, accurate, and legible field records as the sampling activity is performed. Sample custody shall be documented from the time of collection through final disposition. The following minimum sample records shall be maintained:

- Field activity logs (Section 5).
- Sample collection logs (Section 6).
- Sample identification number and labeling.
- COC form.

Each COC form shall be uniquely identified and contain the following information:

- Project name.
- Sample identification number.
- Sample location.
- Printed name and signature of persons involved in sample collection.
- Preservation type.
- Number and type of sample containers.
- Analyses requested.
- Sample matrix (e.g., soil, air).
- Sample type (e.g., composite, grab).
- Sample collection date and time.
- Special handling instructions, if applicable.
- Printed name, signature, date, and time of sample relinquishment and receipt.

### **7.1.2 Sample Identification and Labeling**

Sample labels shall be used to identify individual samples from the time of collection and packaging through final disposition. Sample labels can be computer-generated to automatically preprint a unique sample number and are attached to the sample container. The sample label shall include the following information:

- Sample identification number.
- Date and time of collection.
- Sample type (e.g., grab, composite).
- Sample matrix (e.g., groundwater, sediment, soil).
- Preservation methods.
- Sample collector's initials.
- Analyses to be performed.

### **7.1.3 Request for Analysis**

Prior to any sampling event, analyses must be coordinated with the Fernald Preserve laboratory technical representative. As much advance notice as possible should be given to secure analytical services either from the Fernald Preserve on-site laboratory or from contract laboratories. Analysis requests must be confirmed prior to sample collection.

The following information shall be provided to the laboratories when scheduling analytical services:

- Project name.
- Number of samples.
- Required turnaround time for analysis.
- Sample matrix.
- Required analysis.

### **7.1.4 Field Storage**

In the field, samples shall be handled in a way to preserve sample integrity and maintain custody. As soon as samples requiring refrigeration are collected, filtered as necessary, and preserved, a custody seal shall be applied over the lid (and pH strip attached if used). Samples shall be stored in chests packed with artificial icing material to obtain a temperature range of 0 to 6 °C if refrigerators are unavailable. Care should be exercised to avoid breakage of containers due to rapid extreme temperature changes. Field personnel shall be responsible for ensuring that sample container lids are secure before placing samples in the storage chest.

For soil samples, multiple analytical parameters may be combined in the same sample container as long as all preservation requirements are maintained, volatile organics analysis is not involved, sufficient sample weight is collected, and the parameters are analyzed by a single laboratory. For example, radionuclides and metals may be combined and stored at 0 to 6 °C (for

metals preservation). The laboratory should also be consulted prior to combining parameters for soil samples.

## **7.2 Sample Classification, Packaging, and Shipment**

Samples shall be shipped promptly to the laboratory so that holding times are not exceeded. Samples shipped off site shall be shipped to ensure laboratory receipt within 24 hours of shipment time when required. Environmental samples shall be transported in a manner to preserve their integrity, and if there is any doubt as to the sample classification, it shall be considered a hazardous material and shipped accordingly.

### **7.2.1 Sample Classification**

DOT has regulatory responsibility for the safe transportation of hazardous materials. Regulations for packaging, marking, labeling, and shipping of hazardous materials are promulgated by DOT and documented in 49 CFR 171 through 180. Samples shipments must comply with these regulations. The shipment sender is responsible for ensuring compliance. To classify the sample as an environmental sample or a hazardous material, historical analytical data in addition to type and concentration of chemical preservative in the sample shall be compared to the definition of a hazardous material in the DOT regulations. Environmental samples containing the following upper limit concentrations do not meet the definition of corrosive and are not subject to hazardous materials regulations:

- HCl in water solutions at concentrations of 0.15 percent by weight or less;
- HNO<sub>3</sub> in water solutions at concentrations of 0.28 percent by weight or less;
- H<sub>2</sub>SO<sub>4</sub> in water solutions at concentrations of 0.38 percent by weight or less;
- NaOH in water solutions at concentrations of 0.20 percent by weight or less; or
- H<sub>3</sub>PO<sub>4</sub> in water solutions at concentrations yielding a pH range between 2 and 4.

If percentages exceed the concentrations listed above, the sample container must be reclassified as a hazardous material, labeled, and shipped accordingly. It is anticipated that samples collected under the FPQAPP will be designated as environmental samples.

Transportation of radioactive material (RAM) over public roads is regulated under DOT regulations contained in 49 CFR Parts 171–178. The DOT defines RAM as any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in 49 CFR Part 173.436.

Samples collected at the Fernald Preserve generally do not meet the definition of RAM for transportation purposes. However, it is possible that certain samples may require shipment as RAM. Sample shipments that meet the definition of RAM shall be categorized and shipped in accordance with the DOT regulations.

### 7.2.2 Packaging and Shipment of Samples

The sample custodian shall check the sample containers to verify that the custody tape is intact and ensure that the information on the sample labels agrees with the information recorded on the COC. Errors and discrepancies discovered on the COC prior to sample transfer to the courier can be corrected by drawing a single line through the error and entering the correct information. Each correction must be initialed and dated. If the discrepancy affects sample analysis (e.g., sample collected in the wrong container or improperly preserved), the sample custodian shall also notify the Fernald Preserve laboratory technical representative immediately and store the samples until a resolution is received.

Sample preservation (e.g., refrigeration) shall be maintained from receipt of samples until sample shipment. It is the responsibility of the sample custodian to ship samples in a manner that maintains sample preservation requirements during shipment and ensures that holding times can be achieved by the laboratories.

A COC form shall accompany each set of samples shipped to the laboratory for analysis. The container shall be placed in a plastic bag to minimize potential for contamination by vermiculite or other packing material. Sample containers placed in a box with cardboard separators need not be placed in plastic bags (e.g., subsurface soil sample jars may be returned to their original shipping container, a cardboard box with cardboard inserts). Neither ice nor earth shall be used as a packing material.

Metal or sturdy plastic coolers used for shipping refrigerated/preserved samples shall be initially filled with approximately 1 to 2 inches of vermiculite or other suitable (noncombustible, absorbent packing) material. Breakable (e.g., glass) sample containers shall be placed in a cooler and isolated from contact with one another using protective material such as bubble wrap. Artificial icing material shall be placed in the cooler. Dry ice shall not be used. After packing container with icing material, the remaining space in the cooler shall be filled with vermiculite or a suitable, inert substitute. The original COC record shall be transported to the laboratory along with samples by placing the COC in a plastic bag inside the shipping container.

Filament tape or duct tape and custody tape shall be wrapped around the shipping container to prevent access to its contents without breaking the custody seal. The custody tape shall be dated and initialed with black or blue indelible ink. Shipping containers shall be addressed individually. If any sample containers are labeled with hazard warnings, then the shipping container shall be labeled accordingly.

Transportation of samples shall be arranged with the commercial carrier. When custody is relinquished to the commercial carrier, notify the receiving laboratory custodian of sample shipment and holding time constraints (if applicable). Commercial carriers are not required to sign the COC as long as the COC is enclosed in the shipping container and the custody seals are intact upon receipt at the laboratory.

## **7.3 Analytical Laboratory**

### **7.3.1 Laboratory Sample Receipt**

Laboratory personnel are responsible for the care and custody of samples from the time of receipt until the sample is exhausted, disposed, or returned to the Fernald Preserve. Upon receipt of the samples by the laboratory, the laboratory sample custodian, the laboratory project manager, or a representative shall examine the samples as specified below. The laboratory project manager or a representative shall notify the Fernald Preserve laboratory technical representative of discrepancies noted during sample receipt as specified below.

### **7.3.2 Sample Examination and Management**

The laboratory sample custodian shall document any irregularities observed with the shipment, temperature, preservation, condition, or custody seals of samples received. If no anomalies are noted for the sample shipment, a brief statement to that effect shall be provided on login worksheets and in the case narrative.

If custody seals (including seals on individual sample containers) indicate tampering, the laboratory shall notify the Fernald Preserve laboratory technical representative. If the samples were collected at least 24 hours earlier and the temperature is outside the range of 0 to 6 °C, this information shall be documented on the COC and on a laboratory nonconformance form and the laboratory shall notify the Fernald Preserve laboratory technical representative. Samples shall be properly stored until directions for disposition are received. If the samples were collected less than 24 hours earlier and cooling agents were added to the shipping container, but the temperature has not yet reached the range of 0 to 6 °C, this information shall be documented but the Fernald Preserve laboratory technical representative need not be notified. In this case, processing of the sample shall continue.

With the exception of samples collected for VOC and TOX analysis, the pH of all aqueous samples (i.e., preserved and unpreserved) shall be checked during sample login. Samples collected for VOC and TOX analyses are checked at the time of analysis. If preserved samples arrive unpreserved or inadequately preserved the laboratory must contact the Fernald Preserve laboratory technical representative for further instructions. If the laboratory is instructed to adjust the pH, metals samples must be held 16 hours and radionuclide samples must be held 24 hours prior to withdrawing an aliquot for analysis.

If sample holding time has been exceeded or cannot be met, the laboratory shall notify the Fernald Preserve laboratory technical representative and document the nonconformance.

The laboratory shall notify the Fernald Preserve laboratory technical representative by electronic mail of sample receipt and any irregularities noted during the sample receiving process. Any problems with a sample shipment that adversely affect data quality shall be described in the case narrative.

Samples shall be stored by the laboratory to maintain preservation requirements. Custody rules shall be followed throughout the life of the sample in the laboratory. Each laboratory must follow its established system for ensuring that sample custody is documented for all movements

of both the sample and its extracts/digestates. Each laboratory shall have SOPs for sample custody.

For off-site laboratories, all documentation of sample custody within the laboratory shall become a permanent part of the laboratory project files.

### **7.3.3 Sample Holding and Disposition**

Sample disposition shall be traceable to the original COC either electronically or through hard-copy records. Nonhazardous and nonradioactive samples shall be disposed in accordance with standard laboratory practices or returned to the Fernald Preserve as specified by the Fernald Preserve laboratory technical representative.

When environmental samples are held for reanalysis, proper environmental storage control and holding times shall be maintained. When reanalysis is not anticipated but samples must be held for a specific time, environmental storage controls are not required. When radioactive samples are held, they shall be stored in accordance with individual laboratory license requirements. Special arrangements may be necessary for samples stored longer than 6 months.

## **7.4 Evidence Files**

Evidence files for sampling and analysis data are maintained at the Fernald Preserve and contain relevant records, reports, correspondence, logs, field logs, original laboratory data packages, photographs, subcontractor reports, COCs, and data validation reports. All information supporting Fernald Preserve CERCLA decisions shall be included in the final evidence file as support for the CERCLA Administrative Record and the Post-ROD files in accordance with the ACA.

Evidence files shall be in the custody of the Fernald Preserve Administrative Record Coordinator, who controls the files for environmental sampling and analysis at the Fernald Preserve in addition to managing the CERCLA Administrative Record and the Post-ROD files in accordance with the ACA. The final evidence file shall be maintained for at least 10 years after the termination of the ACA. If DOE decides to discard the files after this time, the ACA specifies that the files be offered to EPA.

The DOE record retention policy must be consulted prior to destroying any environmental documents. DOE record retention requirements may exceed those established by EPA or the ACA. In general, records produced by subcontracted laboratories for Fernald Preserve sample analysis shall be retained for a period of 5 years. After the 5-year period has expired, the laboratory shall request written permission for disposal from the LMS contractor.

Data generated by subcontractors for the Fernald Preserve are the property of DOE and shall be maintained temporarily under contract at the facility where they were generated. Off-site record storage (e.g., at analytical laboratories prior to return to the Fernald Preserve) shall be as secure as and similar to the storage of on-site project files. If a storage, security, or other problem is discovered at the facility, files shall immediately be transferred to the Fernald Preserve.

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## 8.0 Analytical Methods

Analytical methods and required detection limits are listed in Table 8–1. The methods included in Table 8–1 are those either commonly used for Fernald Preserve analyses (by both subcontracted and LMS contractor-operated laboratories), or those potentially used.

### 8.1 Chemical Analyses

Organic, inorganic, and various wet chemical analyses are performed on Fernald Preserve samples for a wide variety of programs including CAA, CWA, NPDES, RCRA, and CERCLA.

The inorganic, organic, and wet chemical methods listed in Table 8–1 are EPA methods or other standard methods readily performed by commercial analytical laboratories. EPA methods include 200 and 500 Series methods (40 CFR 141), 600 Series methods (40 CFR 136), and SW 846 methods (40 CFR 261). Other standard methods include those listed in *Standard Methods for the Examination of Water and Wastewater* (Eaton 2005) and those documented in ASTM publications.

### 8.2 Radiochemical Analyses

Unlike organic and inorganic chemical analytical methods, few standard methods are available for the radiochemical analysis of environmental samples. Different commercial environmental laboratories may have different sample preparation and analytical techniques for specific radiochemical analytes. Minimum QC requirements for radiochemical analyses are specified in the QSAS.

The QSAS is based on EPA's National Environmental Laboratory Accreditation Conference (NELAC), Chapter 5, "Quality Systems," (NELAC 2003) as implemented in July 2005, and ISO 17025, General Requirements for the Competence of Testing and Calibration Laboratories. The QSAS provides specific technical requirements and clarification for the implementation of DOE and EPA requirements.

Table 8-1. Analytical Method Requirements

Media	Analytes	RDL <sup>a</sup>	Units	Method
Groundwater (IEMP)	<b>Metals</b>			
	Antimony	5.0	µg/L	SW846 6010B
	Arsenic	20	µg/L	
	Boron	10	µg/L	
	Lead	10	µg/L	
	Manganese	5	µg/L	
	Molybdenum	20	µg/L	
	Nickel	20	µg/L	
	Potassium	5,000	µg/L	
	Sodium	5,000	µg/L	
	Zinc	15	µg/L	
	Total Uranium	0.1	µg/L	SW-846 6020
	<b>VOCs</b>			
	Benzene	1.0	µg/L	SW-846 8260B
	Carbon disulfide	1	µg/L	
	Ethyl Benzene	1	µg/L	
	Isopropyl Benzene	1	µg/L	
	Toluene	1	µg/L	
	Trichloroethene	1	µg/L	
	Xylenes, Total	1	µg/L	
	<b>Other Inorganic and General Chemistry</b>			
Fluoride	500	µg/L	SW-846 6056 EPA 300.0	
Phosphorus	10	µg/L	EPA 365.1, EPA 365.2, EPA 365.3	
Nitrate/Nitrite as Nitrogen	50	µg/L	EPA 353.1, EPA 353.2	
Total Uranium	1	µg/L	KPA <sup>b</sup>	
<b>Radionuclides</b>				
Technetium-99	15	pCi/L	Liquid Scintillation	
Groundwater (GWLMP)	<b>VOCs</b>			
	Acetone	10	µg/L	SW-846 8260B
	Acrylonitrile	10	µg/L	
	Benzene	1	µg/L	
	Bromochloromethane	10	µg/L	
	Bromodichloromethane	10	µg/L	
	Bromoform	10	µg/L	
	Bromomethane	2	µg/L	
	2-Butanone	10	µg/L	
	Carbon disulfide	5	µg/L	
	Carbon tetrachloride	10	µg/L	
	Chlorobenzene	10	µg/L	
	Chloroethane	1	µg/L	
	Chloroform	10	µg/L	
	Chloromethane	10	µg/L	
	Dibromomethane	10	µg/L	
Dibromochloromethane	10	µg/L		
1,2-Dibromo-3-chloropropane	10	µg/L		

Table 8-1 (continued). Analytical Method Requirements

Media	Analytes	RDL <sup>a</sup>	Units	Method
Groundwater (GWLMP)	<b>VOCs (continued)</b>			
	Ethylene Dibromide	10	µg/L	SW-846 8260B
	1,2-Dichlorobenzene	10	µg/L	
	1,4-Dichlorobenzene	10	µg/L	
	trans-1,4-Dichloro-2-butene	10	µg/L	
	1,1-Dichloroethane	10	µg/L	
	1,2-Dichloroethane	1	µg/L	
	1,1-Dichloroethene	5	µg/L	
	1,2-Dichloroethene (Total)	10	µg/L	
	1,2-Dichloropropane	10	µg/L	
	cis-1,3-Dichloropropene	10	µg/L	
	trans-1,3-Dichloropropene	10	µg/L	
	Ethylbenzene	10	µg/L	
	2-Hexanone	10	µg/L	
	Methylene Chloride	4	µg/L	
	Methyl Iodide	10	µg/L	
	4-Methyl-2-pentanone	10	µg/L	
	Styrene	10	µg/L	
	1,1,1,2-Tetrachloroethane	10	µg/L	
	1,1,2,2-Tetrachloroethane	10	µg/L	
	Tetrachloroethene	10	µg/L	
	Toluene	10	µg/L	
	1,1,1-Trichloroethane	1	µg/L	
	1,1,2-Trichloroethane	10	µg/L	
	Trichloroethene	3	µg/L	
	Trichlorofluoromethane	10	µg/L	
	1,2,3-Trichloropropane	10	µg/L	
	Vinyl Acetate	10	µg/L	
	Vinyl Chloride	1	µg/L	
	Xylenes (Total)	10	µg/L	
	<b>SVOCs</b>			
	Carbazole	10	µg/L	SW-846 8270C
	4-Nitroaniline	50	µg/L	
bis(2-Chloroisopropyl)ether	5	µg/L		
<b>Pesticide</b>				
alpha-Chlordane	0.05	µg/L	SW-846 8081A	
<b>PCBs</b>				
Aroclor-1016	0.1	µg/L	SW-846 8082	
Aroclor-1221	0.1	µg/L		
Aroclor-1232	0.1	µg/L		
Aroclor-1242	0.1	µg/L		
Aroclor-1248	0.1	µg/L		
Aroclor-1254	0.1	µg/L		
Aroclor-1260	0.1	µg/L		

Table 8-1 (continued). Analytical Method Requirements

Media	Analytes	RDL <sup>a</sup>	Units	Method
Groundwater (GWLMP)	<b>Metals</b>			
	Antimony	5	µg/L	SW-846 6010B
	Arsenic	20	µg/L	
	Barium	20	µg/L	
	Beryllium	1	µg/L	
	Boron	10	µg/L	
	Cadmium	2	µg/L	
	Calcium	5,000	µg/L	
	Chromium	5	µg/L	
	Cobalt	30	µg/L	
	Copper	8	µg/L	
	Iron	100	µg/L	
	Lead	10	µg/L	
	Magnesium	5,000	µg/L	
	Manganese	5	µg/L	
	Nickel	20	µg/L	
	Potassium	5,000	µg/L	
	Selenium	5	µg/L	
	Silver	5	µg/L	
	Sodium	5,000	µg/L	
	Thallium	20	µg/L	
	Vanadium	20	µg/L	
	Zinc	15	µg/L	
	Mercury	0.1	µg/L	SW-846 7470A
	Lithium	2	µg/L	SW-846 6010B/ 6020
	Total Uranium	0.1	µg/L	SW-846 6020
	<b>Other Inorganic and General Chemistry</b>			
	Total Dissolved Solids	10	mg/L	SM 2540C
	TOX	25	µg/L	SW-846 9020
	TOC	1.0	mg/L	SW-846 SM 3510B,C,D
	Ammonia as Nitrogen	0.1	mg/L	EPA 350.1
	Nitrate/Nitrite as Nitrogen	0.05	mg/L	EPA 353.1
Chloride	500	µg/L	SW-846 9056	
Alkalinity	10	mg/L	SM 2320B	
Sulfate	500	µg/L	SW-846 9056	
<b>Radionuclides</b>				
Technetium-99	15	pCi/L	Liquid Scintillation	

Table 8-1 (continued). Analytical Method Requirements

Media	Analytes	RDL <sup>a</sup>	Units	Method
Surface Water (NPDES)	<b>Metals</b>			
	Antimony	2	µg/L	EPA 200.2, 200.7, 200.8
	Arsenic	1	µg/L	
	Barium	10	µg/L	
	Boron	10	µg/L	
	Beryllium	0.5	µg/L	
	Cadmium	1	µg/L	
	Cobalt	0.5	µg/L	
	Copper	1	µg/L	
	Chromium	1	µg/L	
	Lead	1	µg/L	
	Manganese	5	µg/L	
	Mercury	0.2	µg/L	
	Molybdenum	1	µg/L	
	Nickel	1	µg/L	
	Selenium	5	µg/L	
	Silver	1	µg/L	
	Zinc	10	µg/L	
	Total Uranium	0.1	µg/L	SW-846 6020
	Low Level Mercury	0.5	ng/L	EPA 1631
	<b>VOCs</b>			
	Chloroform	1	µg/L	EPA 624
	1,1-Dichloroethene	1	µg/L	
	Trichloroethene	1	µg/L	
	<b>SVOCs</b>			
	Bis(2-ethylhexyl)phthalate	5	µg/L	SW-846 8270C
	<b>Other Inorganic and General Chemistry</b>			
	Total Suspended Solids	5	mg/L	SM 2540D
	Total Dissolved Solids	10	mg/L	SM 2540C
	CBOD	2	mg/L	SM 5210B
	Total Residual Chlorine	0.05	mg/L	SM 4500G
	Ammonia as Nitrogen	0.1	mg/L	EPA 350.1, SM 4500
	Oil & Grease	5	mg/L	EPA 1664
	Fluoride	0.5	mg/L	EPA 300.0, SM 4500BC
	Cyanide, Free	0.005	mg/L	EPA 335.1, SM 4500G
	Total Cyanide	0.005	mg/L	EPA 335.3, 335.4, SM 4500C,E
Nitrate/Nitrite as Nitrogen	0.05	mg/L	EPA 353.1, EPA 353.2, SM 4500E,H	
Fecal Coliform	0	counts	SM 9222E	
pH	0.1	S.U.	EPA 150.1, SM 4500B, SW-846 9040	
Total Hardness	10	mg/L	EPA 130.2, SM 2340C	
Total Uranium	1	µg/L	KPA	

Table 8-1 (continued). Analytical Method Requirements

Media	Analytes	RDL <sup>a</sup>	Units	Method
Surface Water (NPDES)	<b>Radionuclides</b>			
	Radium-226	1	pCi/L	Gas Proportional Counter
	Radium-228	1	pCi/L	
	Technetium-99	15	pCi/L	Liquid Scintillation Counter
	Isotopic Thorium (Th-228, Th-230, and Th-232)	1	pCi/L	Alpha Spec.
Sediment (LMICP)	Total Uranium	1	mg/kg	SW-846 6020
Air Particulates	Air Particulates	NA	g	40 CFR 50.6
	Total Uranium	1	µg/L	KPA
	Isotopic Thorium (Th-228, Th-230, and Th-232)	1	pCi/L	Alpha Spec.
	Isotopic Uranium (U-233,234, U-235, and U-238)	1	pCi/L	
	Radium-226	1	pCi/L	Gas Proportional Counter

<sup>a</sup>Required Detection Limit

<sup>b</sup>Kinetic phosphorescence analyzer

### 8.3 Non-standard Methods

Non-standard methods shall be validated prior to use. Method validation data must include information demonstrating that the method can meet all identified data quality objectives and performance criteria. The method and method validation data must receive independent verification that they will meet the accuracy and precision requirements of the DQO sampling plan as specified by project management prior to analysis of any Fernald Preserve samples.

### 8.4 Compliance with Performance Requirement

To ensure that subcontractor analytical laboratories can perform the analyses in the Integrated Contractor Purchasing Team Basic Ordering Agreement (ICPT BOA), meet chemical and radiochemical performance specifications, and report the data in a format that facilitates data validation, the laboratories will be evaluated prior to contract award and during contract performance as specified in the QSAS and FPQAPP.

Performance of the LMS contractor operated laboratory located at the Fernald Preserve is evaluated through data validation and annual laboratory audit.

### 8.5 Specific Routine Procedures to Assess Data Precision, Accuracy, and Completeness

Subcontract laboratories shall have SOPs for monitoring the validity of environmental tests undertaken as specified in the QSAS. The resulting data shall be recorded in such a way that trends are detectable and, where practicable, statistical techniques shall be applied to the reviewing of the results. This monitoring shall be planned and reviewed.

The laboratory must have a SOP for ensuring that data review is inclusive of all quality-related steps in the analytical process, including sample preparation, dilution calculations, chromatography evaluation, and spectral interpretations. The SOP shall require that documentation of data review will be maintained and available for review.

The precision, accuracy, and completeness of the analytical data generated in the LMS contractor operated laboratory are assessed during data validation.

### 8.5.1 Precision

A routine program of duplicate analyses shall be performed to determine the precision of the method (Section 9). The results of the duplicate analyses are used to calculate the relative percent difference (RPD), which is the governing QC parameter for precision.

$$\text{Where: } RPD = 100 \times \frac{[S - D]}{(S + D) / 2}$$

S = Sample Result (original)  
D = Duplicate Result

Additional determiners of precision may be specified by methods, such as the relative error ratio (RER) for radiochemical analyses.

$$\text{Where: } RER = \frac{|Original - Duplicate|}{(TPU_{Original}^2 + TPU_{Duplicate}^2)^{1/2}}$$

$TPU_{Original}^2$  = Square of the One Sigma Total Propagated Uncertainty of the Original Analysis

$TPU_{Duplicate}^2$  = Square of the One Sigma Total Propagated Uncertainty of the Duplicate Analysis

### 8.5.2 Accuracy

Accuracy shall be estimated based on results of laboratory control samples (LCS) analyses, matrix spike (MS) recoveries (Section 9), or both. The use of other performance evaluation samples or standards as specified by the methods may also be taken into account. Accuracy is expressed in terms of percent recovery as expressed in the following formulas:

A. For LCSs:  $Percent\ Recovery = 100 \times \frac{C_i}{C}$

B. For MSs:

$$\text{Percent Recovery} = 100 \times \frac{C_i - C_o}{C_t}$$

Where:  $C_o$  = value of unspiked aliquot  
 $C_i$  = value of spiked aliquot  
 $C_t$  = value of spike added

### 8.5.3 Completeness

Completeness shall be reported as the percentage of all measurements made with results judged to be valid following data validation (Section 13.2). The following formula will be used to estimate percent completeness.

$$\text{Percent Completeness} = 100 \times \frac{V}{T}$$

Where:

$V$  = number of required measurements judged useable for their intended purpose  
 $T$  = total number of required measurements

Completeness shall be evaluated relative to the length of the project and the specified holding time. If the completeness is less than 90 percent, explanatory documentation shall be provided that states why this completeness percentage is acceptable for the project and evaluates the impact of this completeness percentage on the project.

### 8.5.4 Detection Limits

For organic and inorganic analyses, method detection limit (MDL) is an estimate of the minimum amount of a substance that an analytical process can reliably detect. An MDL is analyte and matrix-specific and may be laboratory dependent. The laboratory shall determine the MDL for the method for each target analyte of concern in the quality system matrices as specified in the QSAS. All sample processing steps of the analytical method shall be included in the determination of the MDL.

Reporting limits for organic and inorganic analyses shall be the required detection limits as defined by the SOW and related requirements documents.

For radiochemical analysis, the minimum detectable concentration (MDC) is reported. The MDC is the smallest amount (activity), expressed in terms of concentration, of an analyte in a sample that will be detected with a probability  $\beta$  of non-detection (Type II error) while accepting a probability  $\alpha$  of erroneously deciding that a positive (non-zero) quantity of analyte is present in an appropriate blank sample (Type I error). The alpha ( $\alpha$ ) and beta ( $\beta$ ) probabilities are both set at 0.05 unless otherwise specified. MDC is not comparable to MDL since both Type I and Type II errors are considered.

## 9.0 Quality Assurance Objectives and Quality Control

The QA objective for environmental sampling and analysis at the Fernald Preserve is to verify that LMS contractor personnel and subcontractors comply with the requirements of the FPQAPP, including those for DQOs, sampling plans, field sampling, COC, laboratory analysis, and reporting. Meeting this objective will result in compliance with CERCLA and other regulatory requirements listed in Section 3. This section communicates specific objectives for the level of the QC effort. Details for attaining this include field QC samples; analytical QC samples; training requirements; records administration; document control; and requirements for completeness, representativeness, comparability, precision, accuracy, and sensitivity. Responsibility for overall direction, implementation, and maintenance of the QA program rests with the designated QA organization (Section 1).

A successful QA program must establish controls over planning, implementation, and assessment of data collection activities. In addition, personnel training, document control, field and analytical QC checks, and records management are necessary to fulfill QA objectives. Although administrative in nature, they are required to achieve validated data, ensure data comparability, provide reasonable access to the data, and prevent duplication of efforts in site projects.

### 9.1 Level of QC

Data generated shall be of known quality and in compliance with specified DQOs. Guidelines for development of Fernald Preserve DQOs are included in Section 3. Data shall be traceable, technically accurate and legally defensible, and data shall have definable characteristics.

Traceability is a legal requirement that provides a documented trail beginning with requirements for data and ending with effective use of the data. Elements that provide traceability include defined DQOs, documented collection and measurement techniques, sample and data custody records, and original and final data used to support decisions.

Legal defensibility requires that data generated be scientifically defensible (i.e., accurate, precise, and representative). Therefore, it is required to maintain complete files of generated data and supporting documentation sufficient to support litigation.

Fundamental mechanisms for achieving established quality goals can be categorized as prevention, quality assessment, and correction and include the following:

- Prevention of errors by planning and careful selection and training of skilled, qualified personnel.
- Quality assessment through a program of audits and surveillances to supplement continual informal review.
- Correction of processes to prevent recurrence of conditions adverse to quality.
- Incorporation of new processes as they develop.

### 9.1.1 Analytical Support Levels

There are five Fernald Preserve–defined analytical levels that will be assigned depending on the intended use of the data. The following are definitions of ASLs A through E.

#### **ASL A (Field Analyses)**

Field measurements of alkalinity, DO, ORP, temperature, and other parameters may be required on a project-specific basis. Specific conductance, pH, and turbidity may also be required or may be used as stabilization parameters when purging a monitoring well.

#### **ASL B (Qualitative with Results Only Deliverable)**

Laboratory data shall be fully compliant with requirements specified in the QSAS, the SOW, or project-specific documents. The Results Only Deliverable comprises the sample results, case narrative, and COC documentation. No calibration or QC sample data are reported. ASL B may be used when rapid turn-around results of undocumented quality are needed.

#### **ASL C (Quantitative with Standard Deliverable)**

Laboratory data shall meet the same requirements as for ASL B with a Standard Deliverable. The Standard Deliverable includes those deliverables defined for ASL B plus all applicable EPA Contract Laboratory Program forms or their equivalent. No raw data, spectra, or laboratory logbook copies are required.

#### **ASL D (Quantitative with Standards Plus Raw Data Deliverable)**

Laboratory data shall meet the same requirements as ASL C with a Standard Plus Raw Data Deliverable. The Standard Plus Raw Data Deliverable includes those deliverables defined for the Standard Data Package plus all raw data and spectra generated in the acquisition of the analytical data. This is to include, but not limited to, laboratory–originating quality indicator samples, analyses performed but not used for reporting, preparation and instrument data generated during sample analysis.

#### **ASL E (Nonstandardized Protocols)**

Nonstandardized protocols are analytical methods for unusual analytes or when the method performance standards cannot be met. This could be caused by interferences, analyses performed outside of accepted requirements for existing methods, or new methods developed to meet site requirements or project-specific requirements that cannot be met by existing analytical methods. Nonstandard methods may be needed to meet project-specific requirements that cannot be met using existing analytical methods.

Example: Determination of organic compounds (e.g., benz(a)anthracene) in drinking water at sub-part per billion levels by special method on-column injection gas chromatography/mass spectrometry with selective ion monitoring detection and a full suite of field and laboratory QC samples as required for ASLs C and D data. A complete raw data package may be required for validation. The results are required to assess risks associated with use of this water as a drinking water source.

### 9.1.2 Type and Frequency of Field QC Samples

Collection of field QC samples is based on the requirements of the project's DQO. Requirements and justification for field QC samples for each sampling event shall be documented in the DQO and the corresponding sampling plan. Section 6 summarizes requirements for field sample collection.

Field QC and the rationale for selection of specific field QC samples include the following:

- **Trip blanks** are used to determine whether conditions encountered during sample shipment and handling have affected sample quality. One trip blank shall be collected per shipping container containing VOC samples.
- **Field blanks** are used to determine whether the sample collection process or conditions at the collection point have affected sample quality. A field blank is prepared using analyte-free and appropriate containers and equipment. Field blanks are collected at the rate of 1 per 20 samples or 1 per sampling round, whichever is more frequent.
- **Equipment rinsate samples** are used to determine the effectiveness of decontamination procedures and to help ensure that cross-contamination of samples does not occur. A rinsate sample is not required when dedicated or disposable equipment is used for sample collection. Rinsate samples shall be collected at a rate of 1 per 20 samples collected with non-dedicated equipment or 1 per sampling round where non dedicated equipment is used, whichever is more frequent.
- **Duplicate samples** are two separate samples collected from the same source as close to each other in time and space as practical at a specific location (i.e., in separate containers and analyzed independently) and analyzed for the same constituents as the original sample. A duplicate sample is used to evaluate precision of analytical laboratory performance and sample collection techniques. Duplicate samples are collected at a rate of 1 per 20 samples or 1 per sampling round, whichever is more frequent.

### 9.1.3 Type and Frequency of Analytical QC Samples

The types of QC sample analysis and frequency are identified in Table 9-1 or Section 8. The frequency of these may be increased but shall not be less stringent. The acceptance criteria for these QC samples is specified in the laboratory SOPs based on method requirements and performance data, or determined by the performance evaluation study provider.

Laboratory QC and the rationale for selection of specific laboratory QC samples include the following:

**Laboratory Control Samples:** a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

Table 9-1. General Laboratory QC Specifications

Inorganic Analyses QC	Frequency
Initial Calibration	As specified in the analytical method.
Initial Calibration Verification/ Continuing Calibration Verification (ICV/CCV)	Following calibration and then 1 / 10 samples as applicable to the analytical method.
Initial Calibration Blank/ Continuing Calibration Blank (ICB/CCB)	Following calibration and then 1 / 10 samples as applicable to the analytical method.
Method Blank (MB)	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Laboratory Control Sample (LCS)	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Duplicate	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Matrix Spike (MS)	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Interference Check	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Dilution Check/Serial Dilution	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Organic Analyses QC	Frequency
Initial Calibration	As specified in the analytical method.
Continuing Calibration	As specified in the analytical method.
Method Blank (MB)	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Laboratory Control Sample (LCS)	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Matrix Spike (MS)	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Matrix Spike Duplicate (MSD)	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Surrogates	Present in every determination if specified in the method
DFTPP and BFB performance results (GC-MS)	Once every 12 hours or as specified in the analytical method.
Performance Evaluation Standard (Pesticides/PCBs)	1 / 10 samples as applicable to the analytical method.
Second Column Confirmation (GC analyses)	For all positive hits as specified in the laboratory SOPs.
Review of compound identification for Target Analytes	For all positive hits.
Review of Tentatively Identified Compounds	As specified in the laboratory SOPs.
Radiochemical Analyses QC	Frequency
Reagent Blank	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the analytical method.
Laboratory Control Sample (LCS)	Same as above. The LCS shall include at least one radioisotope from those being analyzed when using alpha and gamma counting techniques.
Duplicate	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to analytical method (Table 8-1).
Matrix Spike (MS)	1 / 20 samples or analytical batch, whichever is more frequent (per matrix) as applicable to the method (Table 8-1).
Tracer, Carrier, or Spike	Present in every determination in which chemical separation is required to isolate the analytes of concern. Those methods not requiring yield determinations are direct gamma spectrometry, gross alpha analysis, and gross beta analysis. When a tracer or carrier is not used to determine chemical recovery, a spiked duplicate must be analyzed concurrently with each sample. A sample-specific chemical recovery monitor (i.e., tracer, carrier, or spike) must be used for each sample being analyzed by a method that involved chemical separation. The use of batch efficiency or batch recovery factors is unacceptable.

Note: This table represents the QC that may be typically seen for inorganic, organic, and radiochemical analyses. For more specific guidelines on laboratory QC, refer to Section 8 or the applicable analytical method.

**Method blank:** a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

**Matrix spike:** a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

**Matrix spike duplicate:** a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

**Surrogate spikes:** a sample prepared most often in organic chromatography test methods. Surrogate spikes are chosen to reflect the chemistries of the targeted components of the method. Added prior to sample preparation/extraction, they provide a measure of recovery for every sample matrix.

**Blind sample:** a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

**Performance evaluation sample:** a sample, the composition of which is unknown to the analyst that is provided by a certified performance evaluation study provider to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

## 9.2 Accuracy, Precision, and Sensitivity of Analysis

Field and laboratory data must be of sufficient quantitative and qualitative value for intended use. The quality of laboratory data are dependent on method precision, accuracy, and sensitivity and the basic nature of the analysis. Precision is a measure of the reproducibility of an analytical measurement, and accuracy is the difference between a measured value and a true or known value. Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different concentrations or a variable of interest. Details on accuracy, precision, and sensitivity are presented in Section 8.

The field and analytical methods are chosen to meet the project precision, accuracy, and sensitivity objectives.

## 9.3 Completeness, Representativeness, and Comparability

### 9.3.1 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.

If sufficient valid data are not obtained to meet project objectives, additional sampling and analysis may be performed.

### **9.3.2 Representativeness**

Representativeness is a qualitative parameter based on professional judgment that reflects the design of the sampling program, the proper selection of sampling locations, and collection of a sufficient number of samples. It expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at sampling points, or an environmental condition.

For the Fernald Preserve, this is addressed through the use of a carefully designed sampling and analysis plan, the selection of appropriate sample locations, and the design of adequate sampling and analysis procedures. The goal is to obtain samples representative of the specific matrix (solids, liquids, and air) so that sampling performance can be evaluated.

### **9.3.3 Comparability**

Comparability is a qualitative expression of the confidence with which one data set can be compared to another. Analytical data generated by the same analytical procedures are comparable provided that relevant, specified QC elements (such as detection limits, initial and continuing calibration performance, accuracy, precision, and matrix interference acceptance criteria) are met or exceeded. Data generated for the same analytes generated by different analytical procedures are also comparable, provided that relevant QC performance criteria similar to those above are met or exceeded.

## **10.0 Preventive Maintenance**

### **10.1 Program Development**

Preventive maintenance is an organized program developed to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use. An adequate preventive maintenance program increases the reliability of a measurement system.

The requirements of a preventive maintenance program depend on the instruments and equipment used within a laboratory or field program. This section does not attempt to specify instrument or equipment requirements; rather, it sets minimum guidelines for maintenance practices. Preventive maintenance requirements may be documented in SOPs or in separate preventive maintenance documents. If necessary, additional preventive maintenance requirements may be stipulated in sampling plans.

The following factors shall be addressed in the Fernald Preserve preventive maintenance programs:

- Instruments, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics in the absence of routine maintenance.
- Spare parts necessary to minimize downtime.
- Optimum frequency of maintenance.

Laboratories are required to have SOPs for preventive maintenance of each measurement system (including analytical instruments) and necessary support equipment (e.g., refrigerators, ovens) as specified in the QSAS. Maintenance activities shall be documented in logs.

Preventive maintenance programs shall include the following at a minimum:

- Frequency of maintenance, which is based on manufacturer recommendations and experience with the equipment.
- Service contracts, as necessary.
- Items to be checked or serviced during maintenance
- SOPs for performing maintenance.

Records of maintenance shall be documented in maintenance logs maintained with the instrument or at an instrument storage and service area.

### **10.2 Responsibilities**

Laboratories shall implement preventive maintenance as specified in the QSAS. Compliance shall be verified during laboratory audits.

For field projects, each project manager (or a designee) is responsible for the preparation, implementation, and documentation of the preventive maintenance program. Table 10-1 lists preventive maintenance requirements for commonly used field equipment.

Table 10–1. Minimum Preventive Maintenance for Commonly Used Field Equipment

Equipment Type	Maintenance	Minimum Frequency	Spare Parts
pH meter	Check battery Clean electrode Check connectors	With each use Monthly With each use	Batteries Electrode
Specific conductance meter	Check battery Clean probe Check connectors Inspect cable	With each use Monthly Daily With each use	Batteries Probe
Dissolved oxygen meter	Check battery Clean probe Check cable and connectors	Daily Monthly With each use	Batteries
Thermometers	Clean and check for cracks	With each use	
Electronic water level indicator	Check battery Clean probe Accuracy check	With each use As needed Annually	Batteries
Pressure transducers	Check cables Clean probe Zero check	With each use As needed Annually	
Water quality meter	Check battery Clean probe Inspect cable Replace sensors Check connections	With each use After each use With each use As needed With each use	

## **11.0 Instrument/Equipment Calibration and Frequency**

Equipment used in the field and the laboratory shall comply with formally prescribed calibration requirements and shall be of the type, range, accuracy, and precision necessary to provide data compatible with the ASL specified in sampling plans. Equipment shall be calibrated in accordance with documented and approved procedures. When available, accepted procedures published by the ASTM, EPA, NIST, or manufacturer equipment manuals shall be incorporated into SOPs.

### **11.1 Responsibilities**

The instrument user is responsible for inspecting the calibration status of the instrument, ensuring that calibration requirements are met, and documenting the calibration in the appropriate calibration log.

### **11.2 Field Calibration Procedures**

The following shall be included in procedures for the calibration of equipment:

- Source of the calibration procedure.
- Provision for recording unique identification numbers for equipment requiring calibration on appropriate logs.
- Specified reference standards with known relationships to nationally recognized standards (e.g., NIST or accepted values of natural physical constants). If national standards do not exist, reference and document the basis for calibration.
- Prescribed frequencies for the calibration of equipment.
- Specification for a log to document each calibration, including the applicable criteria and minimum information required.

#### **11.2.1 Calibration Frequency**

Frequency of calibration and calibration verification shall be determined based on the following applicable criteria:

- Type of equipment;
- Inherent stability;
- Manufacturer recommendations;
- Intended use;
- Results of QC sample analysis or checks with standards; or
- Instrument response time.

### **11.2.2 Calibration Documentation Requirements**

Documentation shall be maintained for each piece of calibrated equipment to indicate that established calibration procedures have been followed. Calibration records for field equipment shall be retained in project files. At a minimum, the following information shall be recorded and available for project use:

- Equipment identification number.
- Type and manufacturer of equipment.
- Calibration frequency and acceptable tolerances.
- Calibration dates, results, and any problems encountered during calibration.
- Identification of calibration procedures employed.
- Identification of personnel performing calibration.
- Dates of maintenance and inspections.
- Certification or statement of calibration provided by manufacturer or external agency, if applicable.
- Statement of calibration acceptance or failure.
- Disposition of equipment that fails calibration.

### **11.2.3 Equipment Failure**

Equipment that cannot be calibrated or becomes inoperable during use shall be tagged and removed from service until it can be repaired and/or recalibrated to the acceptance criteria specified in the applicable procedure. Equipment that cannot be repaired shall be permanently removed from service.

Calibration checks shall be performed on all field instruments before use each day. If the instrument does not meet the criteria specified in the SOP or instrument calibration procedure, then use of the instrument shall be discontinued until the appropriate corrective action has been taken.

### **11.2.4 Calibration Reference Standards**

Calibration standards shall be traceable to NIST, EPA-certified standards, or the best quality materials available.

### **11.2.5 Equipment Calibration**

#### **11.2.5.1 Environmental (High-Volume) Air Monitoring Station Calibration**

Environmental air sampling systems shall be calibrated prior to initial use, yearly thereafter, and after equipment maintenance that would affect calibration. Calibration shall be performed in accordance with manufacturer's instructions as documented in approved SOPs. The power source shall be within manufacturer specifications and checked at least annually. Calibration worksheets and records for each station shall be maintained in the project files.

#### 11.2.5.2 Water Quality Meter Calibration

Water quality meters shall be calibrated in accordance with manufacturer's instructions. Meters with a pH sensor shall be direct-reading, temperature-compensating, and capable of responding within 0.1 pH unit, within 4 percent of full scale for specific conductance, and within 0.1 mg/L for DO over a temperature range of 0 to 40 °C. The response time of the instrument shall not be greater than two minutes.

Calibration for instruments used for field activities (e.g., parameter stabilization for monitoring well samples) shall be checked daily and shall be calibrated when the daily checks indicate a problem or monthly at a minimum (per manufacturer's recommendations). Calibration shall be performed using standard solutions selected according to the expected parameter range of the sample per manufacturer's instructions.

#### 11.2.5.3 Water Level Indicator Verification

Water level indicators shall be compared to a dedicated independent measuring instrument annually or after being subjected to unusual stress. Water level meters that deviate from the reference water level indicator by more than  $\pm 0.1$  ft or are otherwise unusable (e.g., numbers not readable) shall be removed from service. The measured difference from the dedicated reference shall be posted on each piece of equipment.

#### 11.2.5.4 Thermometer Verification

Thermometers directly used to collect environmental data shall be verified annually using an NIST-traceable thermometer. Thermometers used for ancillary purposes shall be verified according to SOPs. Thermometers shall be discarded if readings differ by  $\pm 0.5$  °C. Combination meters with thermometers must be returned for recalibration if annual verification readings differ by  $\pm 1$  °C, or manufacturer's specification, whichever is more stringent.

#### 11.2.5.5 Pressure Transducer Verification

Pressure transducers are used at the Fernald Preserve for the collection of long-term water level data and in pumping tests. Each transducer is calibrated by the vendor. Pressure transducers shall be recalibrated according to recommended intervals supplied by the vendor. If the vendor does not provide a recommended schedule, pressure transducers shall be recalibrated based on the documented outcome of performance checks.

A performance check will be conducted when a transducer is installed and at least annually thereafter to document that the transducer is giving acceptable readings. The reading obtained from the pressure transducer will be compared with that of an independent measuring instrument. If the elevations differ by more than  $\pm 0.1$  ft, the transducer will be removed from service. It will either be replaced with a properly calibrated transducer or repaired and recalibrated.

## **11.3 Analytical Laboratory Equipment Calibration Procedures**

Any laboratory performing analyses to support activities at the Fernald Preserve shall calibrate analytical equipment in accordance with approved procedures prior to performing sample analyses. Instrument calibrations must be verified on an ongoing basis by processing calibration verification standards and other QC samples as prescribed in Section 9 and in analytical contracts. Calibration information shall be documented.

If initial calibrations do not meet acceptance criteria, analyses shall not be performed, corrective action shall be taken, and the calibration standards shall be reanalyzed. If continuing calibration check samples do not meet acceptance criteria, corrective action shall be taken and the instrument shall be recalibrated. Samples analyzed since the last calibration that met specified criteria shall be reanalyzed.

If deviations from procedures are necessary, the laboratory technical representative shall be notified immediately. Documentation and explanation of the deviation shall be presented in the final analytical report.

### **11.3.1 Laboratory Equipment Calibration Schedules**

The calibration of laboratory equipment shall be verified at least annually or at the time of a repair that affects the function of the equipment. Laboratory personnel shall maintain calibration records for all commonly used laboratory equipment, including, but not limited to, the following:

- Automatic/manual pipettors.
- Laboratory balances.
- Thermometers used to verify compliance with the requirements of this document (e.g., to monitor sample preservation) or monitor analytical methods that produce data in accordance with this document.

### **11.3.2 Laboratory Instruments Calibration Frequency**

Laboratory instruments must be calibrated at least as frequently as the shortest of the following:

- The frequency specified in the applicable SOP;
- The frequency specified in the laboratory contract (for off-site laboratories); or
- The frequency specified by the manufacturer.

In addition, laboratory instruments must be calibrated before use and after a repair that affects the function of the equipment. The minimum instrument calibration and performance evaluation requirements for radiochemistry instrumentation are listed in the QSAS.

## **12.0 Inspection/Acceptance of Supplies and Consumables**

The integrity of supplies and consumables used for environmental sampling and analysis shall be maintained at all times. All equipment, supplies and consumables shall be inspected prior to use for defects, suitability of intended purpose and cleanliness, at a minimum. Suspect items shall not be used and will be discarded to prevent inadvertent use. Expiration dates of standard and reference solutions must be checked prior to each use. Any expired solutions/materials shall not be used and will be properly disposed.

### **12.1 Sample Containers**

Sample containers shall be purchased pre-cleaned in accordance with the U.S. EPA *Specifications and Guidance for Contaminant-Free Sample Containers* (EPA 1992c). Suppliers shall also be required to provide supporting quality control summary documentation to demonstrate that the containers are contaminant-free.

Soil samples collected for radiological or metals analyses may be containerized in a plastic liner tube (with end caps) that was used to collect the sample using direct-push methods. Plastic liner tubes and end caps will be pre-cleaned using the Level II decontamination procedure described in Section 6.

### **12.2 Reagent-Grade Water**

Reagent-grade water is used at the Fernald Preserve for reagent preparation, field and method blank preparation, and decontamination of field equipment. The quality of reagent-grade water shall be directly related to the sample analysis to be performed. Requirements for water quality will differ for organic, inorganic, and biological analytical methods. Reagent-grade water shall be free of substances that interfere with the intended analytical method.

Reagent-grade water will range from Type I with no detectable concentration of analytes at the detection limit of the intended method to Type III for laboratory equipment washing and qualitative analysis. In general, Type I water is used for field quality control sample preparation and decontamination of field equipment.

At a minimum, reagent water systems shall be tested prior to each use for conductivity or resistivity, as applicable. Additional testing requirements, acceptance criteria, system maintenance, and frequencies for reagent-grade water shall be specified in SOPs or sampling plans.

### **12.3 Standard Solutions and Materials**

Primary reference standards and calibration solutions must be traceable to NIST, EPA, or another reliable, documented source. Secondary reference standard materials shall be traceable to primary standards or compared to a primary standard, if available. Suppliers shall be required to provide supporting quality control summary documentation.

Chemicals used for sample preservation or during analysis must be at least reagent-grade, although specific procedures or methods may require the use of higher-grade reagents or preservatives. Materials of lesser purity than specified shall not be used. Purity grades shall be stated in SOPs or sampling plans.

## **13.0 Data Management and Reporting**

The following procedures shall be used by Fernald Preserve personnel, the Fernald Preserve laboratory, and subcontractor laboratories for data management and reporting as applicable.

### **13.1 Data Reduction and Review**

Data reduction is the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more usable form. In general, data shall be reduced in one of the following ways:

- Manual computation of results directly on the data sheet or on attached calculation pages.
- Input of raw data for computer processing.
- Direct acquisition and processing of raw data by a computer.

The results of data reduction are reviewed to verify that the data reduction has been performed correctly in accordance with the SOPs. This review shall be documented and signed off by the laboratory manager, field supervisor, or designee, as applicable. At a minimum, the data reduction review shall consist of a completeness and legibility check as well as verification of the calculated results. The reviewer shall have a general knowledge of the test method for which the data review is being performed. If the method and/or project requirements specify a more stringent review, the additional review requirements and the qualifications of the reviewer shall be stated in the applicable SOP or sampling plan.

#### **13.1.1 Responsibilities**

Data reduction shall be performed by the laboratories analyzing samples or by field personnel responsible for obtaining field measurements. All calculations and results, including field measurements, shall be independently reviewed. The reviewer shall initial and date the applicable reporting forms (Sections 5.2 and 6.2).

#### **13.1.2 Data Reduction Procedures**

Data reduction performed by the laboratories and by field personnel shall be documented in laboratory SOPs. Data reduction shall be done on data sheets specified for the field method or in the field notebook. Equations and other information required to reduce field data shall be specified in the individual field methods.

### **13.2 Analytical Data Validation**

The purpose of data validation is to determine if analytical data meet the specific technical and quality control criteria established in the applicable requirements documents and to establish the usability and extent of bias of any data not meeting those criteria. All data are subject to validation as a specified level. Data used to support a decision making process should be validated prior to use.

Laboratory data shall be validated using Procedure GT-9(P), “Standard Practice for Validation of Laboratory Data,” in the *Environmental Procedures Catalog* (LMS/POL/S04325) which is based on the following guidance:

- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2002b).
- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA 1999).
- *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review* (EPA 2001c).
- *DOE Evaluation for Radiochemical Data Usability* (DOE 1997).

### **13.2.1 Validation Review Levels**

This procedure presents the guidelines used to evaluate analytical data packages to consistently qualify data using defined criteria; however, it is not intended to eliminate the need for professional judgment in evaluating the data quality. On the basis of experience and familiarity with the analytical techniques, historical data, or sample matrices, the data validator may be more or less stringent in evaluating the results. To make judgments at this level requires a complete understanding of the intended use of the data. When variations in the application of data qualifiers are warranted, the justification and rationale shall be explained in the validation report.

A graded approach shall be applied to determine validation requirements. Data will generally be validated at a level corresponding to the ASL specified for the project or sample submittal. Certain data may require a higher level of confidence or defensibility and are obtained by specifying a higher ASL. These data require complete validation to meet the data use requirements.

Depending on project needs, ASL E (nonstandard methods) may be validated at any of the three validation review levels; specialized QA/QC requirements, acceptance criteria, and documentation submitted from the laboratory must be defined in the analytical contracts or in the applicable sampling plan.

#### **13.2.1.1 Data Deliverables Examination; Level 1**

Data deliverables examination is the minimum data validation level and is performed on all data packages received from contract laboratories. The purpose of the examination is to assess the completeness of the deliverables, identify any reporting errors, and assess the usability of the data based on the laboratory’s evaluation of their data as described in the case narrative received with the data. The following are reviewed at this level:

- Chain of Custody.
- Case narrative.
- Presence of field and sample identifications.

- Holding times.
- Preservation and cooler receipt.

This validation level is appropriate for ASL B data where limited documentation is received from the laboratory.

#### 13.2.1.2 Data Deliverables Verification; Level 2

Data deliverables verification consists of an evaluation of the data package report forms to determine the extent to which the laboratory met the method and contract-specific quality control and reporting requirements.

In addition to the elements listed for Level 1, the following are reviewed at this level:

- Surrogate recoveries (tracers and/or carriers).
- Laboratory blank data.
- Spike data.
- Laboratory control samples.

This validation level is appropriate for ASL C data where the documentation received from the laboratory includes the appropriate quality control reporting forms.

#### 13.2.1.3 Data Validation; Level 3

Data validation consists of determining the data quality and the extent to which the laboratory accurately and completely reported all sample and quality control results and satisfied all contract requirements. In addition to the elements listed for Level 2, the following are reviewed at this level:

- Initial calibration.
- Continuing calibration.
- Internal standard recoveries.
- Laboratory control sample performance.
- Target compounds.
- Duplicates.
- MS performance.

This validation level is appropriate for ASL D data where complete documentation is received from the laboratory.

### 13.2.2 Special Considerations

The data validation procedure specifically covers the validation of routine analytical results from environmental methods for organic, inorganic, and radiochemical analysis. While the procedure is to be used as an aid in the formal data validation process, other sources of guidance and

information, as well as professional judgment, should also be used to determine the ultimate usability of data, especially in those cases where all data do not meet specific technical criteria. When possible, data may be compared to historical values for a particular sampling location as an additional check to identify potential errors.

Results must be reported in correct units for all analytes requested. Method detection limits and contract required detection limits must be met, or an explanation must be provided in the case narrative. Supporting documentation must be completed and must include the appropriate data for the analyte and ASL specified.

Laboratories will generally use commercial software wherever possible. Spreadsheets and laboratory-developed software are required to be verified and uniquely identified to include version control. Re-verification of commercial software is not routinely required. Hand-calculated data or data calculated from a spreadsheet or software not under version control must be verified by the random recalculation of some of the results. Hand-calculated results and spreadsheets shall have all required formulas and data included in the data package.

### 13.2.3 Data Qualifier Codes

The laboratory assigns qualifier codes when reporting data as specified by the SOW and requirements document. These codes are reviewed during data validation. Additionally, data validation qualifiers may be assigned during the data validation process. Table 13–1 provides a description of the data validation qualifiers used.

Table 13–1. Data Validation Qualifier Codes and Definitions

Code	Definition
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
R	The sample result is unusable. The analyte may or may not be present in the sample resampling and/or reanalysis may be necessary to confirm or deny presence of the analyte.
U	Analyses were performed, but the analyte was not detected above the reported sample quantitation limit. Associated numerical value indicates the approximate concentration above which the analyte was determined not to be present.
UJ	The analyte was not detected above the quantitation limit. However, the reported adjusted quantitation limit is approximate and may be inaccurate or imprecise. The reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is a combination of the "U" and "J" qualifiers. The detection limit is considered estimated based on QC considerations. If a decision requires quantitation of the analyte close to the associated numerical level, reanalysis or alternative analytical methods should be considered.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification." The result can be used for decision making purposes, but further information may be necessary to confidently identify the analyte in this sample.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration. This qualifier indicates the presumptive presence of the analyte, but the result can only be considered estimated. This qualifier is not used in typical inorganic analyses, but could be used to qualify organic or radiochemistry data due to spectral interpretation problems.
Null	The data validator has not assigned a qualifier code to the positive result, signifying that the result is confident as reported by the laboratory and includes the qualifiers assigned by the laboratory.

### 13.2.4 Data Validation Report

Data validation reports shall document, on the basis of instrumentation and methodology, the results of the data review and validation. The report shall include a summary of samples and all qualifiers applied to the data as a result of the validation process. The report shall include a discussion of the qualification that was applied. The following sections are included as appropriate for the analysis performed and level of validation:

- Sample shipping and receiving.
- Holding times and preservation.
- Calibration.
- Internal standard.
- Surrogates.
- Tentatively identified compounds.
- Confirmation.
- Reporting limit verification.
- Inductively Coupled Plasma (ICP) interference check sample (ICS).
- ICP serial dilution.
- Tracer/carrier.
- Blanks.
- Laboratory control samples.
- MS.
- Laboratory replicates.
- Detection limits and dilutions.
- Corrective action reports.

Validation worksheets may be included to further document the basis for the data qualification. Quality elements that are documented on the worksheets include the validator's name; laboratory names; compliance to holding and preservation requirements; calibration data; compliance with calibration, reporting limit verification, and serial dilution acceptance criteria; laboratory, field, equipment, and trip blanks; surrogate, internal standard MS/MSD, and LCS recoveries; replicate RPDs; and/or replicate error ratios.

### 13.3 Field Data

Field data shall be assessed for accuracy, precision, and completeness, taking into account overall project objectives, background data points, and field QC samples as defined in Section 9.1.2. Requirements for field documentation are included in Sections 5, 6, and 7. If additional requirements are required for a specific project, they shall be defined in sampling plans.

## **13.4 Assessment of Data Quality**

All Fernald Preserve sampling projects support surveillance monitoring are driven by permit requirements (e.g., NPDES); or support detection, assessment, and corrective action monitoring as established in OAC 3745 (i.e., OSDF monitoring). As such, the data are used to verify long-term trends, determine permit limits or FRL exceedances, or detection type monitoring.

Based on the results of the data validation process, the project lead or a designee evaluates caveated data (VQ = J or UJ) based on the effect on the data set. For example, if the qualified data is close to an FRL or NPDES permit limit, an additional data review will be performed to determine whether the bias of the data point indicates that the data point may be anomalous. Moreover, for data that has not been caveated but is highly variant when compared to historical results, an additional data review will be performed to determine whether the bias of the data point indicates that the data point may be anomalous.

## **13.5 Data Management**

Environmental data may be used to support decisions other than that for which they were originally intended. The LM central computerized data repository helps to ensure that environmental data are accurately and completely maintained and that appropriate data are accessible for multiple uses.

Data qualifiers resulting from the data validation process shall be present in the data repository and referenced whenever Fernald Preserve environmental data are used. The Fernald Preserve environmental data management system shall allow attachment of data qualifiers to each piece of data.

## **13.6 Life Cycle of Fernald Preserve Environmental Data**

Guidelines for establishing DQOs and developing sampling plans, data transfer and handling procedures, sample analysis requirements, and data validation procedures are detailed in other parts of the FPQAPP. Each activity directly related to the generation and management of environmental data is summarized in a chronological sequence in the following paragraphs.

### **13.6.1 Planning**

When a project manager has identified the need to collect samples to acquire environmental data, a DQO and sampling plan shall be prepared in compliance with FPQAPP requirements. These planning documents shall specify the type and number of samples to be collected in order to provide the desired data. Typically, a sampler will review the sampling plan and assign individual computer-generated sample numbers and sample delivery group numbers from the Sample Management System (SMS) database.

### **13.6.2 Collection of Samples**

Samples shall be collected in accordance with the sampling plan and FPQAPP. Field sampling teams collect and package physical samples (e.g., soil, groundwater) for transfer to a sample

receiving group following COC requirements. Required field observations (e.g., temperature, pH, specific conductance) are also measured and recorded as part of the field data package. Each sample or piece of recorded data is referenced to a sampling location through the State of Ohio planar coordinate system. The northing and easting of each sample location are entered into the Site Environmental Evaluation for Projects (SEEPPro) database and linked with information for that sample, including sampling information and analytical results.

### **13.6.3 Transfer and Handling of Samples**

Samples collected for laboratory analysis are identified with a sample number, packaged, and transported to a sample receiving group. When the samples are received, the sample receiving group shall complete the COC, enter other appropriate tracking data into the electronic SMS, and package and ship the samples to the designated laboratory for analysis.

### **13.6.4 Laboratory Analysis and Reporting**

Sample analysis is performed at an on-site or off-site analytical laboratory. Analytical results, along with supplemental information on analytical techniques, filtering, dilutions, and COC records, are documented and organized into a data package. Data packages are transferred to the LM contractor in electronic format (e.g., portable document format [PDF]) and become part of the permanent record. The receipt of data packages from off-site and on-site laboratories is tracked in SMS. On-site analytical data generated by the on-site laboratory shall be entered into the SMS application and are ultimately transferred to the SEEPPro database. Off-site analytical laboratory data shall be electronically loaded in the SEEPPro database from electronic data delivery files.

### **13.6.5 Completeness Verification**

Data packages shall be examined to ensure specified deliverable requirements are met. Data package requirements are dependent on the specified ASL of the samples and the relevant laboratory contract.

### **13.6.6 Data Validation**

Data validation is an independent assessment of data against established criteria to determine the technical reliability of the reported analytical results. Data validators shall review each data package and, if necessary, assign qualifiers. These data qualifiers shall be entered into the SEEPPro database.

### **13.6.7 Data Analysis Reports**

Analytical results data shall be retrieved and reported to support a wide range of activities, including modeling, statistics, mapping and visual display, and summary tabular data listings. Some data analysis reports may include an assessment of the usability of existing data for current applications. The assessments may lead to definition of a need for additional sampling efforts, which connects the data analysis phase of the data life cycle to the data requirements and sampling plan phases.

### **13.6.8 Records Management**

Records management begins when the need for data collection is identified. It concludes when all appropriate documentation has been archived as a record for the project. Accurate and complete records shall be tracked and collected in a systematic and methodical manner that satisfies requirements imposed on the Fernald Preserve by site, local, State, and Federal agencies. These records shall become part of the evidence files.

### **13.6.9 Data Archiving and Storage**

Sample data in the SEEPro database are linked to the laboratory data package through the sample delivery group number. The electronic database that track the data covered by the FPQAPP will be managed under the guidance of the National Archives and Records Administration when the database is no longer in active use. The file format, storage media, and documentation used will be determined at that time to facilitate the long-term usefulness of the data in supporting project activities.

## **13.7 Data Reporting**

Subcontract laboratories generate analytical data packages. The analytical data packages contain information about analytical tests performed, date and condition of samples received, results, methodology, and quality of data reported. Field measurements shall be reported on applicable forms specified in Sections 5 and 6.

Subcontract laboratories generate SEDD of analytical data in accordance with the SOW and requirements documents. Each Fernald Preserve project manager shall be responsible for checking and approving the final presentation of reported data to ensure that project-specific requirements are met.

Analytical data generated by the LMS contractor-operated laboratory are entered into the SMS application with the data ultimately transferred to the SEEPro database.

### **13.7.1 ASL A**

Field-generated data reports for ASL A shall include field logs, report forms, and COC records.

### **13.7.2 ASL B**

For ASL B analyses, the deliverable data package shall include, at a minimum, reports of the following analysis results, as applicable:

- Signed and dated original COC forms received with each sample shipment, indicating sample receipt and custody by the laboratory.
- A case narrative that describes the contents of the data package and provides an index of samples associated with the sample delivery group number. A description of problems encountered in sample receipt, login, and analysis shall also be included in the narrative. The case narrative shall describe the circumstances leading to the use of data qualifiers and list the affected samples. In addition, the type of digestion used shall always be clearly

specified in the case narrative for general inorganic analysis of soil samples. All case narratives shall include a signed statement affirming that the analytical work and data package have been reviewed and are in compliance with the requirements.

- One Analysis Results Form (equivalent to the Contract Laboratory Program [CLP] Form I) for each sample associated with the deliverable. The laboratory shall specify the sample number, date analyzed, date extracted (where appropriate), sample delivery group number, and report date on each page of the Analysis Results Form. For each result, the laboratory shall provide the parameter name, parameter value, uncertainty value (where applicable), MDL, and practical quantitation limit (PQL) or MDC, and decision level concentration (DLC) (as applicable), units of measure, data qualifiers, method of analysis, and analysis date on the Analysis Results Form. Analysis results forms shall include the extraction date (as applicable). Alternatively, a tabular summary of extraction dates may be provided immediately following the Analysis Results Forms.

### 13.7.3 ASL C

The deliverable data package for ASL C analyses shall contain all the items listed for ASL B and QC data deliverables consisting of completed CLP QC data reporting forms or equivalent for all sample analyses associated with the delivery order.

QC data deliverables for general inorganic chemistry shall include items listed below. The sample delivery group number shall be identified on each page of the QC data deliverable. QC acceptance limits shall be included in the QC deliverable. All QC forms shall be clearly labeled.

- Initial calibration verification (ICV) and continuing calibration verification (CCV) analysis data shall include the parameter name, true ICV concentration, analyzed ICV concentration, ICV percent recovery, true CCV concentration, analyzed CCV concentrations, and each CCV percent recovery. The use of EPA CLP Form II-IN or an equivalent format is acceptable.
- Initial calibration blank (ICB) and continuing calibration blank (CCB) analysis data shall include the parameter name, ICB analysis result, and CCB analysis results. The use of EPA CLP Form III-IN, or equivalent, is acceptable.
- Preparation blank (PB) analysis data shall include the parameter name and PB results for each analytical batch. The use of EPA CLP Form III-IN, or equivalent, is acceptable.
- ICS analysis data shall include the parameter name, true concentration values for solutions A and AB, initial measured values for solutions A and AB, initial percent recovery for solution AB, final measured values for solutions A and AB, and the final percent recovery for solution AB. The use of EPA CLP Form IV-IN, or equivalent, is acceptable.
- Spike analysis data shall include the parameter name, spiked sample result, sample result, spike added, and spike percent recovery for each spike analysis. In addition, the required data qualifiers for spike analyses that fall outside the control limits shall be included. The use of EPA CLP Form V (Part 1)-IN, or equivalent, is acceptable.
- Replicate analysis data shall include the parameter name, sample result, replicate result, and RPD. The required data qualifiers for replicate analyses that fall outside the applicable control limit. The use of EPA CLP Form VI-IN, or equivalent, is acceptable.

- LCS analysis data shall include the parameter name, true concentration of the LCS, measured concentration of the LCS, and the percent recovery for the LCS. The use of EPA CLP Form VII-IN, or equivalent, is acceptable. Solid LCS data shall be accompanied by the applicable acceptance criteria.
- Analysis run logs shall be provided. The use of EPA CLP Form XIV-IN, or equivalent, is acceptable for all parameters.
- Initial calibration data shall be provided and shall include the number and concentration levels of calibration standards, curve equations, and correlation coefficients.
- Reporting limit verification Contract Required Quantitation Limit Check Standard data shall be provided (Form 2B-IN or equivalent) and shall include the parameter name, true standard concentration, measured concentration, and percent recovery value.
- ICP-Atomic Emission Spectroscopy serial dilution data shall be provided (Form 8-IN or equivalent) and shall include for each parameter the parameter name, parameter concentration in the sample, parameter concentration in the diluted sample (corrected for the 5 X dilution), and the percent difference value.
- ICP-MS tune reports shall be provided and shall include for elements representing all mass ranges of interest the mass calibration values and the full width resolution values at 10 percent peak height.

QC data deliverables for radiochemistry chemistry shall include items listed below. The sample delivery group number shall be given on each page of the QC data deliverable. QC acceptance limits shall be included in the QC deliverable. All forms shall be clearly labeled.

- The instrument calibration date and associated calibration file names shall be provided. Alternatively, this information may be placed on chemist worksheets. All calibration files shall be archived and retrievable.
- PB data shall be provided for each batch and shall include the parameter name, result, and uncertainty. Aliquot size corrected blank results shall be included.
- MS data shall include the parameter name, spiked sample result, sample result, spike added, and spike percent recovery for each spike analysis. Include the required data qualifiers for spike analyses that fall outside the control limits.
- Replicate data shall include the parameter name, sample result, replicate result, and RER value. Sample and replicate results for radionuclide and gross radiation determinations shall be accompanied by the 95 percent confidence level uncertainty values. Include the required data qualifiers for replicate analyses that fall outside the control limit.
- LCS data shall include the parameter name, true concentration of the LCS, measured concentration of the LCS, and the percent recovery for the LCS. Solid LCS data shall be accompanied by the applicable acceptance criteria.
- The instrument and detector identifiers shall be provided for each sample. This is typically present on the instrument printouts. If so, it need not be repeated in the QC summary.
- Radionuclide tracer or carrier recoveries, or standard addition recoveries used for sample-specific chemical recovery correction, shall be reported in the QC deliverable. For recoveries that fail to meet the criteria specified in QSAS, a record of Fernald Preserve

laboratory technical representative approval to report shall be provided in the case narrative.

QC data deliverables for organic chemistry shall include items listed below. The sample delivery group number shall be given on each page of the QC data deliverable. QC acceptance limits shall be included in the QC deliverable. All forms shall be clearly labeled.

- Initial calibration data, ICV data, and CCV data shall be presented. The initial calibration data shall include the average response factor (or calibration factor) and relative standard deviation, or the curve equations and correlation coefficients if regression is used. The calibration verification data shall include the percent difference values.
- Preparation or method blank data shall be provided for each batch and each 12-hour period, as applicable. The method blanks that follow CCVs in some gas chromatography (GC) methods shall be reported. Blank data shall include the parameter name and analysis result and shall be reported on an EPA CLP Form I.
- MS/MSD analysis data shall include the parameter name, spiked sample result, sample result, spike added, spike percent recovery, and RPD for each MS/MSD analysis. Include the required data qualifiers for MS/MSD analyses that fall outside the control limits. If the MS/MSD is run on a sample from another sample delivery group, that sample delivery group must be identified on the report.
- If replicate analyses are performed, the replicate data shall include the parameter name, sample result, replicate result, and RPD. Include the required data qualifiers for replicate analyses that fall outside the applicable control limits. If a replicate is run on a sample from another SDG, that SDG must be identified in the report.
- LCS analysis data shall include the parameter name, true concentration of the LCS, measured concentration of the LCS, and the percent recovery for the LCS.
- Analysis run logs shall be provided for all analytical runs for which data are reported.
- Surrogate and internal standard recoveries, and associated acceptance criteria, shall be reported in the QC deliverable. Recoveries that fail to meet the applicable criteria shall be explained in the case narrative.
- Laboratories shall include Form 10 or equivalent reports to describe replicate precision and second column results for all dual-column GC and High Performance Liquid Chromatography work.
- GC/MS tune reports shall be submitted and shall include the relative abundance values and acceptance criteria.

Laboratories performing ASL C analyses will be required to maintain all documentation and supporting information required to generate an ASL D data package for all ASL C analyses they perform.

#### **13.7.4 ASL D**

ASL D data packages shall contain the requirements specified in Section 12.10.3 for ASL C reporting as well as the following, as applicable:

- Shipping and login documents, analyst worksheets, instrument run logs, instrument printouts, standard preparation logs, digestion and extraction logs, and other forms of raw data as necessary to support data defensibility. Analyst worksheets and logs shall meet the minimum requirements given in this document. If the vendor name, lot number, and expiration date is given in tabular form on the chemist worksheets for all calibration and second-source calibration verification standards, the standards preparation logs need not be included.
- For radiochemistry, laboratories shall adhere to the spirit of the inorganic and organic chemistry reporting requirements in preparing analytical reports. This means that laboratories performing radiochemical analyses shall include shipping documents, analyst worksheets, instrument printouts, standard preparation logs, digestion logs, and other forms of raw data in the reports. Raw data shall include all aliquot weights/volumes, tracer/carrier recoveries, counting times, detector efficiencies, and other information necessary to re-create analytical results. Radiochemistry counting instrument calibration and background data shall not be included with data reports, but rather shall be maintained by laboratories as record material. However, radiochemistry data packages shall include copies of the calibration verification, blank check results, and acceptance criteria associated with the sample results being reported.
- Standards certificate of analysis information, log entries for water quality, log entries for balance calibration verification, and other similar ancillary information shall not be included in analytical reports. Such information shall be maintained as record material by the laboratories.

Site-specific summary sheets shall be developed for reporting specified deliverable items. The summary sheets shall contain information similar to that specified for report forms in SW-846 (EPA 1998) and the EPA CLP report forms.

### **13.7.5 ASL E**

ASL E analysis is nonstandard, so it is not possible to predetermine report requirements. Requirements for ASL E analyses shall be specified in the sampling plan, DQO, and SOW.

## **13.8 LM Environmental Data Management System**

A collection of integrated environmental data management systems is used to support the range of data-related activities previously outlined. These systems are designed to manage the complete set of sampling and analytical data, along with site maps and other spatially oriented data.

The following paragraphs contain brief descriptions of each computerized system commonly used for environmental data by the LM contractor.

### **13.8.1 Sample Management System**

SMS supports sampling, laboratory analysis, and analytical reporting activities. SMS includes the following subsystems:

**Field Data Collection System**—Used by sampling crews to automate, collect, and verify collection of key data fields, including sample location identifier, sample volume requirements, sample preservation, sample date and time, and COC information.

**Sample Tracking System**—Used to track the life history of samples through initial planning, sample collection, laboratory analysis, validation, and input into SEEPro. The subsystem also monitors the schedule status of both routine and nonroutine sampling activities on an ongoing basis. A key function of the sample tracking subsystem is the issuance of a sample number unique to each analytical sample collected.

### **13.8.2 Data Validation System**

Data from subcontract analytical laboratories are reported in both PDF and staged electronic data deliverable (SEDD) formats. SEDD files are used to automate portions of the data validation process.

### **13.8.3 SEEPro Database**

SEEPro is an Oracle<sup>®</sup> based database system which serves as the central repository for all LM environmental data. SEEPro contains descriptive information about LM sites, sampling locations, and samples in addition to the results of field measurements and sample analysis.

## **13.9 LM Software Environment**

The core of the LM environmental data management system is the Oracle<sup>®</sup> relational database management system. The SeePro uses Oracle<sup>®</sup> for data storage and retrieval. A data dictionary that describes each Oracle<sup>®</sup> data table, the data elements in each table, keyed data elements, definitions of each data table and each data element, and field characteristics for each data element is also maintained. In addition, entity relationship diagrams describe relationships among the Oracle<sup>®</sup> tables.

The Oracle<sup>®</sup>-based SEEPro is the repository for LM environmental software modules. SEEPro provides a clear and concise definition of environmental data that can be easily communicated to data users.

SEEPro is designed to minimize data redundancy to the highest practical degree except when performance factors on key software applications require addition of redundant data elements to some data tables. This approach minimizes confusion and the possibility for error when multiple groups of users access the same data elements in different applications.

### **13.9.1 Data Input Standards**

Certain general standards are enforced, recognizing that each specific application may have some unique data input needs requiring some deviation from other applications. The data input standards apply the following general input standards:

**Use of Predefined Codes and Look-Up Tables**—Look-up tables with predefined lists of valid codes are used when possible for coded data elements to help screen data for valid entries by forcing the use of standard codes.

**Required Fields and Field Completeness**—To the maximum extent possible, data elements are verified during data input for completeness and required fields must be entered for the data to be accepted into SEEPro.

**Data Verification**—Analytical results data entered manually into the Oracle® SEEPro or imported into SEEPro from another system (such as SMS) shall be reviewed for accuracy. This review may be done manually, by an individual other than the person keying in the data, or via computer verification.

### 13.9.2 Data Output

Microsoft Access® front-end modules are used to produce standard reports and graphs from SEEPro data. Other third-party software packages may be used to produce ad hoc reports from SEEPro data.

Data analysis is generally performed using external software packages accessing SEEPro data. New software packages are evaluated as appropriate to ensure that the most effective technology for the project needs is being utilized. Brief descriptions of environmental data analysis software follow:

- **AutoDesk's AutoCAD® Computer Aided Design and Drafting Software**—Graphics-related data are stored in AutoCAD® design files, the appearance of which can be enhanced using standard AutoCAD® menu commands.
- **Relational Database Linkages to SEEPro**—Via the relational interface system that provides linkage between AutoCAD® and SEEPro.
- **Geographic Information System Capability**—Within ESRI's ArcGIS® software and used to facilitate spatially related queries against SEEPro and to plot results on an appropriate site map.
- **Hydrogeologic Analysis**—Supported via direct linkages to software used to generate stratigraphic cross sections, thickness maps, structure maps, and distribution maps. Interfaces are also provided between ArcGIS® and commercial contouring packages.
- **Groundwater Modeling**—Supported via interface with the Variably Saturated Analysis Modeling in 3-Dimensions (VAM3D) finite difference groundwater flow and transport model.
- **Block Modeling**—Mining Visualization System (MVS) software package used to develop block models through kriging of subsurface contaminant data in soil and groundwater to provide representations of the nature and extent of contamination.
- **Visualization**—MVS software package used to visualize and present block modeling and groundwater modeling results.

## 13.10 Computing Environment

The computing environment for new systems development shall be compatible with existing LM computing infrastructure. The computing infrastructure, consisting of desktop hardware, servers, operating systems, and network environments, are managed by the information management department and are periodically upgraded to take advantage of new technologies as appropriate to the LM mission. Upgrades of the environmental systems and those of the computing infrastructure will be coordinated to ensure stable operation and tested in accordance with Section 13.8. The infrastructure includes Intel-based servers running Windows 2000 operating systems, Oracle® Relational Database Management System, Microsoft Windows desktop software, and Microsoft Networking.

Security provisions for system development shall conform to DOE Order 205.1A, *Department of Energy Cyber Security Management Program*. Data users shall be granted appropriate access to databases and network resources. Access is revoked when no longer needed. Individual user names and passwords shall be required access to databases and network resources. Passwords shall be changed on a regular basis at a minimum of once per year.

## 13.11 Computer Hardware and Software Validation

All computer hardware and software used to provide analytical data, manage and maintain analytical data, or support environmental decisions must be validated and verified. The verification/validation must be consistent with the requirements of DOE Order N 203.1, *Software Quality Assurance*.

Computer hardware and software that are calibrated for a specific purpose (including commercial software validated by the manufacturer) do not require further testing unless the scope of software usage changes or modifications are made to the hardware or software configuration. If any components are changed or modified, the resulting new configuration must be documented and tested.

### 13.11.1 Test Requirements

Test requirements and acceptance criteria shall be provided by the organization responsible for the design or use of the program to be tested, unless otherwise specified. Required tests (including, as appropriate, verification tests, hardware integration tests, and in-use tests) shall be controlled. The proposed test requirements and acceptance criteria shall be based on applicable design or other pertinent technical documents.

#### 13.11.1.1 Verification Tests

Verification tests shall demonstrate the capability of the computer program to produce valid results for test problems with a known data set. The test shall encompass the range of permitted usage defined by the program documentation. The results from the tested software shall be compared with hand calculations, calculations from comparable proven programs, or empirical data and information from technical literature to verify their accuracy and precision.

For programs used for operational control, testing shall demonstrate required performance over the range of operation of the controlled function or process.

Depending on the complexity of the computer program being tested or the degree of customization that has occurred, testing may range from a single test of the completed computer program to a series of tests performed at various stages of computer program development to verify correct translation between stages and proper working of individual modules, followed by an overall computer program test. Regardless of the number of stages of testing performed, verification testing shall be sufficient to establish that test requirements are satisfied and that the computer program produces a valid result for its intended function.

#### 13.11.1.2 In-Use Tests

Test problems shall be developed and documented to permit confirmation of acceptable performance of the computer program in the operating system. Test problems shall be run whenever significant hardware or operating system configuration changes are made. Periodic in-use manual or automatic self-check routines shall be prescribed and performed for those applications where computer failures or drift can affect required performance.

The system administrator charged with maintaining each application is responsible for determining whether a proposed change to underlying hardware or software has the potential to impact the operation of that application. The system administrator then determines what testing and modifications, if any, are needed to ensure proper operation of the application.

Examples of operating system changes that would require testing and possible modifications include:

- Changing the client operating system from Windows XP to Windows Vista.
- Upgrading database server software (e.g., moving to a new version of Oracle®).
- Upgrading to a new version of a server operating system.

Examples of hardware system changes that would require testing and possible modifications include:

- Moving from terminal-based to PC-based user workstation.
- Changes in location/designations of server disk drives.
- Changes in printer hardware or print queue definitions.

#### 13.11.2 Test Procedures

Test procedures or plans shall specify the following, as applicable:

- Required tests and test sequence.
- Required ranges of input parameters.
- Identification of the stages at which testing is required.
- Criteria for establishing test cases.

- Requirements for establishing test cases.
- Requirements for hardware integration.
- Anticipated output values.
- Acceptance criteria.
- Reports, records, standard formatting, and conventions.

### **13.11.3 Test Results**

Test results shall be documented. Verification test results shall be evaluated by a responsible authority to ensure that test requirements have been satisfied. When verified test results require validation, an independent authority will qualify verification test results.

### **13.11.4 Test Records**

Verification test records shall identify the following:

- Computer program tested (including the file name and version number).
- Computer hardware used.
- Test equipment and calibrations, where applicable.
- Date of test.
- Person performing the test or recording the data.
- Simulation models used, where applicable.
- Test problems.
- Results and acceptability.
- Actions taken in response to any problems noted.
- Person evaluating test results.

In-use test results shall identify the following:

- Computer program tested.
- Computer hardware used.
- Test equipment and calibrations, where applicable.
- Date of test.
- Person performing the test or recording the data.
- Acceptability.

### **13.11.5 Modification Control**

Software shall be controlled to prevent the use of modified packages that have not been verified. Unauthorized modifications to verified software shall be prevented. If a verified package has been modified but not tested, it must be clearly identified via a new file name or other mechanism to prevent unintentional use until all verification testing has been successfully

completed. Each project manager shall ensure that only tested and approved computer hardware and software are used to generate or manage data that is used for environmental decision making.

## 14.0 Assessments and Oversight

Assessments of work processes shall be performed to ensure quality of performance. Assessments include surveillances, audits, inspections, data verification and validation, and peer reviews performed to evaluate compliance with both technical and procedural requirements. Independent assessments are designed to assess systematic, programmatic, and process adequacy, whereas surveillances are intended to verify compliance with procedures and practices. Assessment of field activities shall be conducted to verify that sampling and analysis are performed in accordance with requirements established in this document. Independent assessments of field and laboratory activities are the responsibility of the LMS contractor QA organization.

To verify compliance with the FPQAPP and project-specific requirements, the Fernald Preserve site manager and LMS contractor's QA organization shall be responsible for scheduling and conducting assessments. Assessment results of activities covered by the FPQAPP are available to EPA once a request is submitted to LM. EPA or OEPA may conduct external assessments of Fernald Preserve activities covered by the ACA as required.

### 14.1 Independent Assessment Personnel

The LMS contractor's QA organization manager is responsible for assigning and authorizing assessment and surveillance personnel based on personnel qualification and assessment subject matter. The LMS contractor's QA organization manager shall ensure that only qualified personnel perform independent project surveillances and that assigned personnel are independent of the responsibilities in the areas being assessed.

The lead auditor is responsible for:

- Ensuring that assessment team has the training and competence for the activities to be assessed.
- Directing and organizing the assessment.
- Preparing and issuing the assessment report and evaluating report responses, if necessary.

The lead auditor shall meet one of the following requirements:

- Certified Quality Auditor by the American Society for Quality;
- Registered International Organization for Standardization (ISO) 9000 Quality Management Systems Auditor by the Registrar Accreditation Board (RAB);
- Registered ISO 9000 Quality Management Systems Auditor by RAB;
- Registered ISO 14000 Environmental Management Systems Lead Auditor by RAB;
- Registered ISO 14000 Environmental Management Systems Auditor by RAB; or
- Certified by another nationally-recognized certifying agency with the LMS contractor's QA organization manager's approval.

The lead auditor must maintain his or her certification in accordance with the requirements set forth by the accrediting body. Documentation of recertification will be kept in the training files.

Assessment team members must have education, experience, and training commensurate with the scope, complexity, and special nature of the activities that will be assessed. Team members must also have training in performing assessments, shall be qualified by education or experience to perform the surveillances, and shall be technically knowledgeable of the activity being monitored.

Qualification of personnel conducting assessments and surveillances shall be documented and maintained as records per Section 4.

## **14.2 Independent System Assessments**

### **14.2.1 Pre-Assessment Activities**

Pre-assessment activities shall consist of defining the assessment purpose, scheduling, identification of subject and scope, selection of assessment team and lead assessor, development of assessment plan and checklists, and notification of organization to be assessed.

Assessments shall be scheduled to provide coverage and coordination with ongoing activities and at a frequency commensurate with the status and importance of the activity. Schedules may be revised as necessary and may be supplemented by additional assessments as necessary.

As with scheduling, when determining activities to be assessed, consideration shall be given to ensure adequate coverage of pertinent activities. Scope definition of each assessment shall consider the activity status and importance of required validity/acceptability of its product and supporting documentation (e.g., records, reports).

The lead assessor shall develop plans for each assessment, assisted as required by team members. Plans shall identify scope, applicable requirements, personnel, activities to be assessed, organizations to be assessed, schedule, and checklist items.

Checklists are assessment-specific and based on requirements and goals. They are designed to document results; items requiring review shall be listed on the checklist and checked off as they are assessed. Preparation of checklists is the responsibility of the assessment team prior to the assessment.

The assessed group shall be formally notified in advance of the scheduled assessment. The notification, as a minimum, shall include the date, associated meetings, assessing organization, identity of assessors, subject, and intended scope. Additional items to be covered in laboratory audits are specified in Section 14.4.

### **14.2.2 Assessment Conduct**

Assessments shall be conducted in accordance with written checklists. If portions of the proposed scope as identified on the checklist are not addressed during the assessment, this shall be discussed at the closeout meeting and documentation shall be recorded in the report.

Pre- and post-assessment meetings between assessors and assessed organization management and personnel shall be held to review the purpose and scope of the assessment, establish personnel contacts, and present assessment results.

During an assessment and at completion, assessors shall discuss results and findings with individuals assessed. Nonconformances shall be recorded on checklists and included in assessment reports.

### **14.2.3 Post-Assessment Activities**

Upon completion of an assessment, assessors shall prepare and submit a formal report to the responsible management. The report may also be sent to LMS contractor's senior management, individuals contacted during the assessment, and management of applicable subcontractors. The report shall be prepared as soon as possible after the assessment (within 30 days) and contain the following information as applicable:

- Assessment scope.
- Identification of team members and individuals contacted.
- Summary of results.
- Description of items requiring corrective action and, if possible, the means of correction.

Management of the assessed organization or activity must investigate the findings, implement corrective actions, and notify the lead assessor, in writing, of actions planned or taken. The lead assessor then evaluates the adequacy of the response by written communication or re-assessment. After verification and acceptance of the corrective action, the lead assessor shall issue an assessment closure report to the same individuals receiving the original assessment report. If a dispute arises regarding the corrective action of a finding, resolution will be deferred to the next-highest level of management. Assessments resulting in no findings are closed with issuance of the assessment report. Assessment records must be maintained by the LMS contractor and may include plans, reports, written responses, and records of completion of corrective actions.

## **14.3 Surveillances**

### **14.3.1 Pre-Surveillance Activities**

Surveillances shall be scheduled by selecting project activities based on the program schedule defined in the sampling plan. Actual date and time of a surveillance shall be coordinated with applicable project personnel. Field activities, sample preparation, sample handling and shipping, document completion, laboratory analysis, data management, and security items shall be subject to surveillance. Activity procedures or surveillance checklists shall be prepared by surveillance personnel if applicable.

### **14.3.2 Surveillance Conduct**

Personnel conducting surveillances shall follow applicable procedures or surveillance checklists. Surveillance personnel may communicate directly with project personnel during conduct of the surveillance to expedite corrective actions.

### **14.3.3 Post-Surveillance Activities**

Surveillance personnel shall prepare a report documenting surveillance results. Observations identified during the surveillance do not require a response by the responsible manager. Observations are provided for information only as potential areas for improvement. Other nonconformances identified during the surveillance shall constitute cause to initiate a nonconformance in accordance with the established QA procedures. The surveillance report, when completed and approved, shall be distributed to applicable project personnel.

The Fernald Preserve Site Manager is responsible for ensuring that the corrective action required by assessment or surveillance reports is implemented and completed on schedule. If required, DOE or the LMS contractor's QA organization is authorized to stop project work until corrective actions have been implemented.

## **14.4 Laboratory Assessments**

Subcontracted analytical laboratories provide services as specified in the ICPT BOA SOW, which includes the QSAS to address the following objectives:

- Maximize reliability and laboratory performance.
- Provide for review, evaluation and improvement of performance based on an approved QA program.
- Establish a single, integrated QA program.
- Establish criteria for independent assessments through the DOE Consolidated Audit Program (DOE-CAP) to measure and promote improvement.

The DOE-CAP conducts annual audits of analytical laboratories that have contracts or agreements to provide laboratory services to DOE. DOE-CAP audits are performed on behalf of, and with the voluntary participation of, sites throughout the DOE complex. The intent of this consolidated program is to eliminate redundant audits previously conducted independently by DOE sites. This program also achieves standardization of audit methodology, processes, and procedures.

An assessment of the LMS contractor operated laboratory located at the Fernald Preserve is performed annually by LMS contractor personnel. This audit meets the intent of the DOE-CAP process with a graded approach based on the types of analyses completed by the laboratory.

## **14.5 Nonconformances**

All Fernald Preserve employees are responsible for reporting nonconformances. Any individual who identifies an apparent nonconformance should follow the identifying organization's system

for review. If the condition is judged to be reportable by the identifying organization, a nonconformance report will be initiated. The reporting organization should request the QA organization's assistance in evaluating conditions and documenting the identified nonconformance.

The nonconformance report will include the following information:

- Brief descriptive title that identifies the subject of the nonconformance.
- Date discovered.
- Project, program, or work activity area affected by, or responsible for, the item or activity.
- Responsible manager.
- Location.
- Assessment activity.
- Requirements (identify and quote the requirement directly from the document that best describes the acceptance criteria for the item or activity).
- Nonconformance (fully describe the nonconformance as it relates to the requirements).

The QA organization shall review and track the nonconformance reports, administer the documentation, and coordinate the nonconformance resolution process by consulting with appropriate individuals to identify technical and management individuals for the evaluation and disposition of the nonconformance report. The QA organization is responsible for working actively toward the disposition of the nonconformance report by meeting formally or informally with technical and management personnel to obtain disposition consensus, justification, or instruction.

Technical and management personnel are responsible for assisting the QA organization with determining an appropriate disposition. Individuals identified as action parties are responsible for investigating the identified nonconformance, assisting in its resolution, evaluating the root cause of the nonconforming condition, and evaluating actions to prevent recurrence.

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## **15.0 QA Reports to Management**

### **15.1 Summary Reports of QA Activities**

The QA organization shall notify project management of field assessment and surveillance results, performance of measurement systems, data quality, results of QA activities, and, if applicable, repetitive and significant QA problems through routine distribution of surveillance and assessment reports, nonconformance documentation (Section 14), and activity reports. Records of QA activities within the project shall become part of project files.

Project managers shall be responsible for variance requests and implementation (Section 3) as well as assessment of the variance effect on final project results. The effects shall be reported on a timely basis to other potentially affected parties.

QA reports shall be distributed to the responsible project manager and applicable project personnel. When requested, the LM Site Manager shall receive QA reports pertaining to ACA activities. Required reports of activities that affect ACA requirements shall be distributed by DOE to the EPA RPM.

### **15.2 Final Project Reports**

The final report for each phase of a program or project shall include a separate QA section that summarizes data quality information collected during the project. A brief description of QA elements implemented within the project, surveillances, and assessments; significant assessment and surveillance findings (findings that could affect data interpretation); and implemented corrective actions shall also be provided. Limitations on data use shall be identified by data users based on results of data validation and specific project requirements. A summary of the applicability of QA elements to data quality objectives and achieved data quality shall be included.

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## 16.0 References

### *Code of Federal Regulations*

- 10 CFR 71, "Packaging And Transportation of Radioactive Material."
- 10 CFR 830.120, "Quality Assurance Requirements."
- 10 CFR 851, "Worker Safety and Health Program."
- 29 CFR 1910.120, "Hazardous waste operations and emergency response."
- 36 CFR 12, "Federal Records Management."
- 40 CFR 61. "National Emission Standards for Hazardous Air Pollutants."
- 40 CFR 122, "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System."
- 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants."
- 40 CFR 141, "National Primary Drinking Water Regulations."
- 40 CFR 50.6, "National Primary and Secondary Ambient Air Quality. Standards for Particulate Matter."
- 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants."
- 40 CFR 261, "Identification and Listing of Hazardous Waste."
- 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan."
- 49 CFR 170–189, Federal Register "Final Rule" documents
- 49 CFR 171, "General Information, Regulations, and Definitions."
- 49 CFR 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements."
- 49 CFR 173, "Shippers--General Requirements for Shipments and Packagings."
- 49 CFR 175, "Carriage by Aircraft."
- 49 CFR 177, "Carriage by Public Highway."
- 49 CFR 178, "Specifications for Packagings."
- 49 CFR 180, "Continuing Qualification and Maintenance of Packagings."

### *United States Code*

- 7 U.S.C. 136, "Federal Insecticide, Fungicide, and Rodenticide Act," May 22, 2008.
- 15 U.S.C §2601–2692, "Toxic Substances Control Act of 1976."
- 33 U.S.C. §1251, "Federal Water Pollution Control Act (Clean Water Act) of 1972."
- 42 U.S.C. 23, Division A, "Atomic Energy Act of 1954."
- 42 U.S.C 103, "Comprehensive Environmental Response, Compensation, and Liability Act," §121 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), Pub. L. 99-499, October 1986.

42 U.S.C. §4332, "National Environmental Policy Act of 1969."

42 U.S.C. §6901, "Resource Conservation and Recovery Act of 1976."

42 U.S.C. §7401, "Clean Air Act of 1970."

Aller, Linda, T.W. Bennett, and G. Hackett, 1989. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*, EPA 600/4-89/034, Environmental Monitoring Systems Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Bennett & Williams, Inc., Columbus, Ohio.

American Society for Testing and Materials, 1999 (2004). *Standard Guide for Sample Chain of Custody Procedure*, ASTM D 4840-99.

American Society for Testing and Materials, 2004. *Practice for Using the Disposable En Core Sampler for Sampling and Storing Soil for Volatile Organic Analysis*, ASTM D 6418-04.

Driscoll, F., 1986. *Ground Water and Wells*, Johnson Division, UOP, Inc., St. Paul, Minnesota.

DOE Orders	200.1	<i>Information Management Program</i> , September 1996.
	205.1A	<i>Cyber Security Management Program</i> , December 2006.
	414.1C	<i>Quality Assurance</i> , June 2005.
	241.1A	<i>Managing the Department of Energy's Scientific and Technical Information</i> , 2003.
	435.1	<i>Radioactive Waste Management</i> , June 2001.
	450.1A	<i>Environmental Protection Program</i> , June 2008.
	2321.1B	<i>Auditing of Programs and Operations</i> , 1992.
	5400.5	<i>Radiation Protection of the Public and the Environment</i> , Change 2, January 7.
	N 203.1	<i>Software Quality Assurance</i> , 2000.

DOE (U.S. Department of Energy), 1990. *Remedial Investigation and Feasibility Study Ground Water Report (Draft)*, prepared for Oak Ridge Operations Office, December.

DOE (U.S. Department of Energy), 1991. *Quality Assurance Project Plan, Remedial Investigation and Feasibility Study, Feed Materials Production Center, Fernald, Ohio*, Rev. 3, prepared for Oak Ridge Operations Office, March.

DOE (U.S. Department of Energy), 1996. *Final Record of Decision for Remedial Actions at Operable Unit 5*, 7478 U-007-501.4, Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio, January.

DOE (U.S. Department of Energy), 1997. *Evaluation for Radiochemical Data Usability*, DOE/ES/ER/MS-5, April.

DOE (U.S. Department of Energy), 2001. *Explanation of Significant Differences for Operable Unit 5*, Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio, October.

DOE (U.S. Department of Energy), 2009. *Fernald Preserve Legacy Management and Institutional Controls Plan*, Revision 3, Draft Final, LMS/POL/S03496.

Earlougher, R.C., 1977. *Advances in Well Test Analysis*, Society of Petroleum Engineers of AIME.

*Environmental Procedures Catalog*, LMS/POL/S04325, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

EPA (U.S. Environmental Protection Agency), 1986a. *Federal Facilities Compliance Agreement*, Federal Facilities Restoration and Reuse Office.

EPA (U.S. Environmental Protection Agency), 1986b. *Superfund Remedial Design and Remedial Action Guidance*, EPA/9355.0-04A, Office of Emergency and Remedial Response.

EPA (U.S. Environmental Protection Agency), 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*.

EPA (U.S. Environmental Protection Agency), 1990. *Consent Agreement*, Region V, April.

EPA (U.S. Environmental Protection Agency), 1991. *Amended Consent Agreement*, Region V, September.

EPA (U.S. Environmental Protection Agency), 1992a. *Guidance for Data Useability in Risk Assessment*, EPA/540/G-90/008, April.

EPA (U.S. Environmental Protection Agency), 1992b. *Guidance for Obtaining Contaminant-Free Sample Containers*, EPA/540/R-93/051, December.

EPA (U.S. Environmental Protection Agency), 1992c. *Specifications and Guidance for Contaminant-Free Sample Containers*.

EPA (U.S. Environmental Protection Agency), 1998. *Test Methods for Evaluating Solid Waste*, SW-846, 3rd ed., latest update.

EPA (U.S. Environmental Protection Agency), 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-99/008.

EPA (U.S. Environmental Protection Agency), 2001a. *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, March.

EPA (U.S. Environmental Protection Agency), 2001b. *EPA Requirements for Quality Management Plans*, Draft Interim Final, EPA-QA/R-2, March.

EPA (U.S. Environmental Protection Agency), 2001c. *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review*, EPA-540/R-00-006.

EPA (U.S. Environmental Protection Agency), 2002a. *EPA Guidance for Quality Assurance Project Plans*, EPA QA/G-5, EPA/240/R-02/009, December 2002.

EPA (U.S. Environmental Protection Agency), 2002b. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA-540/R-01-008.

EPA (U.S. Environmental Protection Agency), 2006. *EPA Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001, February.

EPA (U.S. Environmental Protection Agency), 2007a. *Contract Laboratory Program Guidance for Field Samplers*, Draft Final, EPA-540-R-07-06, July.

EPA (U.S. Environmental Protection Agency), 2007b. *SESD Operating Procedures: Sample and Evidence Management*, SESDPROC-005-R1, November 2007.

ISO (International Organization for Standardization), 9000. "Quality Management."

ISO (International Organization for Standardization), 14000. "Environmental Management."

ISO (International Organization for Standardization), 17025. "General Requirements for the Competence of Testing and Calibration Laboratories," International Organization for Standardization, May 2005.

Kruseman, G.P. and N.A. DeRidde, 1976. *Analysis and Evaluation of Pumping Test Data*, International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands.

NELAC 2003. *National Environmental Laboratory Accreditation Conference*, The NELAC Institute).

O.A.C. 3745-27, "Ohio Solid Waste and Infectious Waste Regulations," *Ohio Administrative Code*, November 1, 2007.

O.A.C. 3745-54, "Ohio Solid Waste and Infectious Waste Regulations," *Ohio Administrative Code* December 7, 2004.

OEPA (Ohio Environmental Protection Agency), 2006. *Technical Guidance for Ground Water Investigations*.

OEPA (Ohio Environmental Protection Agency), 2008. *Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring (TGM)*.

State of Ohio, 1988. *Consent Decree*, State of Ohio v. United States Department of Energy, et al, Civil Action No. C-1-86-0217, Judge Spiegel.

Theis, C.V., 1935. "The Relation between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Ground Water Storage," *American Geophysical Union Transactions*, Vol. 16, p. 519-524.

Todd, D.K., 1980. *Ground Water Hydrology*, John Wiley and Sons, 2nd ed.

Walton, W.C., 1970. *Ground Water Resource Evaluation*, McGraw-Hill, New York, New York.

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